

MATEMATIK TAMBAHAN



PERATURAN PEMARKAHAN
KOLEKSI
SPMC 2023



+ PP MODUL KOLEKSI SPMC 2023:

MATEMATIK TAMBAHAN

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PERATURAN PEMARKAHAN



SCAN ME

TERIMA KASIH KEPADA SEMUA PENYUMBANG SOALAN.

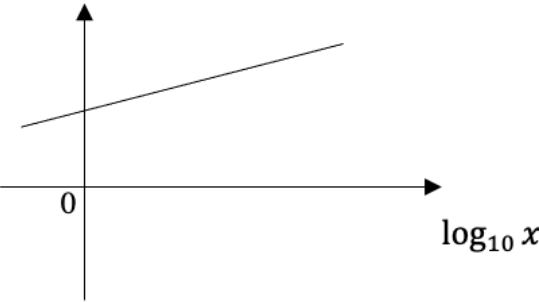
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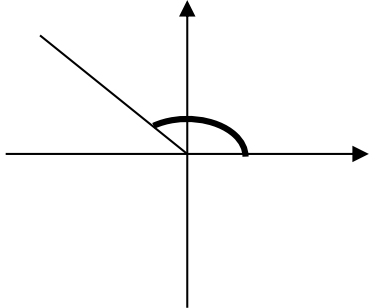
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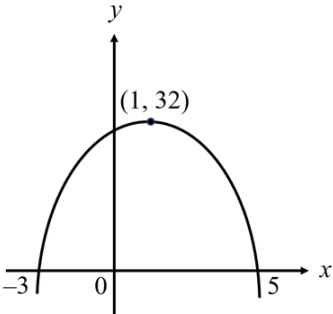
SKEMA PERMARKAHAN
KERTAS 1

NO SOALAN	SKEMA	SUB MARKAH	JUMLAH MARKAH
1	a) Banyak kepada satu	N1	3
	b) $0 \leq x \leq 3$ $2 \leq f(x) \leq 6$	N1 N1	
2	a) $-\log_m abc$	N1	4
	b) $49m^5n^c = \frac{2401}{a}m^{10+b-7}n^{4+2-1}$	K1	
	$49 = \frac{2401}{a}$ or $5 = 3 + b$ or $c = 4 + 2 - 1$ $a = 49, b = 2$ and $c = 5$	K1 N1	
3	a) $3x + 2 = \log_e 10$ OR $3x + 2 = \ln 10$ $x = 0.1009$	K1 N1	6
	b) $\frac{\log_3(2+x)}{\log_3 9}$ (Change base) $(6+5x) = (2+x)^2$ $(x+1)(x-2) = 0$ $x = 2, \quad x = -1$ (rejected)	K1 K1 K1 N1	
4	a) $m_1 = -\frac{1}{8}$ atau $m_2 = 8$ atau setara Guna $m_1 \times m_2 = -1$ $\left((4(2)^3 - p(2))\left(-\frac{1}{8}\right) = -1\right)$ atau $8 = 4x^3 - px$ $p = 12$	K1 K1 N1	6
	b) Kamirkan y terhadap x $y = \frac{4x^4}{4} - \frac{12x^2}{2} + c$ Ganti (2, 5) ke dalam *kamiran & Selesaikan untuk c $5 = (2)^4 - 6(2)^2 + c$ $c = 13$ $y = x^4 - 6x^2 + 13$	K1 K1 N1	

5	a) $\binom{1}{p-1} = \lambda \binom{9}{8}$ atau setara $\frac{17}{9}$	K1 N1	4
	b) $\sqrt{1^2 + (p-1)^2} = \sqrt{9^2 + 8^2}$ $p^2 - 2p - 143 = 0$ $(p-13)(p+11) = 0$ *mesti ada kedua-duanya $p = 13, p = -11$ *mesti betul kedua-dua nilai	K1 N1	
6	a) $y = pq^x$ $\log_{10} y = \log_{10} p + \log_{10} q^x$ $\log_{10} y = \log_{10} q (x) + \log_{10} p$ $\log_{10} q = -\frac{3}{7}$ or $\log_{10} p = 3$ $q = 0.3728$ and $p = 1000$	P1 K1 N1	4
	b) Lukiskan graf $\log_{10} y$ kepada $\log_{10} x$ $\log_{10} y = \log_{10} x (b) + \log_{10} a$ $\log_{10} a =$ penggal pada paksi-lg y b = kecerunan garis lurus itu atau $\log_{10} y$  $\log_{10} x$	N1	
7	a) $\frac{4}{9} \pi$ rad atau 1.396 rad	N1	7
	b) $x + x + x(\frac{4}{9} \pi) = 33.97$ $x = 10$	K1 N1	
	$\frac{1}{2} (10)(10) \sin 80$ atau $0.4924 (10)^2$	K1	
	$\frac{1}{2} (y)^2 (\frac{4}{9} \pi)$ atau $0.698y^2$	K1	
	$\frac{1}{2} (10)(10) \sin 80 - \frac{1}{2} (y)^2 (\frac{4}{9} \pi) = 15.03$ atau $0.4924 (10)^2 - 0.698y^2 = 15.03$ atau setara $y = 7$	K1 N1	

8	a) $X = \{0, 1, 2, 3, 4\}$	N1	7
	b) i) $P(X = 4) = 1 - 0.959$ ${}^4C_4 p^4 q^0 = 0.041$ $p^4 = 0.041$ $p = 0.45$	K1 K1	
	ii) Min = 4×0.45 $= 1.8$ Varians = $4 \times 0.45 \times 0.55$ $= 0.99$	N1 N1	
	Nota: Markah K1 diberi di salah satu rumus min atau varians.	N1	
9	$P(\frac{40-45}{9.5} < Z < \frac{k-45}{9.5}) = 0.1025$ $z = -0.248$ $-0.248 = \frac{k-45}{9.5}$ $k = 42.644$	K1 K1 N1	3
10	(a) (i) ${}^{12}P_4 \times {}^8C_6$ atau ${}^{12}C_4 \times 4! \times {}^8C_6$ $= 332\,640$	K1 N1	6
	(b) (ii) ${}^7P_2 \times {}^5P_2 \times {}^8C_6$ atau ${}^7C_2 \times 2! \times {}^5C_2 \times 2! \times {}^8C_6$ $= 23520$	K1 N1	
	(c) ${}^2P_2 \times (9-1)!$ atau $7! \times {}^8C_1 \times 2!$ atau setara $= 80\,640$	K1 N1	
11	$(23 - 3\sqrt{5})\pi = \pi(3 + \sqrt{20})^2 h$ Nampak mana-mana satu pengembangan surd: $-3 \times \sqrt{20}$ atau $-3 \times 2\sqrt{5}$ atau $-6 \times \sqrt{4 \times 5}$ atau $-6 \times 2\sqrt{5}$ atau $6\sqrt{20}$ atau $12\sqrt{5}$ atau $-138 \times \sqrt{4 \times 5}$ atau $-138 \times 2\sqrt{5}$ atau $-138 \times 2\sqrt{5}$ atau $276 \times \sqrt{5}$ atau $363\sqrt{5}$ atau $-138\sqrt{20}$ atau setara $\frac{23-3\sqrt{5}}{29+6\sqrt{20}} \times \frac{29-6\sqrt{20}}{29-6\sqrt{20}}$ or $\frac{23-3\sqrt{5}}{29+12\sqrt{5}} \times \frac{29-12\sqrt{5}}{29-12\sqrt{5}}$ $\frac{667-138\sqrt{20}-87\sqrt{5}+18\sqrt{100}}{841-36(20)}$ or $\frac{667-276\sqrt{5}-87\sqrt{5}+180}{841-144(5)}$ $h = 7 - 3\sqrt{5}$	P1 K1 K1 K1 N1	5

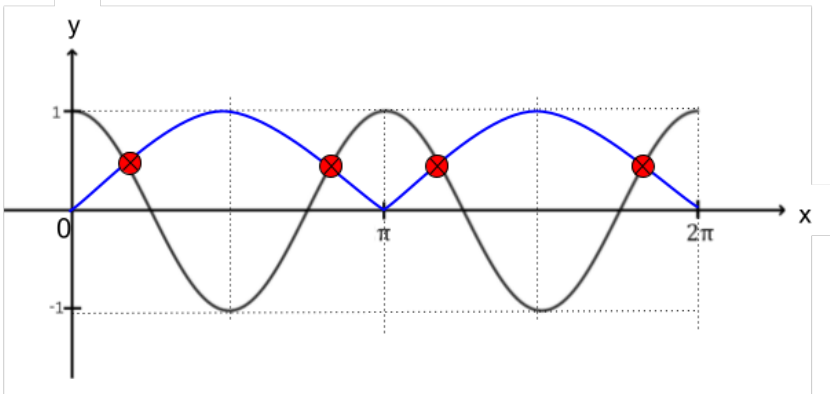
12	a) $S_n = a + (a + d) + (a + 2d) + \cdots + [a + (n - 2)d] + [a + (n - 1)d]$ or $S_n = [a + (n - 1)d] + [a + (n - 2)d] + \cdots + (a + 2d) + (a + d) + a$ Atau (hasil tambah n sebutan pertama ditulis dengan terbalikkan susunan) $2S_n = [2a + (n - 1)d] + [2a + (n - 1)d] + \cdots + [2a + (n - 1)d]$ $2S_n = n[2a + (n - 1)d]$ dan lihat/ and $S_n = \frac{n}{2}[2a + (n - 1)d]$	K1	9
	b) $S_n = \frac{n}{2}[2(5) + (n - 1)4]$ $= 2n^2 + 3n$	K1 N1	
	c) $2n^2 + 3n = 2277$ $2n^2 + 3n - 2277 = 0$ $(n - 33)(2n + 69) = 0$ $n = 33$ $T_{33} = 5 + 32(4) = 133$ atau $\frac{33}{2}[5 + x] = 2277$ $x = 133$	K1 N1 K1 N1	
13	a) i) $\cos \alpha \cos \beta - \sin \alpha \sin \beta = \frac{1}{4}$ $\frac{3}{4}$ ii) $\cos \alpha \cos \beta + \sin \alpha \sin \beta$ $\frac{5}{4}$	K1 N1 K1 N1	8
	b) $4 \sin \theta \cos \theta = \sqrt{2}$ $\sin 2\theta = \frac{\sqrt{2}}{2}$ $2\theta = \sin^{-1}(\frac{\sqrt{2}}{2})$ $2\theta = 45^\circ, 135^\circ, 405^\circ, 495^\circ$ $\theta = 22.5^\circ, 67.5^\circ, 202.5^\circ, 247.5^\circ$	K1 K1 N1	
	c) 	P1	

14	a) $(h - 1)^2 - 4(2)(2k^2) = 0$ $h = 1 \pm 4k$	K1 N1	8
	b) i) $-2\left(x^2 - 2x + \left(\frac{-2}{2}\right)^2 - \left(\frac{-2}{2}\right)^2\right) + 30$ atau setara $-2(x - 1)^2 + 32$ $(1, 32)$ Nota: KON0 bila guna rumus $f(x) = (x + \frac{b}{2a})^2 + \frac{b^2}{4a} + c$ b) ii) $-2(x - 5)(x + 3)$ 	K1 N1 N1 N1	
	Bentuk graf Punca-punca dan titik maksimum dilabel	P1 P1	
15	a) $-2 \times m_{BC} = -1$ atau $(-2)\left(-\frac{3}{\beta}\right) = -1$ -6	K1 N1	8
	b) $(-6, 15)$	N1	
	c) $\frac{1}{2}[-6(3) + 0(0) + (-6)(15)] - [0(15) + (-6)(3) + (-6)(0)]$ 45	K1 N1	
	d) $\sqrt{(x - 0)^2 + (y - 3)^2}$ atau $\sqrt{(-6 - 0)^2 + (0 - 3)^2}$ $\sqrt{(x - 0)^2 + (y - 3)^2} = \sqrt{(-6 - 0)^2 + (0 - 3)^2}$ atau $\sqrt{(x - 0)^2 + (y - 3)^2} = \sqrt{45}$ atau $x^2 + y^2 - 6y + 9 = 45$ atau setara $x^2 + y^2 - 6y - 36 = 0$	K1 K1 N1	

SKEMA PERMARKAHAN
KERTAS 2

NO SOALAN	SKEMA	SUB MARKAH	JUMLAH MARKAH																		
1	a) Garis $y = x$ dilukis Graf f^{-1} dilukis.	P1 P1	7																		
	b) $x^2 - 6 = x$ OR $\sqrt{x + 6} = x$ $(x - 3)(x + 2) = 0$ $(3, 3)$	K1 K1 N1																			
	c) $[g(x)]^2 - 6 = x^2 + 2x - 5$ atau $(x + 1)^2 - 6$ $g(x) = \pm(x + 1)$	K1 N1																			
2	a) $m + n = -\frac{-6}{2}$ dan $mn = \frac{7}{2}$ $3(3) + 2$ atau $9\left(\frac{7}{2}\right) + 3(3) + 1$ $2x^2 - 22x + 83 = 0$	K1 K1 N1	6																		
	b) $(x - 3)(x + 3) > 0$ DAN <table><tr><td></td><th colspan="3">Range of values of x</th></tr><tr><td></td><th>$x < -3$</th><th>$-3 < x < 3$</th><th>$x > 3$</th></tr><tr><td>$x + 3$</td><td>-</td><td>+</td><td>-</td></tr><tr><td>$x - 3$</td><td>-</td><td>+</td><td>-</td></tr><tr><td>$(x + 3)(x - 3)$</td><td>+</td><td>-</td><td>+</td></tr></table> atau atau mana-mana kaedah yang betul $x < -3$ and $x > 3$ 3			Range of values of x				$x < -3$	$-3 < x < 3$	$x > 3$	$x + 3$	-	+	-	$x - 3$	-	+	-	$(x + 3)(x - 3)$	+	-
	Range of values of x																				
	$x < -3$	$-3 < x < 3$	$x > 3$																		
$x + 3$	-	+	-																		
$x - 3$	-	+	-																		
$(x + 3)(x - 3)$	+	-	+																		

3	$a + b + c = 1160$ $0.1a + 0.2b + 0.3c = 258$ <u>Nota:</u> Terima apa-apa pemboleh ubah yang digunakan. Hapuskan atau gantikan mana-mana satu pemboleh ubah: $b = 1160 - 3a$ atau $-0.1a + 0.1c = 26$ atau setara Hapuskan atau gantikan ke dalam mana-mana persamaan: $0.1a + 0.2(1160 - 3a) + 0.3(2a) = 258$ <i>atau</i> $-0.1a + 0.1(2a) = 26$ Selesaikan, dapat nilai satu pemboleh ubah: $a = 260$ Ganti masuk nilai pemboleh ubah ke dalam persamaan: $b = 1160 - 3(260)$ $= 380$ <i>atau</i> $c = 2(260)$ $= 520$ Pernyataan: Harga sewa bagi unit kondominium jenis A ialah RM260, unit kondominium jenis B ialah RM380 dan unit kondominium jenis C ialah RM520.	P1 P1 K1 K1 N1 N1 N1	7
4	a) Pertimbangkan, $S_n = \frac{a(1-r^n)}{1-r}$, $ r < 1$ Apabila $n \rightarrow \infty$, oleh itu/ hence $(1 - r^n) \rightarrow 1$ Maka, $S_\infty = \frac{a}{1-r}$, $ r < 1$ b) $r = \frac{67.2}{70} = 0.96$ $a = 20 \left(\frac{70 \times \pi}{180} \right)$ $= 24.44 \text{ cm}$ $S_\infty = \frac{24.44}{1-0.96}$ $= 611 \text{ cm}$ Tidak, jumlah jarak tidak melebihi jarak 700 cm apabila ia berhenti	K1 N1 N1 N1 N1 N1	7

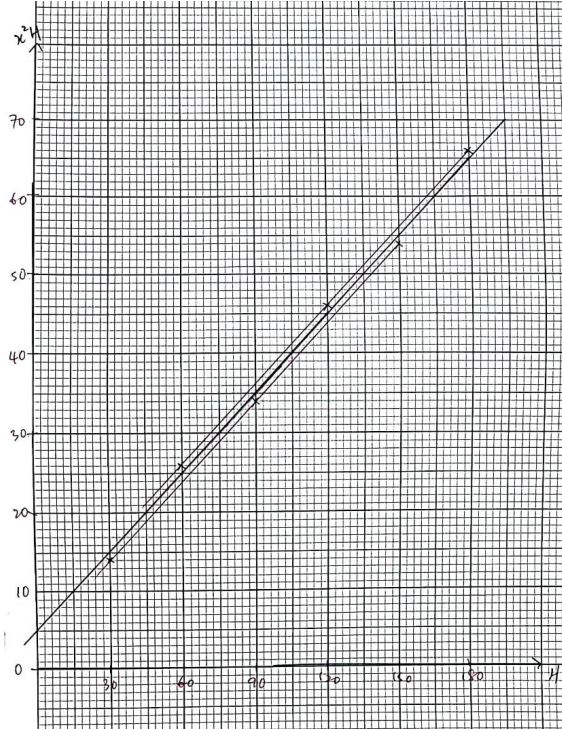
5	a) $y - 3 = -\frac{1}{2}(x - 0)$ $y = -\frac{1}{2}x + 3$ $y = 2x - 2$ Selesaikan persamaan $-\frac{1}{2}x + 3 = 2x - 2$ Titik tengah BD = (2, 2) $\frac{p+0}{2} = 2, \frac{q+3}{2} = 2$ $p = 4$ dan $q = 1$	K1 N1	
	b) Guna titik tengah (2, 2) $\frac{x+(-1)}{2} = 2$ dan $\frac{y+(-4)}{2} = 2$ Koordinat C = (5, 8) $= \frac{1}{2} [-1(3) + 0(8) + 5(1) + 4(-4)] - [-4(0) + 3(5) + 8(4) + 1(-1)] $ $= 30$	K1 N1	
6	a) $\cos 2x = \cos^2 x - \sin^2 x$ $= (1 - \sin^2 x) - \sin^2 x$ $= 1 - 2\sin^2 x$ (proven) OR $= (\sin^2 x + \cos^2 x) - 2\sin^2 x$ $= \cos^2 x - \sin^2 x$ $= \cos 2x$ (proven)	K1 N1	6
	b) i) $y = \cos 2x$ ii) 	P1 P1 P1 N1	
	Shape graph reflected on the x-axis number of solutions : 4		

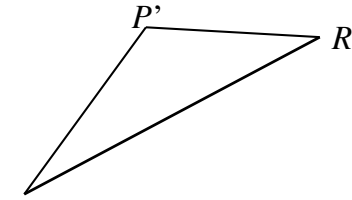
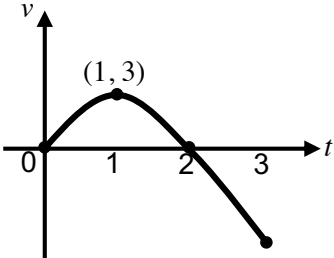
7	a) $\pi r^2 h = 81\pi$ $L = \pi r(2r) + 2\pi r\left(\frac{81}{r^2}\right) + \pi r^2$ $L = 3\pi\left(r^2 + \frac{54}{r}\right)$	K1 K1 N1	10
	b) Bezakan L terhadap r $\frac{dL}{dr} = 3\pi\left(2r - \frac{54}{r^2}\right)$ Samakan $\frac{dL}{dr}$ dengan 0 & Selesaikan untuk r $3\pi\left(2r - \frac{54}{r^2}\right) = 0$ 81π	K1 K1 N1	
	c) $\frac{dr}{dt} = \frac{1}{3\pi\left(2(6) - \frac{54}{(6)^2}\right)} \times 63\pi$ 2	K1 N1	
	d) $\frac{dL}{dr} = (6.002 - 6) \times \frac{63}{2}\pi$ 0.063π	K1 N1	
8	a) i) $\hat{r} = \frac{15\mathbf{i}+3\mathbf{j}}{\sqrt{15^2+3^2}}$ $\hat{r} = \frac{15\mathbf{i}+3\mathbf{j}}{\sqrt{234}}$	K1 N1	10
	b) i) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ $\overrightarrow{AO} = 10\mathbf{i} - 6\mathbf{j}$ $\overrightarrow{AO} // \overrightarrow{BC}$, then $\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC}$ $\overrightarrow{OC} = 5\mathbf{i} + 9\mathbf{j} + 10\mathbf{i} - 6\mathbf{j}$ $\overrightarrow{OC} = 15\mathbf{i} + 3\mathbf{j}$ Coordinate C = (15,3)	K1 K1 K1 N1	
	ii) $\overrightarrow{AB} = \mu \overrightarrow{BD}$ $15\mathbf{i} + 3\mathbf{j} = \mu[h\mathbf{i} + (k-2)\mathbf{j}]$ $15 = \mu h \quad 3 = \mu(k-2)$ Selesaikan persamaan serentak. $\frac{15}{h} = \frac{3}{k-2}$	P1 K1 K1	
	$k = \frac{h+10}{5}$	N1	

9	a) $1 - P(X = 7) - P(X = 8)$ $= 1 - {}^8C_7(0.85)^7(0.15)^1 - {}^8C_8(0.85)^8(0.15)^0$ $= 1 - 0.3847 - 0.2725$ $= 0.3428$	K1 K1 N1	10
	b) i) $P(\frac{52-55}{7.5} < Z < \frac{72-55}{7.5})$ $= P(-0.400 < Z < 2.267)$ $= 0.6437$ $\frac{258}{N} = 0.6437$ $N = 401$	K1 K1 N1	
	ii) $P(Z > \frac{m-55}{7.5}) = 0.9812$ $z = -2.08$ $-2.08 = \frac{m-55}{7.5}$ $m = 39.4, \text{ markah lulus} = 40$	K1 K1 K1 N1	

10	a) i) Gantikan $x = 2$ ke dalam $\frac{dy}{dx}$ & Samakan $\frac{dy}{dx}$ dengan 0 	K1	10
	$p = -1$ Kamirkan $\int (-x + 2) dx$ & Gantikan $x = 2$ dan $y = 8$ ke dalam kamiran 	K1	
	$8 = -\frac{(2)^2}{2} + 2(2) + c$ $c = 6$ $y = -\frac{x^2}{2} + 2x + 6$	N1	
	ii) Kamirkan $\int \left(-\frac{x^2}{2} + 2x + 6\right) dx$ 	K1	
	$2 \int_0^2 \left(-\frac{x^2}{2} + 2x + 6\right) dx$		
	$2 \left[\left(-\frac{(2)^3}{6} + (2)^2 + 6(2)\right) - \left(-\frac{(0)^3}{6} + (0)^2 + 6(0)\right) \right]$	K1	
	$\frac{88}{3} \times 30$ 880	N1	
	Atau Kamirkan $\int \left(-\frac{x^2}{2} + 2x + 6\right) dx$ 	K1	
	$\int_0^4 \left(-\frac{x^2}{2} + 2x + 6\right) dx$		
	$\left(-\frac{(4)^3}{6} + (4)^2 + 6(4)\right) - \left(-\frac{(0)^3}{6} + (0)^2 + 6(0)\right)$	K1	
	$\frac{88}{3} \times 30$ 880	N1	

b) Kamirkan $\pi \int (\sqrt{x + 6})^2 dx$ @ cari isipadu kon $\left(V_1 = \pi \left[\frac{x^2}{2} + 6x \right] \text{ @ } V_2 = \frac{1}{3} \pi (3)^2 (k - 3) \right)$ Guna had $\int_3^k$ ke dalam V_1 $\left(V_1 = \pi \left[\left(\frac{(k)^2}{2} + 6(k) \right) - \left(\frac{(3)^2}{2} + 6(3) \right) \right] \right)$ Samakan $*V_1 - *V_2$ ($V_1 > V_2$) dengan $42 \frac{1}{2} \pi$ $\pi \left[\left(\frac{(k)^2}{2} + 6(k) \right) - \left(\frac{(3)^2}{2} + 6(3) \right) \right] - \frac{1}{3} \pi (3)^2 (k - 3) = 42 \frac{1}{2} \pi$ $k = 8$	K1 K1 K1 N1	
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11	H	30	60	90	120	150	180	N1		
	x^2H	14	26	34	46	54	66			
a)									K1	10
										
Paksi dilukis dengan betul dan skala seragam, sekurang-kurangnya 1 titik plot betul dengan menggunakan data yang diberi dalam soalan saja.										
6 titik diplot dengan betul									N1	
Garis lurus penyuaian terbaik, sekurang-kurangnya 5 titik diplot betul									N1	
b) $x^2H = \frac{a}{2}H + \frac{b}{2}$									P1	
$m = \frac{a}{2}, \quad c = \frac{b}{2}$									K1K1	
Dari graf;										
$\frac{a}{2} = \frac{1}{3} \quad \frac{b}{2} = 5$									N1N1	
$a = \frac{2}{3} \quad b = 10$										
c) Dari graf; $x^2H = 20$ $x = 0.6667$									N1	

12	a) i) $PR^2 = 8^2 + 17^2 - 2(8)(17)\cos 118^\circ$ 21.92 ii) $\frac{8}{\sin \angle PRQ} = \frac{21.92}{\sin 118^\circ} \text{ or } \frac{\sin \angle PRQ}{8} = \frac{\sin 118^\circ}{21.92}$ 18.80° iii) $\frac{1}{2}(8)(17)\sin 118^\circ \text{ or } \sqrt{27.46(27.46 - 21.92)(27.46 - 13)(27.46 - 20)}$ $\frac{1}{2}(8)(17)\sin 118^\circ + \sqrt{27.46(27.46 - 21.92)(27.46 - 13)(27.46 - 20)}$ or 60.04 + 128.10 or equivalent 188.14	K1 N1 K1 N1 K1 K1 N1	10
	b) i)  Nota: S 1. $\angle S'P'R'$ adalah sudut cakak 2. Sisi-sisi dilakarkan dengan pembaris ii) 115.96	 N1 N1 N1	
13	a) $0 = a(2) - b(2)^2 \quad @ \quad s = \frac{at^2}{2} - \frac{bt^3}{3} \quad @ \quad 4 = \frac{a(2)^2}{2} - \frac{b(2)^3}{3}$ Selesaikan secara serentak $a = 6$ $b = 3$	K1 K1 N1 N1	10
	b) i) $3t^2 - t^3 = 0$ $t = 3$ ii) $6 - 6t = 0$  # bentuk # titik pusingan & 1 titik di kiri atau kanan bentuk iii) $s = 3(0)^2 - (0)^3 = 0 \text{ atau } s = 3(2)^2 - (2)^3 = 4$ atau $s = 3(3)^2 - (3)^3 = 0$ Jarak = 4 + 4 8	 K1 N1 K1 N1 N1 K1 K1 N1	

14	a) $x = \frac{9.00}{6.00} \times 100$ $160 = \frac{y}{3.00} \times 100$ $115 = \frac{8.20}{z} \times 100$ $x = 150$ $y = 4.80$ $z = 7.13$	N1 N1 N1	10
	b) $\bar{I} = \frac{114(300)+150(120)+160(80)+115(500)}{300+120+80+500}$ 122.5	K1 N1	
	c) Anggapkan pemberat = 100 Nota: Terima apa-apa nombor pemberat asalkan nombor yang sama $\bar{I} = \frac{114(100)+150(100)+160(100)+115(100)}{100+100+100+100}$ $\bar{I} = 134.50$ Indeks harga dengan pemberat yang sama lebih tinggi daripada dengan pemberat berbeza	K1 N1 N1	
	d) $120 = \frac{P_{2023}}{40.00} \times 100$ $P_{2023} = 48.00$	K1 N1	

15	a) $x \geq 2y$ or $2y \leq x$ or $y \leq \frac{1}{2}x$ $8x + 5y \leq 5600$ $12x + 9y \geq 4500$ or $4x + 3y \geq 1500$ or equivalent	N1 N1 N1	10
	b) 		
	Lukis dengan betul sekurang-kurangnya satu garis lurus dari ketaksamaan yang melibatkan x dan y	K1	
	Lukis dengan betul SEMUA garis lurus dari ketaksamaan yang melibatkan x dan/atau y	N1	
	Rantau R dilorek dengan betul	N1	
	c) i) 700 ii) $y = 200, x = 400$ keuntungan minimum = $4(400) + 4(200)$ = RM2400	N1 N1 K1 N1	



KIT GEMPUR SPM MATEMATIK TAMBAHAN

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MATEMATIK TAMBAHAN

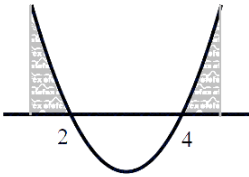
Kertas 1

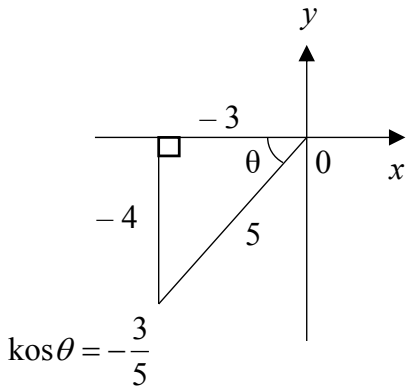
PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN
KERTAS 1

UNTUK KEGUNAAN PEMERIKSA SAHAJA

Peraturan Pemarkahan ini mengandungi 8 halaman bercetak.

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
1(a)	$36 = p(3)^2 + q(3) \quad @ \quad 4 = p(1)^2 + q(1)$ $p = 4 \quad \text{dan} \quad q = 0$	K1 N1	2	4
(b)	$\frac{y}{x} = px + q \text{ dan } = 4(2)$ $k = 8 \quad \text{dan} \quad h = 3$	K1 N1	2	
2(a)	$1.6 - x$	N1	1	5
(b)	$x^2 + (1.6 - x)^2 = 1.4^2$ $x = \frac{-(-3.2) \pm \sqrt{(-3.2)^2 - 4(2)(0.6)}}{2(2)} \quad @$ $x = \frac{-(-16) \pm \sqrt{(-16)^2 - 4(10)(3)}}{2(10)} \quad @ \text{ setara}$ $x = 0.2169, x = 1.3831$	P1 K1 N1	3	
(c)	$(0, -0.2169) \text{ and } (0, -1.3831)$	N1	1	
3(a)	$f(x) = x^2 - 2px + \left(\frac{-2p}{2}\right)^2 - \left(\frac{-2p}{2}\right)^2 + 8$ $= (x - p)^2 + 8 - p^2$ $8 - p^2 = -1$ $p = 3, -3 \text{ dan } q = 3$	K1 K1 N1	3	5
(b)	$f(x) = x^2 - 6x + 8$ $x^2 - 6x + 8 > 0$ $(x - 4)(x - 2) > 0$  $x < 4, x > 2$	 K1 N1	2	

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
4(a)	$f(x) = x^2 - 8x + \left(-\frac{8}{2}\right)^2 - \left(\frac{8}{2}\right)^2 + 15$ $q = 4$	K1 N1	2	4
	(b) $f^{-1}(3) = m$ or $f(m) = 3$ $m = 2$	K1 N1	2	
5(a)	(i) $y = \frac{4x - 7}{5x - r}$ $k^{-1}(x) = \frac{xr - 7}{5x - 4}, x \neq \frac{4}{5}$	K1 N1	 2	5
	(ii) $m = 1$	N1	1	
	(b) $\frac{4x - 7}{5x - r} = \frac{xr - 7}{5x - 4}$ $s = \frac{4}{5}$	K1 N1	 2	
6(a)	Menggunakan teorem Pythagoras,  $\text{kos } \theta = -\frac{3}{5}$	K1 N1	 2	3
(b)	$\tan \theta = \frac{-4}{-3} = \frac{4}{3}$	N1	1	

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
7(a)	$\vec{AB} = \vec{AO} + \vec{OB}$ $-12\hat{i} + 6\hat{j}$	K1 N1	2	6
(b)	$\vec{AP} = -16\hat{i} + 8\hat{j}$ $\vec{OP} = -6\hat{i} + 6\hat{j}$ $\frac{-\hat{i} + \hat{j}}{\sqrt{2}}$	K1 N1 N1	3	
(c)	$\frac{-3\hat{i} + 3\hat{j}}{\sqrt{2}}$	N1	1	
8(a)	$15.71 = 30\theta$ $\theta = 0.5237$	K1 N1	2	7
(b)	$(44)(0.5237)^*$ $23.04 \text{ (} 23.03 \leftrightarrow 23.05 \text{)}$	K1 N1	2	
(c)	$\frac{1}{2}(0.5237)^* (15)^2$ atau/or $\frac{1}{2}(0.5237)^* (30)^2$ $\frac{1}{2}(0.5237)^* (30)^2 - \frac{1}{2}(0.5237)^* (15)^2$ $176.75 \text{ (} 176.7 \leftrightarrow 177 \text{)}$ $\text{RM } 2209.38 \text{ (} 2208.8 \leftrightarrow 2212.5 \text{)}$	K1 K1 N1	3	
9(a)	$g'(x) = \frac{(3-2x)(1) - (x+3)(-2)}{(3-2x)^2}$ $g'(x) = \frac{9}{(3-2x)^2}$	K1 N1	2	
(b)	$g'(2) = \frac{9}{[3-2(2)]^2}$ dan $m_2 = -\frac{1}{9}$	K1		

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
	$g(2) = \frac{2 + 3}{3 - 2(2)}$ Persamaan Normal, $y - (-5) = -\frac{1}{9}(x - 2)$ $y = -\frac{1}{9}x - \frac{43}{9}$	K1 K1 N1	 4	 6
10(a)	(i) -40 (ii) $3\int_1^3 g(x)dx + [2x]_1^3$ $3(8) + [2(3) - 2(1)]$ 28	N1 K1 N1	 3	
10(b)	$2\left[\frac{3x^2}{2x+1}\right]_0^2$ $2\left[\frac{3(2)^2}{2(2)+1} - \frac{3(0)^2}{2(0)+1}\right]$ $\frac{24}{5}$	P1 K1 N1	 3	
11(a)(i)	105	N1		
(ii)	${}^{15}C_2 - {}^3C_2$ 102	K1 N1	3	
(b)(i)	${}^2P_1 \times {}^6P_4 \times {}^4P_1$ 2880	K1 N1		7
(ii)	${}^3P_1 \times {}^7P_5$ 7560	K1 N1	4	

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
12(a)	Peristiwa A: Pemboleh ubah rawak diskret kerana kehadiran murid dapat dibilang. Peristiwa B: Pemboleh ubah rawak selanjar kerana ketinggian murid bukan integer tetapi dapat diukur.	N1 N1	 2	6
(b)(i)	5	N1	1	
(ii)	$\frac{8-5}{\sigma} = 0.479$ $1 - P\left(z < \frac{2-5}{6.263}\right) - P\left(z > \frac{7-5}{6.263}\right)$ 0.3091	K1 K1 N1	 3	
13(a)	$4(8^x) = 2^y$ $2^{2+3x} = 2^y$ $2 + 3x = y$ $\log_5 \frac{y}{x-2} = \log_5 5$ $\frac{y}{x-2} = 5$ Selesaikan $2x = 12$ $x = 6$ dan $y = 20$	K1 K1 K1 N1	 4	8
b(i)	$\frac{2^n}{5} = 1250^n$ $n \log_{10} 2 - \log_{10} 5 = n \log_{10} 1250$ $n = -\frac{1}{4}$	K1 N1	 2	
(ii)	$(\sqrt{5} - 3)^2 = 5 + 9 - 6\sqrt{5}$ $b\sqrt{c} + a = 14 - 6\sqrt{5} = -6\sqrt{5} + 14$ $b = -6, a = 14, c = 5$	K1 N1	 2	

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
14(a)	$S_n = a + ar + ar^2 + + ar^{n-1} @$ $rS_n = ar + ar^2 + ar^3 + + ar^n$ $rS_n - S_n = (ar + ar^2 + ar^3 + ... + ar^n) -$ $(a + ar + ar^2 + + ar^{n-1})$ $S_n (r - 1) = ar^n - a$ $S_n = \frac{a(r^n - 1)}{r - 1}$	K1 K1 N1	 3	8
(b)(i)	$ar^2 + ar^3 = 20 @ ar^3 + ar^4 = -10$ $ar^2(1 + r) = 20 @ ar^3(1 + r) = -10$ $r = -\frac{1}{2}$ $a = 160$	K1 N1 N1	 3	
(b)(ii)	$\frac{160}{1 - (-\frac{1}{2})}$ $\frac{320}{2}$	K1 N1	 2	
15(a)	$3\cos 2\theta = 8\sin \theta - 5$ $3(1 - 2\sin^2 \theta) = 8\sin \theta - 5$ $3\sin^2 \theta + 4\sin \theta - 4 = 0$ $(3\sin \theta - 2)(\sin \theta + 2) = 0$ $\theta = 41.81^\circ$ (sudut rujukan) $\theta = 41.81^0, 138.19^0$	K1 K1 N1 N1	 4	2
(b)(i)	$\sec 2\theta = \frac{1}{2(-p)^2 - 1}$ $\sec 2\theta = \frac{1}{2p^2 - 1}$	K1 N1	 2	

No	Peraturan Pemarkahan	Sub Markah	Markah	Jumlah Markah
(b)(ii)	$\tan(45^{\circ} - \theta) = \frac{1 - \left(\frac{-q}{p}\right)}{1 + (1)\left(\frac{-q}{p}\right)}$ $\tan(45^{\circ} - \theta) = \frac{p + q}{p - q}$	K1	2	8
		N1		

PERATURAN PEMARKAHAN TAMAT



KIT GEMPUR SPM MATEMATIK TAMBAHAN

2023

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MATEMATIK TAMBAHAN

Kertas 2

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN
KERTAS 2

UNTUK KEGUNAAN PEMERIKSA SAHAJA

No soal		Peraturan markah	Markah	Jumlah markah
1	(a)	$3a + 6b + 5c = 176$ $4a + 4b + 7c = 181$ [betul 3 dapat P2, P1, P0] $5a + 7b + 2c = 207$ Menghilangkan satu anu $12b - c = 161$ $316b = 4424$ selesaikan $b = 14$ $a = 19$ $c = 7$	P2 K1 K1 N1 N1 N1	7
2	(a)	$\left(\frac{m}{36}\right)^{\frac{1}{2}} \times \sqrt{m} = 5$ $\left(\frac{m}{6^2}\right)^{\frac{1}{2}} \times \sqrt{m} = 5$ $\frac{\sqrt{m}}{6} \times \sqrt{m} = 5$ $m = 6 \times 5$ $m = 30$	K1 N1	6
	(b)	$\log_3(x+1) + 2 \log_3 x - 6 \log_9 x$ $\log_3(x+1)x^2 - 6 \log_9 x$ $\log_3(x+1)x^2 - 6 \frac{\log_3 x}{\log_3 3^2}$ $\log_3(x+1)x^2 - \log_3 x^3$ $\log_3 \frac{(x+1)x^2}{x^3}$ $\log_3 \frac{(x+1)}{x}$	K1 K1 K1 N1	

3	(a)	$\vec{QR} = \vec{QP} + \vec{PR}$ atau $\vec{QT} = \vec{QR} + \vec{RT}$	K1	8
	(i)	$\vec{QR} = -8\hat{x} + 10\hat{y}$	N1	
	(ii)	$\vec{QT} = -8\hat{x} + 6\hat{y}$	N1	
	(b)	$\vec{QS} = \vec{QP} + \vec{PS}$		
	(i)	$= -8\hat{x} + n \left(\vec{PU} \right)$ $= -8\hat{x} + n \left(\vec{PQ} + \vec{QU} \right)$ $= -8\hat{x} + n \left[8\hat{x} + \frac{1}{3}(-8\hat{x} + 10\hat{y}) \right]$ $= -8\hat{x} + \frac{16}{3}n\hat{x} + \frac{10}{3}n\hat{y}$ $\vec{QS} = \left(\frac{16}{3}n - 8 \right)\hat{x} + \frac{10}{3}n\hat{y}$	K1	
	(ii)	$\left(\frac{16}{3}n - 8 \right)\hat{x} + \frac{10}{3}n\hat{y} = \lambda [-8\hat{x} + 6\hat{y}] \text{ atau setara}$ $\frac{16}{3}n - 8 = -8\lambda \text{ dan } \frac{10}{3}n = 6\lambda$ $n = \frac{9}{11}$	N1	
4	(a)	$x = m, x = \frac{1}{2}$ $(x - m)(2x - 1) = 0$ $2x^2 - x - 2mx + m = 0$ $2x^2 - (1 + 2m)x + m = 0$ $n = -(1 + 2m)$ $n = -1 - 2m$	K1	7
			N1	

	(b)	Halaju Feri = x $\frac{\text{Jarak}}{\text{laju}} = \text{masa}$ $\frac{24}{x+3} + \frac{24}{x-3} = 6$ $24(x-3) + 24(x+3) = 6(x-3)(x+3)$ $24x - 72 + 24x + 72 = 6x^2 - 54$ $6x^2 - 48x - 54 = 0$ $6(x-9)(x+1) = 0$ $x = 9, x = -1$ (<i>abaikan</i>)	K1 K1 K1 K1 N1	
5	(a)	LHS $\sin\left(\frac{3}{2}\theta + \frac{\pi}{6}\right) - \sin\left(\frac{3}{2}\theta - \frac{\pi}{6}\right)$ $\sin\frac{3}{2}\theta\cos\frac{\pi}{6} + \cos\frac{3}{2}\theta\sin\frac{\pi}{6} - \left[\sin\frac{3}{2}\theta\cos\frac{\pi}{6} - \cos\frac{3}{2}\theta\sin\frac{\pi}{6}\right]$ $\sin\frac{3}{2}\theta\cos\frac{\pi}{6} + \cos\frac{3}{2}\theta\sin\frac{\pi}{6} - \sin\frac{3}{2}\theta\cos\frac{\pi}{6} + \cos\frac{3}{2}\theta\sin\frac{\pi}{6}$ $\sin\frac{3}{2}\theta\left(\frac{\sqrt{3}}{2}\right) + \cos\frac{3}{2}\theta\left(\frac{1}{2}\right) - \sin\frac{3}{2}\theta\left(\frac{\sqrt{3}}{2}\right) + \cos\frac{3}{2}\theta\left(\frac{1}{2}\right)$ $\sin\frac{3}{2}\theta\left(\frac{\sqrt{3}}{2}\right) + \cos\frac{3}{2}\theta\left(\frac{1}{2}\right) - \sin\frac{3}{2}\theta\left(\frac{\sqrt{3}}{2}\right) + \cos\frac{3}{2}\theta\left(\frac{1}{2}\right)$ $\left(\frac{1}{2}\right)\cos\frac{3}{2}\theta + \left(\frac{1}{2}\right)\cos\frac{3}{2}\theta$ $\cos\frac{3}{2}\theta = \text{RHS (terbukti)}$	K1 K1 N1	7

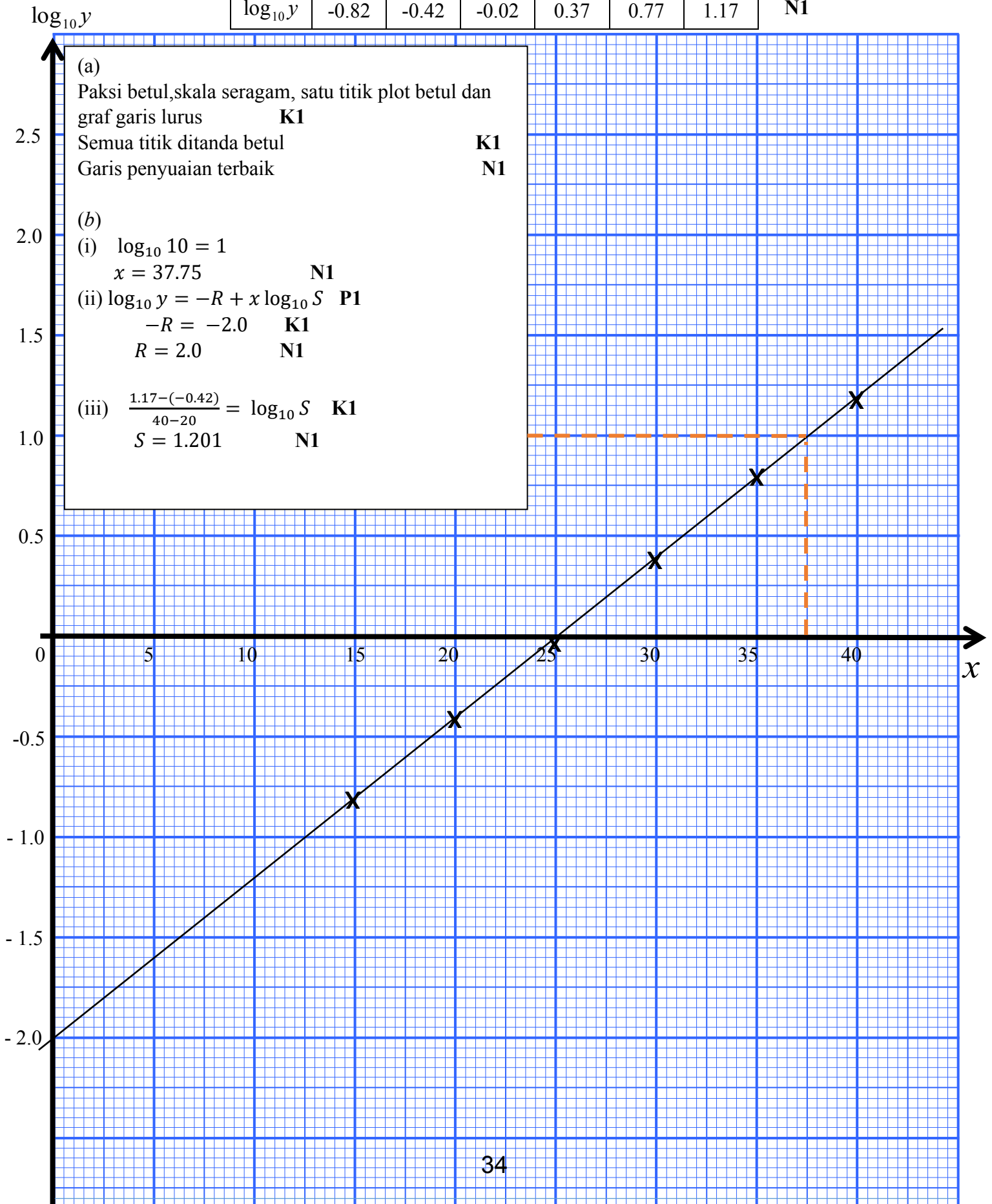
7	(a)	Kamirkan $6x$ $y = 3x^2 + c$ Gantikan (1,6) $6 = 3(1)^2 + c$ $c = 6 - 3$ $y = 3x^2 + 3$	K1	8
	(b)	Kamirkan $x = \sqrt{\frac{y-3}{3}}$ dan guna had $\int_3^6 \left(\sqrt{\frac{y-3}{3}} \right) dy$ $= \left[2 \left(\frac{1}{3} y - 1 \right)^{\frac{3}{2}} \right]_3^6$ $= 2 \left[\frac{1}{3} (6) - 1 \right]^{\frac{3}{2}} - 2 \left[\frac{1}{3} (3) - 1 \right]^{\frac{3}{2}}$ $= 2$	K1 N1	
	(c)	Kamirkan $\pi \int \frac{y-3}{3} dy$ $\pi \left[\frac{y^2}{6} - y \right]$ Guna had $\pi \left[\frac{y^2}{6} - y \right]_3^6$ $\left(0 + \frac{9}{6} \right) \pi$ $\frac{3}{2} \pi$ atau/or 1.5π	K1 K1 N1	

8	(a)	$m_{pq} = \frac{1}{3}$ $\frac{k-8}{h-6} \times \frac{1}{3} = -1$ $k = 26 - 3h$	K1 K1 N1	10
	(b)	$\frac{1}{2} [0(k) + h(8) + 6(6)] - [h(6) + 6(k) + 0(8)] $ $h - 3k + 18$	K1 N1	
	(c)	$h + 18 - 3k = \frac{60}{2}$ $h = 9$ or $k = -1$ $R(9, -1)$	K1 K1 N1	
	(d)	$m_{PR} = \frac{6-(-1)}{0-9}$ or equivalent $\frac{x}{54} + \frac{y}{6} = 1$	K1 N1	

NO. 9

x	15	20	25	30	35	40
$\log_{10} y$	-0.82	-0.42	-0.02	0.37	0.77	1.17

N1

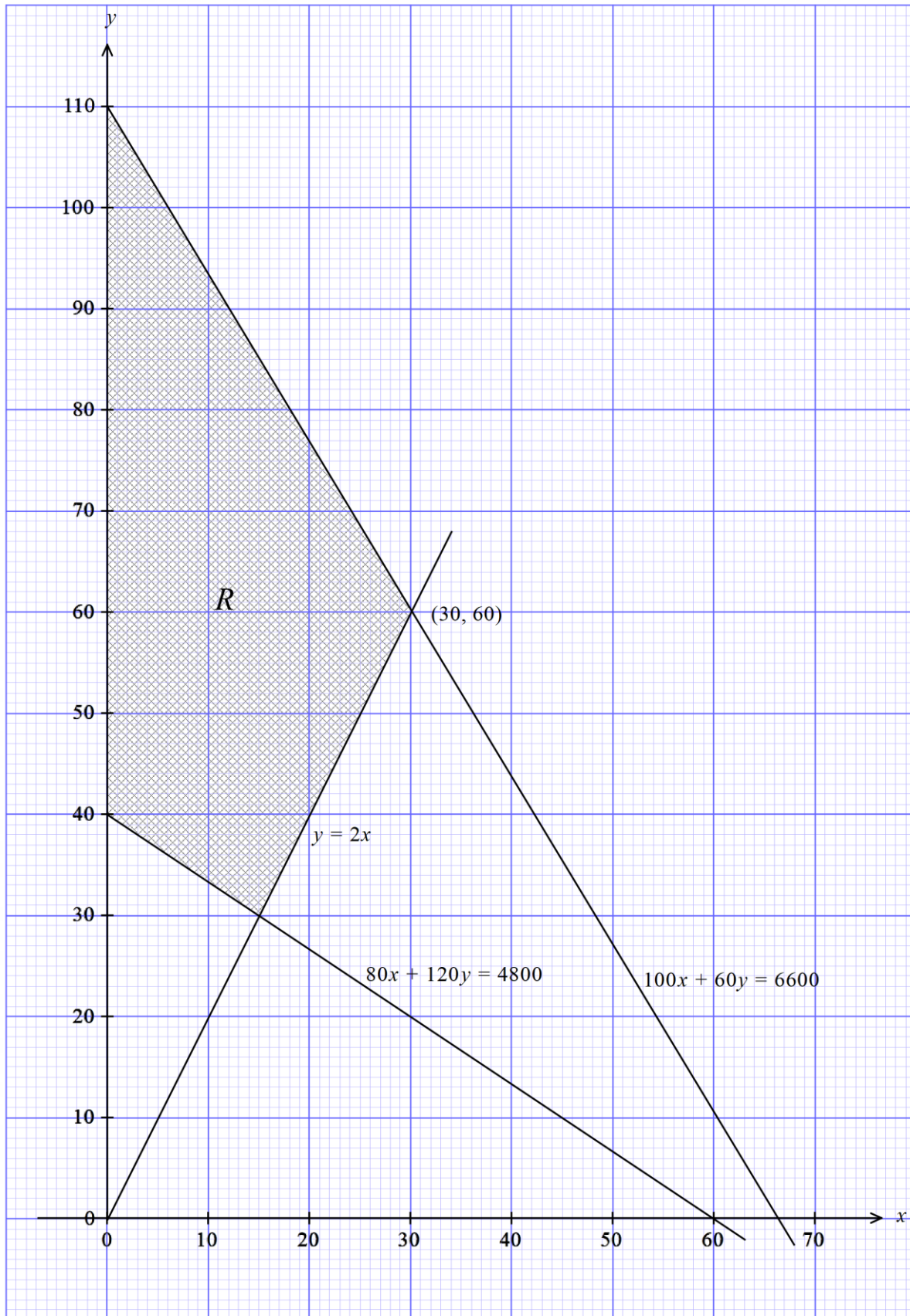


10	(a)	$(15 - h)^2 + r^2 = 15^2$	K1	10
	(i)	$15^2 - 30h + h^2 + r^2 = 15^2$ $r^2 = 30h - h^2$	N1	
	(ii)	$L = \pi(30h - h^2)$ $L = 30\pi h - \pi h^2$	N1	
	(b)	$\frac{dL}{dh} = 30\pi - 2\pi h$ $h = 3, \frac{dL}{dh} = 30\pi - 2\pi(3)$ $\frac{dL}{dh} = 24\pi$ $\frac{dL}{dt} = \frac{dL}{dh} \times \frac{dh}{dt}$ $= 24\pi \times 0.5$ $= 12\pi$	K1 K1 N1	
11	(c)	$\delta L = \frac{dL}{dh} \times \delta h$ $= 24\pi \times k$ $= 24\pi k$ $h = 3, L = 30\pi(3) - \pi(3)^2$ $= 81\pi$ $L_2 = L + \delta L$ $= 81\pi + 24\pi k$	K1 K1 K1 N1	10
	(a)	$P(X = 6) = {}^6C_6(p)^6(1-p)^0$ atau $P(X = 6) = {}^6C_6(p)^6(q)^0$	K1	
	(i)	${}^6C_6(p)^6(1-p)^0 = 0.046656$ $p = 0.6$	N1	
	(ii)	$P(X > 4) = P(X = 5) + P(X = 6)$ $= {}^6C_5(0.6)^5(0.4)^1 + {}^6C_6(0.6)^6(0.4)^0$ $= 0.2333$	K1 K1 N1	
	(b)	$\mu = 2$ dan $\sigma = 0.8$		10
	(i)	$P(X > 1) = P\left(Z > \frac{1-2}{0.8}\right)$ or $P(Z > -1.25)$ $= 0.8944$	K1 N1	
	(ii)	$P(X < k) = 0.68$ atau $P(X > k) = 0.32$ $\frac{k-2}{8} = 0.468$ $k = 2.374$	K1 K1 N1	

12	(a)	$\frac{100x + 120y}{x + y} = \frac{340}{3}$ $y = 2x$ $\frac{100x + 80z}{x + z} = \frac{165}{2}$ $z = 7x$ $x : y : z = x : 2x : 7x$ $x : y : z = 1 : 2 : 7$	K1	10
			K1	
			N1	
	(b)	$\bar{I} = \frac{100(1) + 120(2) + 80(7)}{1 + 2 + 7}$ $\bar{I} = 90$	P1 K1	
13	(c)	$\frac{450.00}{Q_{2001}} \times 100 = 90$ $Q_{2001} = RM\ 500.00$	K1	10
			N1	
	(d)	$\frac{12\ 000.00}{Q_{2006}} \times 100 = 110$ $Q_{2006} = RM\ 10\ 909.09$	K1	
			N1	
13	(a)	$\frac{\sin \theta}{11} = \frac{\sin 52}{9.3}$ $\theta = 68.76$	K1	10
			K1	
		$\frac{VW}{\sin 59.24} = \frac{9.3}{\sin 52}$ $VW = 10.14$	N1	
	(b)	$x = \sqrt{10.14^2 - 3.75^2} = 9.421$ $y = \sqrt{9.3^2 - 3.75^2} = 8.510$ $11^2 = 8.510^2 + 9.421^2 - 2(8.510)(9.421)\cos \theta$ $\theta = 75.48$	K1	
13			K1	10
			K1	
			K1	
			N1	

	(c)	$\frac{1}{2}(9.421)(8.510)\sin 75.48$ $= 38.81$ $\frac{1}{2}(11)(h) = 38.81$ $h = 7.056$	K1 K1 N1	
14	(a)	$a_P = 4t - 13$ atau $a_Q = -2$ Zarah Q kerana $a_Q = -2$	K1 N1	10
	(b)	$(2t - 3)(t - 5) < 0$ dan $-2t + 8 < 0$ $4 < t < 5$	K1 N1	
	(c)	$S_P = \frac{2}{3}t^3 - \frac{13}{2}t^2 + 15t + c$ Apabila $t = 0$ dan $S_P = -8$ oleh itu, $-8 = \frac{2}{3}(0)^3 - \frac{13}{2}(0)^2 + 15(0) + c$ $c = -8$ Apabila $t = 4$ $S_P = \frac{2}{3}(4)^3 - \frac{13}{2}(4)^2 + 15(4) - 8$ $S_P = -\frac{28}{3}$	K1 K1 N1	
	(d)	$2\left[\frac{1}{2}(4)(8)\right]$ atau setara 32	K1 N1	

15	(a)	$100x + 60y \leq 6600$ $80x + 120y \geq 4800$ $y \geq 2x$ atau yang setara/or equivalent	N1 N1 N1	10
	(b)	Refer graph Drawing correctly at least one straight line from *inequality which involves x and y All three *straight lines are correct. Note: Accept dotted lines Region shaded correctly	K1 N1 N1	
	(c) (i)	$30 \leq y \leq 85$	N1	
	(c) (ii)	(30, 60) Use $50x + 25y$ for any point in the *shaded region $50(30) + 25(60)$ 3000	N1 K1 N1	





MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM) CAWANGAN KELANTAN

MODUL KOLEKSI ITEM PERCUBAAN SPM 2023

MATEMATIK TAMBAHAN KERTAS 1

UNTUK KEGUNAAN PEMERIKSA SAHAJA

SKEMA PEMARKAHAN

PERATURAN PEMARKAHAN PEPERIKSAAN PERCUBAAN TAHUN 2023

MATEMATIK TAMBAHAN (3472/1)

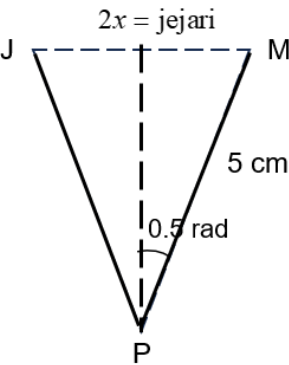
KERTAS 1

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
1	$0 = 2(-5)^2 + k(-5)$ $k = 10$ $\frac{y}{x} = 2x + k$ $-6 = 2p + 10$ or $q = 2(-2) + 10$ $p = -8$ dan $q = 6$	K1 N1 K1 K1 N1	5
2 (a)	$5p - 4 = -19$ atau setara ATAU $ 5x - 4 = 0$ $p = -3$ $q = \frac{4}{5}$	K1 N1 N1	5
2 (b)	$-(5x - 4) = 4$ atau setara $-3 \leq x \leq 0$	K1 N1	
3 (a)	$\cos \theta = h$ $h = 1 - 2 \sin^2 \frac{\theta}{2}$ $\frac{1-h}{2}$	P1 K1 N1	6
3 (b)	$8 \sin^2 x - \sin x - 7 = 0$ $\sin x = -\frac{7}{8}$ dan $\sin x = 1$ $x = 90^\circ, 241.04^\circ, 298.96^\circ$	K1 K1 N1	
4 (a)	$T_7 = a + (7-1)\left(\frac{1}{2}\right) = 13$ $a = 10$	K1 N1	

4 (b)	$S_n = \frac{10(1 - (\frac{1}{2})^n)}{1 - \frac{1}{2}} \text{ atau } T_{11} = 15$ $S_n = \frac{10(1 - (\frac{1}{2})^n)}{1 - \frac{1}{2}} = 15$ $\left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^2 \text{ or } n \log_{10} 0.5 = \log_{10} 0.25$ $n = 2$	K1 K1 K1 N1	6
5 (a)	$27^{y+1} + 27^y \text{ atau } 3^{3y+3} + 3^{3y} \text{ atau } (27+1)27^y$ $a = 28 \text{ dan } b = 27$	K1 N1	5
5 (b)	$\frac{\log_p(3-x)}{\log_p \sqrt{p}}$ $5 + x^2 = (3-x)^2$ $x = \frac{2}{3}$	P1 K1 N1	
6 (a)	$1000x - x = 168$ $x = \frac{56}{333}$	K1 N1	5
6 (b)	$\frac{\sqrt{6}}{\sqrt{12}-\sqrt{5}} \times \frac{\sqrt{12}+\sqrt{5}}{\sqrt{12}+\sqrt{5}}$ $\frac{\sqrt{6 \times 12} + \sqrt{6 \times 5}}{\sqrt{12^2} - \sqrt{12 \times 5} + \sqrt{12 \times 5} - \sqrt{5^2}}$ $p = 6 \text{ dan } q = 30$	K1 K1 N1	
7	$\frac{1}{2}(2x+10)(5x-20)\sin 30^\circ = 1700$ $x = \frac{-5 \pm \sqrt{5^2 - 4(5)(-3500)}}{2(5)}$ $x = 26$ 62 m 110 m	K1 K1 N1 N1 N1	5

8	$16a + 12 = 64a$ $a = \frac{1}{4}$ and $p = 4$ (Both) $\pi \int_4^{16} 4y \, dy = \pi [2y^2]_4^{16}$ $\pi [2(16)^2 - 2(4)^2]$ 480π	K1 N1 K1 K1 N1	5
9. (a)	$ \overline{OQ} = \sqrt{3^2 + (-4)^2}$ 5 unit	K1 N1	4
9. (b)	$\overline{RQ} = \overline{RO} + \overline{OQ}$ $-r + q$	K1 N1	
10 (a)	$\frac{6!1!}{2!2!2!}$ 90	P1 K1 N1	7
10 (b)	(i) $\frac{5!}{(5-3)!3!}$ atau $\frac{5 \times 4 \times 3 \times 2 \times 1}{2 \times 1 \times 3 \times 2 \times 1}$ 10 (ii) ${}^1C_1 \times {}^3C_1 \times {}^6C_1$ atau ${}^1C_1 \times {}^6C_2$ 33	K1 N1 K1 N1	
11 (a)	$\frac{\delta y}{\delta x} = \frac{\delta y}{\delta u} \times \frac{\delta u}{\delta x}$ $\text{had} \frac{\delta y}{\delta x} = \text{had} \frac{\delta y}{\delta u} \times \text{had} \frac{\delta u}{\delta x}$ $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$	K1 K1 N1	

11 (b)	$\frac{dy}{dx} = 10t + 2 \text{ or } \frac{dx}{dt} = -2$ $\frac{dy}{dx} = (10t + 2) \times \frac{1}{-2}$ $\frac{dy}{dx} = \frac{5x - 7}{2}$	K1 K1 N1	6
12 (a)	(i) ${}^4C_4(p^4)(q^0)$ atau setara $p = \sqrt[4]{m}$ (ii) $P(X \geq 1) = 1 - P(X = 0)$ $= 1 - k$	K1 N1 K1 N1	
12 (b)	(i) 15 (ii) 3	N1 N1	
13 (a)	$y = \frac{2x^2 + 4x}{3}$ $\frac{2x^2 + 4x}{3} < 10$ $(x + 5)(x - 3) < 0$ $-5 < x < 3$	P1 K1 K1 N1	
13 (b)	$2 \left[x^2 - 4x + \left(\frac{-4}{2} \right)^2 - \left(\frac{-4}{2} \right)^2 - 5 \right]$ $2(x - 2)^2 - 18$ $a = 2$ dan $b = -2$ dan $c = -18$ Nilai minimum = -18	K1 N1 N1 N1	8

14 (a)	(i) $2 \times m_{AB} = -1$ dan $m_{AB} = \frac{-1}{2}$ $y = \frac{-1}{2}x - 4$ (ii) $2x - 9 = -\frac{1}{2}x - 4$ $x = 2$ $C = (2, -5)$	K1 N1 K1 N1	8
14 (b)	$B(7, 5)$ $\frac{1}{2} ((0 \times -5) + (7 \times -5) + (2 \times -1) + (-6 \times 5)) - ((5 \times 7) + (5 \times 2) + (-5 \times -6) + (-1 \times 0))$ 71 unit²	P1 K1 N1	
15 (a)	 $\sin 28.64^\circ = \frac{x}{5}$ $x = 2.397 \text{ cm}$ Jejari = $2(2.397) = 4.794 \text{ cm}$	K1 N1	
15 (b)	Panjang lengkok JKL = $4.794(3.6) = 17.2584 \text{ cm}$ atau Panjang lengkok JM/ML = 5 (1) Perimeter kawasan berlorek = $17.2584 + 5 + 5$ $= 27.2584 \text{ cm}$	K1 N1	

15 (c)	Luas sektor JKL = $\frac{1}{2}(4.794)^2(3.6) = 41.3684 \text{ cm}^2$ atau Luas segitiga PJM / QML = $\frac{1}{2}(5)^2 \sin 57.29^\circ = 10.5177 \text{ cm}^2$ atau Luas sektor PJM = $\frac{1}{2}(5)^2(1) = 12.5 \text{ cm}^2$ Luas tembereng JM / ML = $12.5 - 10.5177 = 1.9823$ Luas Rantau Berlorek = $41.3684 - 2(1.9823)$ $= 37.4038 \text{ cm}^2$	K1 K1 K1 N1	8
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MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM) CAWANGAN KELANTAN

MODUL KOLEKSI ITEM PERCUBAAN SPM 2023

MATEMATIK TAMBAHAN KERTAS 2

UNTUK KEGUNAAN PEMERIKSA SAHAJA

SKEMA PEMARKAHAN

PERATURAN PEMARKAHAN PEPERIKSAAN PERCUBAAN SPM TAHUN 2023

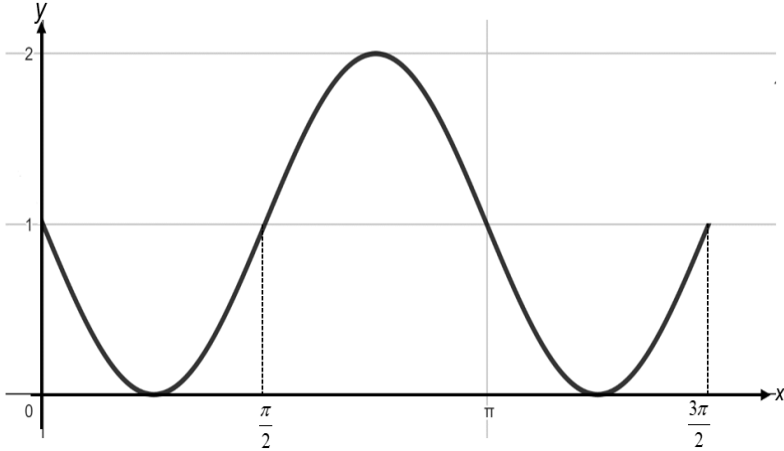
MATEMATIK TAMBAHAN (3472/2)

KERTAS 2

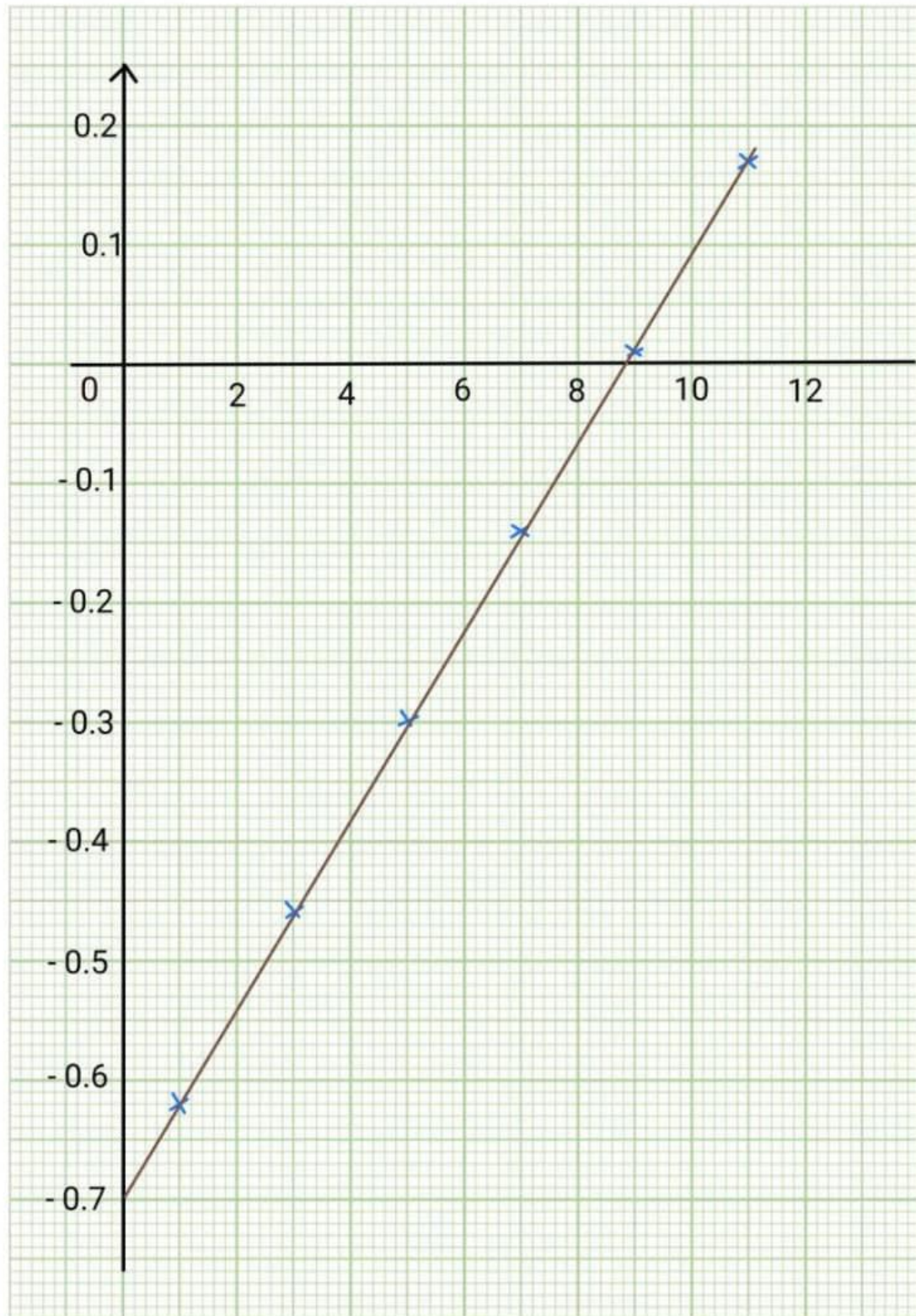
NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
1 (a)	$7x + 7z = 8$ atau $7x + [(a^2 - 14) + 5]z = a + 4$ $(-a^2 + 16)z = -a + 4$ $a = \pm 4$ $a = -4$	K1 K1 N1 N1	6
1 (b)	$-a^2 + 16 = 0$ $a = 4$	K1 N1	
2 (a)	$f^2(x) = p^2x + pq + q$ atau $f^3(x) = p^3x + p^2q + pq + q$ $p = 2$ $q = 2$	K1 N1 N1	8
2 (b)	$f^{-1}(x) = \frac{x-2}{2}$ atau $2x + 2 = -6$ -4	K1 N1	
2 (c)	$f^4(x) = 16x + 30$ $f^1(x) = 2x + 2$ $f^2(x) = 4x + 6$ $f^3(x) = 8x + 14$ $f^4(x) = 16x + 30$ $f^n(x) = 2^n x + 2^{n+1} - 2$	N1 K1 N1	

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
3(a)	$10.47 = 15\theta$ $\theta = 0.698 \text{ rad}$ Bilangan keratan = $\frac{2 \times 3.142}{0.698} = 9 \text{ keratan}$	K1 N1 N1	7
3(b)	$2 \times \frac{1}{2} \times 15^2 \times 0.698 = 157.05$ $10.47(8) = 83.76 \quad \text{atau} \quad 2 \times 15 \times 8 = 240$ Jumlah luas Permukaan = $157.05 + 83.76 + 240$ 480.81 cm^2	K1 K1 K1 N1	
4			7
(a)(i)	$0.8 + (n-1)0.02 = 1.18$ $n = 20$	K1 N1	
(ii)	$S_n = \frac{20}{2} [0.8 + 1.18] \quad \text{atau} \quad S_n = \frac{20}{2} [2(0.8) + (20-1)(0.02)]$ 19.8 kg	K1 N1	
4(b)	$0.02 : 0.5 \quad (d = 0.5)$ $T_n = 3.5 + 19(0.5)$ $X = 13 \text{ minit}$	N1 K1 N1	
5(a)	$C\left(-\frac{2}{3}, 2\right)$ $\frac{2n + \left(-\frac{2}{3}\right)m}{m+n} = 0 \quad \text{atau} \quad \frac{-2n + 2m}{m+n} = 1$ $3:1$	P1 K1 N1	

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
5(b)(i)	$PB = \frac{1}{2} PE$ $\sqrt{(x-0)^2 + (y-4)^2} = \frac{1}{2} \sqrt{(x-2)^2 + (y-(-2))^2}$ $3x^2 + 3y^2 + 4x - 36y + 56 = 0$	P1 K1 N1	8
6 (a)	$m + (n-9) = \frac{n-1}{2}$ atau $m(n-9) = \frac{7}{2}$ $m(17-2m-9) = \frac{7}{2}$ atau $\left(\frac{17-n}{2}\right)(n-9) = \frac{7}{2}$ $(2m-7)(2m-1) = 0$ atau $(n-10)(n-16) = 0$ $m = \frac{1}{2}$ $n = 16$	P1 K1 K1 N1 N1	8
6 (b)	$2 \left[x^2 - \frac{15x}{2} + \left(\frac{-15/2}{2} \right)^2 - \left(\frac{-15/2}{2} \right)^2 + \frac{7}{2} \right]$ $2 \left(x - \frac{15}{4} \right)^2 - \frac{169}{8}$ $x = \frac{15}{4}$	K1 N1 N1	

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
7 (a)	Use $\sin^2 x + \cos^2 x = 1$ atau $\sin 2x = 2 \sin x \cos x$ $1 - 2 \sin x \cos x$ atau $\cos^2 x + \sin^2 x - 2 \sin x \cos x$	K1 N1	8
7 (b)	 Bentuk graf $-\sin x$ $1\frac{1}{2}$ pusingan bagi domain $0 \leq x \leq \frac{3}{2}\pi$ Min = 0, max=2, titik tengah = 1	P1 P1 P1	
7 l(i)	2	N1	
(ii)	Julat $0 < k < 1$ atau $y = k + 1, 1 < y < 2$ 2 penyelesaian	K1 N1	
8 (a)	$\overrightarrow{PB} = \overrightarrow{PO} + \overrightarrow{OB}$ atau $\overrightarrow{PB} = \overrightarrow{PA} + \overrightarrow{AB}$ atau $\overrightarrow{OQ} = \overrightarrow{OA} + \overrightarrow{AQ}$ $\overrightarrow{PB} = -6\hat{h} + 4\hat{k}$ $\overrightarrow{OQ} = \frac{9}{2}\hat{h} + 2\hat{k}$	P1 N1 N1	

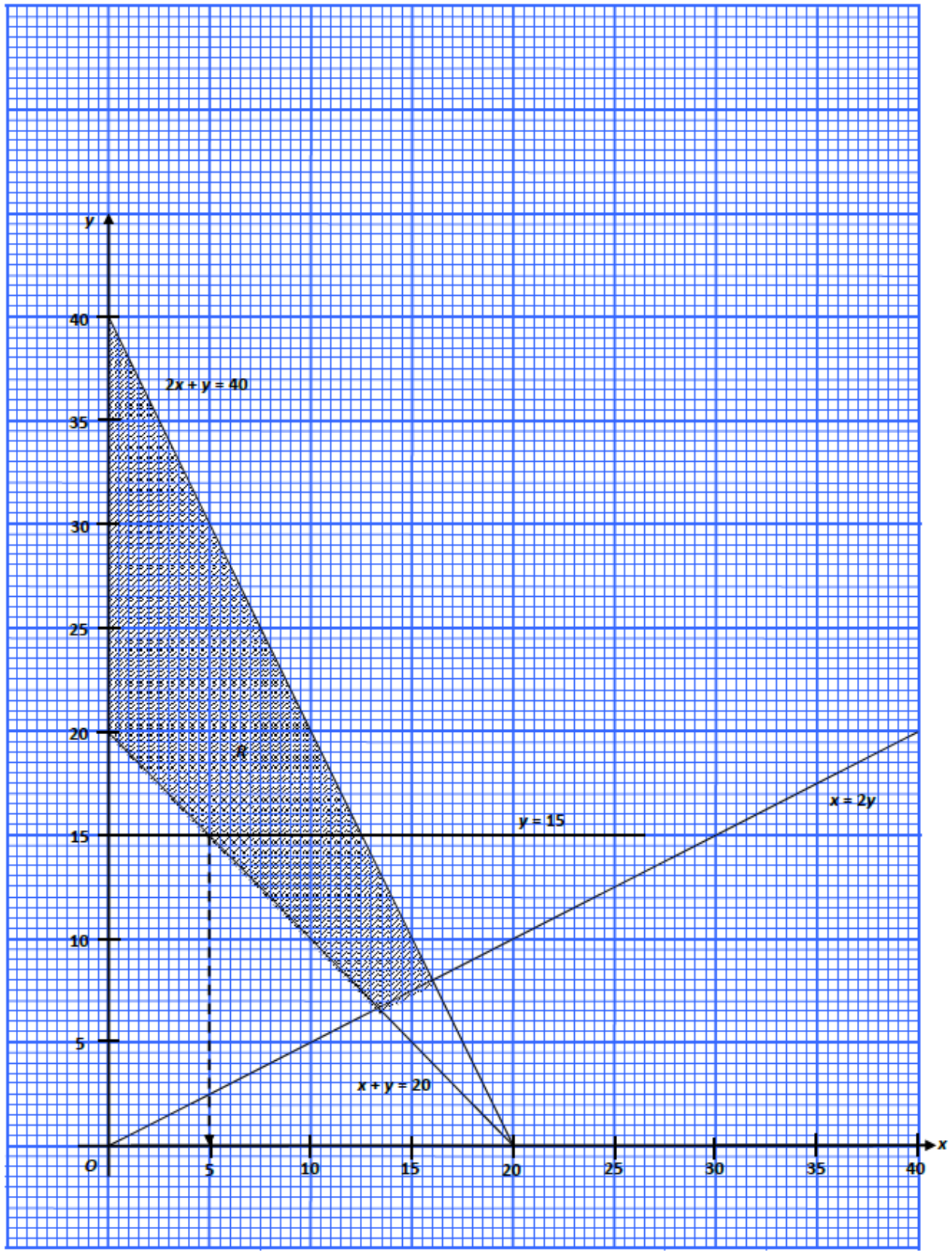
NO.	PERATURAN PEMARKAHAN							SUB-MARKAH	MARKAH PENUH
8 (b)	$\overrightarrow{PR} = -\frac{12}{5}\hat{h} + \frac{8}{5}\hat{k}$ atau setara							K1	10
	$-\frac{12}{5} = -6\lambda$ dan $\frac{8}{5} = 4\lambda$							K1	
	$\lambda = \frac{2}{5}$ atau setara							K1	
	$\overrightarrow{PR} = \frac{2}{5}\overrightarrow{PB}$ atau setara							N1	
(c)	$\frac{1}{2} 3\hat{h} h = 12$ atau $\frac{1}{2}(3PA)h$ atau $\frac{OAB}{PAB} = \frac{3}{1}$							K1	
	$\frac{1}{2} 9\hat{h} \left(\frac{8}{ \hat{h} }\right)$ atau 3×12 atau $OAB = 3(12)$							K1	
	36							N1	
9	2x-1	1	3	5	7	9	11	N1	10
(a)	$\log_{10} y$	-0.62	-0.46	-0.30	-0.14	0.01	0.17	N1	
(b)	plot $\log_{10} y$ melawan $(2x+1)$							K1	
	• paksi-paksi betul dan skla seragam • sekurang-kurangnya satu titik di plot betul								
	6 titik di plot betul							N1	
(c)	garis penyuaian terbaik							N1	
	$\log_{10} y = \log_{10} s(2x-1) + \log_{10} r$							P1	
	$\log_{10} r = -0.7$ atau $\log_{10} s = \frac{0.2 - (-0.7)}{11.4 - 0}$							K1	
	$r = 0.1995$							N1	
	$s = 1.199$							N1	
	$\log_{10} y = -0.38$							N1	



NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
10 (a)(i)	${}^{10}C_0(0.7)^0(0.3)^{10}$ atau ${}^{10}C_1(0.7)^1(0.3)^9$ atau ${}^{10}C_2(0.7)^2(0.3)^8$ ${}^{10}C_0(0.7)^0(0.3)^{10} + {}^{10}C_1(0.7)^1(0.3)^9 + {}^{10}C_2(0.7)^2(0.3)^8$ 0.00159	K1 K1 N1	10
(a)(ii)	Bilangan Pelajar = $\frac{280}{0.7}$ 400	K1 N1	
10 (b)(i)	$z = 1.406$ $\frac{70-m}{5} = 1.406$ $m = 62.97$	P1 K1 N1	
(b)(ii)	$\frac{50 - 62.97}{5}$ 0.00474	K1 N1	
11(a)	$Q(4,0)$ $\sin 60^\circ = \frac{h}{4}$ atau $\cos 60^\circ = \frac{b}{4}$ atau $h = 2\sqrt{3}$ atau $b = 2$ $V_1(kon) = \frac{1}{3}\pi(2\sqrt{3})^2(2)$ atau $V_2 = \pi\left[16x - \frac{x^3}{3}\right]_2^4$ $\pi\left[\left(16(4) - \frac{4^3}{3}\right) - \left(16(2) - \frac{2^3}{3}\right)\right]$ $V_1 + V_2 = \frac{1}{3}\pi(2\sqrt{3})^2(2) + \pi\left[\left(16(4) - \frac{4^3}{3}\right) - \left(16(2) - \frac{2^3}{3}\right)\right]$ $\frac{64\pi}{3}$	P1 K1 K1 K1 N1	

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
11(b)	$-\frac{1}{5} \times m_T = -1 \text{ dan } m_T = 5$ $\frac{dy}{dx} = 4x - 3 = 5$ $y = 2(2)^2 - 3(2) + 2 \text{ atau } A(2, 4)$ $y = 5x - 6$	K1 K1 K1 N1	10
12 (a)	$CF = \sqrt{10^2 + 8^2} \text{ atau } CM = \sqrt{14^2 + 5^2} \text{ atau}$ $FM = \sqrt{8^2 + 14.87^2}$ $CF = 12.81 \text{ atau } CM = 14.87 \text{ atau } FM = 16.89$ $16.89^2 = 14.87^2 + 12.81^2 - 2(14.87)(12.81)\cos \angle FCM$ 74.79°	P1 N1 K1 N1	10
12 (b)	$\frac{\sin \angle CMF}{12.81} = \frac{\sin 74.79^\circ}{16.89}$ $\angle CMF = 47.04^\circ$	K1 N1	
12 (c)	$\text{luas FCM} = \frac{1}{2}(16.89)(14.87)\sin 47.04^\circ \text{ atau}$ $\text{luas FCM} = \frac{1}{2}(12.81)(14.87)\sin 74.79^\circ \text{ atau}$ $\text{luas FCM} = \frac{1}{2}(16.89)(12.81)\sin 58.17^\circ$ $91.90 / 91.91 \text{ cm}^2$	K1 N1	
12 (d)	$\frac{1}{2} \times h \times 12.81 = 91.90 \text{ atau } \frac{1}{2} \times h \times 12.81 = 91.91$ $h = 14.35 \text{ cm}$	K1 N1	

NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
13(a) (i)(ii)	$\frac{20.00}{Q_{2022}} \times 100 = 137$ atau $\frac{y}{x} \times 100 = 125$ atau $\frac{y}{y-8} \times 100 = 125$ atau $\frac{x+8}{x} \times 100 = 125$ Bahan A : $Q_{2022} = RM14.60$ Bahan E : $Q_{2022} = RM32.00$ $Q_{2023} = RM40.00$	K1 N1 N1 N1	10
13(b)	$\frac{137(1) + 90(1) + (h-2)(1) + 2h(1) + 125(1)}{1+1+1+1+1} = 127$ $h = 95$	K1 N1	
13(c)	$I_{\frac{2024}{2023}} = \frac{143}{100} \times \frac{100}{127} \times 100$ atau $\frac{85.00}{Q_{2022}} \times 100 = 127$ $\frac{x}{85.00} \times 100 = 112.60$ atau $\frac{Q_{2024}}{66.93} \times 100 = 143$ RM95.71	K1 K1 N1	
14(a)	$x + y \geq 20$ $x \leq 2y$ $10x + 5y \leq 200$	N1 N1 N1	10
14(b)	Draw one line correctly Draw all line correctly Shaded and label R Rujuk graf di bawah	K1 N1 N1	
14(c)	$y = 15$, x minimum = 5 $10(5) + 5(15) = 125$ Baki maksimum = $200 - 125$ 75	K1 K1 K1 N1	



NO.	PERATURAN PEMARKAHAN	SUB-MARKAH	MARKAH PENUH
15 (a)	$v_0 = 8$	P1	10
15 (b)	$8 + 2t - t^2 = 0$ $(t - 4)(t + 2) = 0$ $t = 4$	K1 K1 N1	
15 (c)	$2 - 2t = 0$ $v_{\max} = 8 + 2(1) - (1)^2$ $v_{\max} = 9$	K1 K1 N1	
15 (d)	$8t + t^2 - \frac{t^3}{3}$ $\left(8(4) + (4)^2 - \frac{(4)^3}{3}\right) - \left(8(0) + (0)^2 - \frac{(0)^3}{3}\right)$ atau $\left(8(6) + (6)^2 - \frac{(6)^3}{3}\right) - \left(8(4) + (4)^2 - \frac{(4)^3}{3}\right)$ $41\frac{1}{3}$	K1 K1 N1	

**MODUL PENINGKATAN PRESTASI MURID TINGKATAN 5
TAHUN 2023**

**MATEMATIK TAMBAHAN
KERTAS 1
TINGKATAN 5**

PERATURAN PEMARKAHAN

PERATURAN PEMARKAHAN INI MENGANDUNGI 10 MUKA SURAT

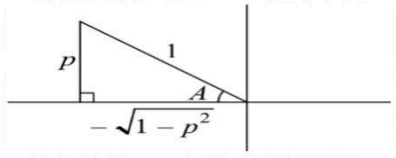
Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
1 (a)	$c = -4$ N1	1	4
1 (b)(i)	$p^{-1}(x) = \frac{x+3}{3}$ N1	1	
1 (b)(ii)	$qp(x) = 9\left(\frac{p(x)+3}{3}\right)^2 - 6\left(\frac{p(x)+3}{3}\right) + 2$ K1 $q(x) = x^2 + 4x + 5$ N1	2	
2 (a)	$k = -1$ N1	1	4
2 (b)	$f(x) = a(x+1)(x-4)$ P1 $-3 = a(-2+1)(-2-4)$ K1 $a = -\frac{1}{2}$ $f(x) = -\frac{1}{2}(x+1)(x-4)$ N1	3	
3 (a)	$\frac{dy}{dx} = \frac{1}{3}t^2 \times \frac{1}{2}$ K1 $\frac{dy}{dx} = \frac{(x+7)^2}{24}$ N1 $x = 1,$ $\frac{dy}{dx} = \frac{27}{8} \quad \text{atau} \quad \frac{dy}{dx} = 3.375$ N1	3	5
3 (b)	$f'(x) = \frac{(3x-2)^5(1) - x[5(3x-2)^4(3)]}{[(3x-2)^5]^2}$ K1 $f'(x) = -\frac{2(6x+1)}{(3x-2)^6}$ $a = 6$ N1	2	

Selamat mengulangkaji dari telegram@soalanpercubaanspm
Skema Matematik Tambahan K1 2023

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
4 (a)	$\frac{(3^n)(3^2) + (3^1) \times 5(3^n)(3^{-1})}{7 \times 2 \times 3}$ Catatan: Guna hukum indeks bagi salah satu sebutan 3^{n-1} K1 N1	2	7
(b)	$\frac{1}{7\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \text{ or } \frac{1}{7\sqrt{3}} \times \frac{7\sqrt{3}}{7\sqrt{3}}$ a=1 ,b=3 (Kedua-dua betul) K1 N1	2	
(c)	$\log_9 xy = \frac{\log_3 xy}{\log_3 3^2}$ $= \frac{\log_3 x + \log_3 y}{2}$ $= \log_9 \sqrt{x} + \log_9 \sqrt{y}$ K1 K1 N1	3	
5 (a)	$= 2 + \frac{0 \cdot xy}{1 - 0.01}$ $p + \frac{xy}{q} = 2 + \frac{xy}{99}$ $\therefore p = 2, q = 99$ K1 N1 [Kedua-dua betul]	2	6
5 (b)	100 cm, 95 cm, 90 cm, ... ialah suatu jangjang aritmetik dengan $a = 100, d = -5$ $S_n = \frac{n}{2} [2(100) + (n-1)(-5)] \geq 1060$ $n^2 - 41n + 424 \leq 0$ $b^2 - 4ac = (-41)^2 - 4(1)(424)$ $= -15$ $b^2 - 4ac < 0$, tiada nilai nyata n yang memuaskan ketaksamaan kuadratik. Kumar tidak menang pertandingan itu K1 K1 N1 N1 Catatan: (1) Terima kaedah lakaran graf dan beri K1. (2) Tidak terima kaedah pemfaktoran atau rumus	4	

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
6.	$\log_{10} y = p \log_{10} x + C$ $\log_{10} \left(\frac{y}{x^p} \right) = C$ K1 Ganti (1, 0.1) $\log_{10} \left(\frac{0.1}{1^p} \right) = C$ $C = -1$ Ganti (10, 10) $\log_{10} \left(\frac{10}{10^p} \right) = -1$ atau $\log_{10} \left(\frac{0.1}{1^p} \right) = C$ K1 $p = 2$ N1 $q = 2$ N1	4	4
7. (a)	$D(-5, -2)$ N1	1	6
(b)	$C(3, -1)$ N1 $-1 = \frac{7}{4}(3) + c$ K1 $c = -\frac{25}{4}$ $4y - 7x + 25 = 0$ N1	3	
(c)	$DP = PM$ $\sqrt{(-5-x)^2 + (-2-y)^2} = \sqrt{(x-1)^2 + (2-y)^2}$ K1 $3x + 2y + 6 = 0$ N1	2	
8. (a)(i)	$\sqrt{(9)^2 + (5)^2}$ K1 $\sqrt{106}$ unit N1	2	6
(ii)	$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$ P1 (tulis hukum) $\overrightarrow{AC} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$ N1	2	
(b)	$\frac{1}{\sqrt{(4)^2 + \left(-\frac{8}{3}\right)^2}} \begin{pmatrix} 4 \\ -\frac{8}{3} \end{pmatrix}$ atau $\frac{1}{\sqrt{(4)^2 + \left(-\frac{8}{3}\right)^2}} 4\hat{i} - \frac{8}{3}\hat{j}$ K1 $\frac{3}{\sqrt{13}}\hat{i} - \frac{2}{\sqrt{13}}\hat{j}$ N1	2	

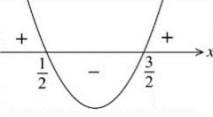
Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
9.	$\sin 60^\circ = \frac{\sqrt{3}}{2} \quad \text{atau} \quad \sin 120^\circ = \frac{\sqrt{3}}{2} \quad (\text{dilihat}) \quad \text{P1}$ $\sqrt{3}MP = MQ$ $MQ = \sqrt{3}s \quad \text{P1}$ $\text{Luas P} = \frac{1}{2}s^2 \left(\frac{4\pi}{3} \right) + \frac{1}{2}s^2 \sin \frac{2}{3}\pi$ $= \frac{2\pi s^2}{3} + \frac{\sqrt{3}s^2}{4}$ $\text{Luas Q} = \frac{1}{2}(\sqrt{3}s)^2 \left(\frac{5\pi}{3} \right) + \frac{1}{2}(\sqrt{3}s)^2 \sin \frac{\pi}{3}$ $= \frac{5\pi s^2}{2} + \frac{3\sqrt{3}s^2}{4}$ Mana-mana luas P atau Q ditunjukkan $\frac{1}{2}s^2 \left(\frac{4\pi}{3} \right) \text{ atau } \frac{1}{2}(\sqrt{3}s)^2 \left(\frac{5\pi}{3} \right) \quad \text{K1}$ $\frac{1}{2}s^2 \sin \frac{2}{3}\pi \text{ atau } \frac{1}{2}(\sqrt{3}s)^2 \sin \frac{\pi}{3} \text{ atau } \frac{1}{2}(\sqrt{3}s)^2 \sin 60^\circ \quad \text{K1}$ $P + Q = \frac{2\pi s^2}{3} + \frac{\sqrt{3}s^2}{4} + \frac{5\pi s^2}{2} + \frac{3\sqrt{3}s^2}{4}$ $= \frac{19\pi s^2}{6} + \sqrt{3}s^2$ $\text{luas kawasan jubin} = k - \left(\frac{19\pi s^2}{6} + \sqrt{3}s^2 \right)$ $= k - s^2 \left(\frac{19\pi}{6} + \sqrt{3} \right) \quad \text{N1}$	5	5

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
11 (a)	$\sin A = p$  P1 $\cot A = \frac{-\sqrt{1-p^2}}{p}$ $= -\frac{\sqrt{1-p^2}}{p}$ N1	2	4
11 (b)	$\sin 2x = 1$ K1 $2x = 90^\circ, 450^\circ$ $x = 45^\circ (Q1), 225^\circ (Q2)$ $x = 225^\circ (Q2)$ N1	2	

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 Skema Matematik Tambahan K1 Kedah 2023

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
12 (a)	Bil. susunan kes 1 $= {}^6C_1 \times {}^5P_5$ atau ${}^6P_1 \times {}^5P_5$ $= 720$ Bil. susunan kes 2 $= {}^6P_2 \times {}^4P_4$ $= 720$ ${}^6C_1 \times {}^5P_5$ atau ${}^6P_1 \times {}^5P_5$ atau ${}^6P_2 \times {}^4P_4$ dilihat K1 Jumlah susunan $= {}^6C_1 \times {}^5P_5 + {}^6P_2 \times {}^4P_4$ K1 atau ${}^6P_1 \times {}^5P_5 + {}^6P_2 \times {}^4P_4$ $= 1440$ N1	3	7
12 (b)	Semua pasu = PBRRMGGGD Bilangan cara menyusun $= \frac{8!}{3!}$ K1 $= 6720$ N1	2	
12 (c)	Semua pasu = PBRMGD Bilangan susunan $= 1 \times 3 \times 4!$ K1 $= 72$ cara N1 ATAU = Susun tanpa syarat – Susun PR bersama $= (6-1)! - 1 \times 2 \times 4!$ K1 $= 120 - 48$ $= 72$ N1	2	
13 (a)	$P(z \geq \frac{1.7 - 1.88}{\sigma}) = 0.63$ P1 $\frac{1.7 - 1.88}{\sigma} = -0.332$ K1 0.5422 N1	3	8
13 (b)	$0.37 - 0.2653 = 0.1047$ P1 $P(-1.255 \leq Z \leq -0.332)$ K1 $1.2 \leq X \leq 1.7$ N1	3	
13 (c)	1200×0.1047 K1 125 N1	2	

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
14 (a)	$972\pi = \pi \left(\frac{18}{2}\right)^2 (h)$ K1 $h = 12$ tinggi air dalam gelas = $\frac{1}{3}(12) = 4$ N1	2	8
14 (b)	$y = \frac{kx^2}{2} + c$ K1 pada titik $(3, 0)$ dan $(0, -4)$ $0 = \frac{k(3)^2}{2} + c$ and $-4 = \frac{k(0)^2}{2} + c$ K1 $y = \frac{4}{9}x^2 - 4$ N1	3	
14 (c)	$V_{\text{gelas}} = \pi \int_{-4}^0 \frac{9}{4}(y+4)dy$ $V_{\text{gelas}} = \frac{9}{4}\pi \left[\frac{(0)^2}{2} + 4(0) - \left(\frac{(-4)^2}{2} + 4(-4) \right) \right]$ K1 $V_{\text{gelas}} = 18\pi = 56.556\text{cm}^3$ $3 \text{ jag} = 3 \times 972\pi \text{ml}$ $= 2916\pi \text{cm}^3$ N1 Jumlah gelas = $\frac{2916\pi}{18\pi}$ Jumlah gelas = 162 gelas N1	3	

Bil.	Penyelesaian dan Skema Pemarkahan	Sub markah	Jumlah Markah
15 (a)	$f(x) = \frac{2}{3}x^2 - \frac{4}{3}x + 1$ $= \frac{2}{3}\left(x^2 - 2x + \left(\frac{-2}{2}\right)^2 - \left(\frac{-2}{2}\right)^2 + \frac{3}{2}\right)$ $= \frac{2}{3}(x-1)^2 + \frac{1}{3}$ ketinggian dari permukaan air = $\frac{1}{3}m$ alternatif (a) $x = -\frac{b}{2a}$ $x = -\frac{\left(\frac{-4}{3}\right)}{2\left(\frac{2}{3}\right)} = 1$ $f(1) = \frac{2}{3}(1)^2 - \frac{4}{3}(1) + 1$ ketinggian dari permukaan air = $\frac{1}{3}m$	3	8
15 (b) (i)	$f(x)_{new} = \frac{2}{3}x^2 - \frac{4}{3}x + 1 - \frac{1}{2}$ $b^2 - 4ac = \left(-\frac{4}{3}\right)^2 - 4\left(\frac{2}{3}\right)\left(\frac{1}{2}\right) = \frac{4}{9} > 0$ $b^2 - 4ac > 0,$ maka buaian berada di bawah paras air	3	
15 (b) (ii)	 $4x^2 - 8x + 3 < 0$ $(2x-3)(2x-1) < 0$ $\frac{1}{2} < x < \frac{3}{2}$	2	

TAMAT
THE END

**MODUL PENINGKATAN PRESTASI TINGKATAN 5
TAHUN 2023**

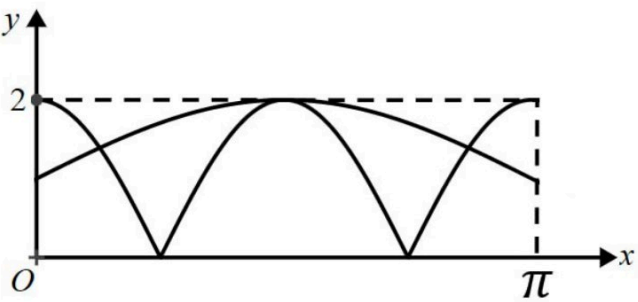
**MATEMATIK TAMBAHAN
KERTAS 2**

PERATURAN PEMARKAHAN

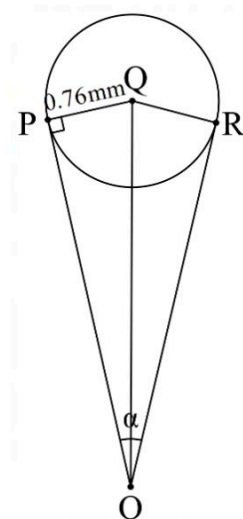
Peraturan Pemarkahan ini mengandungi **18** halaman bercetak

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
1	$\sin(y + z - x) = 1$ $y + z - x = \sin^{-1}(1)$ $y + z - x = 90^\circ \quad \dots(1) \quad P1$ $\cos(x + y + z) = -1$ $x + y + z = \cos^{-1}(-1)$ $x + y + z = 180^\circ \quad \dots(2) \quad P1$ $\tan(x + y - z) = 1$ $x + y - z = \tan^{-1}(1)$ $x + y - z = 45^\circ \quad \dots(3)$ $(2) - (1): 2x = 90^\circ \quad K1$ $x = 45^\circ \quad N1$ $(2) - (3): 2z = 135^\circ \quad K1$ $z = 67.5^\circ \quad N1$ Ganti $x = 45^\circ, z = 67.5^\circ$ dalam (2) $45^\circ + y + 67.5^\circ = 180^\circ$ $y = 67.5^\circ \quad N1$ **P1 diberi jika satu ATAU dua persamaan yang betul. P1 P1 diberi jika tiga persamaan betul.	7	7

Selamat mengulangkaji dari telegram@soalanpercubaanspm
Skema Matematik Tambahan K2 Kedah 2023

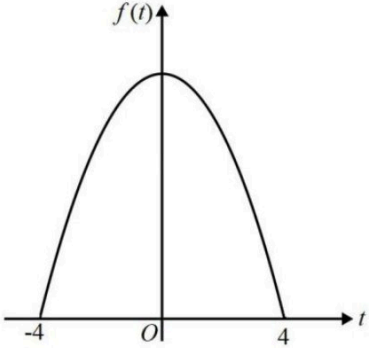
BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
2 (a)	ALTERNATIF A $\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x}$ $= \frac{\cos 2x \cos x + \sin 2x \sin x}{\sin x \cos x}$ $= \frac{\cos(2x - x)}{\cos x \sin x}$ $= \frac{\cos x}{\cos x \sin x} \quad \text{K1}$ $= \frac{1}{\sin x}$ $= \operatorname{cosec} x \quad \text{N1}$ ALTERNATIF B $\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x}$ $= \frac{\cos 2x \cos x + \sin 2x \sin x}{\sin x \cos x}$ $= \frac{(1 - 2\sin^2 x) \cos x + (2 \sin x \cos x) \sin x}{\sin x \cos x}$ $= \frac{\cos x - 2\sin^2 x \cos x + 2\sin^2 x \cos x}{\sin x \cos x}$ $= \frac{\cos x(1 - 2\sin^2 x + 2\sin^2 x)}{\sin x \cos x} \quad \text{K1}$ $= \frac{1}{\sin x}$ $= \operatorname{cosec} x \quad \text{N1}$	2	7
(b)	 P1 - Bentuk graf kos atau sin. P1 - 2 kitaran & mutlak bagi graf kos. P1 - Anjakan 1 unit ke atas bagi graf sin. P1 - Gabungan graf kos dan sin pada paksi yang sama dengan betul. Bilangan penyelesaian / NOS = 3 N1	5	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
3 (a)	$\text{Beza} = 2\pi R - r\left(\frac{5}{3}\pi\right)$ $2\pi(15) \text{ OR } 8\left(\frac{5}{3}\pi\right) \quad \text{K1}$ $= *2\pi(15) - *8\left(\frac{5}{3}\pi\right) \quad \text{K1}$ $= \frac{50}{3}\pi \quad \text{N1}$	3	
(b)	ALTERNATIF A $OQ = 8 - 0.76 \quad \text{P1}$ $= 7.24$ $\sin \frac{\alpha}{2} = \frac{0.76}{7.24} \quad \text{K1}$ $\frac{\alpha}{2} = \sin^{-1}\left(\frac{0.76}{7.24}\right)$ $\alpha = 12.0512^\circ$ $\text{Sudut satu sektor pada muka jam} = \frac{360^\circ}{12} = 30^\circ$ $\text{Sudut sektor major} = 10 \times 30^\circ = 300^\circ$ $\text{Bilangan berlian} = \frac{300^\circ}{12.0512^\circ} = 24.8938 \quad \text{K1}$ $\therefore \text{Bilangan berlian maksimum} = 24 \quad \text{N1}$ ALTERNATIF B $OQ = 8 - 0.76 \quad \text{P1}$ $= 7.24$ $\text{Sudut satu sektor pada muka jam} = \frac{360^\circ}{12} = 30^\circ$ $\text{Sudut sektor major} = 10 \times 30^\circ = 300^\circ = 5.2367 \text{ rad}$ $s = 7.24(5.2367) \quad \text{K1}$ $= 37.9137$ $\text{Bilangan berlian} = \frac{37.9137}{1.52} = 24.9432 \quad \text{K1}$ $\therefore \text{Bilangan berlian maksimum} = 24 \quad \text{N1}$	4	7



BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah																
4 (a)	$y = -x\left(\frac{1}{2}x - 3\right)^3$ $-1 \quad \text{OR} \quad 3\left(\frac{1}{2}x - 3\right)^2\left(\frac{1}{2}\right) \quad \text{P1 (Boleh Tersirat)}$ $\frac{dy}{dx} = -1\left(\frac{1}{2}x - 3\right)^3 + (-x)\left[3\left(\frac{1}{2}x - 3\right)^2\left(\frac{1}{2}\right)\right] \quad \text{K1}$ <table border="1"> <tr> <td>x</td><td>5</td><td>6</td><td>7</td></tr> <tr> <td>$\frac{dy}{dx}$</td><td>–</td><td>0</td><td>–</td></tr> <tr> <td>Lakaran Tangen</td><td></td><td></td><td></td></tr> <tr> <td colspan="4">(6,0) ialah titik lengkok balas.</td></tr> </table> KI N1	x	5	6	7	$\frac{dy}{dx}$	–	0	–	Lakaran Tangen				(6,0) ialah titik lengkok balas .				4	
x	5	6	7																
$\frac{dy}{dx}$	–	0	–																
Lakaran Tangen																			
(6,0) ialah titik lengkok balas .																			
(b)	$\frac{dy}{dx} = \left(\frac{1}{2}x - 3\right)^2 (-2x + 3)$ $\frac{\delta x}{x} \times 100 = 1, \quad \delta x = 0.02$ @ K1 (Dilihat δx atau δy) $\frac{\delta y}{0.02} = -4, \quad \delta y = -0.08$ when $x=2, y = -2\left(\frac{1}{2}(-2) - 3\right)^3$ $y = 16$ $\frac{\delta y}{y} \times 100 = \frac{-0.08}{16} \times 100 \quad \text{K1}$ $= -0.5 \quad \text{N1}$	3	7																

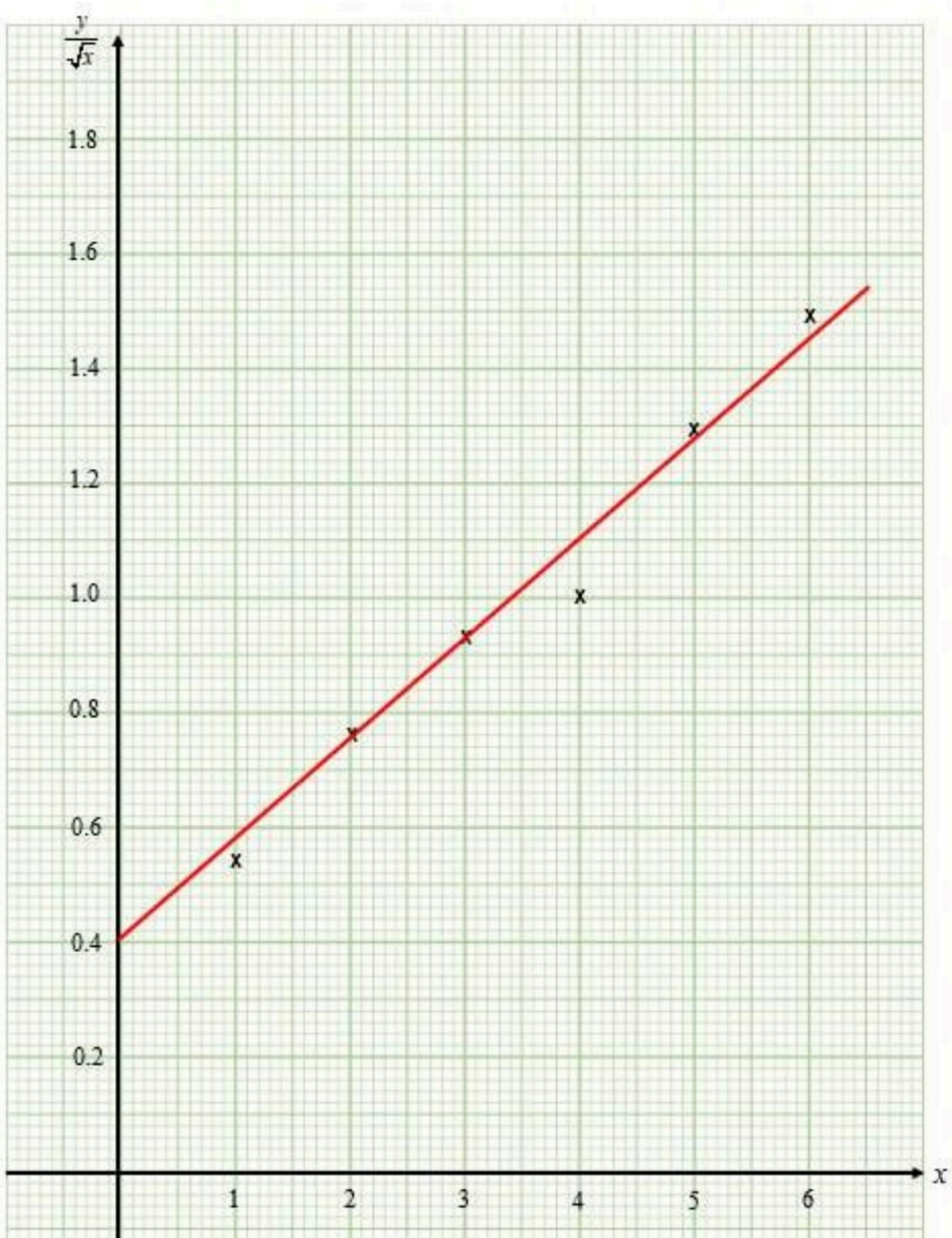
BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
5 (a)	i) $\overrightarrow{BD} = \overrightarrow{BG} + \overrightarrow{GD} \quad \text{P1}$ Tulis hukum segi tiga bagi $\triangle GBD @ \triangle GBC @ \triangle ABE$ $\triangle GBF @ \triangle GFD$ $\overrightarrow{BD} = -8\tilde{a} + 3\tilde{b} \quad \text{N1}$ ii) $\overrightarrow{EF} = \frac{1}{3}(\overrightarrow{GB} + \overrightarrow{BF})$ $\overrightarrow{EF} = \frac{1}{3}\left[8\tilde{a} + \frac{1}{2}(-8\tilde{a} + 3\tilde{b})\right] \quad \text{K1}$ Guna hukum segitiga bagi $\triangle GBD @ \triangle GBC @ \triangle ABE$ $\triangle GBF @ \triangle GFD$ $\overrightarrow{EF} = \frac{1}{3}\left(4\tilde{a} + \frac{3}{2}\tilde{b}\right)$ $\overrightarrow{EF} = \frac{4}{3}\tilde{a} + \frac{1}{2}\tilde{b} \quad \text{N1}$	4	7
(b)	ALTERNATIF A $\frac{h}{2\tilde{b}} = \frac{m}{\tilde{b}}$ $m = 0.5h \quad \text{K1}$ $\frac{1}{2}(h)(2\tilde{b}) = 25$ $h\tilde{b} = 25$ $\text{Luas } ABE = \frac{1}{2}(\tilde{b})(0.5h) \quad \text{K1}$ $= \frac{1}{2}(0.5)(25)$ $= 6.25 \quad \text{N1}$ ALTERNATIF B $\text{Luas } ABE = \frac{1}{(2)^2} \times 25 \quad \text{K1}$ P1 (Dilihat 2) $= \frac{25}{4} @ 6.25 \quad \text{N1}$	3	

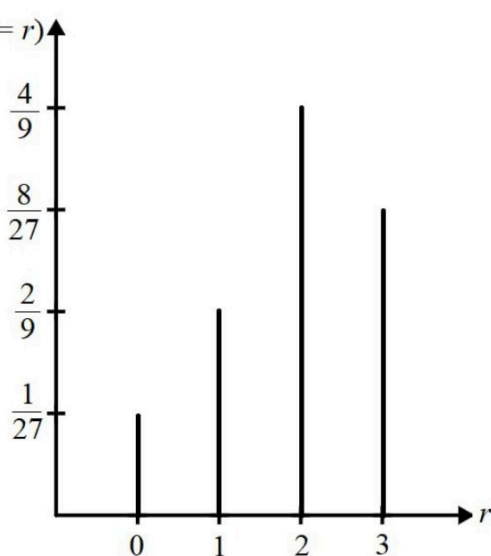
BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
6 (a)	i)  P1 – Bentuk P1 – Refleks pada paksi-x dengan julat yang betul ii) $-7 \leq t^2 - 16 \leq 7 \quad \text{P1 (Boleh tersirat)}$ $t^2 - 16 \geq -7$ (Dilihat menggunakan kaedah graf, garis nombor atau jadual) $-3 \leq t \leq 3 \quad \text{N1}$	4	7
(b)	$0 \leq f(x) \leq 16$	1	
(c)	Fungsi songsang tidak wujud. N1 Memotong lebih daripada satu titik melalui ujian garis mengufuk. N1	2	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
7 (a)	$s = \frac{6.08 + 3.16 + 8.06}{2} \quad \text{K1}$ $= \frac{173}{20} \text{ or } 8.65$ $\text{Area} = \sqrt{*8.65(*8.65 - 6.08)(*8.65 - 3.16)(*8.65 - 8.06)} \quad \text{K1}$ $= 8.49\text{km}^2 \quad \text{N1}$	3	8
(b)	$\text{Luas segi tiga: } \frac{1}{2} \times d \times 8.06 = *8.486 \quad \text{K1}$ $d = 2.106 \quad \text{N1}$	2	
(c)	$m = \frac{4 - 0}{5 - (-2)} = \frac{4}{7}$ $\text{Persamaan garis lurus ST, } y - 0 = \frac{4}{7}(x - (-2)) \quad \text{K1}$ $y = \frac{4}{7}x + \frac{8}{7}$ $\text{pintasan-x} = -2, \text{ pintasan-y} = \frac{8}{7}$ $\frac{y}{*\left(\frac{8}{7}\right)} + \frac{x}{(-2)} = 1 \quad \text{K1}$ $\frac{7y}{8} - \frac{x}{2} = 1 \quad \text{N1}$	3	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
8 (a)	$f(x) = \int \frac{-1}{2} (x-4)^{-\frac{1}{2}} dx \quad \text{P1}$ $= \frac{-1}{2} \int (x-4)^{-\frac{1}{2}} dx$ $= \frac{-1}{2} \left(\frac{(x-4)^{1+\left(-\frac{1}{2}\right)}}{\left(1+\left(-\frac{1}{2}\right)\right)(1)} \right) + c \quad \text{K1}$ $= -1(x-4)^{\frac{1}{2}} + c$ $0 = -1(4-4)^{\frac{1}{2}} + c$ $c = 0 \quad \text{K1}$ $f(x) = -1(x-4)^{\frac{1}{2}} / -(x-4)^{\frac{1}{2}} - \sqrt{(x-4)} \quad \text{N1}$	3	10
(b)	$A_1 = \int_4^{13} \left -(x-4)^{\frac{1}{2}} \right dx$ $A_2 = \left(\frac{1}{2} \times 3 \times 3 \right)$ $A_1 = \left[\frac{-(x-4)^{\frac{1}{2}+1}}{\left(\frac{1}{2}+1\right)(1)} \right]_4^{13}$ ATAU K1 $A_2 = \left(\frac{9}{2} \right)$ Luas kawasan berlorek = $*A_1 - *A_2$ K1 Luas kawasan berlorek = 13.5 N1	4	
(c)	$\pi \int_4^{10} [f(x)]^2 dx = \pi \int_4^{10} [-\sqrt{x-4}]^2 dx$ $= \pi \int_4^{10} x-4 dx$ $= \pi \left[\frac{x^2}{2} - 4x \right]_4^{10} \quad \text{K1}$ $= \pi \left[\left(\frac{10^2}{2} - 4(10) \right) - \left(\frac{4^2}{2} - 4(4) \right) \right] \quad \text{K1}$ $= 18\pi \quad \text{N1}$	3	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah															
9 (a)	<table><tr><td>$\frac{y}{\sqrt{x}}$</td><td>0.54</td><td>0.76</td><td>0.93</td><td>1.00</td><td>1.29</td><td>1.49</td><td>N1</td></tr></table> K1: Graf garis lurus $\frac{y}{\sqrt{x}}$ melawan x dilukis dan sekurang-kurangnya satu *titik diplot dengan betul. NI : 6 *titik diplot dengan betul. N1 : Garis lurus penyuaian terbaik Nota : 1. Jika jadual tidak ditunjukkan, semak titik pada graf mengikut nilai $\frac{y}{\sqrt{x}}$ yang betul. 2. Paksi terbalik K0N0N0. 3. SS-1 jika tidak menggunakan skala yang diberikan.	$\frac{y}{\sqrt{x}}$	0.54	0.76	0.93	1.00	1.29	1.49	N1	4	10							
$\frac{y}{\sqrt{x}}$	0.54	0.76	0.93	1.00	1.29	1.49	N1											
(b)	i) <table><tr><td>$\frac{y}{\sqrt{x}} = px + q$</td><td>P1</td></tr><tr><td>$p = 0.18$</td><td>N1</td></tr><tr><td>$q = 0.4$</td><td>N1</td></tr><tr><td>Syarat $0.42 \leq c \leq 0.38$</td><td></td></tr></table> ii) <table><tr><td>$\frac{y}{\sqrt{x}} = 1.10$</td><td>P1</td></tr><tr><td>Syarat $1.08 \leq \frac{y}{\sqrt{x}} \leq 1.12$</td><td></td></tr></table> <table><tr><td>$\frac{y}{\sqrt{4}} = *1.10$</td><td>K1</td></tr><tr><td>$y = *2.20$</td><td>N1</td></tr></table>	$\frac{y}{\sqrt{x}} = px + q$	P1	$p = 0.18$	N1	$q = 0.4$	N1	Syarat $0.42 \leq c \leq 0.38$		$\frac{y}{\sqrt{x}} = 1.10$	P1	Syarat $1.08 \leq \frac{y}{\sqrt{x}} \leq 1.12$		$\frac{y}{\sqrt{4}} = *1.10$	K1	$y = *2.20$	N1	6
$\frac{y}{\sqrt{x}} = px + q$	P1																	
$p = 0.18$	N1																	
$q = 0.4$	N1																	
Syarat $0.42 \leq c \leq 0.38$																		
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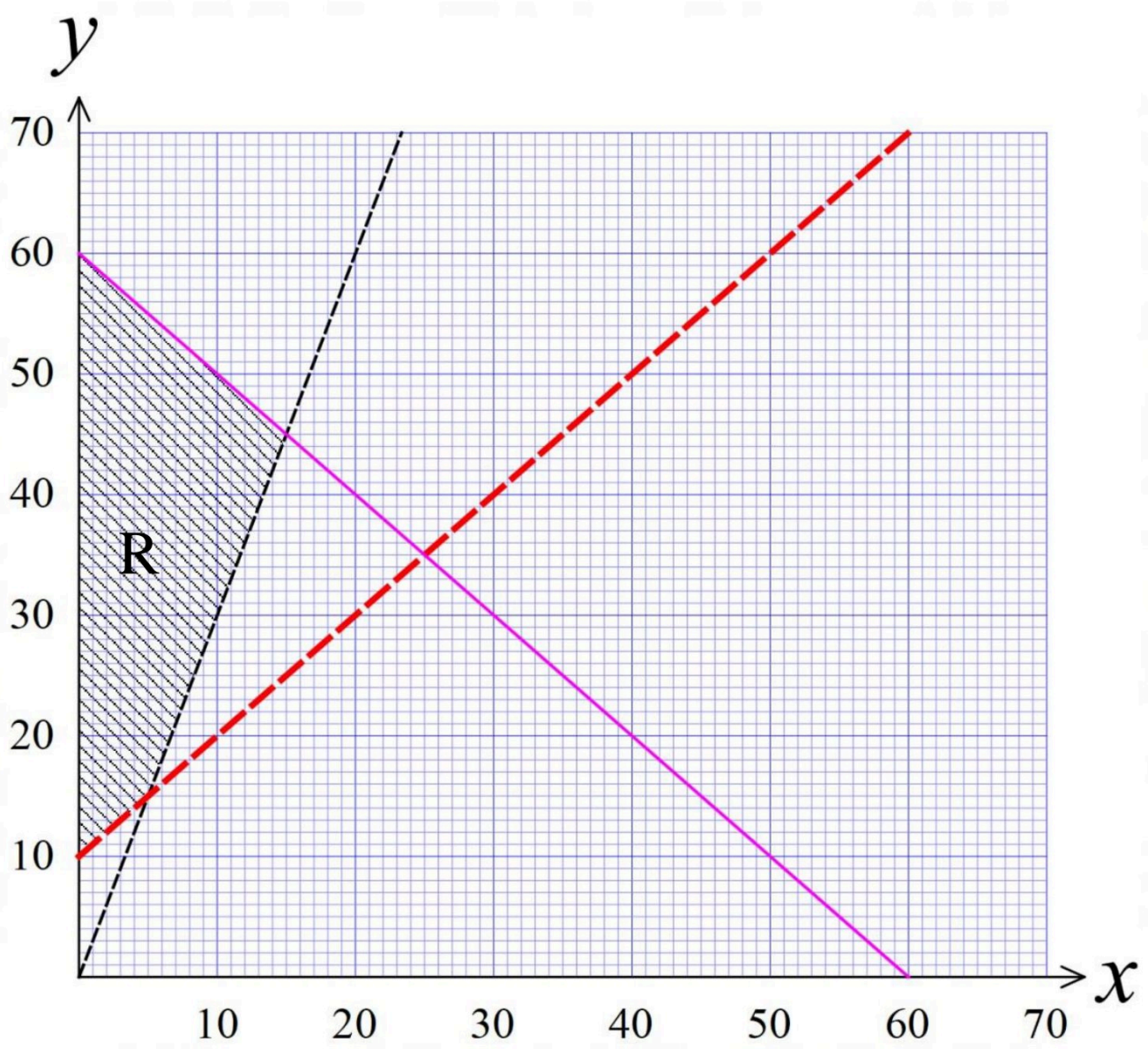
BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
11 (a)	i) $npq = \frac{40}{3} \quad \text{ATAU} \quad np = 20 \quad \text{P1}$ $(20)q = \frac{40}{3}$ $q = \frac{2}{3}$ $p = \frac{1}{3} \quad \text{N1}$ ii) $n * \left(\frac{1}{3}\right) = 20 \quad \text{K1}$ $n = 60$ $10 + m + 30 = 60$ $m = 20 \quad \text{N1}$	4	10
(b)	$P(X \geq 1) = 1 - P(X = 0)$ Tulis $1 - P(X = 0) \quad @ \quad P(X = 1) + P(X = 2) + \dots + P(X = 8) \quad \text{P1}$ (Boleh Tersirat) $P(X \geq 1) = 1 - {}^8C_0 \left(\frac{1}{3}\right)^0 \left(\frac{2}{3}\right)^8 \quad \text{K1}$ $P(X \geq 1) = 1 - 0.039018$ $P(X \geq 1) = 0.96098 / 0.9610 \quad \text{N1}$	3	
(c)	$P(X = r)$  P1 – Bentuk graf taburan binomial P1 – Bilangan pemboleh ubah rawak dan nilai kebarangkalian yang betul $h = \frac{4}{9}$ (Boleh tersirat) N1	3	

BIL	SKEMA PEMARKAHAN	Sub Markah	J M
12 (a)	i) $\angle JLK = 180 - 23 - 33$ $= 124^\circ \quad \text{P1}$ $\frac{JL}{\sin 44} = \frac{40}{\sin 124} \quad \text{K1}$ $JL = 26.28 \text{ cm} \quad \text{N1}$ ii) $LN = 114.24 - 26.28$ $= 87.96 \text{ cm}$ $LM^2 = p^2 + 87.96^2 - 2(p)(87.96)\cos 23^\circ \quad \text{N1}$ iii) $\sin 23 = \frac{x}{87.96} \quad \text{K1}$ $x = 34.3687$ $\therefore \text{Integer terkecil bagi LM} = 35 \text{ cm} \quad \text{N1}$	7	
(b)	$s = \frac{40 + 17 + 33}{2}$ $s = 45$ $\text{Luas } \triangle ABC = \sqrt{45(45 - 40)(45 - 17)(45 - 33)} \quad \text{K1}$ $= 60\sqrt{21} // 274.9545 \quad \text{N1}$ $\text{Isipadu prisma} = 60\sqrt{21} \times 10 \quad \text{K1}$ $= 600\sqrt{21} // 2749.5454 \quad \text{N1}$	4	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
13 (a)	$\frac{3.60}{k} \times 100 = 144$ K1 $360 = 144 \times k$ $k = 2.50$ N1	2	10
(b)	$\frac{1.50}{6.25} \times 100 = 24$ N1 Harga per unit saham bagi Syarikat D menurun 76% pada tahun 2023 berasaskan 2020 N1	2	
(c)	$\frac{177.5 + 137.5 + 144 + 24}{1 + 1 + 1 + 1}$ K1 $= 120.75$ N1 Keuntungan = RM20 000 $\times$ 20.75% = RM4 150 N1	3	
(d)	$\frac{177.5n + 137.5n + 144n + 24m}{n + n + n + m} = 140.1$ K1 $459n + 24m = 140.1(3n + 1)$ $38.7n = 116.1m$ $\frac{n}{m} = \frac{116.1}{38.7} = \frac{3}{1}$ K1 $A : B : C : D = 3 : 3 : 3 : 1$ N1	3	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
14 (a)	Apabila zarah melalui titik O, $t = 0$ $P(0) = 6$ dan $Q(0) = 0$ Beza halaju zarah $= 6 - 0$ $= 6$ N1	1	10
(b)	$P(t) = -2t^2 + 3t + 6$ Paksi simetri, $t = -\frac{3}{2(-2)}$ $t = \frac{3}{4}$ P1 Sesaran zarah Q $= \int_0^{\frac{3}{4}} \frac{1}{5} t^2 dt$ $= \frac{1}{15} \left[t^3 \right]_0^{\frac{3}{4}}$ $= \frac{1}{15} \left[\left(\frac{3}{4} \right)^3 - (0)^3 \right]$ K1 $= \frac{9}{320} // 0.02813 \text{ m}$ N1 di kanan titik O N1	4	
(c)	$P(t) = -2t^2 + 3t + 6$ $P'(t) = -4t + 3$ K1 $P'(3) = -4(3) + 3$ $P'(3) = -9$ $\therefore$ Pecutan zarah P ialah -9 ms^{-2} N1	2	
(d)	$P(t) < 0$ $-2t^2 + 3t + 6 < 0$ K1 * Kaedah Graf, Garis Nombor dan Jadual K1 $t > 2.64$ $t > 3$ N1	3	

BIL	SKEMA PEMARKAHAN	Sub Markah	Jumlah Markah
15 (a)	$y > x + 10$ N1 (Diterima simbol =) $y > 3x // y \geq 3x$ N1 (Diterima simbol =) $x + y \leq 60$ N1 SS-1 jika simbol = digunakan di I dan II, tidak digunakan di III	3	10
(b)	K1 – Lukis dengan betul sekurang-kurangnya satu garis lurus dari *ketaksamaan yang melibatkan x dan y pada paksi-paksi yang bermula dari asalan. N1 – Lukis dengan betul semua *garis lurus dari *ketaksamaan yang melibatkan x dan/atau y Nota : Terima garis putus-putus dan garis lurus N1 – Rantau dilorek dengan betul.	3	
(c)	i) 14 N1 (Integer sahaja) ii) $P = -10x + 5y$ (0, 60) N1 $P = -10(*0) + 5(*60)$ K1 Gantikan mana-mana titik integer dalam *rantau ke dalam $-10x + 5y$ $P = 300$ N1	4	



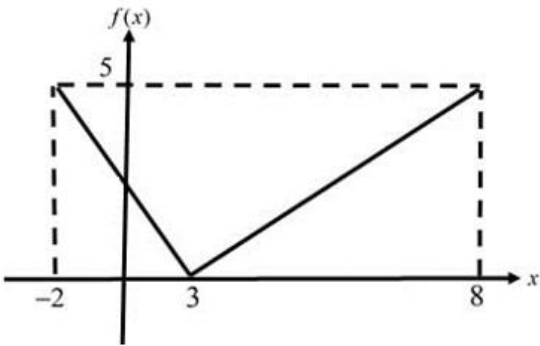
TAMAT
THE END

MODUL PINTAS PPC PAHANG SPM 2023
MATEMATIK TAMBAHAN
PERATURAN PEMARKAHAN
KERTAS 1

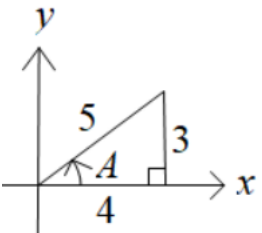
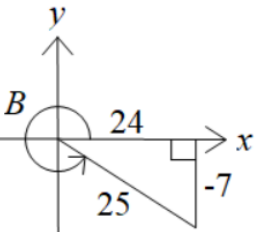
SOALAN			SKEMA	MARKAH	MARKAH PENUH
1			Cari m $\frac{13-3}{8-3}$ atau setara	1	4
			Cari c $13 = 2(8) + c$ atau $3 = 2(3) + c$ atau $Y - 13 = 2(X - 8)$ atau $Y - 3 = 2(X - 3)$	1	
			$\ln y = 2 \ln x - 3$	1	
			$y = \frac{x^2}{e^3}$ atau $y = \frac{x^2}{20.09}$ atau $y = 0.04979x^2$	1	
2	(a)	(i)	$m^{-1}(x) = x - 5$ atau $m(-2) = 3$	1	8
			$(t + 2) - 5 = 3$	1	
			6	1	
	(b)	(ii)	$nm(x) = (x + 5)^2 - 2$	1	
		(i)	$\frac{p}{y} + 2 = x$, y boleh sebarang huruf selain x, k, g, p	1	
			$g(y) = \frac{5\left(\frac{p}{y} + 2\right) - 8}{\left(\frac{p}{y} + 2\right) - 2}$	1	
			$g(x) = \frac{5p + 2x}{p}$ atau $g(x) = 5 + \frac{2}{p}x$	1	
		(ii)	7	1	

3	(a)		$\alpha + \beta = \frac{p}{2}$	1	6
			$\alpha\beta = \frac{q}{2}$	1	
	(b)		$\frac{2}{\alpha} + \frac{2}{\beta} = -\frac{-12}{3}$ dan $\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = \frac{8}{3}$	1	
			$\frac{\frac{4}{q}}{\frac{2}{2}} = \frac{8}{3}$	1	
			Gantikan nilai q : $\frac{2\left(\frac{p}{2}\right)}{\frac{*3}{2}} = \frac{-(-12)}{3}$	1	
			$q = 3, p = 6$	1	
4	(a)		$q - (q + 3) = (q + 3) - (3q - 2)$	1	5
			$q = 4$	1	
	(b)		$a = 10$ dan $d = -3$	1	
			$S_{14} - S_6$ $\frac{14}{2} [2(10) + (14-1)(-3)] - \frac{6}{2} [2(10) + (6-1)(-3)]$ atau setara	1	
			-148	1	
5	(a)	(i)	$\frac{4}{n+1}x^{n+1} + c$	1	5
		(ii)	$n \neq -1$	1	
			$c =$ pemalar pengamiran	1	
	(b)		$\frac{25x^{-3}}{-3} - \frac{x^{-1}}{-1}$	1	
			$-\frac{25}{3x^3} + \frac{1}{x} + c$	1	

6			$10\theta = \frac{25}{9}\pi$	1	2
			$\frac{5}{18}\pi$	1	
7	(a)		$\frac{11!}{4!4!2!}$	1	7
			34650	1	
	(b)	(i)	${}^3C_1 \times {}^2C_1$ atau ${}^2C_1 \times {}^2C_1$ atau ${}^2C_1 \times {}^2C_1$	1	
			$({}^3C_1 \times {}^2C_1) + ({}^2C_1 \times {}^2C_1) + ({}^2C_1 \times {}^2C_1)$	1	
			14	1	
		(ii)	$(6-1)!$ atau setara	1	
			120	1	
8	(a)		$(11,13) = \left(\frac{1(x)+2(14)}{1+2}, \frac{1(y)+2(11)}{1+2} \right)$	1	6
			$K = \left(\frac{1(2)+2(*5)}{1+2}, \frac{1(2)+2(*17)}{1+2} \right)$	1	
			$K(4,12)$	1	
	(b)		$\frac{1}{2} (5(13)+11(12)+4(17)) - (17(11)+13(4)+12(5)) $ atau $\frac{1}{2} (2(11)+14(13)+11(12)+4(2)) - (2(14)+11(11)+13(4)+12(2)) $	1	
			$17 \text{ dan } \frac{119}{2} @ 59.5$	1	
			$2:7$	1	
9	(a)		$a = 22680$, $r = \frac{9}{16}$	1	
			$22680 \left(\frac{9}{16} \right)^{n-1} < 100$	1	

			$n-1 > \frac{\log_{10} \frac{100}{22680}}{\log_{10} \frac{9}{16}}$	1	6
			$n = 11$	1	
	(b)		$\frac{22680}{1 - \frac{9}{16}}$	1	
			51840	1	
10			$V = \pi j^3$	1	5
			$\partial V = -0.6 \text{ cm}^3$	1	
			$\frac{dV}{dj} = 3\pi j^2$	1	
			Guna rumus $\partial V = \frac{dV}{dj} \times \partial j$ dan gantikan nilai $-0.6 = 3\pi(3.1)^2 \times \partial j$	1	
			$\partial j = -0.006624 // -0.006625 // -\frac{20}{961\pi}$	1	
11	(a)		${}^nC_5(0.4)^5(0.6)^{n-5} = 10 \left[{}^nC_4(0.4)^4(0.6)^{n-4} \right]$	1	4
			$\frac{n!}{(n-5)!5!}(0.4)^5 \frac{(0.6)^n}{(0.6)^5} = 10 \left[\frac{n!}{(n-4)!4!}(0.4)^4 \frac{(0.6)^n}{(0.6)^4} \right]$	1	
			$n = 79$	1	
	(b)		Min = 31.6	1	
12	(a)				

			Bentuk V	1	
			Label $(3,0), (-2,5), (8,5)$	1	
			Julat: $0 \leq f(x) \leq 5$	1	
	(b)		$fg(x) = 2x - 9 $	1	6
			$2x - 9 = x$, $2x - 9 = -x$	1	
			$x = 9$, $x = 3$	1	
13	(a)	(i)	$\overrightarrow{BC} = \overrightarrow{AC} - \overrightarrow{AB}$ @ setara ATAU $\overrightarrow{AT} = \overrightarrow{AB} + \overrightarrow{BT}$ @ setara	1	8
			$\overrightarrow{BC} = -2\hat{i} + 10\hat{j}$ atau $\begin{pmatrix} -2 \\ 10 \end{pmatrix}$	1	
		(ii)	$\overrightarrow{AT} = \frac{7}{2}\hat{i} - \frac{7}{2}\hat{j}$ atau $\begin{pmatrix} \frac{7}{2} \\ -\frac{7}{2} \end{pmatrix}$	1	
			$\frac{\frac{7}{2}\hat{i} - \frac{7}{2}\hat{j}}{\sqrt{\left(\frac{7}{2}\right)^2 + \left(-\frac{7}{2}\right)^2}}$	1	
			$\frac{\sqrt{2}}{2}\hat{i} - \frac{\sqrt{2}}{2}\hat{j}$	1	
		(iii)	$-3\hat{i} + k\hat{j} = -2h\hat{i} + 10h\hat{j}$	1	
			$h = \frac{3}{2}$	1	
			$k = 15$	1	
14	(a)	(i)	$\log_a x = p$, $x = a^p$ atau $\log_a y = q$, $y = a^q$	1	
			$\frac{x}{y} = a^{p-q}$	1	
			$\log_a \frac{x}{y} = \log_a x - \log_a y$	1	

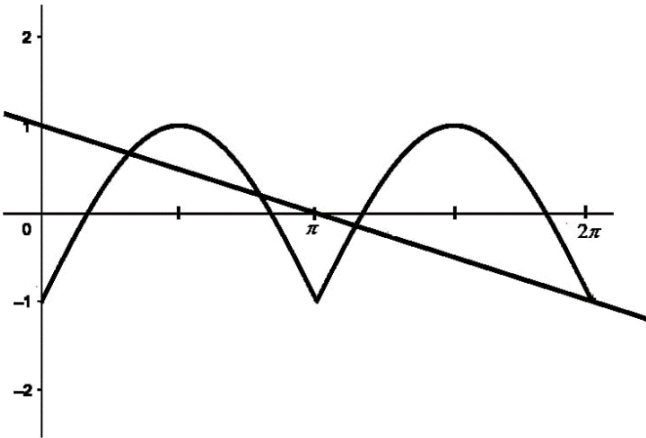
15	(a)	(ii)	Guna hukum hasil bahagi: $\log_3\left(\frac{54}{6} \div 3\right)$	1	8
			1	1	
		(b)	$20\,000e^{-0.03t} < \frac{1}{2}(20\,000)$	1	
			$t > \frac{\ln \frac{1}{2}}{-0.03}$	1	
			24	1	
		(i)	495°	1	
		(ii)	$\frac{2}{-\sin \theta}$	1	
			$-\frac{2}{h}$	1	
		(b)	$\sin A = \frac{3}{5} @ \cos A = \frac{4}{5} @$  ATAU $\sin B = -\frac{7}{25} @ \cos B = \frac{24}{25} @$ 	1	
	(b)		$\left(\frac{3}{5}\right)\left(\frac{24}{25}\right) + \left(\frac{4}{5}\right)\left(-\frac{7}{25}\right)$	1	8
			$\frac{44}{125}$	1	
		(ii)	$\frac{\frac{3}{4} - \left(-\frac{7}{24}\right)}{1 + \left(\frac{3}{4}\right)\left(-\frac{7}{24}\right)}$	1	
			$\frac{4}{3}$	1	

MODUL PINTAS PPC PAHANG 2023
MATEMATIK TAMBAHAN
PERATURAN PEMARKAHAN

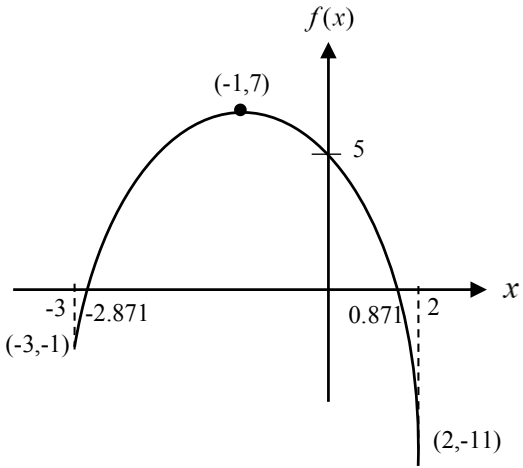
KERTAS 2

SOALAN			PEMARKAHAN	SUB MARKAH	MARKAH
1	(a)	(i)	$mPQ = -2$ dan guna $m_1 \times m_2 = -1$ $m_2 = \frac{1}{2}$	1	8
			Selesaikan $y - 1 = \frac{1}{2}(x - (-4))$ atau $1 = \frac{1}{2}(-4) + c$ $c = 3$	1	
			$y = \frac{1}{2}x + 3$	1	
		(ii)	$y = -2x + 13$	1	
			Selesaikan $y = \frac{1}{2}x + 3$ dan $y = -2x + 13$	1	
			(4, 5)	1	
		(b)	$\sqrt{(x-4)^2 + (y-5)^2} = 6$ atau setara	1	
			$x^2 + y^2 - 8x - 10y + 5 = 0$	1	
2	(a)	(i)	$\log_2 \left(\frac{2 \times 3^2}{5} \right)$	1	
			$1 + 2h - k$	1	
		(ii)	$\log_2(3^2 \times 2 \times 5)$	1	
			$1 + k + 3h$	1	

	(b)		$\frac{8+\sqrt{24}}{\sqrt{2}+\sqrt{8}} \times \frac{\sqrt{2}-\sqrt{8}}{\sqrt{2}-\sqrt{8}} @ \text{ setara}$	1	7
			$\frac{8\sqrt{2}-8\sqrt{8}+\sqrt{48}-\sqrt{192}}{2-\sqrt{16}+\sqrt{16}-8} @ \text{ setara}$	1	
			$\frac{4\sqrt{2}+2\sqrt{3}}{3}$	1	
3	(a)		$ \overrightarrow{SR} + \overrightarrow{RP} + \overrightarrow{PS} = 0$	1	6
	(b)		$\overrightarrow{SQ} = \overrightarrow{SR} + \overrightarrow{RQ} @ \overrightarrow{SQ} = \overrightarrow{SO} + \overrightarrow{OQ}$ $\overrightarrow{SQ} = 11\hat{i} + 4\hat{i} + 10\hat{j} @ \overrightarrow{SQ} = -\hat{i} - \hat{j} + 16\hat{i} + 11\hat{j}$	1	
			$15\hat{i} + 10\hat{j} @ \begin{pmatrix} 15 \\ 10 \end{pmatrix}$	1	
	(c)		$\overrightarrow{SA} = 4\hat{i} + (k-1)\hat{j} @ \overrightarrow{SA} = \begin{pmatrix} 4 \\ k-1 \end{pmatrix}$	1	
			Bandingkan pekali $\hat{i}$ dan $\hat{j}$ $4 = 3t$ dan $k-1 = 4t$	1	
			$t = \frac{4}{3}$ dan $k = \frac{19}{3}$	1	
4			$y + x + 2x - 1 = 40$	1	7
			$y^2 = x^2 + (2x-1)^2$	1	
			$y = 41 - 3x$	1	
			$(41-3x)^2 - 5x^2 + 4x - 1 = 0$	1	
			$(2x-105)(x-8) = 0$	1	
			$x = 8$	1	

			17	1	
5	(a)		$2 \frac{\sin x}{\cos x} \cos^2 x$	1	
			$\sin 2x$ (terbukti)	1	
	(b)	(i)			
			Bentuk graf sin	1	
			Amplitud dan kitaran	1	
			Modulus dan translasi	1	
		(ii)	$y = 1 - \frac{x}{\pi}$	1	
			Garis lurus dilukis dengan betul	1	
			Bilangan penyelesaian = 4	1	
6	(a)		$f(x) = -2 \left[x^2 + 2x + \left(\frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 - \frac{5}{2} \right]$	1	

8

			$f(x) = -2(x+1)^2 + 7$	1	
	(b)				
			Bentuk maksimum	1	
			Titik maksimum dilabel dengan betul	1	
			Label $(-3, -1), (0, 5), (2, -11)$	1	
	(c)		$x = 1$	1	
					6
7	(a)		$\frac{dy}{dx} = 3x^2 - 12x + 9$	1	
			Ganti $x = 2$ dan guna $m_1 \times m_2 = -1$	1	
			$y - 6 = \frac{1}{3}(x - 2)$	1	
			$y = \frac{1}{3}x + \frac{16}{3}$	1	
	(b)		Guna $\frac{dy}{dx} = 0$ dan selesaikan		

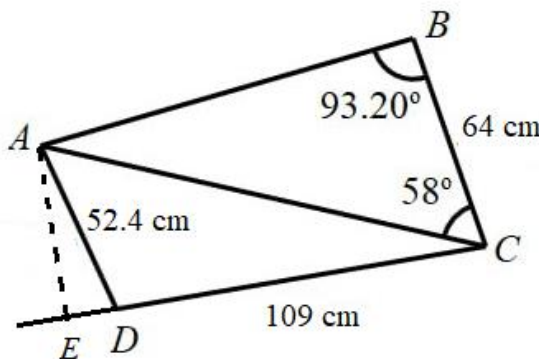
			$(x-1)(x-3)=0$	1	8									
			$L(3,4)$	1										
			Bezakan kali ke-2 dan gantikan nilai $x=3$ ke dalamnya. $\frac{d^2y}{dx^2}=6x-12$ $=6(3)-12$	1										
			$6>0, \therefore$ minimum	1										
8	(a)		$y=p\left(\frac{1}{x}\right)+q$	1										
			<table><tr><td></td><td>$\frac{1}{x}$</td><td>0.50</td><td>0.33</td><td>0.25</td><td>0.17</td><td>0.13</td><td>0.10</td><td></td></tr></table>			$\frac{1}{x}$	0.50	0.33	0.25	0.17	0.13	0.10		1
				$\frac{1}{x}$		0.50	0.33	0.25	0.17	0.13	0.10			
			Paksi mengikut skala yang betul dan satu titik ditanda dengan betul	1										
			Semua titik ditanda dengan tepat	1										
	Garis lurus penyuaian terbaik dilukis dengan betul	1												
	(b)		$p=m^*$	1										
			$p=66.25$	1										
			$q=4.5$ hingga 5.0	1										
	(c)		$\frac{1}{x}=0.08$ (tunjukkan dalam graf)	1										
			12.5	1										

10

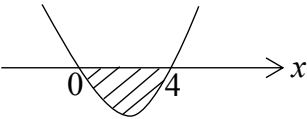
9	(a)	(i)	4.984	1	10
		(ii)	10(4.984)	1	
			10(4.984) + 10 + 10	1	
			69.84	1	
	(b)	(i)	$\frac{1}{2}(10)^2(4.984)$ atau $3.142(5)^2$	1	
			$\frac{1}{2}(10+8)(3)$	1	
			$\frac{1}{2}(10)^2(4.984) - 3.142(5)^2 - \frac{1}{2}(10+8)(3)$	1	
			143.65	1	
		(ii)	143.65 × 50	1	
			7182.50	1	
10	(a)	(i)	Tidak setuju kerana nilai tidak sama luas @ nilai tidak sama besar	1	
		(ii)	$a = 4$ dan $b = -8$	1	
			$\int \frac{x^3}{3} - x^2 - 8 \, dx$ $= \frac{x^3}{3} - x^2 - 8x$	1	
			Guna $\int_0^4 \frac{x^3}{3} - x^2 - 8 \, dx$ atau $\frac{1}{2} \times 4 \times 8$	1	

			$A_1 - A_2$ atau $A_1 - A_3$	1	10		
			$\frac{32}{3}$	1			
	(b)		$p = 18$	1			
			$\pi \left[\frac{y^2}{4} \right]$	1			
			$\pi \left[\frac{18^2}{4} - \frac{0^2}{4} \right]$	1			
			81π	1			
	11	(a)	(i)	$P\left(Z \geq \frac{4500 - 5000}{1000}\right)$		1	
				$1 - P(Z > 0.5)$		1	
				0.6915×1200		1	
$829 // 830$				1			
(ii)			$P(Z \geq \frac{m - 5000}{1000}) = 0.10$	1			
			$\frac{m - 5000}{1000} = 1.281 // 1.28155 // 1.2816$	1			
			$m = 6281 // 6281.55 // 6281.60$	1			

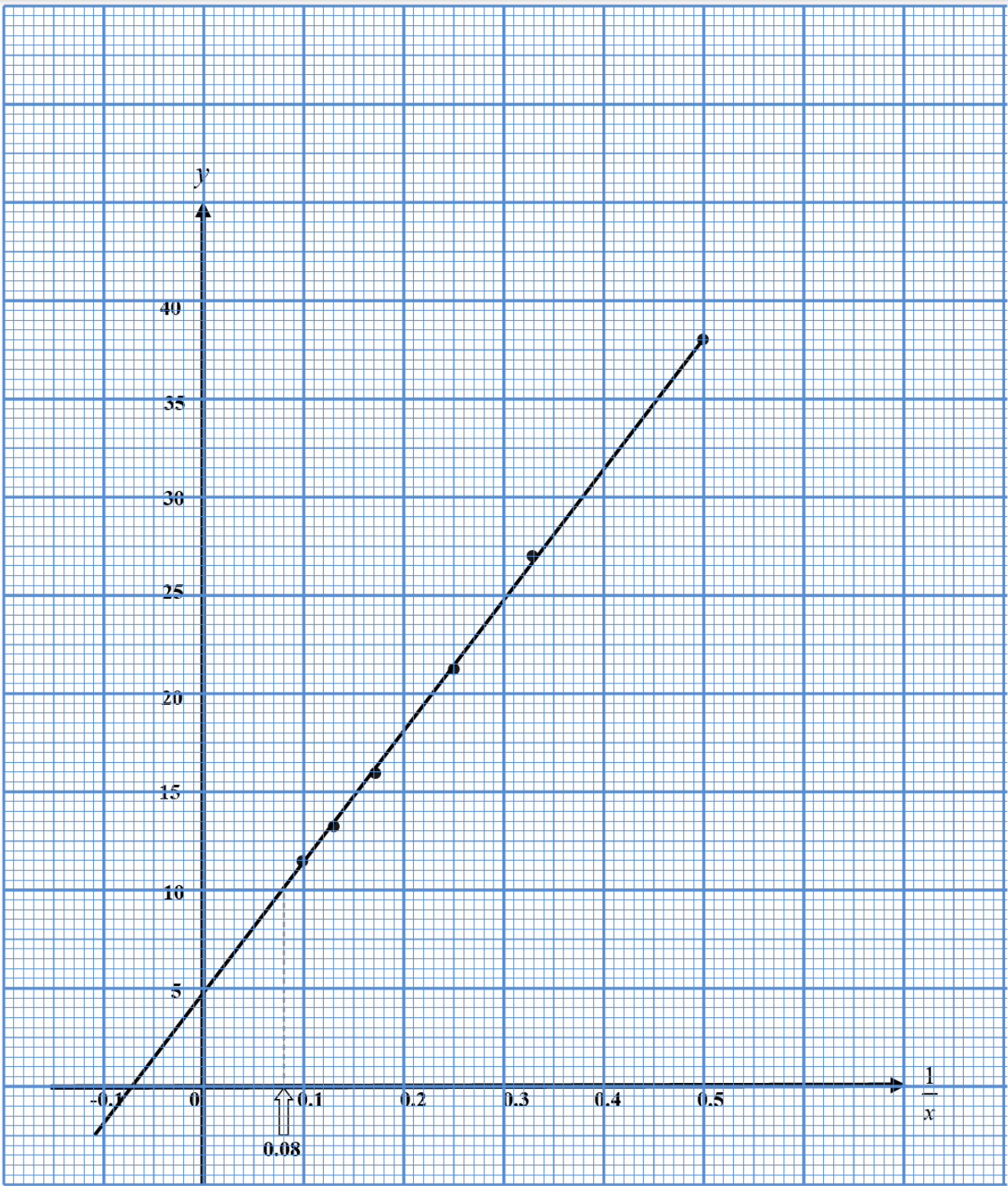
	(b)		${}^7C_0(0.65)^0(0.35)^{7-0} @ {}^7C_1(0.65)^1(0.35)^{7-1} @$ ${}^7C_2(0.65)^2(0.35)^{7-2}$ Atau ${}^7C_5(0.35)^5(0.65)^{7-5} @ {}^7C_6(0.35)^6(0.65)^{7-6} @$ ${}^7C_7(0.35)^7(0.65)^{7-7}$	1	10
			$1 - {}^7C_0(0.65)^0(0.35)^{7-0} - {}^7C_1(0.65)^1(0.35)^{7-1} -$ ${}^7C_2(0.65)^2(0.35)^{7-2}$ Atau $1 - {}^7C_5(0.35)^5(0.65)^{7-5} - {}^7C_6(0.35)^6(0.65)^{7-6} -$ ${}^7C_7(0.35)^7(0.65)^{7-7}$	1	
			0.9444	1	
12	(a)		$q = \frac{100}{80} \times 100$	1	
			$q = 125$	1	
	(b)	(i)	$\left(\frac{110}{100} \times 125\right)$ atau $\left(\frac{110}{100} \times 140\right)$	1	
			137.5 dan 154	1	
		(ii)	$\frac{137.5(2p) + 121(6) + 112(3) + 154(p)}{2p + 6 + 3 + p} = 128$	1,1	
			$p = 2$	1	
	(c)	(i)	Komponen Membeli-belah kerana mempunyai nilai pemberat paling besar.	1	

		(ii)	$\frac{151.25}{121} \times 100 = 125\%$	1	10		
			Peratus peningkatan = 25%	1			
13	(a)		Titik C AC adalah garis terpanjang kerana sudut bertentangannya adalah sudut terbesar bagi kedua-dua segitiga ABC dan ADC .	1			
	(b)	(i)	$\frac{AC}{\sin 93.20^\circ} = \frac{64}{\sin (180^\circ - 93.20^\circ - 58^\circ)}$	1			
			$(*AC)^2 = 52.4^2 + 109^2 - 2(52.4)(109)\cos \angle ADC$	1			
			105.05° atau setara	1			
		(ii)	$\frac{1}{2}(52.4)(109)\sin (*105.05^\circ)$ atau $\frac{1}{2}(64)(*132.64)\sin (58^\circ)$	1			
			$\frac{1}{2}(52.4)(109)\sin (*105.05^\circ) + \frac{1}{2}(64)(*132.64)\sin (58^\circ)$	1			
			6357.37	1			
			(c)	(i)			1

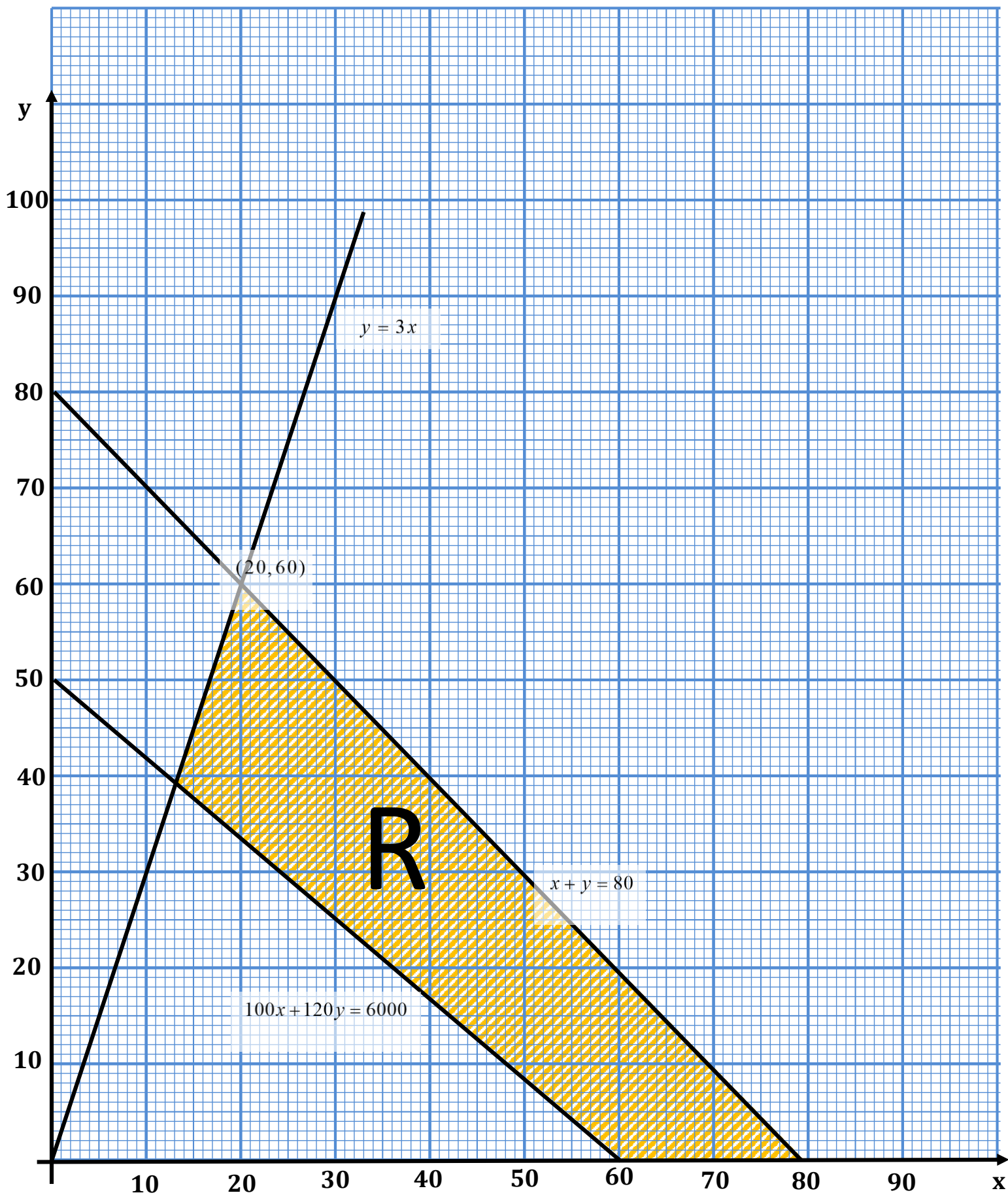
			$\frac{1}{2} \times AE \times 109 = *2757.84$	1	10
			50.60	1	
14	(a)		$x + y \leq 80$	1	
			$\frac{x}{y} \geq \frac{1}{3}$ atau $y \leq 3x$	1	
			$100x + 120y \geq 6000$	1	
	(b)		Sekurang-kurangnya 1 garis dilukis dengan betul mengikut ketaksamaan yang melibatkan x dan y	1	
			3 garis dari ketaksamaannya dilukis dengan betul	1	
			Rantau dilorek dengan betul	1	
	(c)	(i)	39	1	
		(ii)	Titik maksimum (20,60)	1	
			$k = 100(20) + 120(60)$	1	
			2300	1	
15	(a)		$16p + 4q = 0$ atau $a = 2pt + q$	1	
			$q = -4p$ dan $2p + q = -2$	1	
			$2p + (-4p) = -2$	1	
			$p = 1$	1	

			$q = -4$	1	10
(b)			$t(t - 4) < 0$ dan 	1	
			$0 < t < 4$	1	
	(c)		$\left[\frac{t^3}{3} - \frac{4t^2}{2} \right]_3^4$	1	
			$\left[\frac{4^3}{3} - \frac{4(4)^2}{2} \right] - \left[\frac{3^3}{3} - \frac{4(3)^2}{2} \right]$	1	
			$\frac{5}{3}$	1	

Soalan 8



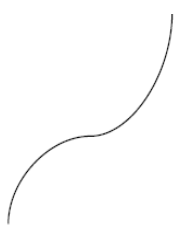
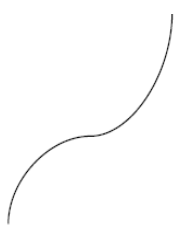
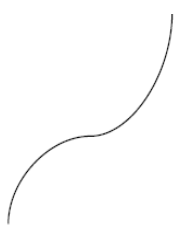
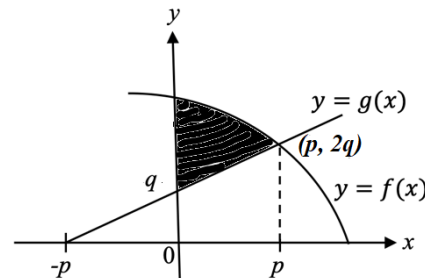
Soalan 14



PERATURAN PEMARKAHAN UJIAN DIAGNOSTIK 3 TINGKATAN 5
MATEMATIK TAMBAHAN
(KERTAS 1 / 2023)

No.	Solutions and marking scheme	Sub Marks	Total Marks
1 (a)	$\tan \theta_1 = \tan \theta_2$	1	5
	$m_1 = m_2$ shown	1	
(b)	$m_{PQ} = \frac{-2-1}{1-(-6)} \quad \text{or} \quad m_{RS} = \frac{h-5}{-3-0}$	1	
	$\frac{-2-1}{1-(-6)} \times \frac{h-5}{-3-0} = -1$	1	
	$h = -2$	1	
2 (a)	$\frac{L}{\pi j^2} = \frac{\theta}{2\pi}$	1	
	$L = \frac{1}{2}j^2\theta$	1	
(b)	$\frac{1}{2} \times 6^2 \times \left(\frac{2\pi}{3}\right) \quad \text{atau} \quad \frac{1}{2} \times 6 \times 6 \sin 120^\circ$	1	5
	$\left[\frac{1}{2} \times 6^2 \times \left(\frac{2\pi}{3}\right) - \frac{1}{2} \times 6 \times 6 \sin 120^\circ\right] \times 3$	1	
	$L = 36\pi - 27\sqrt{3}$	1	
3 (a)	$(2-m)^2 - 4(2)(2) < 0$	1	
	$(m+2)(m-6) < 0$	1	
	$-2 < m < 6$	1	
(b) (i)	$-5\left(x^2 - 6x + \left(-\frac{6}{2}\right)^2 - \left(-\frac{6}{2}\right)^2\right)$	1	6
	3	1	
(ii)	45	1	

4. (a)	Penyelesaian tak terhingga ialah garis-garis/satah-satah bersilang pada satu garis lurus manakala tiada penyelesaian ialah garis-garis/satah-satah tidak bersilang pada mana-mana titik.	1	5
(b)	<u>Alternatif A</u> $y = 1 + 3z$ atau setara $x + (1 + 3z) + z = 2$ atau setara $2(1 - 4z) + (1 + 3z) + 5z = 0$ atau setara $3 = 0$ dan pernyataan palsu, dan tiada penyelesaian atau setara ATAU $3 \neq 0$ dan tiada penyelesaian. <u>Alternatif B</u> $2x + 2y + 2z = 4$ $y - 3z = 4$ $0 = 3$ dan pernyataan palsu atau $0 \neq 3$ Tiada penyelesaian	1 1 1 1 1 1 1 1	
5 (a)	$4^{4x+3} = 4^x$ dan $4x + 3 = x$ atau $2^{4(2x)+6} = 2^{2x}$ dan $4(2x) + 6 = 2x$ $x = -1$	1 1	
(b)	$\frac{\log_3 k}{\log_3 9}$ $\log_3 p^2 k = 6$ $p^2 k = 729$ atau setara	1 1 1	
			5

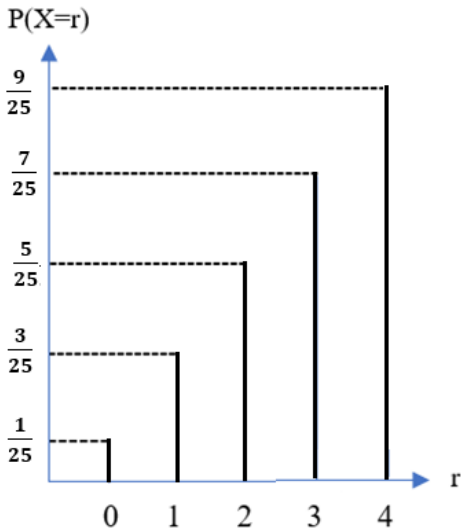
6.	(a)	$\frac{dy}{dx} = -4x^3 + 9x^2$ dan $x^2(-4x + 9) = 0$ $P(0, 4)$ dan $Q\left(\frac{9}{4}, 12.54\right)$ or $Q\left(\frac{9}{4}, 12\frac{139}{256}\right)$	1 1																					
	(b)	<table><tr><td>x</td><td>-1</td><td>0</td><td>1</td></tr><tr><td>$\frac{dy}{dx}$</td><td>$-4(-1)^3 + 9(-1)^2 = 13$</td><td>0</td><td>$-4(1)^3 + 9(1)^2 = 5$</td></tr><tr><td>Tanda bagi $\frac{dy}{dx}$</td><td>+</td><td>0</td><td>+</td></tr><tr><td>Lakaran Tangen</td><td>/</td><td>-</td><td>/</td></tr><tr><td>Lakaran Graf</td><td colspan="3"></td></tr></table> $P(0, 4)$ ialah titik lengkok balas.	x	-1	0	1	$\frac{dy}{dx}$	$-4(-1)^3 + 9(-1)^2 = 13$	0	$-4(1)^3 + 9(1)^2 = 5$	Tanda bagi $\frac{dy}{dx}$	+	0	+	Lakaran Tangen	/	-	/	Lakaran Graf				1 1	4
x	-1	0	1																					
$\frac{dy}{dx}$	$-4(-1)^3 + 9(-1)^2 = 13$	0	$-4(1)^3 + 9(1)^2 = 5$																					
Tanda bagi $\frac{dy}{dx}$	+	0	+																					
Lakaran Tangen	/	-	/																					
Lakaran Graf																								
7.	(a)	$2(7)$ atau $3\left[\frac{x^2}{2}\right]_{-3}^5$ $2(7) - 3\left[\frac{5^2}{2} - \frac{(-3)^2}{2}\right]$ -10	1 1 1																					
	(b) (i)		1																					
	(ii)	$10 + \frac{1}{2}p[q + 2q]$ $10 + \frac{3pq}{2}$	1 1	6																				

8.	(a)	$y = p\sqrt{x} - \frac{q}{x}$ $xy = p\sqrt{x^3} - q$	OR	$y = p\sqrt{x} - \frac{q}{x}$ $\frac{y}{\sqrt{x}} = p - \frac{q}{\sqrt{x^3}}$	1	
		Paksi-Y = xy Paksi-X = $\sqrt{x^3}$	OR	Paksi-Y = $\frac{y}{\sqrt{x}}$ Paksi-X = $\frac{1}{\sqrt{x^3}}$	1	
	(b) (i)	$\ln y = \frac{1}{4} \ln x + \frac{A}{4}$ $m = \frac{1}{4}$			1 1	
		(ii) $0.5 = \frac{A}{4}$ $A = 2$			1 1	
9.	(a)	$\overrightarrow{PT} = \overrightarrow{PQ} + \overrightarrow{QT}$ $4\hat{i} - 6\hat{j} + \frac{3}{4}(-2\hat{i} + 10\hat{j})$ $\frac{5}{2}\hat{i} + \frac{3}{2}\hat{j}$			1 1 1	
	(b)	$\frac{1}{\sqrt{(\frac{5}{2})^2 + (\frac{3}{2})^2}} (\frac{5}{2}\hat{i} + \frac{3}{2}\hat{j})$ $\frac{5}{\sqrt{34}}\hat{i} + \frac{3}{\sqrt{34}}\hat{j}$			1 1	

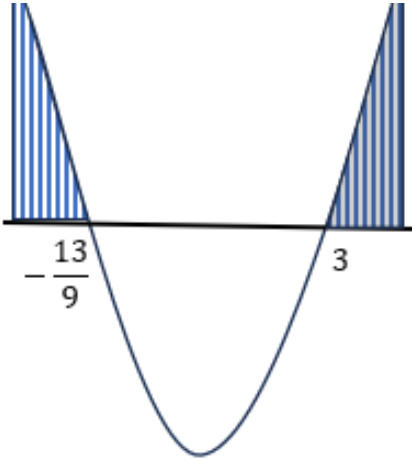
10.	(a)	$42 + 6\sqrt{h} + 28\sqrt{h} + 4h$ $42 + 34\sqrt{h} + 4h$	1 1	5
	(b)	$\frac{1}{2}[(8 - 2\sqrt{h}) + (6 + 4\sqrt{h})][\frac{1}{2}(6 + 4\sqrt{h})] = 27 + 17\sqrt{h}$ $21 + 2h = 27$ $h = 3$	1 1 1	
11.	(a)	$m = -4$ $ -4 + 2n = 0$ $n = 2$	1 1 1	6
	(b)	$0 \leq f(x) \leq 8$	1	
	(c)	$-4 + 2x \geq 2 \quad \text{dan} \quad -4 + 2x \leq -2$ $x \geq 3 \quad \text{dan} \quad x \leq 1$	1 1	
12.	(a)	$\frac{n(n-1)!}{(n-1)!}$ n	1 1	6
	(b) (i)	$(5-1)! \times 2$ 48	1 1	
	(ii)	$(6-1)! - 48$ 72	1 1	

13. (a)	<i>Bentuk kos at least 1 cycle</i> <i>Amplitude</i> <i>Min = -3</i> <i>Max = 3</i> <i>Cycles</i> $1\frac{1}{2}$ cycles & -ve cos graph	1	
(b)	$y = \frac{\pi}{2x}$ Reciprocal graph No of solutions = 3	1	
(c)	$\frac{3p}{2} = 3$ or $\frac{3p}{2} = -3$ $p = 2$ and $p = -2$	1	
		1	8

14.	(a)	$n \rightarrow \infty$, maka $r^n \approx 0$ dan guna $S_n = \frac{a(1-r^n)}{1-r}$ $S_\infty = \frac{a(1-0)}{1-r}$ $S_\infty = \frac{a}{1-r}$, $ r < 1$	1	
			1	
	(b) (i)	$3\left(\frac{1}{2}\right)^{5-1}$ atau kaedah listing: $3, \frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \frac{3}{16}$ $\frac{3}{16}$ atau $T_5 = \frac{3}{16}$ (kaedah listing)	1	
			1	
	(ii)	<u>Alternatif 1</u> $a = \frac{1}{8}$, $r = \frac{\frac{1}{32}}{\frac{1}{8}}$ OR $S_\infty = \frac{\frac{1}{8}}{1-\frac{1}{4}}$ dan $\frac{1}{6} \times (6 \times 6)$ 6 <u>Alternatif 2</u> $a = \frac{1}{2} \times 3 \times 3$, $r = \frac{\frac{1}{2} \times 1.5 \times 1.5}{\frac{1}{2} \times 3 \times 3}$ $S_\infty = \frac{\frac{1}{2} \times 3 \times 3}{1-\frac{1}{4}}$ 6	1, 1	
			1	
			1	
			1, 1	
			1	
			1	8

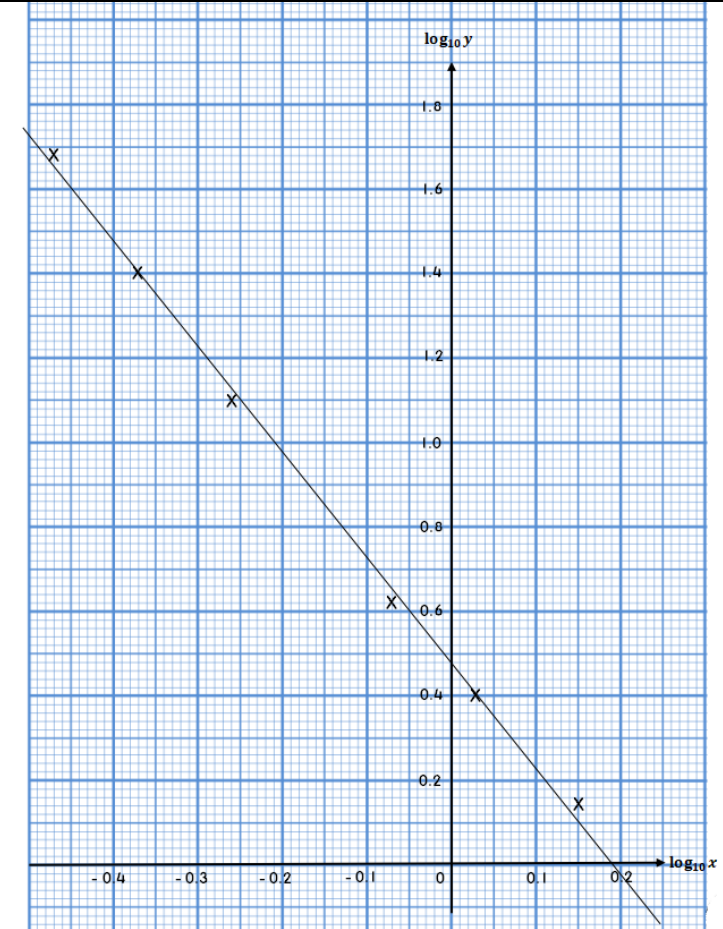
15.	(a)	${}^6C_6p^6q^{6-6} = \frac{1}{64}$ $p^6 = \frac{1}{64}$ $p = \frac{1}{2}$	1											
	(b) (i)	$m(2(0) + 1) + m(2(1) + 1) + m(2(2) + 1) + m(2(3) + 1) + m(2(4) + 1) = 1$ $m = \frac{1}{25}$	1,1											
	(c)	<table><tr><td>r</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>P(X=r)</td><td>$\frac{1}{25}$</td><td>$\frac{3}{25}$</td><td>$\frac{5}{25}$</td><td>$\frac{7}{25}$</td><td>$\frac{9}{25}$</td></tr></table> 	r		0	1	2	3	4	P(X=r)	$\frac{1}{25}$	$\frac{3}{25}$	$\frac{5}{25}$	$\frac{7}{25}$
r	0	1	2	3	4									
P(X=r)	$\frac{1}{25}$	$\frac{3}{25}$	$\frac{5}{25}$	$\frac{7}{25}$	$\frac{9}{25}$									
			1	8										

**Peraturan Pemarkahan Ujian Diagnostik 3 Tingkatan 5 Matematik Tambahan
(Kertas 2 / 2023)**

No	Solutions and marking Scheme	Sub marks	Total Marks
1	$2x^2 + 11y^2 + 2x + 2y = 0 \dots 1$ $x - 3y + 1 = 0 \dots 2$ From 2, $x = 3y - 1 \dots 3$ Substitute 3 into 1 $2(3y - 1)^2 + 11y^2 + 2(3y - 1) + 2y = 0$ $29y^2 - 4y = 0$ $y(29y - 4) = 0$ $y = 0$ or $y = \frac{4}{29}$ Substitute y into 3 $x = 3(0) - 1$ or $x = 3(\frac{4}{29}) - 1$ $= -1$ or $= -\frac{17}{29}$ $(-1, 0)$ and $(-\frac{17}{29}, \frac{4}{29})$	1 1 1 1 1	5
2(a) i	7	1	8
ii	10	1	
(b)	$h+k = -\frac{2}{3}$ dan $hk = -2$ $\frac{h}{k} + \frac{k}{h} = \frac{(-\frac{2}{3})^2 - 2(-2)}{-2}$ atau $\frac{h}{k} \times \frac{k}{h} = 1$ $9x^2 + 20x + 9 = 0$ atau setara	1 1 1	
(c)	$(3h - 1)^2 - 4(1)(2h + 10) > 0$  $h > 3$, $h < -\frac{13}{9}$	1 1 1	

3(a)	Pembahagi dua sama serenjang bagi PQ // perpendicular bisector of PQ	1	8
(b) i	Titik tengah AB, $M = (-2, 5)$ Titik bergerak $P(x, y)$ $BM = \sqrt{(-2 - 1)^2 + (5 - 1)^2}$ atau $AM\sqrt{(-5 + 2)^2 + (9 - 5)^2}$ $PM = \sqrt{(x + 2)^2 + (y - 5)^2}$ Gunakan $PM = AM$ atau BM $\sqrt{(x + 2)^2 + (y - 5)^2} = 5$ $x^2 + y^2 + 4x - 10y + 4 = 0$ OR $\left(\frac{y - 9}{x + 5}\right)$ or $\left(\frac{y - 1}{x - 1}\right)$ $\left(\frac{y - 9}{x + 5}\right)\left(\frac{y - 1}{x - 1}\right) = -1$ $y^2 - 10y + 9 = -x^2 - 4x + 5$ $x^2 + y^2 + 4x - 10y + 4 = 0$	1 1 1 1	
(b) ii	$y^2 - 10y + 4 = 0$ $y = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(4)}}{2(1)}$ Pintasan $-y = 9.583$ dan $y = 0.4174$	1 1 1	
4 (a) (i)	$y + \partial y = 2\sqrt{x} + \partial x$ $\partial y = 2\sqrt{x} + \partial x - 2\sqrt{x}$ $\partial y = (2\sqrt{x} + \partial x - 2\sqrt{x}) \times \frac{(2\sqrt{x} + \partial x + 2\sqrt{x})}{(2\sqrt{x} + \partial x + 2\sqrt{x})}$ $= \frac{4\partial x}{(2\sqrt{x} + \partial x + 2\sqrt{x})}$ had $\frac{\partial y}{\partial x} = \frac{4}{(2\sqrt{x} + \partial x + 2\sqrt{x})}$ $\frac{dy}{dx} = \frac{1}{\sqrt{x}}$	1 1 1	8
(a) ii	$\partial y = \frac{1}{\sqrt{25}} \times (0.04)$ $\partial y = 0.008$	1 1	
(b)	$\frac{\partial V}{\partial j} = 2\pi j^2$ $-1.02\pi = 2\pi j^2 \times (-0.1)$ $j = 2.258\text{cm}$	1 1 1	

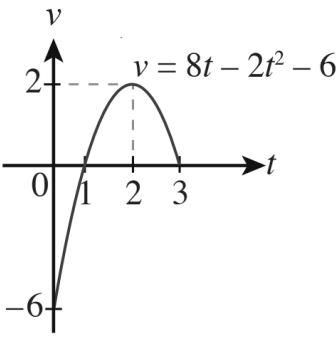
5 (a)	1.746	1	7
(b)	$6 \times (2\pi - 1.746)$	1	
	27.23	1	
(c)	$\text{Luas sektor } AOB, A_1 = \frac{1}{2}(6)^2 \left(130 \times \frac{\pi}{180}\right)$	1	
	$\text{Luas segitiga } AOB, A_2 = \frac{1}{2} \times 6 \times 6 \times \sin 130^\circ$	1	
	$(A_1 - A_2) \times 2$	1	
	54.11	1	
	OR other valid method		
6(a)	$\frac{\cos(A+B)}{\sin A \sin B} = \frac{\cos A \cos B - \sin A \sin B}{\sin A \sin B}$	1	7
	$= \frac{\cos A \cos B}{\sin A \sin B} - \frac{\sin A \sin B}{\sin A \sin B}$ $= \cot A \cot B - 1$	1	
(b)	$\tan(45^\circ + x) = 4 \tan(45^\circ - x)$		
	$\frac{\tan 45^\circ + \tan x}{1 - \tan 45^\circ \tan x} = 4 \left(\frac{\tan 45^\circ - \tan x}{1 + \tan 45^\circ \tan x} \right)$	1	
	$\frac{1 + \tan x}{1 - \tan x} = 4 \left(\frac{1 - \tan x}{1 + \tan x} \right)$	1	
	$(3 \tan x - 1)(\tan x - 3) = 0$	1	
	$\tan x = \frac{1}{3} \text{ atau } \tan x = 3$ $x = 18.43^\circ, 71.57^\circ, 198.43^\circ, 251.57^\circ$	1 1	
7(a)	$\frac{7}{2}[2a + (7 - 1)d] = 511$	1	7
	$\frac{19}{2}[2a + (19 - 1)d] - 511 = -150$	1	
	Solve the equation by using substitution method or elimination method	1	
	$a = 100, d = -9$	1,1	
(b)	$100 + (n - 1)(-9) = -8$	1	
	$n = 13$	1	

8 (a)	<table><tr><td>$\log_{10} x$</td><td>-0.47</td><td>-0.37</td><td>-0.26</td><td>-0.07</td><td>0.03</td><td>0.15</td></tr><tr><td>$\log_{10} y$</td><td>1.68</td><td>1.40</td><td>1.10</td><td>0.62</td><td>0.40</td><td>0.14</td></tr></table>	$\log_{10} x$	-0.47	-0.37	-0.26	-0.07	0.03	0.15	$\log_{10} y$	1.68	1.40	1.10	0.62	0.40	0.14	1	10
	$\log_{10} x$	-0.47	-0.37	-0.26	-0.07	0.03	0.15										
	$\log_{10} y$	1.68	1.40	1.10	0.62	0.40	0.14										
		1															
	Skala uniform pada kedua-dua paksi dengan 1 titik diplot dengan betul.																
Plot semua 6 titik dengan betul.	1																
Graf garis lurus penyuaian terbaik	1																
(b)	$\log_{10} y = \left(-\frac{1}{q}\right) \log_{10} x + \log_{10} p$ $\log_{10} p = 0.48$ $p = 3.02$ $-\frac{1}{q} = \frac{1.4 - 0.4}{-0.37 - 0.03}$ $q = 0.40$	1	1														

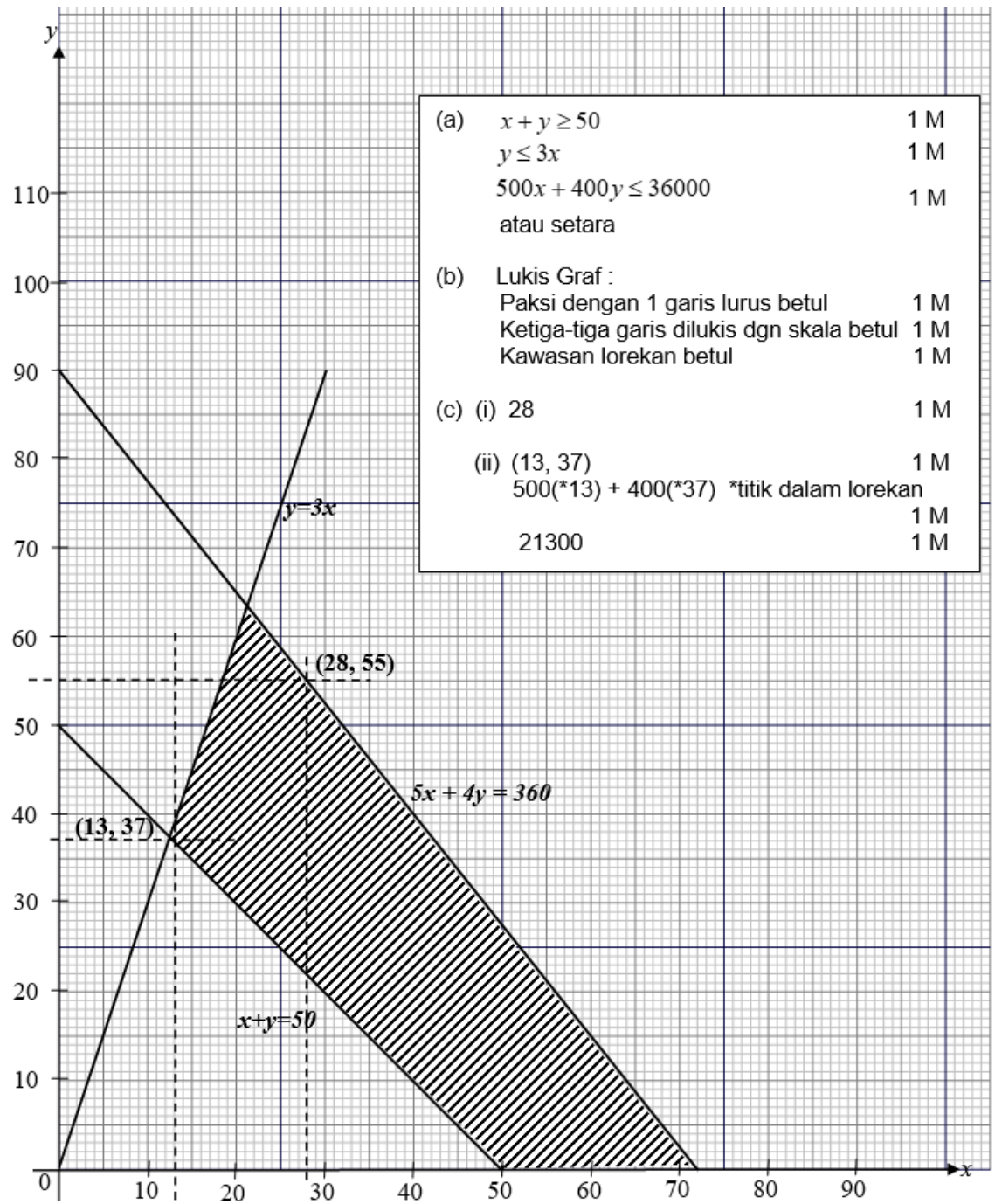
9 (a) i	Tulis hukum bagi segi tiga $AY = \overrightarrow{AO} + \overrightarrow{OY}$ atau setara $\overrightarrow{AY} = -\underline{a} + \underline{b}$	1 1	10
(a) ii	$\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$ $\frac{3}{5}\underline{a} + \frac{2}{5}\underline{b}$	1	
(b) i	$\frac{3}{5}k\underline{a} + \frac{2}{5}k\underline{b}$	1	
(b) ii	$h\underline{b}$ $\overrightarrow{OX} = \overrightarrow{OA} + \overrightarrow{AX}$ atau setara $\frac{3}{5}k\underline{a} + \frac{2}{5}k\underline{b} = \underline{a} + h\underline{b}$ Banding pekali $\frac{3}{5}k = 1$ atau $\frac{2}{5}k = h$ selesaikan $k = \frac{5}{3}$ $h = \frac{2}{3}$	1 1 1 1 1	
(c)	$OM:MX=3:2$	1	
10 (a)	$m = \frac{dy}{dx} = 2x$ $m = 2(1) = 2$ $y - 4 = 2(x - 1)$ $y = 2x + 2$	1 1 1	10
(b)	Luas lengkung, $A_1 = \int_0^1 (x^2 + 3) dx = \left[\frac{x^3}{3} + 3x \right]_0^1$ Luas trapezium, $A_2 = \frac{1}{2}(2 + 4)(1)$ Luas = $A_1 - A_2$ atau setara $= \left[\frac{x^3}{3} + 3x \right]_0^1 - 3$ $= \frac{1}{3}$	1 1 1 1	
(c)	$= \frac{1}{2}\pi \left[\frac{y^2}{2} - 3y \right]_3^5$ $= \frac{1}{2}\pi \left[\frac{5^2}{2} - 3(5) \right] - \frac{1}{2}\pi \left[\frac{3^2}{2} - 3(3) \right]$ $= \pi$	1 1 1	

11 (a)	$30C_0(0.01^0)(0.99^{30})$ atau $30C_1(0.01^1)(0.99^{29}) \times 30C_0(0.01^0)(0.99^{30})$ $1 - [30C_0(0.01^0)(0.99^{30}) + 30C_1(0.01^1)(0.99^{29}) \times 30C_0(0.01^0)(0.99^{30})]$ 9.45% 905 <i>atau</i> 906	1 1 1 1	10
(b) i	$P\left(z \leq \frac{X - 50}{5}\right) = 0.1$ $\frac{X - 50}{5} = -1.282$ 43.59	1 1 1	
(b) ii	$P\left(z \geq \frac{53.73 - 50}{5}\right)$ 0.2278×200 46	1 1 1	
12 (a) i	$PS = \sqrt{90^2 + 80^2}$ $= 120.42$	1	10
(a) ii	$PQ = \sqrt{90^2 + 60^2}$ $= 108.17$	1	
(b)	$(108.17)^2 = (100)^2 + (120.42)^2 - 2(100)(120.42)\cos\angle PSQ$ $\angle PSQ = 57.89^\circ$	1 1	
(c)	$Area = \sqrt{164.295(164.295 - 100)(164.295 - 108.17)(164.295 - 120.42)}$ $= 5100.20$	1 1	

(d)	$\frac{\sin Q}{120.42} = \frac{\sin 57.89}{108.17}$ $Q = 70.55^\circ$ $Q' = 180 - 70.55^\circ = 109.45^\circ$ Q' S'	1 1 1 1	
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13 (a) i	(i) $\frac{7.60}{x} \times 100 = 140$ $x = \text{RM}5.43$	1	
(a) ii	$\bar{I} = \frac{140(5)+110(3)+105(4)}{5+3+4}$ $= 120.83$	1 1 1	
(b) i	$\bar{I} \frac{2017}{2013} = \frac{120.83 \times 120}{100}$ $= 145$	1 1	
(b) ii	$\frac{x}{600} \times 100 = 145$ $x = \text{RM}870.00$	1 1	
(c)	$x = \frac{110}{120} \times 100$ $= 91.67$ Penurunan harga sebanyak 8.33% <i>The decrease of the price 8.33%</i>	1 1 1	
14(a)	Kamirkan $\int 8 - 4t \, dt$ dan gantikan $v = -6$ dan $t = 0$ $v = 8t - 2t^2 - 6$ <u>Guna $a = 0$ untuk cari nilai t.</u> $8 - 4t = 0$ <i>Gantikan $t = 2$ dalam v dan v mak. = 2</i>	1 1 1	
(b)	Kamirkan $\int 8t - 2t^2 - 6 \, dt$ dan gantikan $s = 0$ dan $t = 0$ $s = 4t^2 - \frac{2}{3}t^3 - 6t$ Faktorkan $s = -\frac{2}{3}t(t - 3)^2$ dan gunakan $s = 0$. $t = 3$	1 1 1	
(c)		1	10
(d)	$\left \left[4t^2 - \frac{2}{3}t^3 - 6t \right]_0^1 + \left[4t^2 - \frac{2}{3}t^3 - 6t \right]_1^3 \right $ <u>Gantikan $t = 1$ dan $t = 0$ ke $\left \left[4t^2 - \frac{2}{3}t^3 - 6t \right]_0^1 \right$</u>	1	

	$\frac{\text{dan } t = 3 \text{ dan } t = 1 \text{ ke } \left[4t^2 - \frac{2}{3}t^3 - 6t \right]_1^3}{\left -2\frac{2}{3} \right + \left[0 - \left(-2\frac{2}{3} \right) \right]}$ $5\frac{1}{3}$	1	
		1	



TINGKATAN:



SKEMA JAWAPAN

NO.	BUTIRAN	MARKAH	JUMLAH
1	$\lim_{x \rightarrow -2} \left(\frac{x+2}{\sqrt{5x+14}-2} \right) \left(\frac{\sqrt{5x+14}+2}{\sqrt{5x+14}+2} \right)$ $\lim_{x \rightarrow -2} \frac{(x+2)(\sqrt{5x+14}+2)}{(5x+14)+2\sqrt{5x+14}-2\sqrt{5x+14}-4}$ $\lim_{x \rightarrow -2} \frac{(x+2)(\sqrt{5x+14}+2)}{5(x+2)}$ $\frac{\sqrt{5(-2)+14}+2}{5}$ $\frac{4}{5}$	1 1 1 1	4

NO.	BUTIRAN		MARKAH	JUMLAH
4	(a)	$m = -\frac{2}{4}$ atau $m = -\frac{2-0}{0-4}$ $y = -\frac{1}{2}x + 2$	1 1	4
	(b)	$4 = -\frac{1}{2}x + 2$ $x = -4$	1 1	

NO.	BUTIRAN			MARKAH	JUMLAH
5	(a)	(i)	$\int \frac{m}{x^n} dx$	y	y
			$\int \frac{m}{x^2} dx$	$-\frac{m}{x} + c$	$-\frac{m}{(2-1)x^{2-1}} + c$
			$\int \frac{m}{x^3} dx$	$-\frac{m}{2x^2} + c$	$-\frac{m}{(3-1)x^{3-1}} + c$
			$\int \frac{m}{x^4} dx$	$-\frac{m}{3x^3} + c$	$-\frac{m}{(4-1)x^{4-1}} + c$
			$\int \frac{m}{x^5} dx$	$-\frac{m}{4x^4} + c$	$-\frac{m}{(5-1)x^{5-1}} + c$
	(a)	(ii)	Jika $y = \frac{m}{x^n}$, maka $\int \frac{m}{x^n} dx = -\frac{m}{(n-1)x^{n-1}} + c$		1
	(b)		$\int \frac{2}{x^2} dx = -\frac{2}{(2-1)x^{2-1}} + c$ $\int \frac{2}{x^2} dx = -\frac{2}{x} + c$		1,1 1

NO.	BUTIRAN			MARKAH	JUMLAH
6	(a)		1,1	4	
	(b)	$\overrightarrow{SR} = \overrightarrow{SO} + \overrightarrow{OR}$ $\overrightarrow{SR} = -6\mathbf{i} - 3\mathbf{j} + 3\mathbf{i} + 8\mathbf{j}$ $\overrightarrow{SR} = -(6 + 3)\mathbf{i} + (-3 + 8)\mathbf{j}$ $\overrightarrow{SR} = -3\mathbf{i} + 5\mathbf{j}$ vektor unit dalam arah $\overrightarrow{SR} = \frac{1}{\sqrt{34}}(-3\mathbf{i} + 5\mathbf{j})$	1		
			1		
NO.	BUTIRAN			MARKAH	JUMLAH
7	(a)	(i)	$S_n = a + ar + ar^2 + + ar^{n-2} + ar^{n-1}$ $rS_n = ar + ar^2 + ar^3 + + ar^{n-1} + ar^n$ $S_n - rS_n = a - ar^n$ $(1 - r)S_n = a - ar^n$ $S_n = \frac{a(1 - r^n)}{1 - r}$	1	7
		(ii)	$\text{Hasil tambah} = \frac{64(1 - (\frac{1}{2})^8)}{1 - (\frac{1}{2})} - \frac{64(1 - (\frac{1}{2})^5)}{1 - (\frac{1}{2})}$ $= \frac{7}{2}$	1	
				1	
	(b)		$ar^5 = (ar)(ar^3)$ $a = r$ $a(a^7) = 256$ $a^8 = 256$ $a = 2$	1	
				1	
				1	

NO.	BUTIRAN		MARKAH	JUMLAH
8	(a)	$p = \log_a x$ $x^n = (a^p)^n$ $\log_a x^n = \log_a (a^{np})$ $\log_a x^n = np$ $\log_a x^n = n(\log_a x)$	1 1 1	7
	(b)	$I_0 e^{-1.4x} = \frac{1}{2} I_0$ $\ln e^{-1.4x} = \ln(\frac{1}{2})$ $-1.4x = \ln(\frac{1}{2})$ $x = 0.4951$	1 1 1 1	

NO.	BUTIRAN		MARKAH	JUMLAH
9	(a)	$CD = 60.72 - 12 - 12 - 8 - 8$ $AB = 20.72$ $20.72^2 = 12^2 + 12^2 - 2(12)(12)\cos\theta$ $\theta = 119.39^\circ$ $\theta = 2.084 \text{ rad}$	1 1 1	7
	(b)	$S = (2.5)(3.928)$ $S = 9.82$ $9.82 = 4.8\theta$ $\theta = 2.046 \text{ rad}$ $\text{Luas} = \frac{1}{2} (4.8)^2 (2.046)$ $\text{Luas} = 23.57$	1 1 1 1	

NO.	BUTIRAN		MARKAH	JUMLAH
10	(a)	$\alpha + \beta = -1$ dan $\alpha\beta = -\frac{3}{2}$	1	6
		$\frac{2}{\alpha} + \frac{2}{\beta} = \frac{4}{3}$ dan $\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = -\frac{8}{3}$	1	
		$3x^2 - 4x - 8 = 0$	1	
	(b)	$\frac{30}{2} = 3b$	1	
		$b = 5$		
		$-\frac{a}{2} = 3 + b$	1	
		$a = -16$	1	

NO.	BUTIRAN		MARKAH	JUMLAH
11.	(a)	$m = 1 - \frac{1}{27} - \frac{8}{27} - \frac{13}{27}$	1	5
		$m = \frac{5}{27}$		
		$P(X=0) = \frac{1}{27}$		
	(a)	${}^3C_0 (p)^0 (q)^{3-0} = \frac{1}{27}$		
		$q^3 = \frac{1}{27}$	1	
		$q = \frac{1}{3}$		
		$p + q = 1$		
		$p + \frac{1}{3} = 1$		
		$p = \frac{2}{3}$	1	
	(b)	$P(X < 3) = P(X=0) + P(X=1) + P(X=2)$		
		$P(X < 3) = \frac{1}{27} + \frac{8}{27} + \frac{13}{27}$	1	
		$= \frac{22}{27}$	1	

NO.	BUTIRAN	MARKAH	JUMLAH
12	Use the formula $V = \pi \int y^2 dx$ $V = \int_0^h \left(\frac{R^2 x^2}{h^2} \right) dx$ $V = \left[\frac{R^2 x^3}{3h^2} \right]_0^h$ $V = \left[\frac{R^2 (h)^3}{3h^2} - \frac{R^2 (0)^3}{3h^2} \right]$ $V = \frac{1}{3} \pi R^2 h$ Sub $h = R$ and Volume = 9π $\frac{1}{3} \pi R^2 (R) = 9\pi$ $\frac{1}{3} R^3 = 9$ $R^3 = 27$ $R = \sqrt[3]{27}$ $R = 3$	1 1 1 1 1	5

NO.	BUTIRAN	MARKAH	JUMLAH
13	(a) (i) Persamaan BC atau Persamaan AC $4 = \frac{1}{2}(-1) + c$ $1 = \frac{3}{2}(1) + c$ $\frac{1}{2}x + \frac{9}{2} = \frac{3}{2}x - \frac{1}{2}$ $C(5, 7)$	1 1 1	8

	(ii)	Tidak boleh. (Layak mendapat markah sekiranya ada justifikasi yang betul diberi). Gantikan (3,4) dalam persamaan AC $4 = \frac{3}{2}(3) - \frac{1}{2}$ $4 = 4 \quad (\text{mesti berjaya tunjukkan})$ Kerana pondok rehat itu akan berada di atas garisan tanah sempadan.	1	
	(b)	Bulatan. $\sqrt{(x-1)^2 + (y-3)^2} = 1$ $x^2 + y^2 - 2x - 6y + 9 = 0$	1	
			1	
			1	

NO.	BUTIRAN		MARKAH	JUMLAH
14	(a)	$216\pi = (\frac{1}{2})4\pi r^2 + 2\pi rh$ $h = \frac{108-r^2}{r}$ $V = \left(\frac{1}{2}\right)\left(\frac{4}{3}\pi r^3\right) + \pi r^2\left(\frac{108-r^2}{r}\right)$ $V = 108\pi r - \frac{1}{3}\pi r^3$	1	8
	(b)	$\frac{dV}{dr} = 108\pi - \pi r^2$ $108\pi - \pi r^2 = 0$ $r = 10.39$	1	
			1	
	(c)	$A = 2(3.142)(10.39)^2$ $A = 678.37$ $\text{Kos} = 678.37 \times \text{RM}15$ $\text{Kos} = \text{RM}10176$	1	
			1	

NO.	BUTIRAN		MARKAH	JUMLAH
15	(a)	$\frac{\tan\theta + \tan\frac{\pi}{4}}{1 - \tan\theta\tan\frac{\pi}{4}}$	1	8
		$\frac{\tan\theta + (1)}{1 - \tan\theta(1)}$	1	
	(b)	$\tan\frac{11\pi}{12} = \tan\left(\frac{2\pi}{3} + \frac{\pi}{4}\right)$	1	
		$\frac{1 + \tan\frac{2\pi}{3}}{1 - \tan\frac{2\pi}{3}}$	1	
		$\frac{1 - \sqrt{3}}{1 + \sqrt{3}}$	1	
		$\frac{1 - \sqrt{3}}{1 + \sqrt{3}} \times \frac{1 - \sqrt{3}}{1 - \sqrt{3}}$	1	
		$\frac{1 - \sqrt{3} - \sqrt{3} + 3}{1 + \sqrt{3} - \sqrt{3} - 3}$	1	
		$-2 + \sqrt{3}$	1	

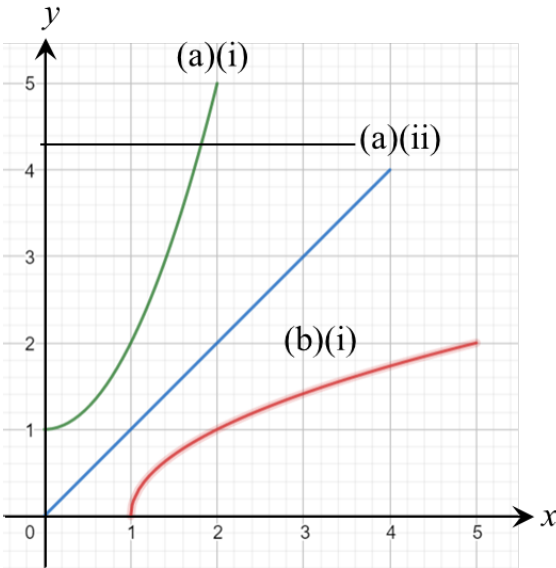


**MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)
NEGERI PERAK**

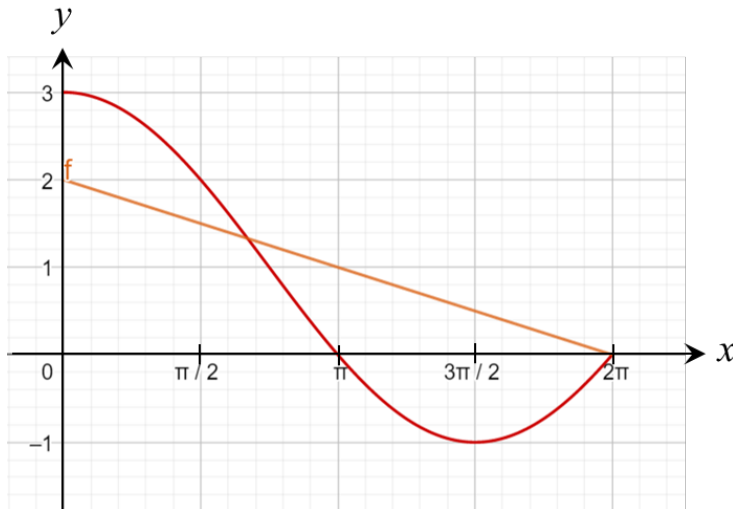
MODUL KECERMERLANGAN SPM 2023
SET 1

MATEMATIK TAMBAHAN
KERTAS 2
SKEMA JAWAPAN

NO.	BUTIRAN	MARKAH	JUMLAH
BAHAGIAN A			
1	$y = \frac{1}{2}x \quad // \quad x = 2y$ $x^2 + 2x\left(\frac{1}{2}x\right) + 2\left(\frac{1}{2}x\right)^2 - 80x - 120\left(\frac{1}{2}x\right) + 1936 = 0$ @ $(2y)^2 + 2(2y)y + 2y^2 - 80(2y) - 120y + 1936 = 0$ $\frac{5}{2}x^2 - 140x + 1936 = 0 \quad @$ $10y^2 - 280y + 1936 = 0$ $5y^2 - 140y + 968 = 0$ $y = \frac{-(-140) \pm \sqrt{(-140)^2 - 4(5)(968)}}{2(5)}$ $x = 31.098, 24.902 \quad @ \quad y = 15.549, 12.451$ $y = 15.549, 12.451 \quad @ \quad x = 31.098, 24.902$	1 1 1 1 1	5

NO.	BUTIRAN		MARKAH	JUMLAH
2		$P = \int \frac{dP}{dV} dV$ $P = \frac{3V^3}{3} - \frac{12V^6}{6} + c$ $P = V^3 - 2V^6 + c$ Sub the values of V = 1 and P = 8 $(8) = (1)^3 - 2(1)^6 + c$ $P = V^3 - 2V^6 + 9$ Sub the value of V = 0.2 $P = (0.2)^3 - 2(0.2)^6 + 9$ $P = 9.008$	1 1 1 1 1	6
NO.	BUTIRAN		MARKAH	JUMLAH
3	(a)	i	1	7
				
		ii Rujuk (a)(i) Lukis garis mengufuk yang memotong graf di a(i)		
		Fungsi songsang untuk f wujud sebab berjaya dalam ujian garisan mengufuk/ garis mengufuk hanya memotong graf hanya di satu titik di mana-mana bahagian		
	(b)	i Lukis garis lurus y=x Lakar graf b(i) [rujuk rajah]		
		ii $f(x) = \sqrt{x-1}$ atau $f : x \rightarrow \sqrt{x-1}$	1	

		iii	$0 \leq y \leq 2$	1	
NO.	BUTIRAN			MARKAH	JUMLAH
4	(a)		$\frac{y-4}{x-(-2)} = \frac{10-4}{10-(-2)} \text{ atau}$ $y = \frac{1}{2}x + c \text{ dan mencari nilai } c=5$ $y = \frac{1}{2}x + 5$	1 1	9
	(b)		$y = -2x + 20$ $-2x + 20 = \frac{1}{2}x + 5$ $(6, 8)$	1 1 1	
	(c)		$\frac{n(-2) + m(10)}{m+n} = 6 \text{ atau } \frac{n(4) + m(10)}{m+n} = 8$ * boleh gunakan selain m dan n * m dan n boleh saling bertukar $2:1$	1 1	
	(d)		$\frac{1}{2} \left [(3)(4) + (-2)(-10) + (15)(10) + (10)(14)] \right $ $- [(14)(-2) + (4)(15) + (-10)(10) + (10)(3)]$ 180 unit^2	1 1	
NO.	BUTIRAN			MARKAH	JUMLAH
5	(a)	i	$m^{xy+2x-xy+yz-xz-yz}$ m^{2x-xz}	1 1	8
		ii	$3^n(3^2 - 1 + \frac{10}{3}) = k(3^n)$ $11\frac{1}{3} / \frac{34}{3}$	1 1	
	(b)	i	$h = \frac{2(10+8\sqrt{2})}{4+3\sqrt{2}} \times \frac{4-3\sqrt{2}}{4-3\sqrt{2}}$ $= 8 - 2\sqrt{2}$	1 1	
		ii	$\sqrt{(8-2\sqrt{2})^2 + (4+3\sqrt{2})^2}$ 9.73 cm	1 1	
NO.	BUTIRAN			MARKAH	JUMLAH
6	(a)		$y = x^2(6-x) + 5$ $= 6x^2 - x^3 + 5$ $\frac{dy}{dx} = 12x - 3x^2$ Fungsi kecerunan = $12x - 3x^2$	1	8

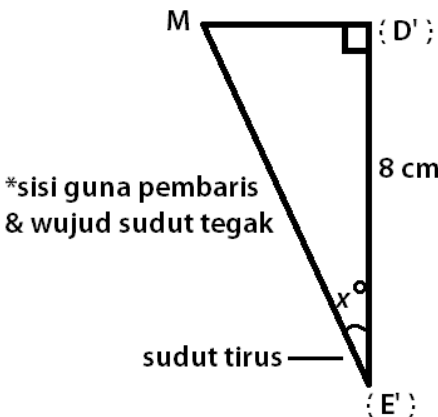
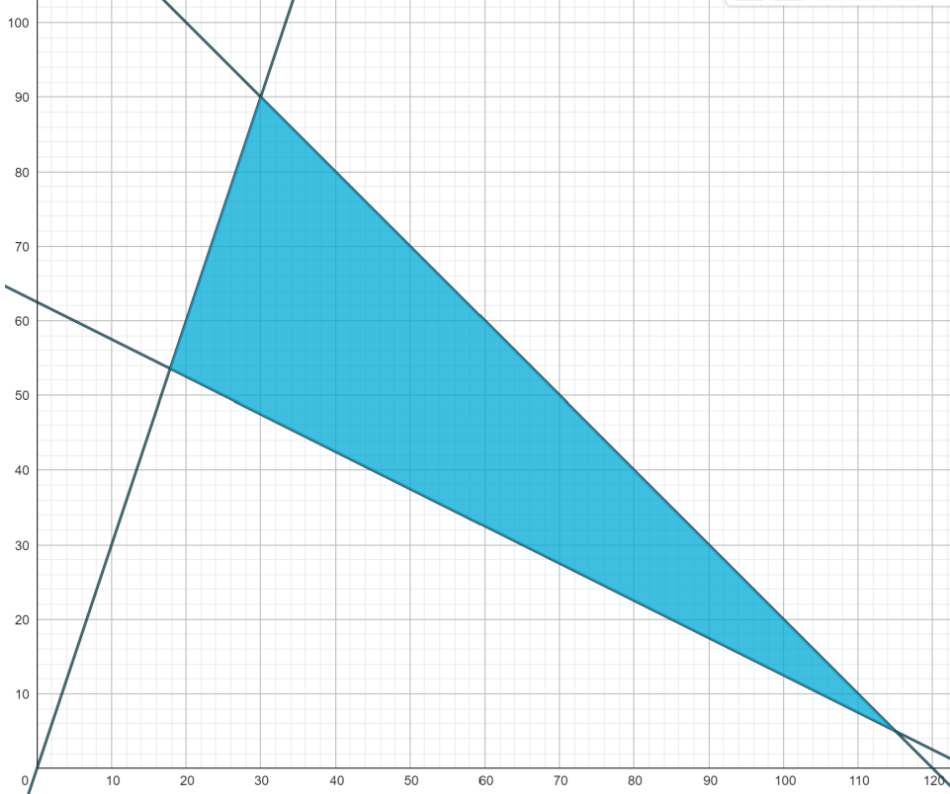
	(b)	Pada titik pusingan, $\frac{dy}{dx} = 0$ $12x - 3x^2 = 0$ $3x(4 - x) = 0$ $3x = 0, \quad 4 - x = 0$ $x = 0, \quad x = 4$ Apabila $x = 0, y = 0 - 0 + 5$ $= 5$ Apabila $x = 4, y = 6(4)^2 - 4^3 + 5$ $= 37$ Titik pusingan ialah, $(0, 5)$ dan $(4, 37)$	1	
			1	
			1	
			1	
	(c)	$\frac{d^2y}{dx^2} = 12 - 6x$ Apabila $x = 0, \frac{d^2y}{dx^2} = 12 - 6(0)$ $\frac{d^2y}{dx^2} = 12 > 0$ Maka, $(0, 5)$ ialah titik minimum. Apabila $x = 4, \frac{d^2y}{dx^2} = 12 - 6(4)$ $\frac{d^2y}{dx^2} = -12 < 0$ Maka, $(4, 37)$ ialah titik maksimum.	1	
			1	
NO.	BUTIRAN		MARKAH	JUMLAH
7	(a)	 Bentuk graf kosinus $\frac{2}{3}$ kitaran untuk $0 \leq x \leq 2\pi$ Amplitud graf = 2 unit Graf dianjak 1 unit dari paksi-x	1	
			1	
			1	
			1	
			7	

	(b)		$y = 2 - \frac{x}{\pi}$ Lakar $y = 2 - \frac{x}{\pi}$ menggunakan paksi-paksi (a) Bilangan penyelesaian= 2	1 1 1	
NO.	BUTIRAN			MARKAH	JUMLAH
BAHAGIAN B					
8	(a)		K (0, 4) and M (3, 0) and Jarak PK / PM / KM : $\sqrt{(3.5 - 0)^2 + (3.5 - 4)^2} / \sqrt{(3.5 - 3)^2 + (3.5 - 0)^2} / \sqrt{4^2 + 3^2}$ $(5)^2 = (\sqrt{12.5})^2 + (\sqrt{12.5})^2 - 2(\sqrt{12.5})(\sqrt{12.5}) \cos \angle KPM$ $\angle KPM = 90^\circ = \frac{\pi}{2}$ radian	1 1 1	10
	(b)	i	$s_Q = (\sqrt{12.5})(\frac{\pi}{2}) // s_O = (\frac{5}{2})(\pi)$ Perimeter = $s_Q + s_O$ 13.409 unit	1 1 1	
		ii	$A_1 = \frac{1}{2} [(3.142)(2.5^2)]$ or $A_2 = \frac{1}{2} (\sqrt{12.5})^2 \left(\frac{3.142}{2}\right)$ $A_3 = \frac{1}{2} (\sqrt{12.5})(\sqrt{12.5})$ Luas kawasan berlorek = $A_1^* - (A_2^* - A_3^*)$ 6.25 unit ²	1 1 1 1	

NO.	BUTIRAN			MARKAH	JUMLAH												
9	(a)	<table><tr><td>$\log_{10} x$</td><td>0.18</td><td>0.30</td><td>0.48</td><td>0.60</td><td>0.70</td><td>0.78</td></tr><tr><td>$\log_{10} y$</td><td>0.93</td><td>0.78</td><td>0.69</td><td>0.54</td><td>0.49</td><td>0.36</td></tr></table> 	$\log_{10} x$	0.18	0.30	0.48	0.60	0.70	0.78	$\log_{10} y$	0.93	0.78	0.69	0.54	0.49	0.36	1 1 1 1 1 <
$\log_{10} x$	0.18	0.30	0.48	0.60	0.70	0.78											
$\log_{10} y$	0.93	0.78	0.69	0.54	0.49	0.36											

			$P(Z < -0.72)$		
			0.2358	1	
	(b)	i	$1 - P(X = 0) - P(X = 1)$	1	
			$1 - {}^7C_0(0.2358)^0(0.7642)^7 - {}^7C_1(0.2358)^1(0.7642)^6$	1	
			0.5190	1	
		ii	$\sigma = \sqrt{(25)(0.2358)(0.7642)}$	1	
			2.122 or 2.1225	1	
NO.	BUTIRAN			MARKAH	JUMLAH
11	(a)		$v_P = \begin{pmatrix} 16 \\ 8 \end{pmatrix} \text{ or } 16\hat{i} + 8\hat{j}$	1	10
			$v_Q = \begin{pmatrix} 5 \\ -3 \end{pmatrix} \text{ or } 5\hat{i} - 3\hat{j}$	1	
			$\begin{pmatrix} 8 + 16t \\ 2 + 8t \end{pmatrix} = \begin{pmatrix} 15 \\ 9 \end{pmatrix} + t \begin{pmatrix} 5 \\ -3 \end{pmatrix}$ OR $8 + 16t = 15 + 5t \text{ or } 2 + 8t = 9 - 3t$	1	
			$t = \frac{7}{11} \text{ @ } 0.636 \text{ jam}$	1	
	(b)	i	$\begin{pmatrix} 15 \\ 9 \end{pmatrix} + (1) \begin{pmatrix} 5 \\ -3 \end{pmatrix}$	1	
			$\overrightarrow{OA} = \begin{pmatrix} 20 \\ 6 \end{pmatrix} \text{ OR } A(20, 6)$	1	
		ii	$\overrightarrow{QA} = \overrightarrow{QO} + \overrightarrow{OA}$ $\overrightarrow{QA} = \begin{pmatrix} -15 \\ -9 \end{pmatrix} + \begin{pmatrix} 20 \\ 6 \end{pmatrix}$	1	
			$\overrightarrow{QA} = \begin{pmatrix} 5 \\ -3 \end{pmatrix} @ 5\hat{i} - 3\hat{j}$	1	
			$\frac{1}{\sqrt{(5)^2 + (-3)^2}} \begin{pmatrix} 5 \\ -3 \end{pmatrix} \text{ OR } \frac{5\hat{i} - 3\hat{j}}{\sqrt{(5)^2 + (-3)^2}}$	1	
			$\frac{1}{\sqrt{34}} \begin{pmatrix} 5 \\ -3 \end{pmatrix} \text{ OR } \frac{5\hat{i} - 3\hat{j}}{\sqrt{34}}$	1	

BAHAGIAN C					
NO.	BUTIRAN			MARKAH	JUMLAH
12	(a)		$4(3) - 8$	1	10
			4 ms^{-2}	1	
	(b)		$2t^2 - 8t - 10 = 0$ & selesaikan untuk t	1	
			$S_A = 2\frac{t^3}{3} - 4t^2 - 10t$ DAN $2\frac{(5)^3}{3} - 4(5)^2 - 10(5)$ ATAU $2\frac{(6)^3}{3} - 4(6)^2 - 10(6)$	1	
			$\left -\frac{200}{3} - 0 \right + \left -60 - \left(-\frac{200}{3} \right) \right $	1	
			$\frac{220}{3} @ 73.333$	1	
	(c)		$V_B = -t^2 - 7t + 4$	1	
			$2t^2 - 8t - 10 = -t^2 - 7t + 4$	1	
			$3t^2 - t - 14 = 0$		
			$(3t - 7)(t + 2) = 0$	1	
			$\frac{7}{3}$	1	
NO.	BUTIRAN			MARKAH	JUMLAH
13	(a)	i	$(\sqrt{p})^2 = (10)^2 - (8)^2$ $p = 36$	1	10
				1	
		ii	$(\sqrt{36})^2 = (10)^2 + (10)^2 - 2(10)(10)\cos AMB$ $\angle AMB = 34.92^\circ \text{ or } 34^\circ 55'$ $Area, A_{ABM} = \frac{1}{2}(10)(10) \sin 34.92$ 28.622 cm^2	1	
				1	
				1	
				1	

NO.	BUTIRAN			MARKAH	JUMLAH
	(b)	 <i>sisi bertentangan</i>, $MD' = \sqrt{(6)^2 - (3)^2}$ $\tan x^\circ = \frac{5.1962}{8}$ 33.00°	1		
			1		
			1		
NO.	BUTIRAN			MARKAH	JUMLAH
14	(a)	$x + y \leq 120$ $y \leq 3x$ $0.8x + 1.6y \geq 100$	1 1 1		
	(b)	 Paksi dan skala yang betul dengan satu garis diplot dengan betul <i>Correct axes and scales with one line correctly plotted</i>	1		

			Tiga garis diplot dengan betul <i>Three lines correctly plotted</i>	1	
			Rantau dilorek dengan betul <i>Correct shaded region</i>	1	
	(c)	i	60	1	
		ii	(30,90)	1	
			$0.2x + 0.3y$ $= 0.2(30) + 0.3(90)$	1	
			33	1	
NO.	BUTIRAN			MARKAH	JUMLAH
15	(a)		$\frac{3.00}{2.50} \times 100$ atau $\frac{q}{1.60} \times 100 = 150$	1	
			p= 120 q= 2.40	1 1	
	(b)		$\frac{125 \times 120}{100}$	1	
			150	1	
	(c)	i	$45+10+m+n=100$ atau $\frac{120(45) + 130m + 150n + 125(10)}{100} = 130$	1	
			Gunakan kaedah penghapusan ATAU penggantian	1	
			m=20	1	
		ii	$\frac{P_{20}+k}{P_{20}} \times 100 = 130$ atau $\frac{P_{22}}{P_{22}-k} \times 100 = 130$	1	
			$\frac{13}{3}k$	1	



**MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)
NEGERI PERAK**

**MODUL KECEMERLANGAN SPM 2023
SET 2**

SKEMA PEMARKAHAN

**MATEMATIK TAMBAHAN
KERTAS 1**

NO.	BUTIRAN	MARKAH	JUMLAH
1	i) Mana-mana 3 yang betul : - Kelebaran graf semakin berkurang - Paksi-simetri tidak berubah iaitu $x = 1$ - nilai maksimum tidak berubah iaitu 3. - Titik maksimum tidak berubah iaitu (1,3) ii) Mana-mana 2 yang betul : - Bentuk graf kekal tetapi graf bergerak 3 unit ke kanan. - Paksi simetri berubah iaitu $x = 4$ - Nilai maksimum tidak berubah iaitu 3. - Titik maksimum berubah kepada (4,3) iii) Mana-mana 2 yang betul : - Bentuk graf kekal tetapi graf bergerak 4 unit ke bawah. - Paksi simetri tidak berubah iaitu $x = 1$ - Nilai maksimum berubah iaitu -1. - Titik maksimum berubah iaitu (1 , -1)	2 1 1	4

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN	MARKAH	JUMLAH
2	(a) $0.83+0.0083+0.000083+.....$		

		$a = 0.83 \quad , \quad r = \frac{0.0083}{0.83}$ $r = 0.01$ $s_{\infty} = \frac{a}{1 - r}$ $s_{\infty} = \frac{0.83}{1 - 0.01}$ $= \frac{0.83}{0.99}$ $= \frac{83}{99}$ Maka nilai N= 83 dan nilai M =99 (terbukti)	1,1	6
		Atau SETARA Rujuk buku teks ms 98	1	
			1,1	
	(b)	Perpuluhan berulang <i>Recurring decimals</i>	1	

NO.	BUTIRAN		MARKAH	JUMLAH
3	(a)	$y = f(x) = \frac{2}{x}$ $\delta y = f(x + \delta x) - f(x)$ $= \frac{2}{x + \delta x} - \frac{2}{x}$ $= \frac{2x - 2(x + \delta x)}{x(x + \delta x)}$ $\delta y = \frac{-2\delta x}{x(x + \delta x)}$ $\frac{\delta y}{\delta x} = \frac{-2}{x(x + \delta x)}$ $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{-2}{x(x + \delta x)}$ $\frac{dy}{dx} = \frac{-2}{x^2}$	1 1 1 1	8
	(b)	i) $y = \sqrt{x}$ $= x^{\frac{1}{2}}$		

		$\frac{dy}{dx} = \frac{1}{2} x^{\frac{1}{2}-1}$ $\frac{dy}{dx} = \frac{1}{2} x^{-\frac{1}{2}}$ $\frac{dy}{dx} = \frac{1}{2\sqrt{x}}$ Apabila $x = 16$, $\frac{dy}{dx} = \frac{1}{2\sqrt{16}}$ $= \frac{1}{2(4)}$ $= \frac{1}{8}$	1	
	(b)	ii) Apabila $x = 16, y = \sqrt{16}$ $y=4$ $\delta x = 16.02 - 16$ $= 0.02$ Menggunakan $f(x + \delta x) \approx y + \frac{dy}{dx} \delta x$ $\sqrt{x + \delta x} \approx y + \frac{dy}{dx} \delta x$ $\sqrt{16 + 0.02} = 4 + \frac{1}{8} (0.02)$ $\sqrt{16.02} = 4.0025$ Maka nilai hampir bagi $\sqrt{16.02} = 4.0025$	1	1

NO.	BUTIRAN	MARKAH	JUMLAH
4	$\frac{3 + \sqrt{5}}{\sqrt{2} + 1} + \frac{1 - \sqrt{5}}{-\sqrt{2} + 1}$ $= \left(\frac{3 + \sqrt{5}}{\sqrt{2} + 1} \times \frac{-\sqrt{2} + 1}{-\sqrt{2} + 1} \right) + \left(\frac{1 - \sqrt{5}}{-\sqrt{2} + 1} \times \frac{\sqrt{2} + 1}{\sqrt{2} + 1} \right)$ $= \frac{3 - 3\sqrt{2} + \sqrt{5} - \sqrt{10}}{-2 + \sqrt{2} - \sqrt{2} + 1} + \frac{1 + \sqrt{2} + \sqrt{5} - \sqrt{10}}{-2 + \sqrt{2} - \sqrt{2} + 1}$ $= -4 + 2\sqrt{2} + 2\sqrt{10} \quad @ \quad 2(\sqrt{2} + \sqrt{10} - 2)$	1, 1 1 1	4

NO.	BUTIRAN	MARKAH	JUMLAH
5	(a) $f(3) = \frac{3(3)+1}{2}$ $f(3) = 5$ $b = 5$ Salah. Kerana $b = 5$.	1	5
		1	
	(b) $x = \frac{2y-1}{3}$ atau setara $g^{-1}(x) = 2\left(\frac{2x-1}{3}\right) - 3$ $= \frac{4x-11}{3}$	1	
		1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN	MARKAH	JUMLAH
6	(a) $\log x$ dan $\log y$ adalah dihubungkan oleh berbentuk $\log y = m(\log x) + c$ $m =$ kecerunan garis lurus $= \frac{5-3}{4-0}$ $= \frac{2}{4}$ $m = \frac{1}{2}$ $c =$ pintasan paksi- $\log y$ $c = 3$ maka, $\log y = \frac{1}{2} \log x + 3$ $\log y = \log x^{\frac{1}{2}} + \log 10^3$ $y = 1000\sqrt{x}$	1	5
		1	
	(b) Apabila $x = 0.01$, $y = 1000 \sqrt{0.01}$ $= 1000 (0.1)$ $y = 100$	1	
		1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN		MARKAH	JUMLAH
7	(a)	(i) $OQ = \alpha$, $OP = \beta$ $(\alpha)^2 + (\beta)^2 = (9)^2$ $\alpha^2 + \beta^2 = 81$	1 1	7
		(ii) $\frac{PR}{RQ} = \frac{1}{2}$ $PR = \frac{1}{2} RQ$ $x = \frac{1}{3}\alpha$: $y = \frac{2}{3}\beta$ <i>maka</i> $R = \left(\frac{1}{3}\alpha, \frac{2}{3}\beta\right)$ <i>gantikan R dalam persamaan $\alpha^2 + \beta^2 = 81$</i> $\alpha = 3x$ dan $\beta = \frac{3}{2}y$ $(3x)^2 + \left(\frac{3}{2}y\right)^2 = 81$ $9x^2 + \frac{9}{4}y^2 = 81$ $36x^2 + 9y^2 = 324$ $4x^2 + y^2 = 36$ (ditunjukkan)	1 1 1	
	(b)	Bila (3,6) $4(3)^2 + (6)^2 = 36$ $72 \neq 36$ kayu yang menggelonggsor itu tidak menyentuh penggantung lukisan kerana apabila titik koordinat (3,6) dimasukkan dalam persamaan lokus R memberikan nilai yang berbeza untuk di bahagian kiri dan kanan persamaan atau $72 \neq 36$.	1 1	

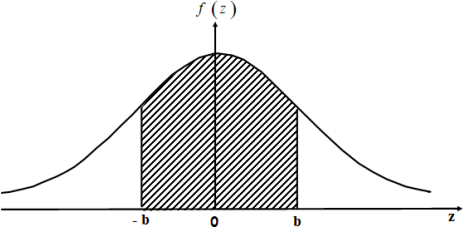
SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN		MARKAH	JUMLAH
8	$T_1 = a = 4, \quad d = T_2 - T_1 = 7 - 4 = 3$		1	4
	$k + 3, k + 6, k + 9$		1	
	$S_3 = 228$		1	
	$k + 3 + k + 6 + k + 9 = 228$ $3k + 18 = 228$ $3k = 210$ $k = 70$ <i>maka tiga sebutan berturutan tersebut ialah:</i> $70 + 3, 70 + 6, 70 + 9 = 73, 76, 79$		1	

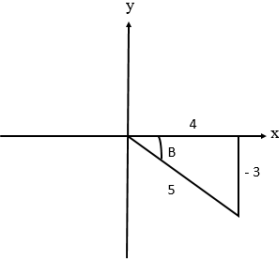
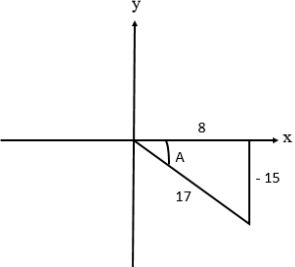
SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

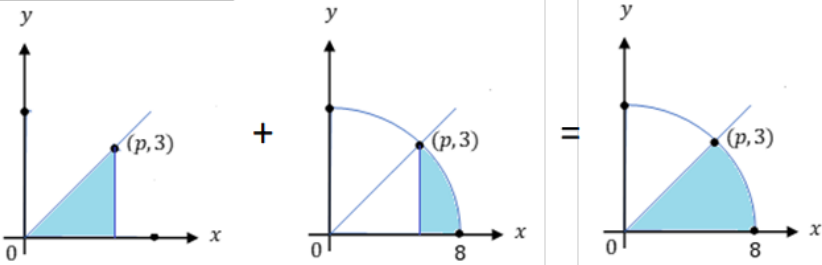
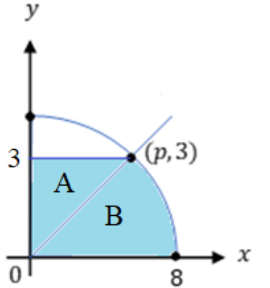
NO.	BUTIRAN		MARKAH	JUMLAH
9	(a)	ii) Sebelah kanan $= ({}^nC_r)(r!)$ $= \frac{n!}{(n-r)!r!} \times r!$ $= \frac{n!}{(n-r)!}$ $= {}^nP_r$ $= \text{sebelah kanan (terbukti)}$	1 1 1	6
	(b)	$6C_3 \times 5C_4 \text{ atau } 6C_4 \times 5C_3$ $= 100 + 150$ $= 250$	1 1 1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN		MARKAH	JUMLAH
10	(a)		1	4
	(b)	$= 0.5 - 0.3415$ $= 0.1585$ 1.001 $m = -1.001$	1 1 1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN		MARKAH	JUMLAH
11	(a)	Dalam sukuan iv  $\sin A = -\frac{15}{17}, \tan A = -\frac{15}{8}$ $\sin B = -\frac{3}{5}, \cos B = \frac{4}{5}$ $\tan (A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$= \frac{-\frac{15}{8} - (-\frac{3}{4})}{1 + (-\frac{15}{8})(-\frac{3}{4})}$$= \frac{(-\frac{9}{8})}{(\frac{77}{32})}$$= -\frac{36}{77}$	1 1 1	5
	(b)	$\sin (\frac{1}{2} A) = \sqrt{\frac{1 - \cos A}{2}}$$= \sqrt{\frac{1 - \frac{8}{17}}{2}}$$= \frac{3}{\sqrt{34}}$ $\operatorname{kosek} (\frac{1}{2} A) = \frac{1}{(\sin \frac{1}{2} A)}$$= \frac{\sqrt{34}}{3}$	1 1	

NO.	BUTIRAN		MARKAH	JUMLAH
12	(a)	$\int_0^p g(x) \, dx + \int_p^8 f(x) \, dx$ 	1 1, 1	6
	(b)	 $\begin{aligned} &\int_0^3 f(x) \, dy \\ &= \text{luas A} + \text{luas B} \\ &= \frac{1}{2}(3)(p) + \int_0^p g(x) \, dx \\ &\quad + \int_p^8 f(x) \, dx \\ &= \left(\frac{3}{2}p + 12\right) \text{unit}^2 \end{aligned}$	1, 1 1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN		MARKAH	JUMLAH
13	(a)	$\begin{aligned} \cos \theta &= \frac{12}{15} \\ \theta &= \cos^{-1}\left(\frac{12}{15}\right) \\ &= 36.87^\circ \times \frac{\pi}{180^\circ} \\ &= 0.644 \text{ radian (terbukti)} \end{aligned}$	1 1	8
	(b)	(i) $\begin{aligned} \sin 36.87^\circ &= \frac{PQ}{15} \\ PQ &= 9 \text{ cm} \\ \text{lengkuk RP} &= 15 \times 0.644 \text{ rad} \\ &= 9.66 \text{ cm} \\ \text{perimeter kawasan berlorek} &= PQ + QR + RP \\ &= 9 + 3 + 9.66 \\ &= 21.66 \text{ cm} \end{aligned}$	1 1 1	
		(ii) $\begin{aligned} \text{uas kawasan berlorek} &= \text{luas OPQR} - \text{luas sektor OPR} \\ &= \frac{1}{2}(3 + 15)(9) - \frac{1}{2}(15^2)(0.644) \\ &= 81 - 72.45 \\ &= 8.55 \text{ cm}^2 \end{aligned}$	1 1 1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)

NO.	BUTIRAN			MARKAH	JUMLAH
15	(a)	(i)	$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$ $4\underline{b} + 4\underline{d}$	1	8
		(ii)	$\overrightarrow{OS} = \frac{3}{4}\overrightarrow{OQ}$ $= \frac{3}{4}(4\underline{b} + 4\underline{d})$ $= 3\underline{b} + 3\underline{d}$	1 1	
		(iii)	$\overrightarrow{OZ} = \overrightarrow{OP} + \overrightarrow{PQ} + \overrightarrow{QZ}$ $= 4\underline{b} + 4\underline{d} + \frac{1}{2}(4\underline{d})$ $= 4\underline{b} + 6\underline{d}$	1	
		(iv)	$\overrightarrow{TS} = \overrightarrow{TO} + \overrightarrow{OS}$ $= \frac{1}{2}(-4\underline{b}) + (3\underline{b} + 3\underline{d})$ $= \underline{b} + 3\underline{d}$	1 1	
	(b)	$\overrightarrow{SZ} = \overrightarrow{SO} + \overrightarrow{OZ}$ $= -(3\underline{b} + 3\underline{d}) + (4\underline{b} + 6\underline{d})$ $= \underline{b} + 3\underline{d}$ $\overrightarrow{TS} = \underline{b} + 3\underline{d}$ Oleh sebab $\overrightarrow{TS} = \overrightarrow{SZ}$ dan S ialah titik sepunya, maka T, S dan Z berada dalam satu garis lurus. Atau setara		1 1	

SOALAN GEMPUR JPN PERAK - 2023 (SET 2 – KERTAS 1)



MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)
NEGERI PERAK

MODUL KECEMERLANGAN SPM 2023
SET 2

MATEMATIK TAMBAHAN
KERTAS 2
SKEMA JAWAPAN

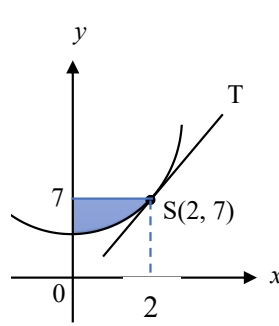
NO.	BUTIRAN			MARKAH	JUMLAH
BAHAGIAN A					
1	(a)		1 1 1 1	7	
	(b)	$y = \frac{x}{\pi}$ Draw straight line $y = \frac{x}{\pi}$ Number of solutions = 6	1 1 1		
2	(a)	$p = -3$ $q = 8$ $5 = a[0 + (-3)]^2 + 8$ $a = -\frac{1}{3}$	1 1 1		

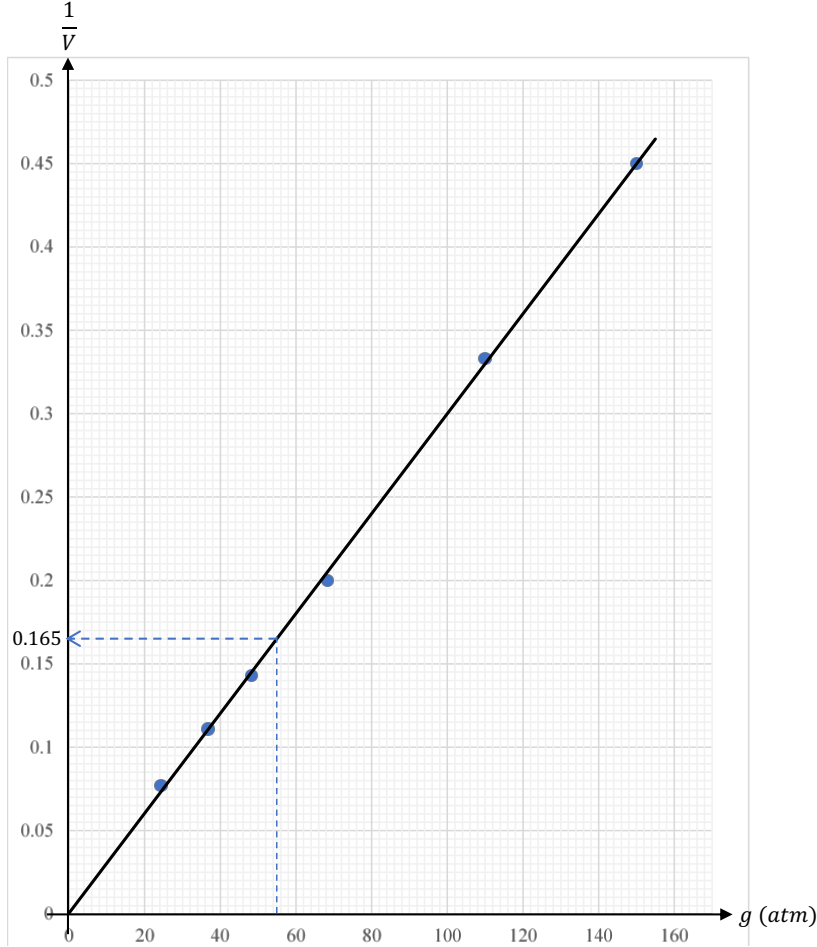
NO.	BUTIRAN		MARKAH	JUMLAH
	(b)	$f(x) = -\frac{1}{3}x^2 + 2x + 5$ Selesaikan $-\frac{1}{3}x^2 + 2x + 5 = 0$ $x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-15)}}{2(1)}$ 7.899 , -1.899	1 1 1 , 1	
3	(a)	<i>N ialah titik tengah bagi BC, maka</i> $\left(\frac{h+5}{2}, \frac{0+k}{2}\right) = (4, 3)$ $\frac{h+5}{2} = 4 \qquad \frac{0+k}{2} = 3$ $h+5 = 8 \qquad k = 6$ $h = 3$	1 1,1	
	(b)	$\text{luas } \triangle CMN = \frac{1}{2} \begin{vmatrix} 5 & 2 & 4 & 5 \\ 6 & 4 & 3 & 6 \end{vmatrix}$ $= \frac{1}{2} (20 + 6 + 24) - (12 + 16 + 15) $ $= \frac{1}{2} 50 - 43 $ $= \frac{1}{2} (7)$ $= 3\frac{1}{2} \text{ unit}^2$ <i>luas segi empat ABNM</i> $= \frac{1}{2} \begin{vmatrix} -1 & 3 & 4 & 2 & -1 \\ 2 & 0 & 3 & 4 & 2 \end{vmatrix}$ $= \frac{1}{2} (0 + 9 + 16 + 4) - (6 + 0 + 6 - 4) $ $= \frac{1}{2} 29 - 8 $ $= \frac{1}{2} (21)$ $= 10\frac{1}{2} \text{ unit}^2$ <i>maka, nisbah luas $\triangle CMN$ kepada luas segi empat ABNM</i>	1 1 1	8

			$\Delta CMN : ABNM = 3\frac{1}{2} : 10\frac{1}{2}$ $= \frac{7}{2} : \frac{21}{2}$ $= 1 : 3$	1	
NO.	BUTIRAN			MARKAH	JUMLAH
4	(a)	$a = 90\,000, \quad r = 100\% + 4\%$ $= 104\%$ $= 1.04$ pada tahun 2029, T_{11} $T_{11} = 90\,000(1.04)^{10}$ $= RM133\,221.99$ $\therefore$ terbukti kurang daripada RM135 000	1	1	8
	(b)	$a = 90\,000, \quad r = 1.04$ $T_n > 280\,000$ $90\,000(1.04)^{n-1} > 280\,000$ $(1.04)^{n-1} > \frac{28}{9}$ $(n-1)\log_{10} 1.04 > \log_{10} \frac{28}{9}$ $(n-1) > \frac{0.4929}{0.017}$ $n > 28.94 + 1$ $n > 29.94$ $n = 30, 31, 32, \dots$ $\therefore$ tahun pertama ramalan keuntungan melebihi RM280 000 ialah pada tahun 2048.	1	1	
	(c)	$S_6 = \frac{90\,000[(1.04)^6 - 1]}{1.04 - 1}$ $= RM596\,967.79$	1	1	
5		$3p + 2q + 2r = -7 \dots\dots\dots (1)$ $5p - 4q - 3r = 6 \dots\dots\dots (2)$ $-2p - 3q - 4r = 5 \dots\dots\dots (3)$ $eq(1) \times 2: \quad 6p + 4q + 4r = -14 \dots\dots\dots (4)$ $eq(2) + eq(4): \quad 11p + r = -8 \dots\dots\dots (5)$ $eq(2) \times 3: \quad 15p - 12q - 9r = 18 \dots\dots\dots (6)$ $eq(3) \times 4: \quad -8p - 12q - 16r = 20 \dots\dots\dots (7)$ $eq(6) - eq(7): \quad 23p + 7r = -2 \dots\dots\dots (8)$ $eq(5) \times 7: \quad 77p + 7r = -56 \dots\dots\dots (9)$ $eq(9) - eq(8): \quad 54p = -54$ $p = -1$	1	1	5

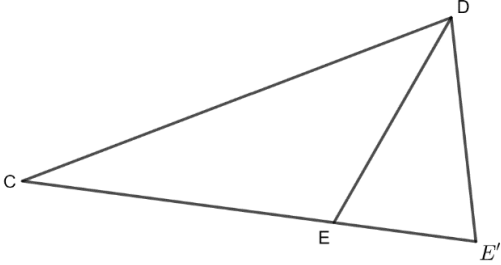
			<i>gantikan $p = -1$ ke dalam eq(5):</i> $11(-1) + r = -8$ $r = 3$ <i>gantikan $p = -1$ dan $r = 3$ ke dalam eq(1):</i> $3(-1) + 2q + 2(3) = -7$ $-3 + 2q + 6 = -7$ $2q = -10$ $q = -5$ $\therefore p = -1, q = -5$ dan $r = 3$	1	
NO.	BUTIRAN			MARKAH	JUMLAH
6	(a)		$\log_x 45 + 4 \log_x 2 - \frac{1}{2} \log_x 81 - \log_x 10$ $= \log_x 45 + \log_x 2^4 - \log_x \sqrt{81} - \log_x 10$ $= \log_x 45 + \log_x 16 - \log_x 9 - \log_x 10$ $= \log_x \left(\frac{45 \times 16}{9 \times 10} \right)$ $= \log_x 8$	1 1 1 1	7
	(b)		$\log_x 45 + 4 \log_x 2 - \frac{1}{2} \log_x 81 - \log_x 10 = \frac{3}{2}$ $\log_x 8 = \frac{3}{2}$ $8 = x^{\frac{3}{2}}$ $x = 8^{\frac{2}{3}}$ $x = 4$	1 1 1	
7	(a)	i.	$PT = \frac{1}{5} PS$ $PS = 5PT$ $\overrightarrow{PS} = 5\overrightarrow{PT}$ $\overrightarrow{PS} = 5(6\underline{q})$ $= 30\underline{q}$ <i>dalam ΔPQS,</i> $\overrightarrow{QS} = \overrightarrow{QP} + \overrightarrow{PS}$ $= -15\underline{p} + 30\underline{q}$ $= 30\underline{q} - 15\underline{p}$	1 1	8
		ii.	$TS = \frac{4}{5} PS$ $\overrightarrow{TS} = \frac{4}{5} \overrightarrow{PS}$ $\overrightarrow{TS} = \frac{4}{5} (30\underline{q})$	1	

			$= 24\underline{q}$ <i>dalam ΔRST,</i> $\overrightarrow{TR} = \overrightarrow{TS} + \overrightarrow{SR}$ $= 24\underline{q} + 15\underline{p} - 18\underline{q}$ $= 15\underline{p} + 6\underline{q}$	1 1		
	(b)		$\overrightarrow{TU} = \frac{2}{3}\overrightarrow{TR}$ $= \frac{2}{3}(15\underline{p} + 6\underline{q})$ $= 10\underline{p} + 4\underline{q}$ $\overrightarrow{US} = \overrightarrow{UT} + \overrightarrow{TS}$ $= -10\underline{p} - 4\underline{q} + 24\underline{q}$ $= 20\underline{q} - 10\underline{p}$ $= 10(2\underline{q} - \underline{p})$ $\overrightarrow{QS} = 30\underline{q} - 15\underline{p}$ $= \frac{3}{2}[10(2\underline{q} - \underline{p})]$ $\overrightarrow{QS} = \frac{3}{2}\overrightarrow{US}, \quad \text{maka } Q, U \text{ dan } S \text{ adalah segaris.}$	1 1 1		
NO.	BUTIRAN			MARKAH		JUMLAH
BAHAGIAN B						
8	(a)	i	$p = 0.45, \quad q = 1 - 0.45 = 0.55, \quad n = 7$ $P(X \geq 3) = 1 - P(X < 3)$ $= 1 - P(X = 0) - P(X = 1) - P(X = 2)$ $= 1 - {}^7C_0(0.45)^0(0.55)^7 - {}^7C_1(0.45)^1(0.55)^6$ $\quad - {}^7C_2(0.45)^2(0.55)^5$ $= 1 - 0.0152 - 0.0872 - 0.2140$ $= 0.6836$	1 1 1	10	
		ii	$\sigma^2 = 866.25$ $npq = 866.25$ $n(0.45)(0.55) = 866.25$ $n = 3500$	1 1 1		
	(b)		$\mu = 65.34 \text{ kg}, \quad \sigma^2 = 56.25 \text{ kg}$ $\sigma = 7.5 \text{ kg}$ $P(48 < X < 72) = P\left(\frac{48 - 65.34}{7.5} < z < \frac{72 - 65.34}{7.5}\right)$ $= P(2.312 < z < 0.888)$	1		

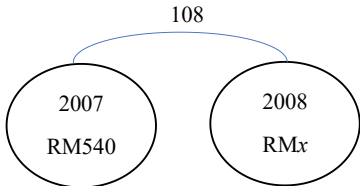
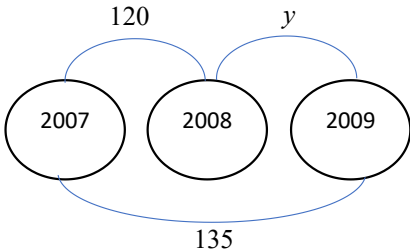
			$= 1 - P(z < -0.312) - P(z > 0.888)$ $= 1 - 0.0103 - 0.1872$ $= 0.8025$ $0.8025 \times n = 321$ $n = \frac{321}{0.8025}$ $= 400 \text{ orang dewasa}$	1	
				1	
				1	
NO.	BUTIRAN			MARKAH	JUMLAH
9	(a)		$y = \frac{1}{2}x^2 + 5$ $\frac{dy}{dx} = 2\left(\frac{1}{2}\right)x^{2-1}$ $\frac{dy}{dx} = x$ pada $P(2,7)$, $\frac{dy}{dx} = 2$ <i>persamaan tangen ST,</i> $y - 7 = 2(x - 2)$ $y = 2x - 4 + 7$ $y = 2x + 3$	1	10
	(b)		<i>luas kawasan berlorek</i> $= (7 \times 2) - \int_0^2 \left(\frac{1}{2}x^2 + 5\right) dx$ $= 14 - \left[\frac{x^3}{6} + 5x\right]_0^2$ $= 14 - \left[\left(\frac{2^3}{6} + 5(2)\right) - 0\right]$ $= 14 - \frac{34}{3}$ $= 2\frac{2}{3} \text{ cm}^2$ 	1	
	(c)		<i>pintasan</i> – $y = 5$, maka $\int_5^7 x^2 dy$ $y = \frac{1}{2}x^2 + 5$ $x^2 = 2y - 10$ $V = \pi \int_5^7 x^2 dy$	1	

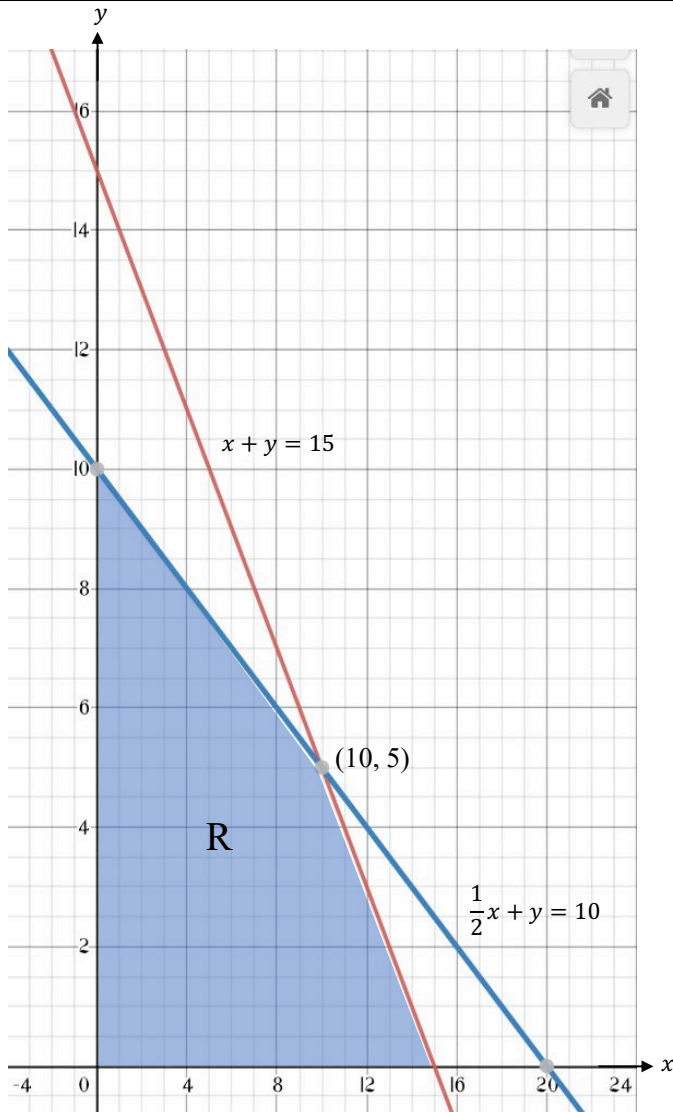
			$= \pi \int_5^7 (2y - 10) \, dy$ $= \pi [y^2 - 10y]_5^7$ $= \pi [(7)^2 - 10(7)] - [(5)^2 - 10(5)]$ $= \pi [-21 - (-25)]$ $= 4\pi \, \text{cm}^3$	1														
NO.	BUTIRAN			MARKAH	JUMLAH													
10	(a)	<table border="1"><tr><td>g (atm)</td><td>150</td><td>110</td><td>68.4</td><td>48.2</td><td>36.7</td><td>24.3</td></tr><tr><td>1/V</td><td>0.450</td><td>0.333</td><td>0.200</td><td>0.143</td><td>0.111</td><td>0.077</td></tr></table> 	g (atm)	150	110	68.4	48.2	36.7	24.3	1/V	0.450	0.333	0.200	0.143	0.111	0.077	1 1 1	10
g (atm)	150	110	68.4	48.2	36.7	24.3												
1/V	0.450	0.333	0.200	0.143	0.111	0.077												
	(b)	i	$gV = k$ $\frac{1}{gV} = \frac{1}{k}$ $\frac{1}{V} = \left(\frac{1}{k}\right) g$ $\text{kecerunan} = \frac{1}{k}$ $\frac{0.45 - 0.333}{150 - 110} = \frac{1}{k}$ $\frac{1}{k} = 0.002925$ $k = 341.88$	1 1 1														

		ii	Daripada graf, apabila $g = 55 \text{ atm}$, $\frac{1}{V} = 0.165$, $V = 6.06 \ell$	1 1	
NO.	BUTIRAN			MARKAH	JUMLAH
11	(a)		$\cos \frac{\theta}{2} = \frac{7}{12}$ $\theta = 1.896 \text{ rad}$	1 1	10
	(b)		Perentas $CD = 2\sqrt{(12^2 - 7^2)}$ Lengkung $CD = 12(1.896)$ Perimeter segment $= 12(1.896) + 2\sqrt{(12^2 - 7^2)}$ $= 42.2456$	1 1 1 1	
	(c)		Luas $\triangle COD = \frac{1}{2}(12)^2 \sin(108.63^\circ)$ Luas sektor $OAB = \frac{1}{2}(7)^2 (1.896)$ Luas Kawasan berlorek $= \frac{1}{2}(12)^2 \sin(108.63^\circ) - \frac{1}{2}(7)^2 (1.896)$ $= 21.7753$	1 1 1 1	

			$= \left -\frac{16}{3} + 6 \right $ $= 3\frac{2}{3}$ <i>jumlah jarak dilalui 4 saat pertama = A + B</i> $= 9 + 3\frac{2}{3}$ $= 12\frac{2}{3}m$	1	
13	(a)	i	$\cos A = \frac{8^2 + 12^2 - 6^2}{2(8)(12)}$ $\angle BAC = 26.38^\circ$	1	
		ii	$\frac{\sin \angle ACB}{8} = \frac{\sin 26.38^\circ}{6}$ $\angle ACB = 36.33^\circ$	1	
		iii	$\angle CED = 118.67^\circ$ $\frac{DE}{\sin 36.33^\circ} = \frac{15}{\sin 118.67^\circ}$ $DE = 10.128$	1	
	(b)	i		1	
		ii	$\angle CDE' = 180^\circ - 36.33^\circ - 61.33^\circ$ $\text{Luas } \triangle C'D'E' = \frac{1}{2}(10.128)(15)\sin(82.34^\circ)$ $= 75.282$	1	

10

NO.	BUTIRAN			MARKAH	JUMLAH
14	(a)	$p = \frac{2.40}{3.20} \times 100 @ \frac{q}{3.00} \times 100 = 130 @ \frac{4.60}{r} \times 10 = 115$ $p = 75$ $q = 3.90$ $r = 4.00$	1 2		10
	(b)	$\bar{I} = 180$ $\frac{120(2) + 75(4) + 130(3) + 115(s)}{2 + 4 + 3 + s} = 108$ $\frac{930 + 115s}{9 + s} = 108$ $930 + 115s = 972 + 108s$ $7s = 42$ $s = 6$	1 1 1		
	(c)	 $\frac{x}{540} \times 100 = 108$ $x = RM583.20$	1 1		
	(d)	 $\frac{I_{2009/2008} \times 120}{100} = 135$ $I_{\frac{2009}{2008}} = \frac{135 \times 100}{120}$ $= 112.5$	1 1		
15	(a)	Katakan x ialah bilangan sepasang anting-anting dan y ialah bilangan rantai. $I: \frac{1}{2}x + y \leq 10$ $II: x + y \leq 15$	1 1		10

NO.	BUTIRAN			MARKAH	JUMLAH
	(b)		1 1 1 1		
	(c)	<i>fungsi objektif, $15x + 20y = k$</i> <i>daripada graf, titik optimum adalah pada (10, 5).</i> <i>gantikan $x = 10$ dan $y = 5$ ke dalam fungsi objektif.</i> <i>keuntungan maksimum = $15(10) + 20(5)$</i> <i>$= 250$</i> <i>$\therefore$ Diona beroleh keuntungan maksimum sebanyak RM250 jika dia menjual 10 pasang anting – anting dan 5 utas rantai</i>	1 1 1 1		

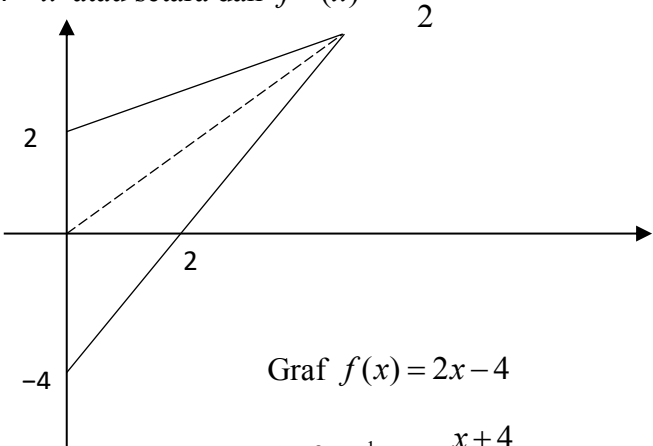
MODUL PERKEMBANGAN PEMBELAJARAN
MPP3 TAHUN 2023 TINGKATAN 5

MATEMATIK TAMBAHAN

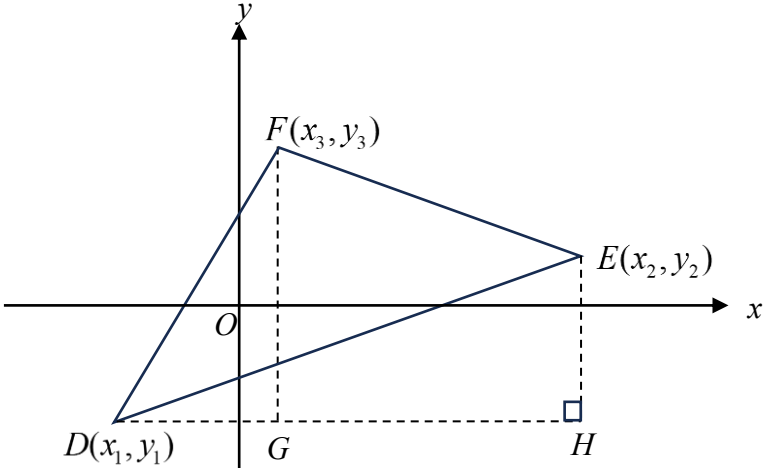
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Kertas 1

PERATURAN PEMARKAHAN

No	Skema Pemarkahan	Σ Markah
1	$\frac{m}{2}\pi$ atau $m\pi$ $\frac{m}{2}\pi < s < m\pi$	2
2	(a) $2y - 4 = x$ atau setara dan $f^{-1}(x) = \frac{x+4}{2}$ (b)  Graf $f(x) = 2x - 4$ Graf $f^{-1}(x) = \frac{x+4}{2}$ Graf bagi f^{-1} adalah pantulan bagi graf f pada garis lurus $y = x$ ATAU setara.	4

3	(a) 0.001447 [Panduan : ${}^{10}C_2 (0.7)^2 (0.3)^{10-2}$] N1 (b) Tulis $1 - P(X=0) - P(X=1)$ @ $P(X=2)+P(X=3)+\dots+P(X=10)$ P1 $1 - {}^{10}C_0 (0.3)^0 (0.7)^{10} - {}^{10}C_1 (0.3)^1 (0.7)^9$ @ setara K1 0.8507 N1	4
4	(a) Guna : $\log_a b = \frac{\log_c a}{\log_c b}$ K1 $b = \frac{a^2}{81}$ N1 (b) Guna : $a^m \times a^n = a^{m+n}$ ATAU $a^m \div a^n = a^{m-n}$ K1 3^{m-1} N1	4
5	$ar^{5-1} = 9(ar^{3-1})$ K1 $r = 3$ N1 $S_6 = \frac{a(3^6-1)}{3-1}$ @ $S_3 = \frac{a(3^3-1)}{3-1}$ K1 $S_6 = 28S_3$ N1	4
6	$\frac{1}{y} = \frac{k}{h} + \frac{3}{h} \left(\frac{1}{x} \right)$ P1 $\frac{3}{h} = \frac{4}{5}$ K1 $\frac{h(4)}{k(4)+3} = 1$ K1 $h = \frac{15}{4}$ dan $k = 3$ N1	4

7	Hapus anu pertama dengan kaedah penggantian @ penghapusan K1 Hapus anu kedua dengan kaedah penggantian @ penghapusan K1 $x = 80 @ y = 30 @ z = 10$ N1 $x = 80 @ y = 30 @ z = 10$ N1 $x = 80$ dan $y = 30$ dan $z = 10$ N1	5
8	(a)  Luas $\triangle DEF = \text{Luas } \triangle DFG + \text{Luas trapezium } EFGH - \text{Luas } \triangle DEH$ $= \left(\frac{1}{2} \times DG \times FG \right) @ \left[\frac{1}{2} \times GH \times (EH + FG) \right] @ \left(\frac{1}{2} \times DH \times EH \right) \quad \text{K1}$ $= \frac{1}{2} (x_3 - x_1)(y_3 - y_1) + \frac{1}{2} (x_2 - x_3)[(y_2 - y_1) + (y_3 - y_1)] - \frac{1}{2} (x_2 - x_1)(y_2 - y_1) \quad \text{K1}$ $= \frac{1}{2} (x_1 y_2 + x_2 y_3 + x_3 y_1) - (x_2 y_1 + x_3 y_2 + x_1 y_3) \quad \text{N1}$ (b) $\frac{1}{2} [[(-6)(5) + 10(8) + 1(-5)] - [(-5)(10) + 5(1) + 8(-6)]] \quad \text{K1}$ 69 N1	5

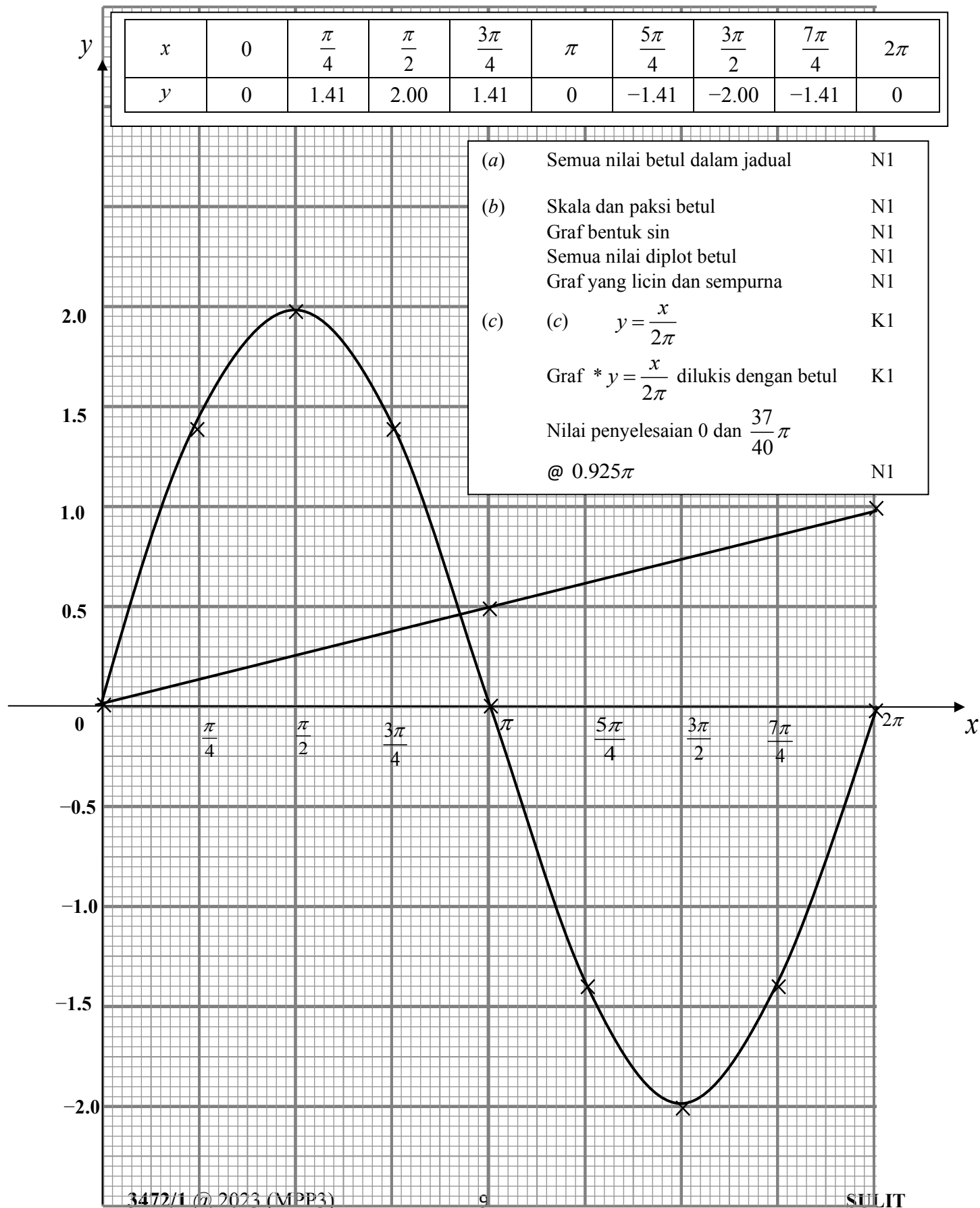
9	(a) (i) 7 N1 (ii) $a^2 - 8a + 7 = -5$ dan $(a - 6)(a - 2) = 0$ K1 $a = 2, 6$ N1 (b) $\delta y = [(x + \delta x)^2 - 8(x + \delta x) + 7] - [x^2 - 8x + 7]$ atau setara K1 $(\delta y \text{ dan ganti } [x^2 - 8x + 7])$ $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} 2x + \delta x - 8$ dan $\frac{dy}{dx} = 2x + 0 - 8$ K1 $\frac{dy}{dx} = 2x - 8$ N1	6
10	(a) (i) ${}^{12}C_4 \times {}^8C_4 \times {}^4C_4$ K1 34650 N1 (ii) ${}^{12}C_7 \times {}^5C_4 \times {}^1C_1$ K1 3960 N1 (b) (i) $59 \times 58 = 3422$ N1 (ii) $21 \times 4 \times 4 \times 62 \times 62$ atau setara K1 K1 1291584 N1	8

11	(a) $(3x-2)(x+1) < 0$ atau setara & Mencari ketaksamaan dengan kaedah Graf @ Jadual @ Garis Nombor K1 $-1 < x < \frac{2}{3}$ N1 (b) $-3 \left[x^2 + \frac{1}{3}x + \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - \frac{2}{3} \right]$ atau setara K1 $-3 \left(x + \frac{1}{6} \right)^2 + \frac{25}{12}$ K1 Nilai maksimum = $\frac{25}{12}$ N1 (c) (i) $\alpha + \beta = \frac{-m-1}{3}$ N1 (ii) $\frac{1}{\alpha} + \frac{1}{\beta} = -k$ & $\frac{1}{\alpha} \left(\frac{1}{\beta} \right) = k - 14$ K1 Mencari *k dalam sebutan m dan n. K1 [Panduan $\frac{-m-1}{n-2} = \frac{-14m-25}{n-2}$] $m = 14n - 26$ N1	9
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12	(a) Bezakan $9 - x^2$ terhadap x dan samakan dengan -2 $P(1,8)$ K1 N1 (b) mencari pintasan $-x$; 3 dan 5 K1 $\left(\frac{1}{2} \times 8 \times 4\right) @ \int_1^3 (9 - x^2) dx$ K1 $\left(\frac{1}{2} \times 8 \times 4\right) - \int_1^3 (9 - x^2) dx$ K1 $\frac{20}{3}$ N1 (c) $9y - \frac{y^2}{2}$ K1 $\pi \int_k^9 (9 - y) dy = 16\pi$ dan selesaikan untuk mencari nilai k K1 $k = 3.343$ N1	9
13	(a) Tulis hukum segi tiga atau hukum poligon dalam (i) atau (ii) P1 $\overrightarrow{AD} = \overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} @ \overrightarrow{QP} = \overrightarrow{QC} + \overrightarrow{CP}$ Guna hukum segi tiga atau hukum poligon dalam (i) atau (ii) $6\tilde{x} + 8\tilde{y} + (-8\tilde{x}) @ (1 - \lambda)(-8\tilde{x}) + 6\tilde{y}$ K1 (i) $-2\tilde{x} + 8\tilde{y}$ N1 (ii) $(-8 + 8\lambda)\tilde{x} + 6\tilde{y}$ [Panduan : $\overrightarrow{CP} = (1 - \lambda)\overrightarrow{CD}$] N1 (b) $\overrightarrow{AD} = k\overrightarrow{QP}$ (guna apa-apa huruf @ simbol selain λ) $-2\tilde{x} + 8\tilde{y} = k[(-8 + 8\lambda)\tilde{x} + 6\tilde{y}]$ K1 Bandingkan : $-2 = (-8 + 8\lambda)k$ & $8 = 6k$ K1 selesaikan persamaan serentak K1 $k = \frac{4}{3}$ & $\lambda = \frac{13}{16}$ N1	8

14	$s = \frac{y}{2} \pi \quad @ \quad A = \frac{y}{8} \pi$	P1	8
	$2x + \frac{2y + y\pi}{2} = 80$	K1	
	$xy + \frac{y^2}{8} \pi = 448$	K1	
	$x = 40 - \left(\frac{2 + \pi}{4} \right) y$	P1	
	$\left(40 - \left(\frac{2 + \pi}{4} \right) y \right) y + \frac{y^2}{8} \pi = 448$	K1	
	$(5y - 112)(5y - 112) = 0$	K1	
	$y = \frac{112}{5} \quad \text{atau setara}$	N1	
	$x = \frac{56}{5} \quad \text{atau setara}$	N1	
15	Rujuk Graf		8

No. 15



MODUL PERKEMBANGAN PEMBELAJARAN
MPP3 TAHUN 2023 TINGKATAN 5

MATEMATIK TAMBAHAN

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Kertas 2

PERATURAN PEMARKAHAN

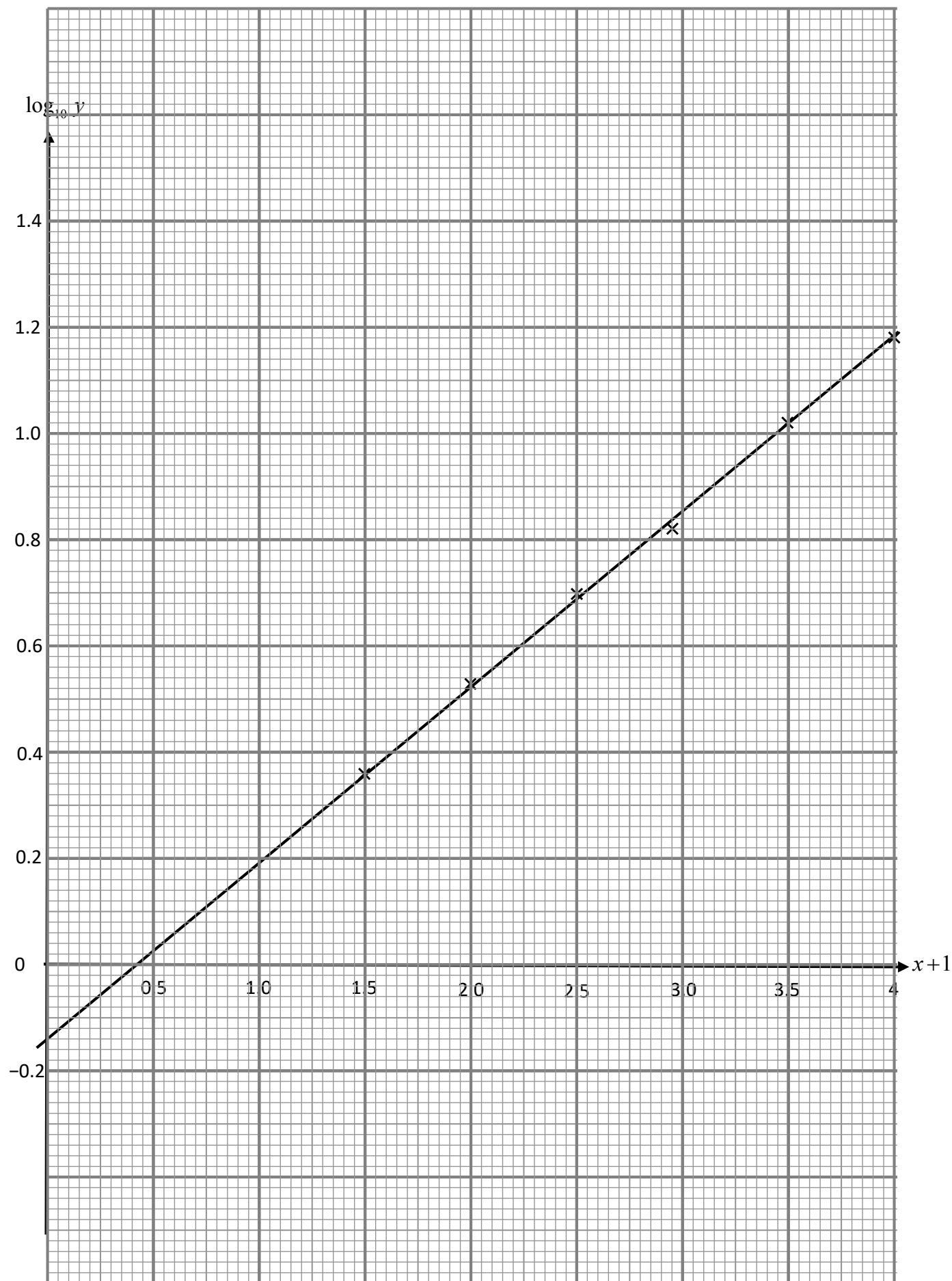
No	Peraturan Pemarkahan	Jumlah
1	(a) (i) $gf(x) = 2\left(\frac{x}{p}\right) + 3$ ATAU $f(x) = (2x + 3) - 3$ atau setara K1 Banding $g^{-1}(x)$ ATAU $f(x)$ atau setara K1 $p = 2$ N1 (b) (i) $f^2(x) = p(px)$ Ganti $p = 2$ K1 $f^2(x) = 4x$ N1 (ii) Tulis $f^3(x) = 9x$ atau $f^4(x) = 16x$ K1 $f^n(x) = 2^n x$ N1	7
2	${}^mC_2 = 15$ P1 $\frac{m!}{(m-2)!2!} = 15$ & Selesaikan $m^2 - m - 30 = 0$ ATAU ${}^mC_2 = {}^6C_2$ K1 $m = 6$ N1	3
3	(a) Pendaraban dengan surd konjugat & selesaikan $\frac{7}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}}$ dan $\frac{21+7\sqrt{2}}{9-2}$ K1 $\left(\sqrt{a+b\sqrt{2}}\right)^2 = (3+\sqrt{2})^2$ K1 $a = 11$ N1 $b = 6$ N1 (b) $e^{\ln(11)^2} + e^{\ln(6)^2}$ & Selesaikan @ $*(11)^2 + *(6)^2$ K1 157 N1	6

4	(a) (i) $\frac{1 - \cos x}{\sin x}$ $= \frac{1 - (1 - 2 \sin^2 \frac{x}{2})}{2 \sin \frac{x}{2} \cos \frac{x}{2}}$ K1 $= \frac{2 \sin^2 \frac{x}{2}}{2 \sin \frac{x}{2} \cos \frac{x}{2}}$ $= \frac{\sin \frac{x}{2}}{\cos \frac{x}{2}}$ $= \tan \frac{x}{2} \quad (LHS = RHS)$ N1 (ii) $\frac{1 - \cos x}{\sin x} + \sin x = 0$ & $1 - \cos x + (1 - \cos^2 x) = 0$ K1 Selesaikan $\cos^2 x + \cos x - 2 = 0$ K1 $0, 2\pi$ N1	8
	(b) $\sqrt{1 - m^2}$ dilihat atau $-\sqrt{1 - m^2}$ P1 Guna kos $2A = \cos^2 A - \sin^2 A$ @ $\cos 2A = 2 \cos^2 A - 1$ @ $\cos 2A = 1 - 2 \sin^2 A$ & Selesaikan K1 $\sin^2 \frac{\theta}{2} = \frac{1 - \sqrt{1 - m^2}}{2}$ @ $\sin^2 \frac{\theta}{2} = \frac{1 + \sqrt{1 - m^2}}{2}$ N1	

5	(a)	$180 = \frac{3}{2}[2a + (3-1)d] \quad @ \quad 396 = a + (30-1)d$	K1	10
		Selesaikan persamaan serentak	K1	
		$d = 12 \quad \& \quad a = 48$	N1	
		$S_{30} = \frac{30}{2}[2(*48) + (30-1)(*12)]$	K1	
		6660	N1	
	(b)	$6660 - \frac{20}{2}[2(*48) + (20-1)(*12)]$	K1	
		3420	N1	
	(c)	$T_{29} = *48 + (29-1)(*12)$	K1	
		$\frac{384}{12}$	K1	
		32	N1	
6	(a)	$24^2 = 13^2 + 13^2 - 2(13)(13)\cos\angle BOQ \quad @$		8
		$\sin \frac{\angle BOQ}{2} = \frac{\left(\frac{24}{2}\right)}{13} \quad @ \text{ setara}$	K1	
		2.352	N1	
	(b)	$\tan\left(\frac{*134.76^\circ}{2}\right) = \frac{BR}{13} \quad @ \quad S_{BAQ} = 13(2\pi - *2.352)$	K1	
		$*31.20 + *31.20 + *51.12$	K1	
		113.52	N1	
	(c)	$\frac{1}{2}(13)^2 \sin *134.76^\circ \quad @ \quad \frac{1}{2}(13)^2 (*0.79)$	K1	
		$\frac{1}{2}(13)^2 \sin *134.76^\circ + \frac{1}{2}(13)^2 (*0.79) \quad @ \text{ setara}$	K1	
		126.76	N1	

7	(a) $\overrightarrow{OP} = -4\hat{i} + \hat{j}$ (Boleh tersirat) P1 Tulis hukum segi tiga bagi ΔPQR P1 Panduan: $\overrightarrow{OR} = \overrightarrow{OP} + \overrightarrow{PR}$ @ $\overrightarrow{OQ} = \overrightarrow{OR} + \overrightarrow{RQ}$ $-4\hat{i} + \hat{j} + 6\hat{i} + 3\hat{j}$ @ $2\hat{i} + 4\hat{j} + 2\hat{i} - 6\hat{j}$ K1 $2\hat{i} + 4\hat{j}$ & $4\hat{i} - 2\hat{j}$ N1 $\left(\frac{2+4}{2}, \frac{4+(-2)}{2}\right)$ @ setara K1 $(3,1)$ N1 (b) $\frac{6\hat{i} + 3\hat{j}}{\sqrt{(6)^2 + (3)^2}}$ K1 $\frac{2}{\sqrt{5}}\hat{i} + \frac{1}{\sqrt{5}}\hat{j}$ @ setara N1	8																
8	(a) <table><tr><td>$x+1$</td><td>1.5</td><td>2</td><td>2.5</td><td>2.95</td><td>3.5</td><td>4</td><td>N1</td></tr><tr><td>$\log_{10} y$</td><td>0.36</td><td>0.53</td><td>0.70</td><td>0.82</td><td>1.02</td><td>1.18</td><td>N1</td></tr></table> Paksi betul dan skala seragam bagi garis lurus K1 Semua titik diplot betul N1 garis lurus penyuaian terbaik N1 (b) (i) $y = 2.754$ N1 (ii) $\log_{10} y = (x+1)\log_{10} p - \log_{10} q$ P1 $*0.328 = \log_{10} p$ & $-\log_{10} q = *-0.14$ K1 $p = 2.128$ N1 $q = 1.380$ N1	$x+1$	1.5	2	2.5	2.95	3.5	4	N1	$\log_{10} y$	0.36	0.53	0.70	0.82	1.02	1.18	N1	10
$x+1$	1.5	2	2.5	2.95	3.5	4	N1											
$\log_{10} y$	0.36	0.53	0.70	0.82	1.02	1.18	N1											

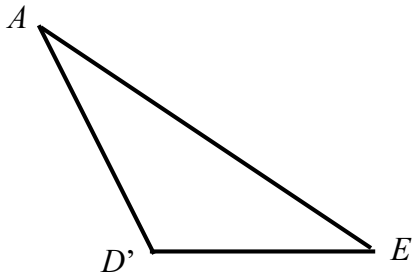
No. 8



9	(a) (i) $\frac{2}{3} \times m_1 = -1$ K1 $2 = -\frac{3}{2}(0) + c$ & selesaikan @ setara ATAU $c = 2$ (DILIHAT) K1 $y = -\frac{3}{2}x + 2$ N1 (ii) $\frac{2}{3}x + \frac{19}{3} = -\frac{3}{2}x + 2$ & selesaikan K1 $B(-2, 5)$ N1 (b) $-2 = \frac{(n-m)(0) + m(-5)}{(n-m) + m}$ @ $5 = \frac{(n-m)(2) + m\left(\frac{19}{2}\right)}{(n-m) + m}$ @ MENGGUNAKAN FORMULA JARAK DENGAN BETUL K1 Selesaikan $-2 = \frac{(n-m)(0) + m(-5)}{(n-m) + m}$ @ $5 = \frac{(n-m)(2) + m\left(\frac{19}{2}\right)}{(n-m) + m}$ @ MENCARI NISBAH JARAK YANG SAH K1 $m : n = 2 : 5$ N1 (c) $\left[\sqrt{[x - (-2)]^2 + (y - 5)^2} = 3 \right]$ K1 $x^2 + y^2 + 4x - 10y + 20 = 0$ N1	10
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10	(a) $P(X \geq 1) > 0.9$ $P(X = 0) < 0.1$ ${}^nC_0 \left(\frac{1}{3}\right)^0 \left(\frac{2}{3}\right)^n < 0.1$ $n \log_{10} \frac{2}{3} < \log_{10} 0.1$ & selesaikan $n = 6$ (b) $P(X > 50.1) = 0.025$ @ $P(X < 50.1) = 0.975$ @ $P(X > 34.3) = 0.8849$ $P(Z > \frac{50.1 - \mu}{\sigma}) = 0.025$ @ $P(Z > \frac{34.3 - \mu}{\sigma}) = 0.8849$ $\frac{50.1 - \mu}{\sigma} = 1.96$ @ $\frac{34.3 - \mu}{\sigma} = -1.2$ $\frac{50.1 - \mu}{1.96} = \frac{34.3 - \mu}{1.2}$ $\mu = 40.3$ $\sigma = 5$	P1 P1 K1 K1 N1 K1 K1 K1 N1 N1	10
11	(a) (i) $3x^2 - 4x$ (ii) $3x^2 - 4x = 0$ & selesaikan $(0, 0)$ dan $\left(\frac{4}{3}, -\frac{32}{27}\right)$ $\frac{d^2y}{dx^2} = 6(*0) - 4 = -4 < 0$ atau $\frac{d^2y}{dx^2} = 6\left(\frac{4}{3}\right) - 4 = 4 > 0$ $(0, 0)$ titik maksimum $\left(\frac{4}{3}, -\frac{32}{27}\right)$ titik minimum (b) $\frac{dy}{dx} = 3(2)^2 - 4(2)$ $3x^2 - 4x = 4$ & selesaikan $x = -\frac{2}{3}$ $P\left(-\frac{2}{3}, -\frac{32}{27}\right)$	N1 K1 N1 K1 N1 N1 K1 K1 N1 N1	10

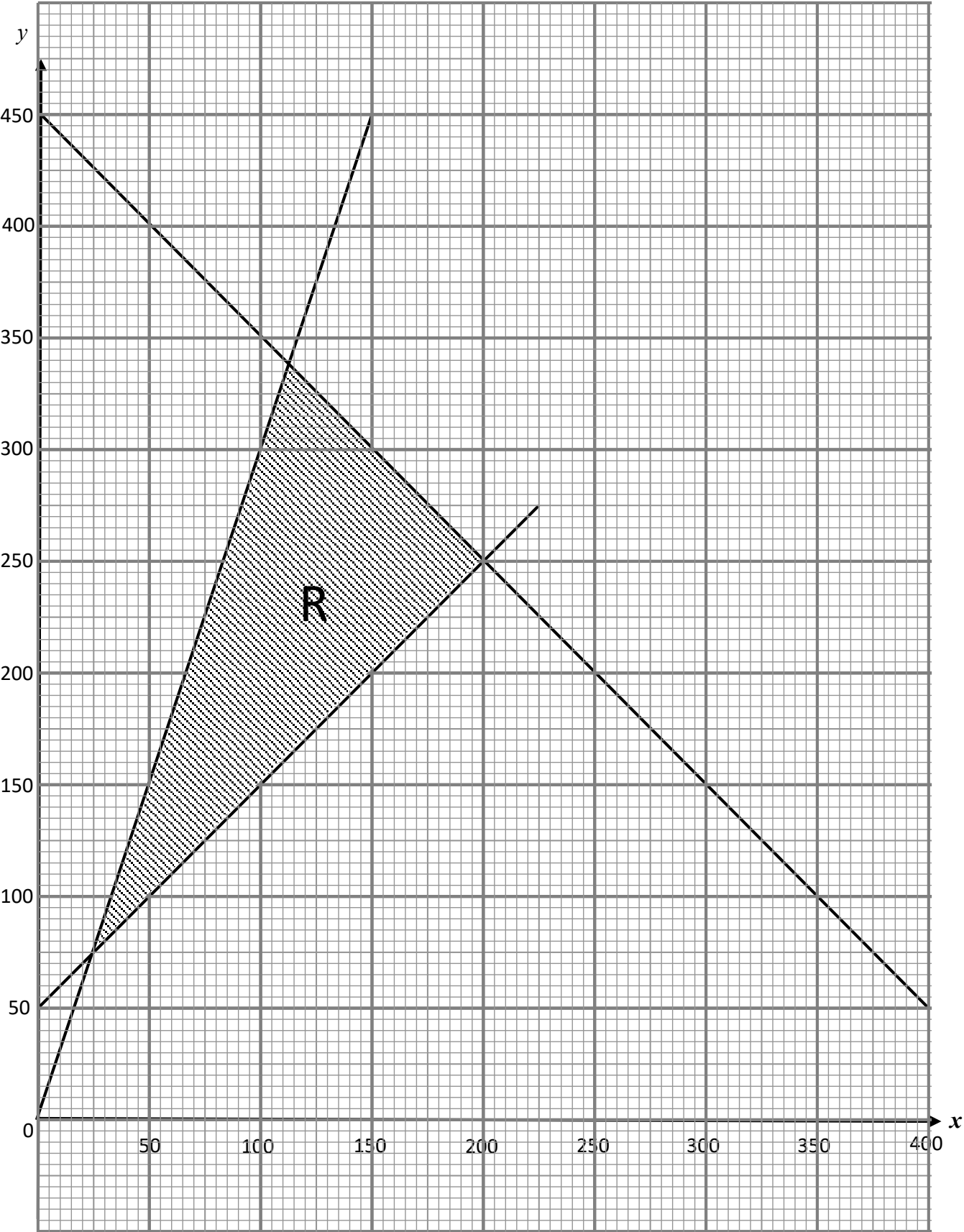
12	(a)	(i)	$7^2 = 5^2 + 8^2 - 2(5)(8)\cos \angle BDC$	K1	
			60°	N1	
		(ii)	$\frac{AD}{\sin 40^\circ} = \frac{12}{\sin 60^\circ}$	K1	
			8.907	N1	
		(iii)	$\text{Luas } \triangle ABD = \frac{1}{2} \times 5 \times 8.907 \times \sin 120^\circ$ @		
			$\text{Luas } \triangle BDC = \frac{1}{2} \times 8 \times 5 \times \sin 60^\circ$	K1	
			19.284 + 17.321	K1	
			36.61	N1	
			@		
			Mencari $\angle BCD$ menggunakan Petua Sinus @ Petua Kosinus	K1	
			$\text{Luas } \triangle ABD = \frac{1}{2} \times 7 \times (8.907 + 8) \times \sin 38.21^\circ$	K1	
			36.60	N1	
	(b)				



$\text{Luas } \triangle AD'E = \frac{1}{2} \times 12 \times 8.907 \times \sin 20^\circ$	K1
18.28	N1

13	(a) $\frac{P_{21}}{3.00} \times 100 = 140$ K1 4.20 N1 (b) $\frac{140(2p) + 135(3) + 120(1) + 130(p)}{2p + 3 + 1 + p} = 134.5$ K1 $p = 2$ N1 (c) $\frac{25}{P_{21}} \times 100 = 134.5$ K1 18.59 N1 (d) $\left(\bar{I}_{23/15} \Rightarrow 130 \times \frac{125}{100} \right)$ K1 $\left(\bar{I}_{23/15} \Rightarrow 162.5 \right)$ N1 $\left[\frac{140[2 * (2)] + 135(3) + 120(1) + *162.5 * (2)}{2 * (2) + 3 + 1 + *2} \right]$ K1 141 N1	10
14	(a) $x + y \leq 450$ N1 $y - x \geq 50$ N1 $y \leq 3x$ N1 (b) Satu *garis lurus dilukis dengan betul K1 Semua *garis lurus dilukis dengan betul K1 Rantau R dilorek N1 (c) (i) $25 \leq x \leq 200$ N1 (ii) $x = 125, y = 175$ N1 Yuran pengajaran minimum $k = 8000(125) + 12000(175)$ K1 RM 3100000 N1	10

No. 14



15	(a)	Bezakan v_A terhadap t dan samakan dengan 0	K1	10
		Gantikan $*t$ dalam v_A	K1	
		$\frac{25}{8}$	N1	
	(b)	$v_A = 0$ dan selesaikan	K1	
		Kamirkan V_A terhadap t	K1	
		Gantikan $t = *2$ ke dalam $*s_A$	K1	
		$\frac{14}{3}$	N1	
	(c)	Kamirkan v_B terhadap t dan tentukan c	K1	
		$*s_B - *s_A$ $(s_B > s_A)$	K1	
		$\frac{34}{3}$	N1	



i-MODUL KECEMERLANGAN SPM SMKA DAN SABK 2023

SIJIL PELAJARAN MALAYSIA 2023 (SET 1)

MATEMATIK TAMBAHAN

Kertas 1

PERATURAN PEMARKAHAN

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan **Hak Cipta Majlis Pengetua SMKA dan Majlis Pengetua SABK**. Kegunaan khusus untuk guru-guru tingkatan 5 di SMKA dan SABK sahaja. Peraturan ini tidak boleh dikeluarkan dalam apa jua bentuk media cetak.

CADANGAN PERATURAN PEMARKAHAN (SKEMA)
Kertas 1

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
1	$x^2 + 3x = px - 1$ $(3 - p)^2 - 4(1)(1) \geq 0$ $(p - 1)(p - 5) \geq 0 \text{ dan } \begin{array}{c} + \quad \quad \quad + \\ \quad \quad \quad \diagdown \quad \diagup \\ \quad \quad \quad 1 \quad \quad 5 \\ \quad \quad \quad \diagup \quad \diagdown \\ - \quad \quad \quad - \end{array}$ $p \leq 1, \quad p \geq 5$	K1 K1 K1 N1	4
2	$3(2+3x)^2(3)$ $\frac{(1+x)(9)(2+3x)^2 - (2+3x)^3(1)}{(1+x)^2}$ $\frac{(2+3x)^2(7+6x)}{(1+x)^2}$	K1 K1 N1	3
3	$\frac{40-\mu}{\sigma} = -0.674 \text{ atau } \frac{75-\mu}{\sigma} = 1.281 \parallel 1.282$ $\frac{40-\mu}{\sigma} = -0.674 \text{ dan } \frac{75-\mu}{\sigma} = 1.281 \parallel 1.282$ Selesaikan persamaan serentak $\mu = 52.06$ $\sigma = 17.89$	K1 K1 K1 N1 N1	5
4 (a)	$\ln y = 2 \ln x - 2$ $y = \frac{x^2}{e^2}$	K1 N1	5
(b)	$4 = 2p - 2 \text{ atau } q = 2(10) - 2$ $p = 3$ $q = 18$	K1 N1 N1	

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
5 (a)	$\frac{9p^{\frac{3}{2}}q}{27p^{\frac{1}{2}}q} = \frac{3p^{\frac{5}{2}}q}{9p^{\frac{3}{2}}q} = \frac{1}{3}p$	P1	
	Janjang Geometri dengan nisbah sepunya $r = \frac{1}{3}p$.	NI	
	(b) $\frac{320}{2}[2(2) + (320-1)(2)]$ 102720 $\frac{12}{2}[2(2000) + (12-1)(900)]$ 83400 Syarikat A. Kerana jumlah gaji lebih tinggi.	K1	
		N1	
6 (a)	$\delta x = \frac{b-a}{n}$ dan $L_{\text{segi empat}} = y_i \delta x$	K1	
	$L_{\text{jumlah}} = \sum_{i=1}^n y_i \delta x$		
	Apabila $n \rightarrow \infty, \delta x \rightarrow 0$,		
	$L_{\text{jumlah}} = \lim_{\delta x \rightarrow 0} \sum_{i=1}^n y_i \delta x$	K1	
(b)	$L_{\text{jumlah}} = \int_a^b y \, dx$	N1	
	$L = \int_1^4 3x^{-2} \, dx$		5
	$L = \left[-\frac{3}{x}\right]_1^4$		
	$L = \left[-\frac{3}{4}\right] - \left[-\frac{3}{1}\right]$	K1	
	$L = 2\frac{1}{4}$	N1	

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
7 (a)	$5^{x-1} = 5^{2(\frac{7-y}{2})}$ $y = 8 - x$ $\left(\frac{h}{k}\right)^7 \text{ atau } \left(\frac{k}{h}\right)^{-x-2y}$ $y = \frac{7-x}{2}$	K1 N1 K1 N1	7
	(b) $\frac{3+x\sqrt{2}}{4-\sqrt{2}} \times \frac{4+\sqrt{2}}{4+\sqrt{2}}$ $\frac{12+3\sqrt{2}+4x\sqrt{2}+2x}{4^2-(\sqrt{2})^2}$ $m = \frac{6+x}{7}, n = \frac{3+4x}{14}$	P1 K1 N1	
8(a)	$h = 3$ $yx - 2x = 3y + 5$ $f^{-1}(x) = \frac{3x+5}{x-2}, x \neq 2$ $k = 2$	N1 K1 N1 N1	5
	(b) (13,4)	N1	
9 (a)	Ganti rumus $\cos(\theta + \theta) = \cos\theta\cos\theta - \sin\theta\sin\theta$ dan $\cos^2\theta = 1 - \sin^2\theta$ $1 - 2\sin^2\theta$	K1 N1	5
	(b) $-3(1 - 2\sin^2\theta) = 5 - 8\sin\theta$ $(3\sin\theta - 2)(\sin\theta + 2) = 0$ dan sudut rujukan, $\alpha = 41^\circ 49' \parallel 41.81$ $\theta = 41^\circ 49', 138^\circ 11' \parallel 41.81, 138.19$	K1 K1 N1	

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
10	$\theta = \frac{2\pi}{6} = \frac{\pi}{3}$ $\frac{1}{2} \times (5r)^2 \times \frac{\pi}{3}$ $\frac{1}{2} \times (5r)^2 \times \frac{\pi}{3} - \frac{1}{2} \times (1.5r)^2 \times \frac{\pi}{3}$ $\frac{91}{24} \pi r^2$ $\left(\frac{91}{24} \pi r^2 \right) \times 3 + \pi r^2$ $\frac{99}{8} \pi r^2$	N1 K1 K1 N1 K1 N1	 6
11 (a)	Nasi Lemak Mi Goreng Lontong Teh (Nasi Lemak, Teh) Kopi (Nasi Lemak, Kopi) Teh (Mi Goreng, Teh) Kopi (Mi Goreng, Kopi) Teh (Lontong, Teh) Kopi (Lontong, Kopi) Bilangan cara : 6	 K1 N1	 5
(b)	$(8 - 1)! = 5040$ $(7 - 1)! \times 2$ 1440 cara	K1 K1 N1	 5

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
12 (a)	$\overrightarrow{OB} = 4i + 3j$	P1	7
(b)	$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$ $\overrightarrow{BC} = -9i + (2i - 5j)$ $\overrightarrow{BC} = -7i - 5j$	K1 N1	
(c)	$\overrightarrow{CS} = \overrightarrow{CO} + \overrightarrow{OS}$ $\overrightarrow{CS} = 3i + 2j + (2i + kj)$ $\overrightarrow{CS} = 5i + (2 + k)j \dots\dots(1)$ $(6i + 9j)t = 5i + (2 + k)j \dots\dots(2)$ Bandingkan 1 dan 2 $t = \frac{5}{6}$ jam $h = 50$ minit $k = 5.5$	K1 K1 N1 N1	
13 (a)	$B(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ B akan menjadi titik tengah AC.	K1 N1	8
(b)	$\frac{4(4t) + 3(3h)}{3 + 4} = h$ atau $\frac{4(t) + 3(4k)}{3 + 4} = k$ $16\left(\frac{-5k}{4}\right) = -2h$ atau $4\left(\frac{-2h}{16}\right) = -5k$ $h = 10k$	K1 K1 N1	
(c)	$\frac{1}{2} \left [-4(3) + 5k - 1(-1)] - [-1(5) - 1(3) - 4k] \right = 15$ $9k - 3 = 30$ atau $9k - 3 = -30$ $R\left(-1, \frac{11}{3}\right)$ dan $R(-1, -3)$	K1 K1 N1	

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
14 (a)	$2b + 2y + \pi y = 120$ atau $L = 2by + \frac{\pi y^2}{2}$	K1	8
	$L = 120y - \left(2 + \frac{\pi}{2}\right)y^2$	N1	
	$\frac{dL}{dy} = 120 - (4 + \pi)y$	K1	
	$120 - (4 + \pi)y = 0$	K1	
	$y = \frac{120}{4 + \pi}$	N1	
(b)	$\frac{dL}{dy} = 120 - (4 + \pi)(10)$	K1	8
	$\frac{dL}{dt} = (80 - 10\pi) \times \frac{1}{p}$	K1	
	$\frac{80 - 10\pi}{p}$	N1	
(c)	$a > 0$ dan $N > 0$	K1	8
	$a > 0, a \neq 1$ dan $N > 0$	N1	
	penukaran asas	K1	
	menggunakan hukum log	K1	
	$-\frac{2q + p}{2(1 + p)}$	N1	
15(a)	$\ln 0.3678 = \ln e^{-a\left(\frac{10}{3}\right)}$	K1	8
	$a = \frac{3}{10}$	N1	
	$1000(2)e^{-\frac{3}{10}(2)} = 1098$	N1	



i-MODUL KECEMERLANGAN SPM SMKA DAN SABK 2023

SIJIL PELAJARAN MALAYSIA 2023 (SET 1)

MATEMATIK TAMBAHAN

Kertas 2

PERATURAN PEMARKAHAN

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan **Hak Cipta Majlis Pengetua SMKA dan Majlis Pengetua SABK**. Kegunaan khusus untuk guru-guru tingkatan 5 di SMKA dan SABK sahaja. Peraturan ini tidak boleh dikeluarkan dalam apa jua bentuk media cetak.

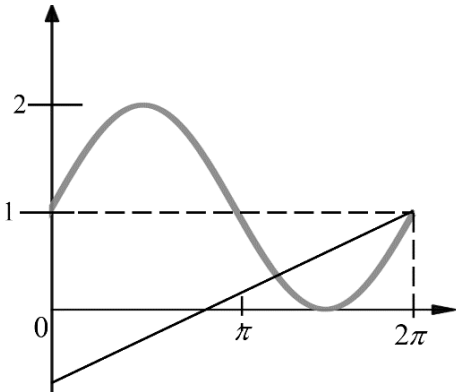
Peraturan pemarkahan ini mengandungi 11 halaman bercetak

CADANGAN PERATURAN PEMARKAHAN (SKEMA)
KERTAS 2
BAHAGIAN A

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
1 (a)	$\frac{1}{2}(x^2 + 10x + 25 + x^2 - 14x + 49)$ $= x^2 - 2x + 37$ $= x^2 - 2x + \left(\frac{-2}{2}\right)^2 - \left(\frac{-2}{2}\right)^2 + 37$ $= (x-1)^2 + 36$ Titik minimum / <i>Minimum point</i> = (1,36)	K1	
1 (b)	$a < 0$	K1 N1 P1	5
2 (a)	$\frac{n \times (n-1)(n-2)!}{(n-2)!}$ $n^2 - n$	K1 N1	
2(b)(i)	${}^9C_6 = 84$	N1	
(b)(ii)	$\left({}^{11}C_5 \times {}^9C_1\right) + \left({}^{11}C_6 \times {}^9C_0\right)$ 4620	K1 N1	5

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
3 (a)	$a \left[x^2 + \frac{b}{a}x + \left(\frac{\frac{b}{a}}{2} \right)^2 - \left(\frac{\frac{b}{a}}{2} \right)^2 + \frac{c}{a} \right] = 0 \text{ (atau setara)}$	K1	8
	$x + \frac{b}{2a} = \pm \sqrt{\frac{b^2 - 4ac}{4a^2}}$	K1	
	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	N1	
3 (b)	$y = 4x - 6$	P1	
	$2x^2 + 3(4x - 6)^2 - 8x(4x - 6) = 24$	K1	
	$18x^2 - 96x + 84 = 0$		
	$3x^2 - 16x + 14 = 0$		
	$x = \frac{-(-16) \pm \sqrt{(-16)^2 - 4(3)(14)}}{2(3)}$	K1	
	$x = 1.10 \quad x = 4.23$	N1	
	$y = -1.60 \quad y = 10.9$	N1	
4 (a)	6000, 6300, 6615	P1	9
	$r_1 = \frac{6300}{6000} \quad r_2 = \frac{6615}{6300}$	K1	
	$r_1 = 1.05 \quad r_2 = 1.05$	N1	
	$r_1 = r_2$		
	$T_{18} = (6000)(1.05)^{18-1}$	K1	
	$= 13752.11$	N1	
	Simpanan RM 15 000 tidak dapat dicapai		
	$T_{10} = (6000)(1.05)^{10-1}$	K1	
	$= 9307.97$		
	$T_{11} = 9959.53$	K1	
	$T_8 = (9959.53)(1.07)^{8-1}$	K1	
	$= 15992.83$	N1	
	Maka, wang simpanan mencapai RM 15000		

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
5 (a) (i)	$TS + SR @ TQ + QR$ $3\tilde{x} + 3\tilde{y}$	K1 N1	7
5 (a) (ii)	$QS + SU @ QR + RU$ $\frac{9}{2}\tilde{x} - \frac{3}{2}\tilde{y}$	K1 N1	
5 (b)	$PR = \lambda TR$ $7\tilde{x} + 7\tilde{y} = \lambda(3\tilde{x} + 3\tilde{y})$ $PR = \frac{7}{3}TR$	K1 K1	
	Jalan pintas ke R boleh dilalui daripada P kerana segaris.	N1	
6	$20x + 30y + 40z = 68500$ $10x + 15y + 15z = 29750$ $x + y + z = 2350$ <u>Hapus satu anu</u> hapus x : $10y + 20z = 21500 // 5y + 5z = 6250$ atau setara hapus y : $-10x + 10z = -2000$ atau setara hapus z : $x + y = 1450$ atau setara Hapus lagi satu anu kaedah penggantian/penghapusan $x = 1100$ (baju kurung) $y = 350$ (baju kurung moden) $z = 900$ (baju kebaya)	N1 N1 N1 K1 K1 N1 N1 N1	8

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
7 (a)	$\frac{1 - \sin^2 x}{1 - \sin x}$ $\frac{(1 - \sin x)(1 + \sin x)}{(1 - \sin x)}$ $1 + \sin x$	K1 N1	
7 (b)	 Bentuk / <i>Shape</i> 1 kitaran / <i>1 cycle</i> Anjakan 1 unit ke atas / <i>Shift 1 unit upwards</i>	P1 P1 P1	
(c)	$y = \frac{x}{\pi} - 1$ Lukis garis lurus / <i>Draw straight line</i> $y = \frac{x}{\pi} - 1$ Bilangan penyelesaian / <i>No of solution</i> = 2	K1 K1 N1	8

BAHAGIAN B
Pilih mana-mana **tiga** soalan

Soalan	Butiran	Markah
8(a) 8(b) <		

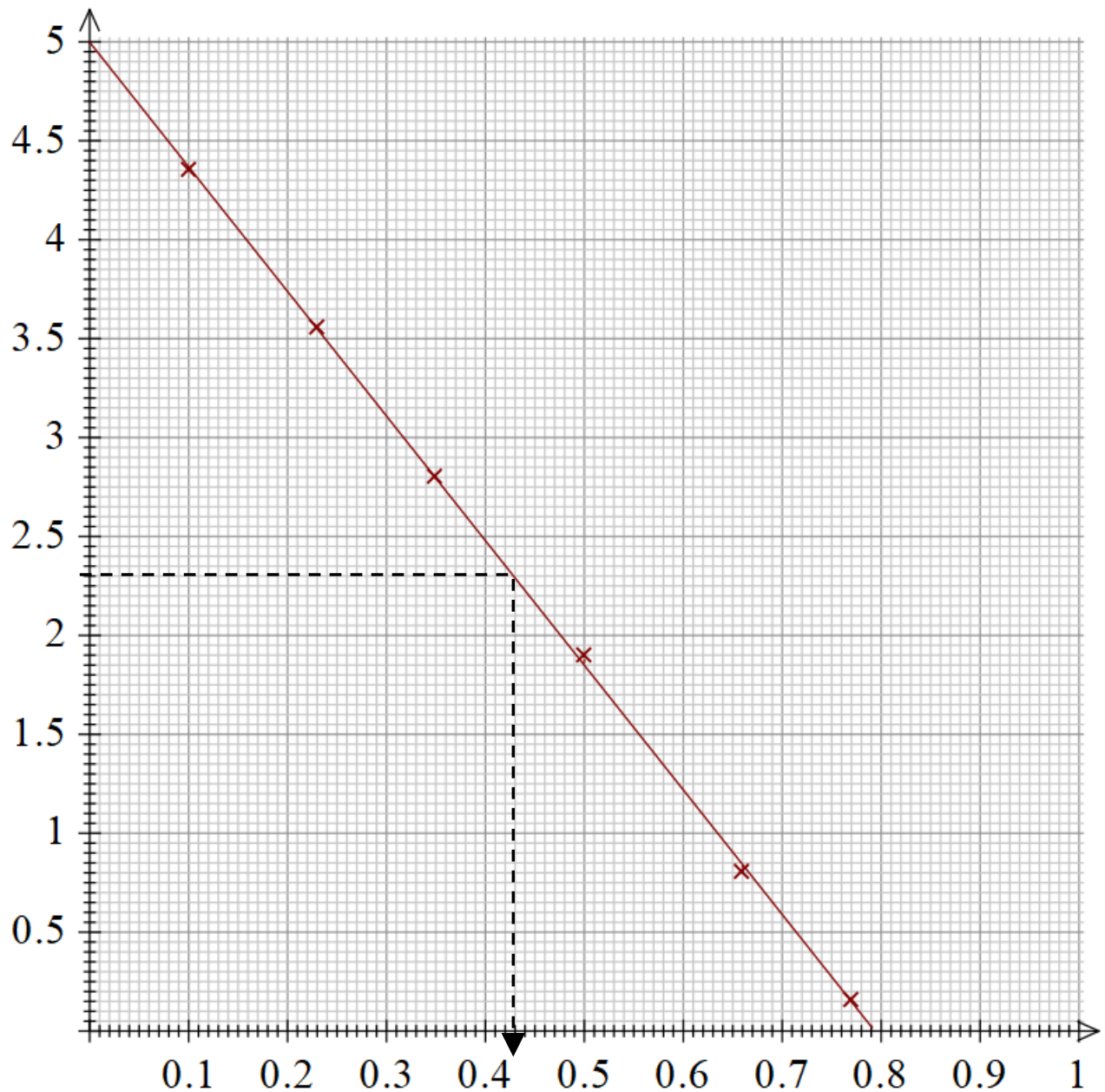
Graf garis lurus y^2 melawan $\sqrt{x}$ dilukis

Paksi-paksi betul dan skala seragam

Sekurang-kurangnya satu *titik diplot betul K1

Enam *titik diplot dengan betul N1

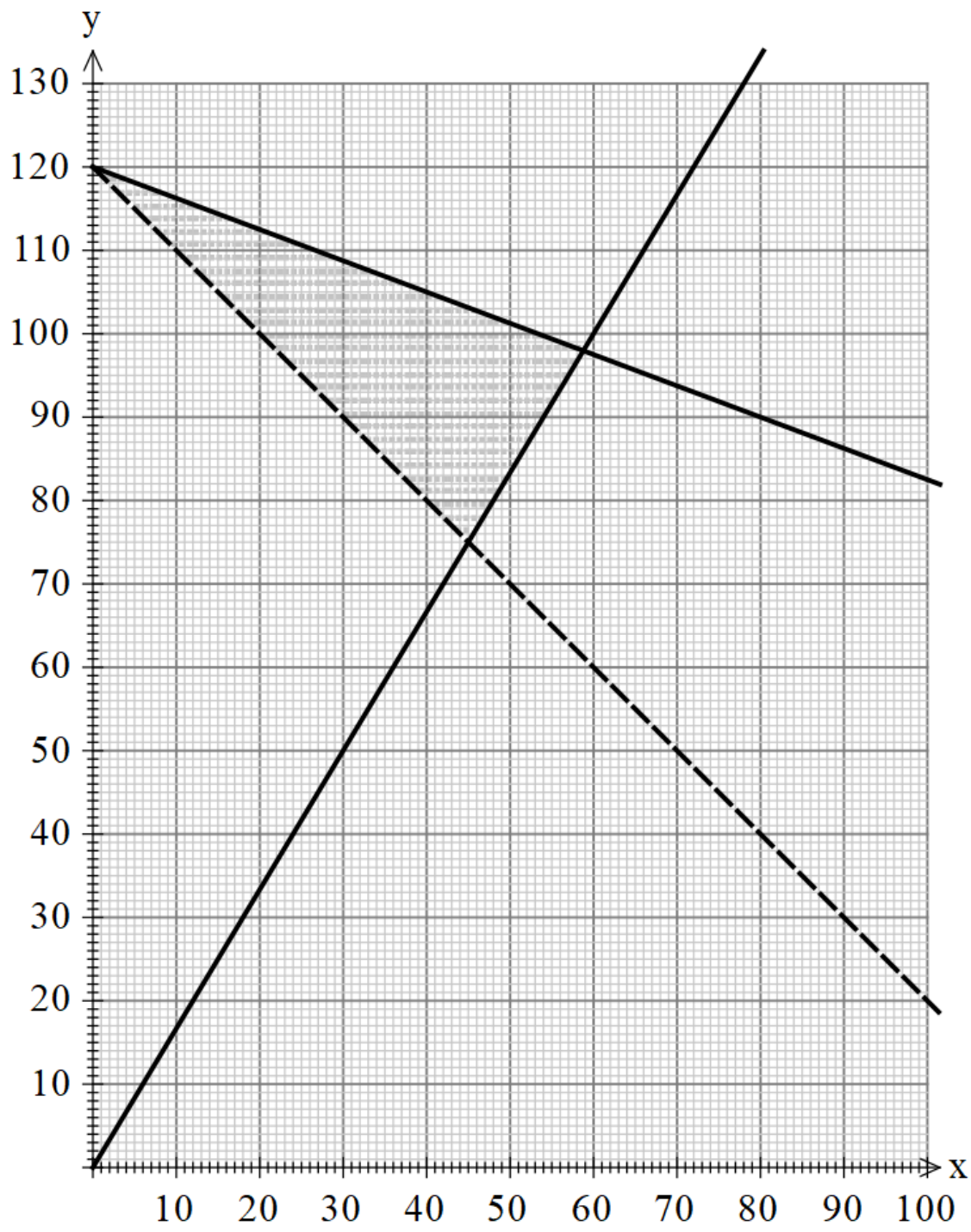
Garis lurus penyuaian terbaik N1



Soalan	Butiran	Markah
10 (a)(i)	Tulis $P\left(\frac{40-40}{12} \leq Z \leq \frac{60-40}{12}\right)$	P1
	$P(Z \geq 0) - P(Z > 1.667)$	K1
	0.4522	N1
	10(a)(ii)	
	Tulis $P\left(Z > \frac{m-40}{12}\right)$ & $1 - 0.58 @$	K1
	Label dan lorek pada lakaran graf normal & $0.42 @ 1 - 0.58$	
	$m = 37.58$	N1
	10 (b)(i)	
	$\sqrt{9(0.8)(0.2)}$	K1
	$\frac{6}{5} @ 1.2$	N1
10 (b)(ii)	$P(x \geq 1) = 1 - [P(x=0) + P(x=1) + P(x=2) + P(x=3)]$ atau setara	K1
	$P(x \geq 1) = 1 - [({}^9C_0(0.8)^0(0.2)^{9-0}) + ({}^9C_1(0.8)^1(0.2)^{9-1})$	K1
	$+ ({}^9C_2(0.8)^2(0.2)^{9-2}) + ({}^9C_3(0.8)^3(0.2)^{9-3}]$	N1
	0.9969	
11 (a)	$0.4x^2$	P1
	$\cos 45.84 = \frac{OR}{5}$ atau $\sin 45.84 = \frac{SR}{5}$	K1
	$luas\ ORS = \frac{1}{2} \times 5 \cos 45.84 \times 5 \sin 45.84$	K1
	$6.2473 = \frac{1}{5} \times 0.4x^2$	K1
	$x = 8.837$	N1
	11 (b)	
	$8.837 (0.8)$	K1
	$3.837 + 7.070 + 5.354 + 5 \sin 45.84^*$	K1
	19.85	N1
	11 (c)	
	Luas sektor OPQ – luas segitiga OSR	
	$= \frac{1}{2} \times (8.837)^2 (0.8) - 6.2473$	K1
	$= 24.99 @ 25$	N1

Soalan	Butiran	Markah
12 (a)	$v = 6 \text{ ms}^{-1}$	P1
12 (b)	$v = 0$ $-2t^2 + 4t + 6 = 0$ $t^2 - 2t - 3 = 0$ $(t+1)(t-3) = 0$ $t = 3$	P1 K1 N1
12 (c)	$\frac{dv}{dt} = -4t + 4 = 0$ $t = 1$ $v = -2(1)^2 + 4(1) + 6$ $v = 8 \text{ ms}^{-1}$	P1 K1 N1
12(d)	$-\frac{2t^3}{3} + \frac{4t^2}{2} + 6t$ $\left[-\frac{2(3)^3}{3} + \frac{4(3)^2}{2} + 6(3) \right] + \left \left(-\frac{2(6)^3}{3} + \frac{4(6)^2}{2} + 6(6) \right) - \left(-\frac{2(3)^3}{3} + \frac{4(3)^2}{2} + 6(3) \right) \right $ 72	K1 K1 N1
13 (a)	$\frac{\sin 55^\circ}{DF} = \frac{\sin 47^\circ}{14}$ $DF = 15.68$	K1 N1
13 (b)	$\frac{\sin 78^\circ}{AD} = \frac{\sin 47^\circ}{14}, AD = 18.72$ $BD = \sqrt{14^2 + 18.72^2} \quad BF = \sqrt{14^2 + 14^2}$ $BD = 23.3795 \quad = 19.799$ $(23.3795^*)^2 = (15.6807^*)^2 + (19.799^*)^2 - 2(15.6807^*)(19.799^*) \cos DFB$ $\angle DFB = 81.55^\circ$ $\text{Luas BFD} = \frac{1}{2} \times (15.6807^*)(19.799^*) \sin 81.55^\circ$ $= 153.55$	K1 K1 K1 N1 K1 N1
13 (c)	$\frac{1}{2} \times (23.3795) \times t = 153.55$ $t = 13.14$	K1 N1

Soalan	Butiran	Markah
14 (a) (i)	140	P1
14 (a) (ii)	$y = \frac{100}{140} \times 7$	K1
	$y = 5$	N1
14 (b)	$\frac{180(5) + 140(2) + 187.5(3)}{5 + 2 + 3}$	K1
	174.25	N1
14 (c) (i)	$\frac{120}{174.25} \times 100$	K1
	68.87	N1
14 (c) (ii)	$\frac{100}{120} \times 90$	K1
	75	N1
	Bilangan maksimum bebola ayam $= \frac{75}{0.2}$ $= 375$	N1
15 (a)	I : $x + y > 120$	N1
	II : $x \leq \frac{3}{5}y$	N1
	III : $1760y + 660x \leq 211200$ @ $8y + 3x \leq 960$	N1
15 (b)	Lukis dengan betul sekurang-kurangnya satu garis lurus dari *ketaksamaan yang melibatkan x dan y . <i>Draw at least one straight line from *inequalities involving x and y Correctly.</i>	K1
	Lukis dengan betul semua garis lurus dari *ketaksamaan yang melibatkan x dan y <i>Draw all straight lines from *inequalities involving x and y correctly</i>	N1
	Rantau dilorek dengan betul <i>Region shaded correctly</i>	N1
15 (c) (i)	$80 < y \leq 105$ atau $81 \leq y \leq 105$	K1
15 (c) (ii)	(48,80)	K1
	$660(48) + 1760(80)$	K1
	RM 172 480	N1





i-MODUL KECEMERLANGAN SPM SMKA DAN SABK 2023

SIJIL PELAJARAN MALAYSIA 2023 (SET 2)

MATEMATIK TAMBAHAN

Kertas 1

PERATURAN PEMARKAHAN

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

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CADANGAN PERATURAN PEMARKAHAN (SKEMA)

Kertas 1

Soalan	Butiran	Markah
1	$(3x - 2)(x + 3) > 0$ kaedah graf, jadual atau garis nombor $x < -3 \quad x > \frac{2}{3}$	1 1 1
		3 m
2	$\frac{dy}{dt} = 1 - 8t$ atau $\frac{dx}{dt} = 5$ $(1 - 8t) \times \frac{1}{5}$ $\left(1 - 8\left(\frac{x - 4}{5}\right)\right) \times \frac{1}{5}$ $\frac{37 - 8x}{25}$	1 1 1 1
		4 m
3 (a)	$k = 1 - \left(\frac{16}{81} + \frac{16}{81} + \frac{7}{27} + \frac{1}{81}\right) = \frac{1}{3}$ ${}^4C_4 p^4 q^0 = \frac{1}{81}$ $p = \frac{1}{3}$	1 1 1
3 (b)	$\frac{1 - 0.7154}{2}$ $\frac{k - 12.45}{5} = 1.07$ $k = 17.80$	1 1 1
		6 m
4	$xy = 4x^3 - b$ $a = 2$ $b = -4$	1 1 1
		3 m

Soalan	Butiran	Markah
5 (a)	$T_2 = a + d = 12$ atau $T_{10} = a + 9d = 52$	1
	$d = 5$	1
	$a = 7$	1
5 (b)	$\frac{2m+2}{m+2} = \frac{5m+4}{2m+4}$	1
	$(m+2)(m-4) = 0$	1
	$m = -2, m = 4$	1
		6 m
6 (a)	$\frac{4}{2}x^2 - 10x + c$	1
	$4 = 2(8)^2 - 10(8) + c$	1
	$y = 2x^2 - 10x - 44$	1
6 (b)	$2\left(\frac{5}{1-x^2}\right) + 3x + c$	1
6(c)	$[2y]_3^k$	1
	$[2k - 2(3)] - \frac{3}{2} = 4$	1
	$k = \frac{23}{4}$	1
		7 m
7 (a)	$3^{3x} - 3^{3x} \cdot 3^{-1} = 54$	1
	$3^{3x} \left(1 - \frac{1}{3}\right) = 54$	1
	$x = \frac{4}{3}$	1
7 (b)	$\frac{1}{2}(10 - 4\sqrt{3} + 5\sqrt{3} - 6)$	1
	$q = 2$	1
		5 m

Soalan	Butiran	Markah
8(a)	$a = 6$	1
8 (b)	$s(12) = \frac{2}{3}$	1
8(c)	$6\left(\frac{4}{k-6}\right) = -12$	1
	$k = 4$	1
		4 m
9 (a)	$2(1 - \sin^2 2x) + 3 \sin 2x - 3 = 0$	1
	$\sin 2x = 1$ atau $\sin 2x = \frac{1}{2}$	1
	sudut rujukan, $\alpha = 90$ atau $\alpha = 30$	1
	$x = 15^\circ, 45^\circ, 75^\circ, 195^\circ, 225^\circ, 255^\circ$	1
9 (b)	$\cos 2x = -\frac{12}{13}$	1
	$-\frac{12}{13} = 2\cos^2 x - 1$	1
	$\cos^2 x = \frac{1}{26}$	1
		7 m
10 (a)(i)	$\frac{1}{2}(25k^2)\left(\frac{1}{3}\right)$ atau $\frac{1}{2}(9k^2)\left(\frac{1}{3}\right)$	1
	$\frac{1}{2}(25k^2)\left(\frac{1}{3}\right) - \frac{1}{2}(9k^2)\left(\frac{1}{3}\right) = 24$	1
	$k = 3$	1
10 (b)	$9\left(\frac{1}{3}\right) + 15\left(\frac{1}{3}\right) + 12$	1
	20	1
		5 m

Soalan	Butiran	Markah
11(a)	$2P_2 \times 2 \times 3P_1 \times 4P_1$ atau $2 \times 2 \times 3 \times 4$ 48	1 1
11(b)	$\frac{5 \times 5!}{3!}$ 100 $100 - \frac{4!}{3!}$ 96	1 1 1 1
		6 m
12(a)	$\overrightarrow{ON} = \overrightarrow{OM} + \overrightarrow{MN}$ $2\underline{i} + 4\underline{j}$	1 1
12(b)	$(-4\underline{i} - \underline{j}) + (2\underline{i} + 4\underline{j})$ atau $(-2\underline{i} - 4\underline{j}) + (-8\underline{i} + 19\underline{j})$ $\overrightarrow{LN} = -2\underline{i} + 3\underline{j}$ $\overrightarrow{NP} = -10\underline{i} + 15\underline{j}$ $-2\underline{i} + 3\underline{j} = \lambda(-10\underline{i} + 15\underline{j})$ $-2 = -10\lambda$ $\overrightarrow{LN} = \frac{1}{5}\overrightarrow{NP}$, L, N, P segaris	1 1 1 1 1 1
		8 m
13 (a)	$\frac{3(3)+2x}{2+3}=5$ atau $\frac{4(3)+2y}{2+3}=0$ $x=8$ atau $y=-6$ $Q(8,-6)$ $\frac{1}{2}[-4(4)+3(-6)+8(-3)]-[-3(3)+4(8)+(-6)(-4)]$ 52.5	1 1 1 1 1
13 (b)	$\sqrt{(x-(-4))^2+(y-(-3))^2}$ atau $\sqrt{(x-8)^2+(y-(-6))^2}$ $\sqrt{(x-(-4))^2+(y-(-3))^2}=2\sqrt{(x-8)^2+(y-(-6))^2}$ $x^2+y^2-24x+14y+125=0$	1 1 1
		8 m

Soalan	Butiran	Markah
14 (a)	$t = \frac{192}{x^2}$	1
	$A = \pi x(2x) + 2\pi x \left(\frac{192}{x^2} \right) + \pi x^2$	1
	$A = 3\pi x^2 + \frac{384\pi}{x}$	
14 (b)	$\frac{dA}{dx} = 6\pi x - \frac{384\pi}{x^2}$	1
	$6\pi x - \frac{384\pi}{x^2} = 0$	1
	$x = 4$	1
14 (c)	$\frac{dA}{dx} = 6\pi(8) - \frac{384\pi}{8^2}$	1
	$\frac{1}{42\pi} \times 84\pi$	1
	2 cms^{-1}	1
		8 m
15 (a)	$(\sqrt{x} - 4)(\sqrt{x} - 3) = 0$ atau $x^2 - 25x + 144 = 0$	1
	$x = 16$ $x = 9$	1
	$\log_4 x + \frac{\log_4 3x}{\log_4 16} = -1$	1
	$\log_4 x^2(3x) = -2$	1
	$x = 0.2752$	1
15 (b)	$\log(1 + 0.08)^n > \log \frac{40}{3}$	1
	$n > 33.66$	1
	$n = 34$	1
		8 m



i-MODUL KECEMERLANGAN SPM SMKA DAN SABK 2023

SIJILPELAJARAN MALAYSIA 2023 (SET 2)

MATEMATIK TAMBAHAN

Kertas 2

PERATURAN PEMARKAHAN

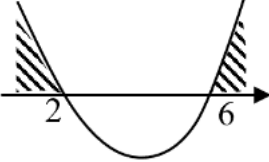
UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan **Hak Cipta Majlis Pengetua SMKA dan Majlis Pengetua SABK**. Kegunaan khusus untuk guru-guru tingkatan 5 di SMKA dan SABK sahaja. Peraturan ini tidak boleh dikeluarkan dalam apa jua bentuk media cetak.

Peraturan pemarkahan ini mengandungi 12 halaman bercetak

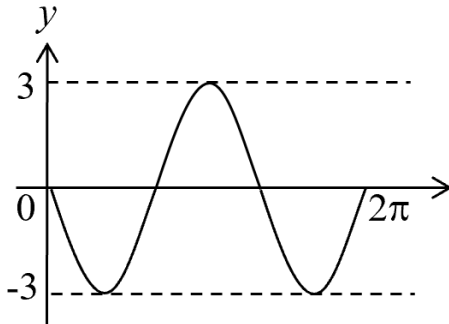
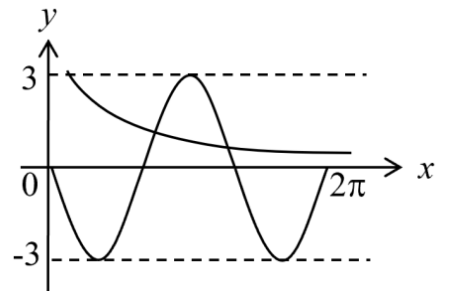
CADANGAN PERATURAN PEMARKAHAN (SKEMA)
KERTAS 2
BAHAGIAN A

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
1 (a)	$x^2 - 8x + 12 \geq 0$ $(x - 2)(x - 6) \geq 0$ $x \leq 2 \quad , \quad x \geq 6$ 	K1 N1	6
1 (b) (i)	$f(x) = -(x^2 - 2x - 8)$ $= -\left[x^2 - 2x + \left(-\frac{2}{2}\right)^2 - \left(-\frac{2}{2}\right)^2 - 8\right]$ $= -[(x - 1)^2 - 9]$ $= -(x - 1)^2 + 9$ $a = 1 \text{ dan } b = 9$	K1 K1 N1	
1 (b) (ii)	$f(x) = -(x + 1)^2 + 9$	N1	
2 (a)	$p - 2q = 0$ $p = 2q$	K1 N1	
2(b)	$({}^7C_6 \times {}^9C_6) + ({}^7C_7 \times {}^9C_5)$ $= 714$	K1K1 N1	5

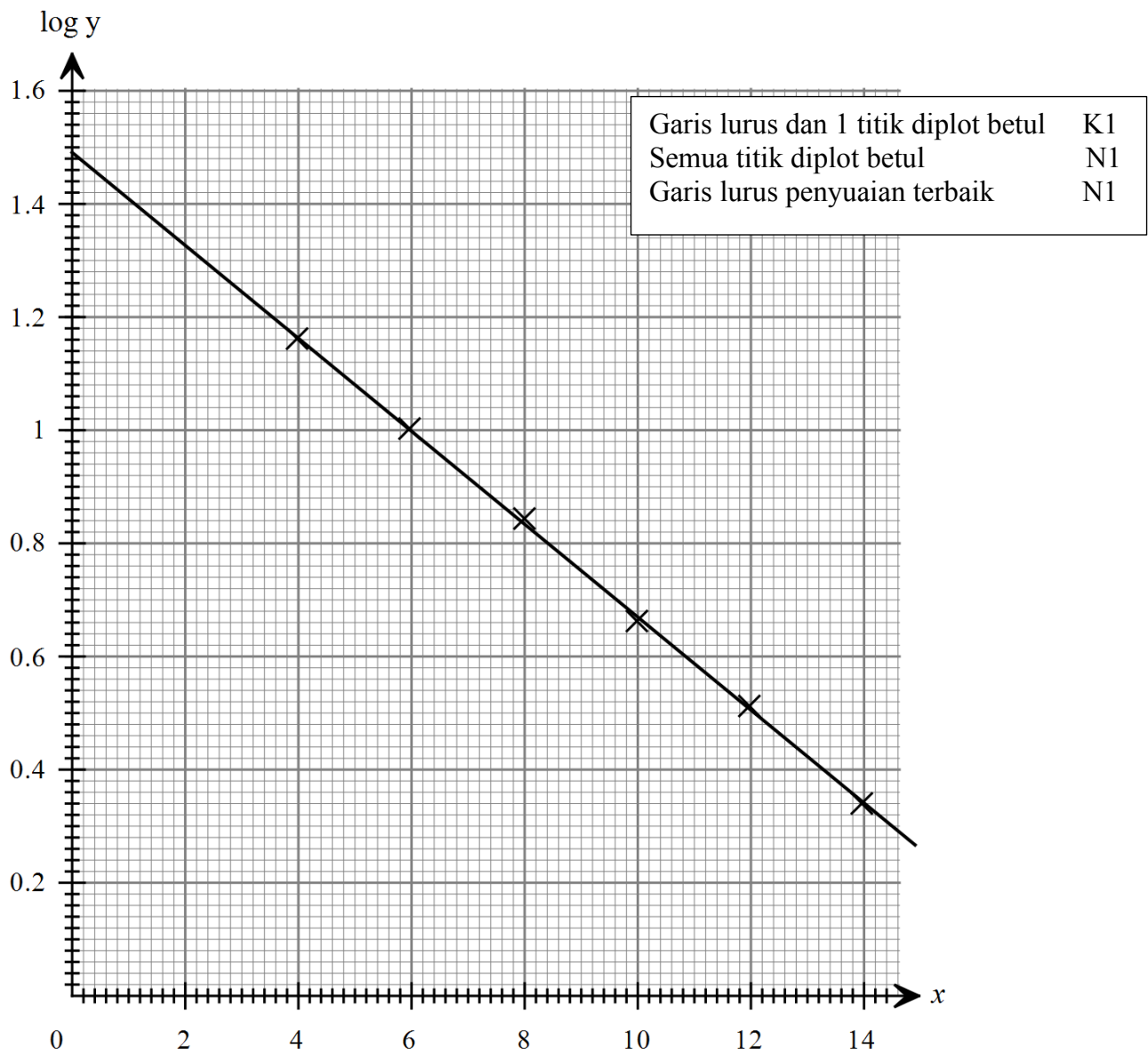
Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
3	$3x + 2y + z = 56$ $4x + 3y + z = 77$ $6x + y + 4z = 83$ Hapus satu anu dalam persamaan / jadikan satu anu sebagai perkara rumus $z = 77 - 4x + 3y$ $3x + 2y + (77 - 4x + 3y) = 56$ Selesaikan persamaan serentak/ penggantian $-x + 5y = 21$ $-10x + 13y = -25$ $x = 6$ $y = 15$ $z = 8$	N1 N1 N1 K1 K1 N1 N1 N1	8

Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
4 (a)	$\left(x+\frac{b}{2a}\right)^2-\left(\frac{b}{2a}\right)^2+\frac{c}{a}=0$	K1	8
	$\left(x+\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}-\frac{c}{a}$	K1	
	$\left(x+\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}-\frac{4ac}{4a^2}$ $x+\frac{b}{2a}=\pm\sqrt{\frac{b^2}{4a^2}-\frac{4ac}{4a^2}}$ $x=-\frac{b}{2a}\pm\sqrt{\frac{b^2}{4a^2}-\frac{4ac}{4a^2}}$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	N1	
4(b)	$y=7-4x$	P1	
	$4x^2-4x(7-4x)+(7-4x)^2-1=0$	K1	
	$36x^2-84x+48=0$		
	$x=\frac{-(-84)\pm\sqrt{(-84)^2-4(36)(48)}}{2(36)}$	K1	
	$x=\frac{4}{3}, x=1$	N1	
	$y=\frac{5}{3}, y=3$	N1	

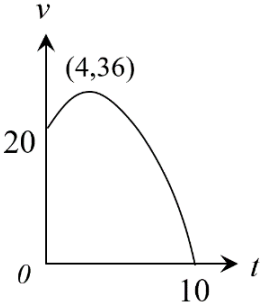
Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh
5 (a)	Skim B 2000, 2100, 2205 $r_1 = \frac{2205}{2100} \quad r_2 = \frac{2100}{2000}$ $r_1 = 1.05 \quad r_2 = 1.05$ $r_1 = r_2$	K1 N1	
5 (b)	Skim A (Salim) $2000 + (n-1)200 \geq 3000$ $200n \geq 1200$ $n = 6$ (tahun ke 6) Simpanan selama 20 tahun pertama bekerja $S_{20} - S_5$ $= \left[\frac{20}{2}(2(200) + (19)200) - \frac{5}{2}(2(2000) + 4(200)) \right] \times 0.15 \times 12$ $= \text{RM } 118800$	K1 K1 N1	9
	Skim B (Sally) $2000(1.05)^{n-1} \geq 3000$ $(n-1)\log 1.05 \geq \log 1.5$ $n \geq 9.311$ $n = 10$ (tahun ke 10) Simpanan selama 20 tahun pertama bekerja $S_{20} - S_9$ $= \left(\frac{2000(1.05^{20} - 1)}{1.05 - 1} - \frac{2000(1.05^9 - 1)}{1.05 - 1} \right) \times 0.15 \times 12$ $= \text{RM } 79341.80$	K1 K1 K1 N1	
	Salim mempunyai jumlah simpanan lebih banyak	N1	

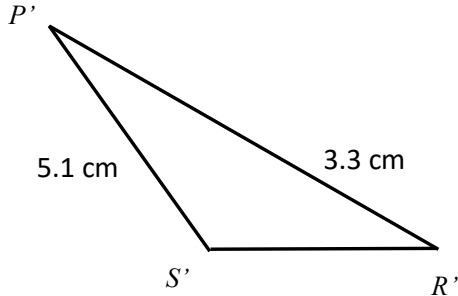
Soalan	Skema Pemarkahan	Sub Markah	Markah Penuh					
6 (a)	$\frac{3}{7}(14u)$ atau $-\frac{4}{7}(14u)$ $6u$ $-8u$	K1 N1 N1	7					
6 (b)	$\sqrt{2^2+(14y)^2}$ @ $\sqrt{2^2+p^2}=\sqrt{40}$ $\sqrt{2^2+(14y)^2}=\sqrt{40}$ @ $14y=6$ $y=\frac{3}{7}$ $\overrightarrow{PR}=\frac{2i+6j}{\sqrt{40}}$	K1 K1 K1 N1						
7 (a)	 bentuk sin negatif sin amplitud kitaran	K1 K1 K1 N1						
7 (b)	$y=\frac{\pi}{x}$ <table border="1"><tr><td>x</td><td>π</td><td>2π</td></tr><tr><td>y</td><td>1</td><td>$\frac{1}{2}$</td></tr></table>  2 bilangan penyelesaian	x		π	2π	y	1	$\frac{1}{2}$
x	π	2π						
y	1	$\frac{1}{2}$						

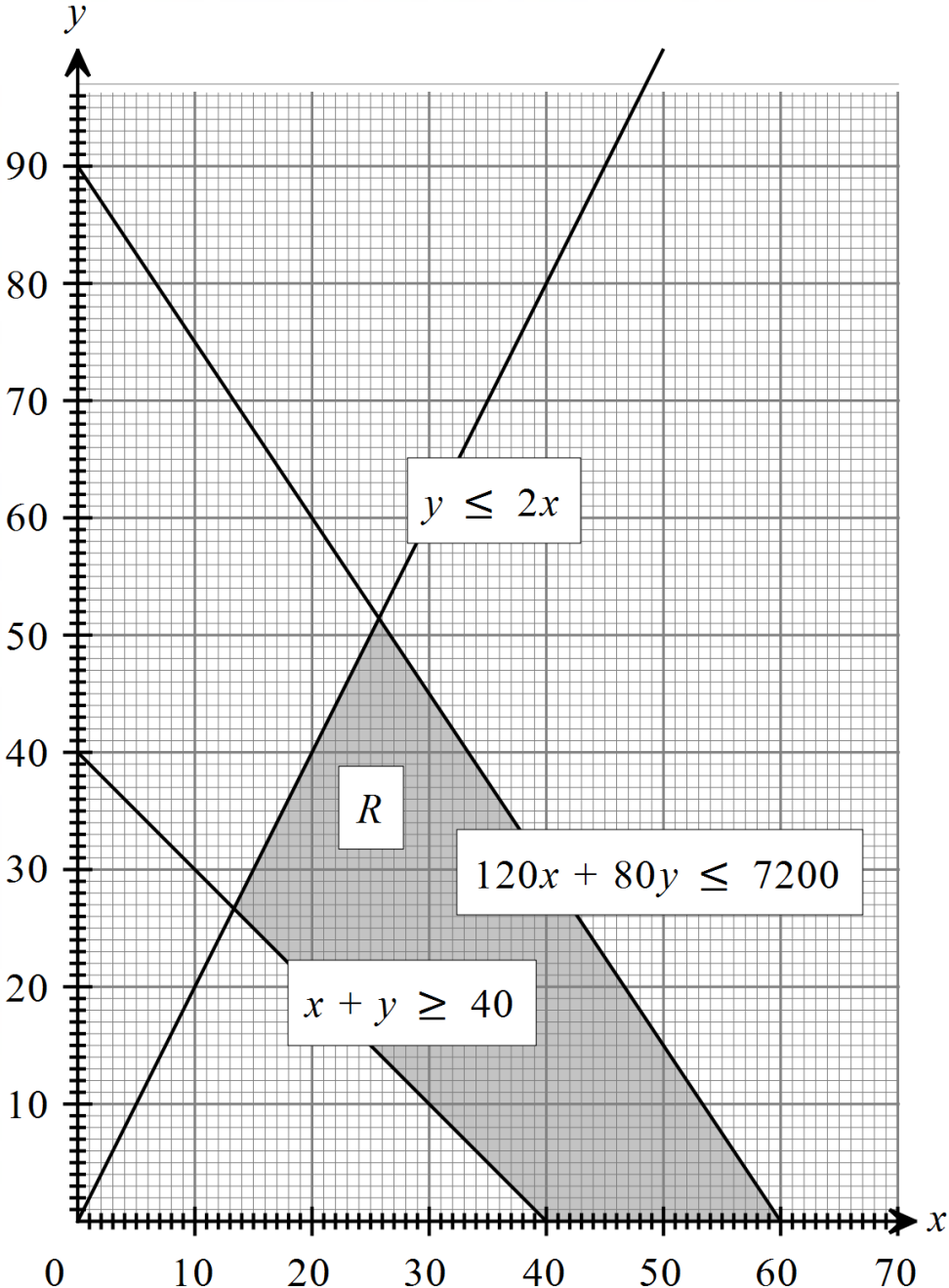
9 (a)	<table><tr><td>x</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td></tr><tr><td>$\log_{10}y$</td><td>1.16</td><td>1.0</td><td>0.84</td><td>0.66</td><td>0.51</td><td>0.34</td></tr></table>	x	4	6	8	10	12	14	$\log_{10}y$	1.16	1.0	0.84	0.66	0.51	0.34	N1
	x	4	6	8	10	12	14									
	$\log_{10}y$	1.16	1.0	0.84	0.66	0.51	0.34									
	$\log_{10} y = \log_{10} p - 2x \log_{10} q$	P1														
	$c = \log_{10} p = 1.5$	K1														
$p = 31.62$	N1															
9 (b)	$m = -2 \log_{10} q = \frac{1.5 - 1.0}{0 - 6}$	K1														
	$q = 1.101$	N1														
	$\log_{10} y = 0.78$															
	$y = 6.03$															
		N1														



11 (a)	$12 = 10\theta$ $1.2 \text{ radian} = \theta$	K1 N1
11 (b)	$2\pi - 1.2 \text{ rad} = 5.08 \text{ rad}$ $s = 4(5.08)$ $= 20.33$ $\text{Perimeter} = 20.33 + 6 + 6 + 12$ $= 44.33$	K1 K1 N1 N1
11 (c)	$= \frac{1}{2}(10)^2(1.2) + \frac{1}{2}(4)^2(5.08)$ $= 60 + 40.67$ $= 100.67$	K1K1 K1 N1
10 (a)(i)	$p = \frac{3}{5}, q = \frac{2}{5}$ $P(X = 4) = {}^9C_4 \left(\frac{3}{5}\right)^4 \left(\frac{2}{5}\right)^5$ $= 0.1672$	K1 K1 N1
10 (a)(ii)	$P(X \geq 7) = {}^9C_7 \left(\frac{3}{5}\right)^7 \left(\frac{2}{5}\right)^2 + {}^9C_8 \left(\frac{3}{5}\right)^8 \left(\frac{2}{5}\right)^1 + {}^9C_9 \left(\frac{3}{5}\right)^9 \left(\frac{2}{5}\right)^0$ $= 0.2318$	K1 N1
10 (b)(i)	$P(56 \leq X \leq 72)$ $= P\left(\frac{56-65}{7.5} \leq Z \leq \frac{72-65}{7.5}\right)$ $= P(-1.2 \leq Z \leq 0.933)$ $= 0.7096$ $n(s) = \frac{250}{0.7097} = 352$	K1 K1 N1
10 (b)(ii)	$\frac{X-65}{7.5} = 1.645$ $X = 77.34 \text{ kg}$	K1 N1

12 (a) (i)	$8 - 2t = 0$	K1
	$t = 4$	
	$v = \int 8 - 2t \, dt$	
	$= 8t - t^2 + c$	
	$v = 8t - t^2 + 20$	K1
12 (a)(ii)	$v_{\max} = 8(4) - (4)^2 + 20 = 36$	N1
	$8t - t^2 + 20 = 0$	K1
	$t^2 - 8t - 20 = 0$	
	$(t - 10)(t + 2) = 0$	
	$t = 10 \quad t = -2$	
12 (b)	Zarah berhenti selepas $k=10$ saat.	N1
		K1
		K1
	$\int_0^{10} -t^2 + 8t + 20 \, dt$	
	$= \left[-\frac{t^3}{3} + \frac{8t^2}{2} + 20t \right]_0^{10}$	K1
	$= -\frac{(10)^3}{3} + \frac{8(10)^2}{2} + 20(10)$	
	$= 266\frac{2}{3}$	N1

13(a)(i)	$7.7^2 = 5.6^2 + 3.3^2 - 2(5.6)(3.3)\cos \angle STR$ $\angle STR = \angle PTQ = 117.45$	K1 N1
13 (a)(ii)	$\frac{\sin \angle SPT}{5.6} = \frac{\sin 62.55}{5.1}$ $\angle SPT = 77.01$ $\frac{PT}{\sin 40.44} = \frac{5.1}{\sin 62.55}$ $PT = 3.728$	K1 NI
13 (a)(iii)	$\frac{PQ}{\sin 40.44} = \frac{5.1}{\sin 31.275} \text{ or } \frac{PQ}{\sin 40.44} = \frac{5.1}{\sin 31.28}$ $PQ = 6.372 / 6.371$	K1 N1
13 (b)(i)		N1
13 (b)(ii)	$\frac{\sin \angle PSR}{7.028} = \frac{\sin 77.01}{7.7}$ $\angle P'S'R' = 180 - 62.79 = 117.21$	K1 N1
14 (a)	$\frac{6}{x} \times 100 = 125$ $x = 4.80$	K1 N1
14 (b)	$\frac{z}{y} \times 100 = 110$ $z = y + 0.40$ $\frac{y + 0.40}{y} \times 100 = 110$ $y = 4, z = 4.40$	K1 N1
14 (c)(i)	$\frac{125(3) + 160(1) + 125(2) + 110(m)}{3 + 1 + 2 + m} = 122.5$ $m = 4$	K1K1 N1

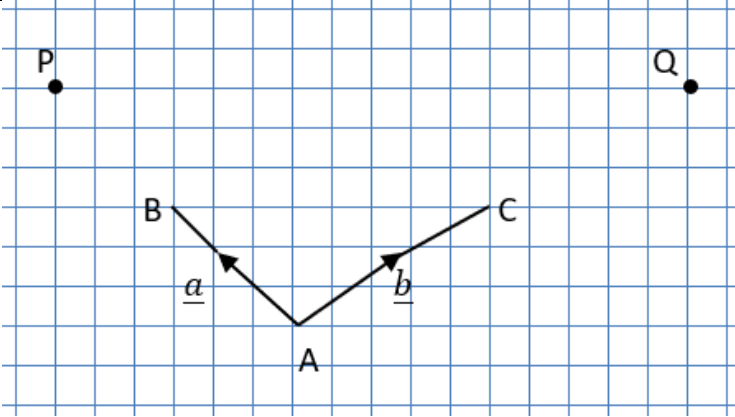
15 (a)	$x + y \geq 40$ $y \leq 2x$ $120x + 80y \leq 7200$	N1 N1 N1
15 (b)	Paksi dan satu graf garis lurus betul Semua graf garis lurus betul Kawasan berlorek betul	K1 N1 N1
		
15 (c)(i)	bilangan minimum 30 bilangan maksimum 53	P1 P1
15 (c)(ii)	$120(14) + 80(26)$ $= 3760$	K1 N1
		10 m

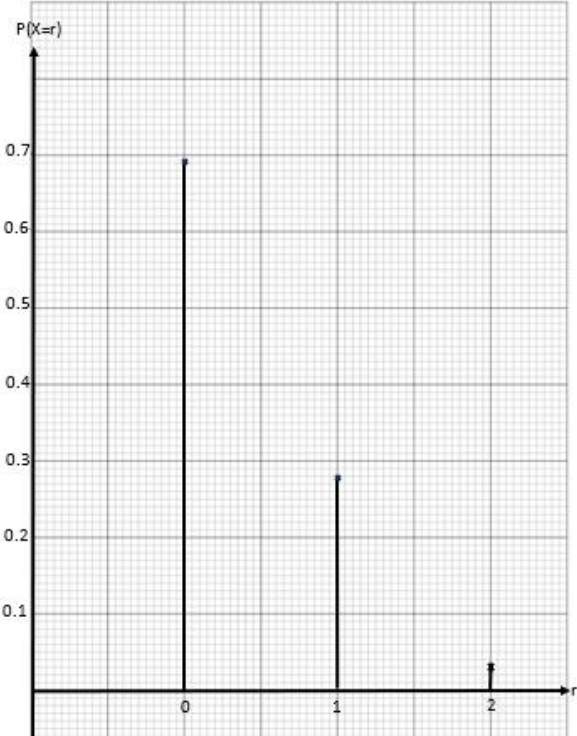
PP PUTRAJAYA K1

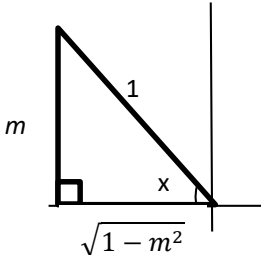
SKEMA PEMARKAHAN
KERTAS PEPERIKSAAN PERCUBAAN SPM 2023
PUTRAJAYA

BIL		JALAN PENYELESAIAN	SUB	MARK
1		$x + y + z = 3 \dots\dots\dots(1)$ $2x + 2y + 2z = 6 \dots\dots\dots(2)$ $-x - y - z = -3 \dots\dots\dots(3)$ $x = 3 - y - z \dots\dots\dots(4)$ Gantikan (4) dalam (2) $2(3 - y - z) + 2y + 2z = 6$ $6 - 2y - 2z + 2y + 2z = 6$ $0 = 0$ Sistem persamaan ini mempunyai penyelesaian tak terhingga kerana $0=0$	K1 K1 N1 N1	4
			4	
2	(a)	$\log_2 8 + \log_3 3$ $\log_2 2^3 + \log_3 3$ $3 + 1 @ 3\log_2 2 + 1$ 4	K1 N1	6
	(b)	$2e^{2x+1} = 9e^{1-x}$ $\frac{e^{2x+1}}{e^{1-x}} = \frac{9}{2}$ $e^{2x+1-(1-x)} = \frac{9}{2}$ $e^x = \frac{9}{2}$ $x \ln e = \ln \frac{9}{2} \text{ (use ln)}$ $x = 1.504$	K1 K1 K1 N1	
			6	

3	(a)	(i) $m + 2q$ (ii) $m=a, d=q$ $T_n = m + (n - 1)q$	N1 N1	6
	(b)	(b) $T_{10} = 2 + 4p$ $a + 9d = 2 + 4p$ $a + 54 = 2 + 4p \dots\dots\dots(1)$ $S_6 = 5p - 8$ $\frac{6}{2}[2a + 5d] = 5p - 8$ $6a + 90 = 5p - 8 \dots\dots\dots(2)$ Selesaikan secara persamaan serentak -penggantian atau penghapusan $p = \frac{214}{19} @ p = 11.263$	K1 K1 K1 N1	
			6	
4	(a)	$xy = a$ $(1)(5) = a$ $a = 5$	K1 N1	5
	(b)	$y = \frac{5}{x}$ $y\sqrt{x} = \frac{5}{x}\sqrt{x}$ $y\sqrt{x} = 5\left(\frac{1}{\sqrt{x}}\right)$ (bentuk $Y = mX+c$) Kecerunan, $m = 5$	K1 K1 N1	
			5	
5	(a)	$3\overrightarrow{BC} = 3(\overrightarrow{BA} + \overrightarrow{AC})$ $= 3(-a + b)$	K1 N1	7

	(b)	 $\overrightarrow{AP} = 2\overrightarrow{AB}$ (Point P seen) (ii) $\overrightarrow{BQ} + \overrightarrow{AB} = 2\overrightarrow{AC}$ Vector $2\overrightarrow{AC}$ seen Point Q seen	NI K1 N1	
	(c)	$ \overrightarrow{BQ} = \sqrt{13^2 + 3^2}$ $\widehat{BQ} = \frac{13i+3i}{\sqrt{178}}$	K1 N1	
			7	
6		$0.5 \times \frac{180}{\pi} = 28.65^0 \quad \text{atau} \quad 61.35^0 \times \frac{\pi}{180}$ $\tan 28.65^0 = \frac{7}{QR} \quad @ \quad \tan 0.5 \text{ rad} = \frac{7}{QR} \text{ (mode rad)}$ $QR = 12.812$ $\text{Luas Segitiga OQR} = \frac{1}{2} \times 7 \times 12.812 = 44.842$ $\text{Luas sektor OQP} = \frac{1}{2} \times 7^2 \times 1.071 = 26.234$ $\text{Luas kawasan berlorek} = 44.842 - 26.234$ $= 18.608 \text{ cm}^2$	P1 K1 K1 K1 K1 N1	6
			6	
7	(a)	$(a) \ y = \int -4x + 3$ $= -\frac{4x^{1+1}}{1+1} + 3x + c$ $-3 = 2(3)^2 + 3(3) + c$ $c = -30$ $y = 2x^2 + 3x - 30$	K1 N1 N1	6
	(b)	$(a) \ \int_a^b f(x)dx = 6$	P1	

		$\int_a^b \frac{1}{2} f(x) dx = \frac{1}{2} \int_a^b f(x) dx$ $= \frac{1}{2} (6)$ $= 3$	K1 N1	
			6	
8	(a)	$\underline{3} \ \underline{5} \ \underline{4} \ \underline{3} \ \underline{2} \ \underline{1} \ \underline{4} \ @ \ {}^3P_1 \times {}^4P_1 \times 5!$ $\underline{3} \ \underline{5} \ \underline{4} \ \underline{3} \ \underline{2} \ \underline{1} \ \underline{4} \times 2 \ @ \ {}^3P_1 \times {}^4P_1 \times 5! \times 2$ 2880	P1 K1 N1	5
	(b)	$\frac{{}^7P_5}{5}$ 504	K1 N1	
			5	
9		$X = \{0,1,2\}, \quad p = \frac{1}{6}, q = \frac{5}{6}$ $P(X=0) = {}^2C_0 \left(\frac{1}{6}\right)^0 \left(\frac{5}{6}\right)^{2-0}$ OR $P(X=1) = {}^2C_1 \left(\frac{1}{6}\right)^1 \left(\frac{5}{6}\right)^{2-1}$ OR $P(X=2) = {}^2C_2 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^{2-2}$ Refer to the graph Appropriate scale and one graph correct ALL graph correct	K1 K1 N1	3
				

			3	
10	(a)	$\text{kosek } x = \frac{1}{m}$ $\frac{1}{\sin x} = \frac{1}{m}$ $\sin x = m$  $\text{sek } x = -\frac{1}{\cos x}$ $= -\frac{1}{\frac{1}{\sqrt{1-m^2}}}$ $= -\frac{1}{\sqrt{1-m^2}}$	P1 K1 N1	
	(b)	$\cos^2 x = 2\cos^2 \frac{x}{2} - 1$ $\cos^2 \frac{x}{2} = \frac{1 + \cos x}{2}$ $= \frac{1}{2} + \left(-\frac{\sqrt{1-m^2}}{\frac{1}{2}}\right)$ $= \frac{1}{2} - 2\sqrt{1-m^2}$ $= \frac{1 - 4\sqrt{1-m^2}}{2}$	K1 K1 N1	6
			6	
11	(a)	$= 50\,000(1 + 0.1)^5$ $= 80\,525.50$	K1 N1	
	(b)	$\frac{1}{2}(t)(6 + 4\sqrt{3}) = 25\sqrt{3} - 12$ $(t) = \frac{25\sqrt{3} - 12}{3 + 2\sqrt{3}} \times \frac{3 - 2\sqrt{3}}{3 - 2\sqrt{3}}$ $(t) = \frac{75\sqrt{3} - 150 - 36 + 24\sqrt{3}}{-3}$ $(t) = \frac{99\sqrt{3} - 186}{-3}$	K1 K1 N1	5

		$(t) = 62 - 33\sqrt{3}$		
			5	
12	(a)	$f(x) = x^2 + 6x + 4$ $= x^2 + 6x + \left(\frac{6}{2(1)}\right)^2 - \left(\frac{6}{2(1)}\right)^2 + 4$ $= (x + 3)^2 - 9 + 4$ $= (x + 3)^2 - 5$ $k = -5$	K1 N1 N1	5
	(b)	bentuk sama / kekal / tidak berubah @ setara kedudukan graf akan bergerak ke atas sebanyak 4 unit	N1 N1	
			5	
13	(a)	Katakan $y = \frac{ax+b}{cx+d}$ $y(cx + d) = ax + b$ $x = \frac{b-yd}{yc-a}$ $f^{-1}(x) = \frac{b-xd}{xc-a}$ $f^{-1}(x) = \frac{5 - x(-3)}{x(1) - 1}$ $f^{-1}(x) = \frac{5 + 3x}{x - 1}$	N1 K1 N1	8
	(b)	$hv(x) = h[v(x)]$ $= h(3x - 2)$ $= \frac{3x-2+2}{3}$ $= x$ $vh(x) = v[h(x)]$ $= v\left(\frac{x+2}{3}\right)$ $= 3\left(\frac{x+2}{3}\right) - 2$	K1 N1 K1	

		$= x$ Since $hv(x) = vh(x) = x$, thus $h(x) = \frac{x+2}{3}$ is an inverse function of $v(x) = 3x - 2$.	N1	
			N1	
			8	
14	(a)	i) $SV = \sqrt{10^2 - 8^2} = 6$ T (14, 8) ii) $\frac{-2(2)+14(3)}{5+3} = \frac{0(2)+8(3)}{5+3}$ $= \left(\frac{38}{5}, \frac{24}{5}\right)$ ii) $m = \frac{1}{2}$ $y = \frac{1}{2}x + 7$	K1 N1	8
			K1	
			N1	
	(b)	$(x - (-4))^2 + (y - 5)^2 = 5^2$ $x^2 + y^2 + 8x - 10y + 16 = 0$	N1	
			8	
15	(a)	isipadu silinder terbuka, $V = 216 \pi \text{cm}^3$ $\pi r^2 h = 216 \pi$ $h = \frac{216}{r^2}$ luas permukaan silinder, $L = \pi r^2 + 2\pi r h$ $L = \pi r^2 + 2\pi r \left(\frac{216}{r^2}\right)$ $L = \pi r^2 + \frac{432\pi}{r}$ $\frac{dL}{dr} = 2\pi r - \frac{432\pi}{r^2}$ pada titik pegun, $\frac{dL}{dr} = 0$ $2\pi r = \frac{432\pi}{r^2}$ $r^3 = 216$ $r = 6$	K1	8
			K1	
			K1	
	(b)	$\frac{dy}{dx} = 12x^2 - 2$	N1	
			K1	

		$\partial x = r$ $\partial y = \frac{dy}{dx} \times \partial x$ $\delta y = (12x^2 - 2) \times r$ <i>apabila</i> $x = 6, \partial y = (12(6)^2 - 2)r$ $\partial y = 430r$	K1 N1	
			8	
		JUMLAH (BAHAGIAN A + 2 SOALAN BAHAGIAN B)	80	

TAMAT PERATURAN PEMARKAHAN

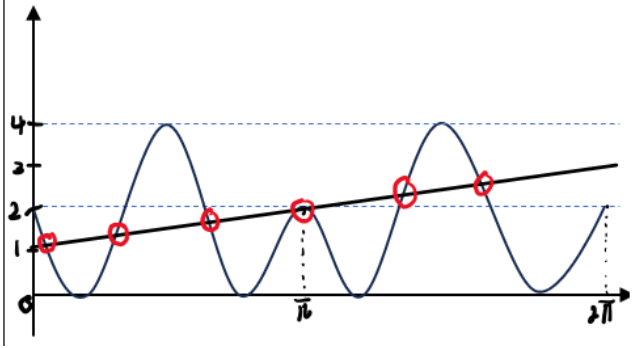
PP PUTRAJAYA K2

SKEMA PEMARKAHAN PEPERIKSAAN PERCUBAAN SPM

MATEMATIK TAMBAHAN KERTAS 2

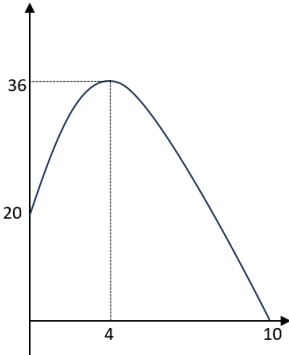
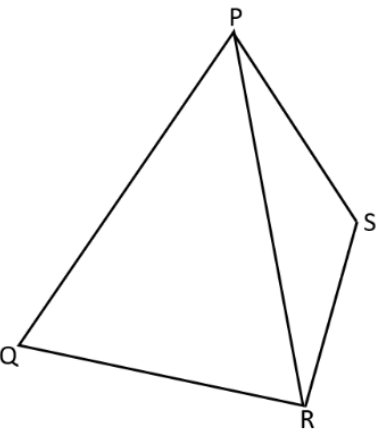
NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
1a	$HTP = -2 + 5$ atau $HDP = -2 \times 5$ $= 3$ $= -10$ $-\frac{h}{3} = 3$ atau $\frac{k}{3} = -10$ $h = -9$ $k = -30$	K1 K1 N1 N1	7	Terima kaedah setara
1b	$h + 8x - x^2 = 3$ $8^2 - 4(-1)(h - 3) = 0$ $h = -13$	K1 K1 N1		
2a	$\cos \theta = \frac{3}{5}$ $\theta = 0.927 \text{ rad}$	K1 N1	6	
2b	$PR = 5 \times 0.927$ $PQ = 4$ <i>Perimeter kawasan berlorek</i> $= 4.635 + 4 + 2$ $= 10.635$ atau $\frac{2127}{200}$	K1 P1 K1 N1		
3	$(1 - m)^2 + 2m^2 + (1 - m)m = 8$ $2m^2 - m - 7 = 0$ $m = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-7)}}{2(2)}$ $m = 2.137$, $m = -1.637$ $p = -1.137$, $p = 2.637$	K1 K1 K1 N1 N1	5	
4a	$\frac{T_2}{T_1} = \frac{102}{120}$ atau $\frac{T_3}{T_2} = \frac{86.7}{102}$ $\frac{T_2}{T_1} = \frac{T_3}{T_2}$ maka <i>janjang geometri</i> $r = 0.85$	K1 N1 N1	8	Terima kaedah setara

NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
4b	$120(0.85)^{n-1} = 32.70$ $(n-1) \log_{10} 0.85 = \log_{10} 0.2725$ $n = 9$	K1 K1 N1		
4c	$S_{\infty} = \frac{120}{1-0.85}$ $= 800$	K1 N1		
5a	$\frac{x-4}{2-\sqrt{8-x}} \times \frac{2+\sqrt{8-x}}{2+\sqrt{8-x}}$ $2+\sqrt{8-x}$ $\lim_{x \rightarrow 4} 2+\sqrt{8-x} = 2+\sqrt{8-4}$ $= 4$	K1 N1 K1 N1	8	
5b	$t = \frac{2}{3}j$ $\frac{dv}{dj} = \frac{3}{2}\pi j^2$ $\frac{dj}{dt} = \frac{50}{75.408}$ $= 0.663$	P1 K1 K1 N1		
6a	$\frac{k-2}{4-0} = 2$ $k = 10$	K1 N1		
6b	$A = (-16,10)$ <i>Luas segitiga ABC</i> $= \frac{1}{2} 0(10) - 16(10) + 4(2) + 16(2) - 4(10) - 0(10) $ $= 80$	P1 K1 N1	8	
6c	<i>titik tengah BC</i> $= (\frac{4+0}{2}, \frac{10+2}{2})$ $= (2,6)$ <i>Persamaan garis lurus</i> $y-6 = \frac{1}{2}(x-2)$ $y = -\frac{1}{2}x + 7$	K1 K1 N1		

NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
7a	$\tan^2 x + 2\cos^2 x - (1 + \tan^2 x)$ $= 2\cos^2 x - 1$ $= \cos 2x$	K1 N1	8	dilihat
7b	 Bentuk kos Tempoh Amplitude : 2 Amplitude : 4 (modulus) $y = \frac{x}{\pi} + 1$ Bilangan penyelesaian = 6	N1 N1 N1 N1 K1 N1		
8a	$\frac{dy}{dx} = 2x$ $y - 12 = 4(x - 2)$ $y = 4x + 4$	K1 K1 N1	10	
8b	Luas trapezium $= \frac{1}{2}(4 + 12)(2)$ luas bawah lengkung $= \left[\frac{x^3}{3} + 8x \right]_0^2$ $= \left[\frac{2^3}{3} + 8(2) \right] - 0$ Luas Kawasan berlorek $= \frac{56}{3} - 16$ $= \frac{8}{3}$	K1 K1 K1 N1		Kamir betul dan masuk nilai

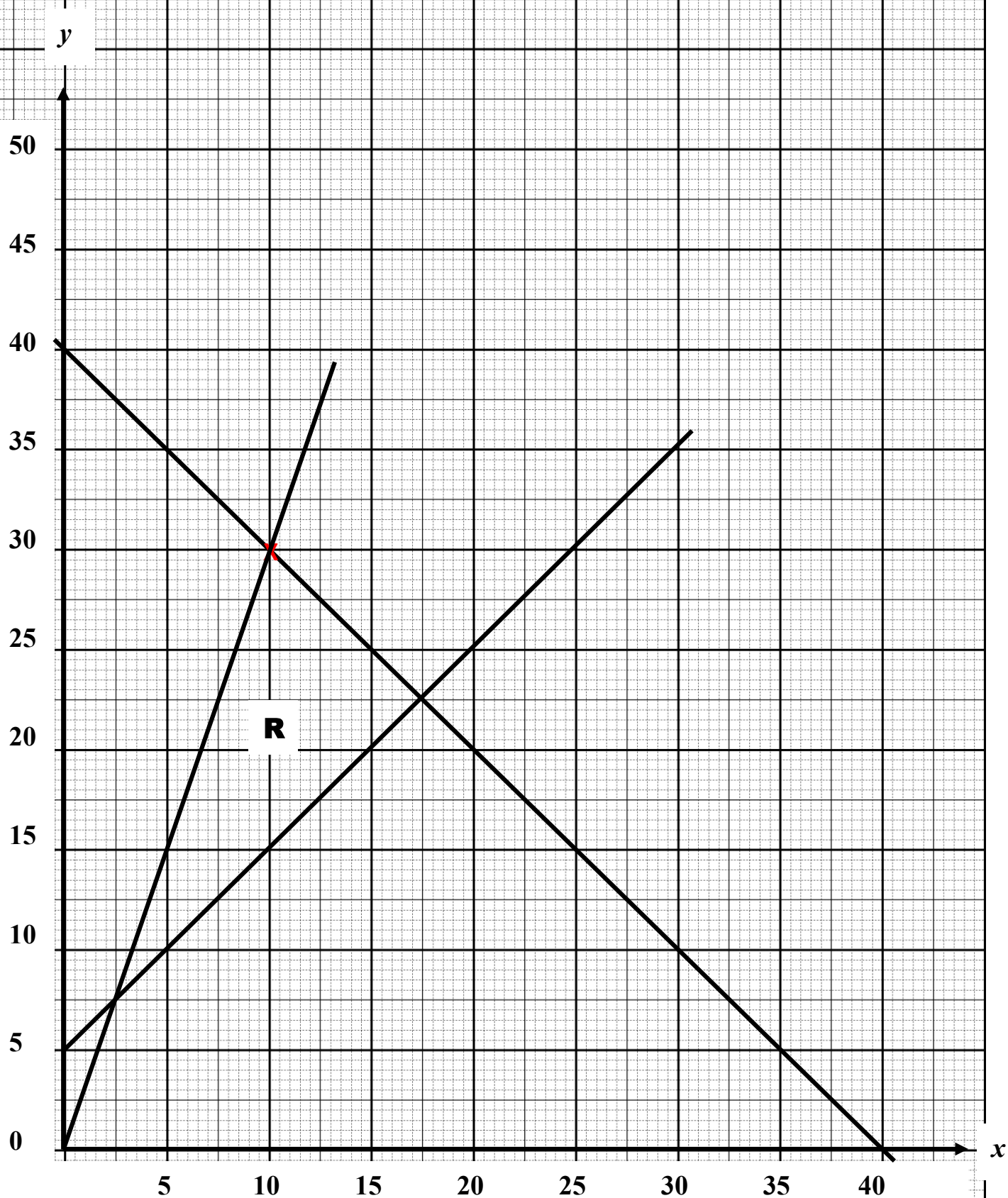
NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
8c	<i>Isipadu</i> $\pi \int_8^{13} y - 8 \, dy$ $\pi \left(\left[\frac{13^2}{2} - 8(13) \right] - \left[\frac{8^2}{2} - 8(8) \right] \right)$ $= \frac{25}{2} \pi \text{ atau } 12.5\pi$	P1 K1 N1		Julat betul Kamir betul dan isi nilai
9a	$\overrightarrow{BD} = \overrightarrow{BA} + \overrightarrow{AD} \text{ atau } \overrightarrow{EC} = \overrightarrow{ED} + \overrightarrow{DC}$ $\overrightarrow{BD} = -20\underset{\sim}{x} + 32\underset{\sim}{y}$ $\overrightarrow{EC} = 25\underset{\sim}{x}$	K1 N1 N1		
9b	$\overrightarrow{FD} = -15\underset{\sim}{x} + 24\underset{\sim}{y}$ $-15\underset{\sim}{x} + 24\underset{\sim}{y} = \lambda(-20\underset{\sim}{x} + 32\underset{\sim}{y})$ $-15 = -20\lambda \quad \text{atau} \quad 24 = 32\lambda$ $\overrightarrow{FD} = \frac{3}{4}\overrightarrow{BD}$	K1 K1 K1 N1		Terima kaedah setara Semak nilai λ mesti sama
	ATAU KAEDAH		10	
	$\overrightarrow{FD} = -15\underset{\sim}{x} + 24\underset{\sim}{y}$ $\overrightarrow{FD} = 3(-5\underset{\sim}{x} + 8\underset{\sim}{y}) \text{ atau } \overrightarrow{BD} = 4(-5\underset{\sim}{x} + 8\underset{\sim}{y})$ $\overrightarrow{BD} = 4\left(\frac{\overrightarrow{FD}}{3}\right)$ $\overrightarrow{BD} = \frac{4}{3}\overrightarrow{FD}$	K1 K1 K1 N1		
9c	$\overrightarrow{BF} = (-5\underset{\sim}{x} + 8\underset{\sim}{y})$ $ \overrightarrow{BF} = \sqrt{(-5(2))^2 + (8(3))^2}$ $ \overrightarrow{BF} = 26$	K1 K1 N1		
10ai	${}^{10}C_7(0.7)^7(0.3)^{10-7}$ $= 0.2668$	K1 N1		
10aai	${}^{10}C_0(0.3)^0(0.7)^{10} + {}^{10}C_1(0.3)^1(0.7)^{10-1} +$ ${}^{10}C_2(0.3)^2(0.7)^{10-2}$ $= 0.3824$ ATAU KAEDAH 2	K1 N1	10	

NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
12a	$\frac{28,000}{Q_{2016}} \times 100 = 125$ $Q_{2016} = RM22,400$	K1 N1		
12b	$\frac{125(2) + 110(5) + x(4) + 120(1)}{2 + 5 + 4 + 1} = 123$ $x = 139$	K1 N1		
12ci	$\bar{I}_{2021} = \frac{115(2)+100(5)+100(4)+97(1)}{2+5+4+1}$ $= 102.25$ $\frac{350,000}{Q_{2019}} \times 100 = 102.25$ $Q_{2019} = RM\ 342\ 298.29$	K1 K1 N1	10	
12cii	$\frac{I_{2023}}{2019} = \frac{115 \times 115}{100}$ $= 132.25$ $\frac{Q_{2023}}{28,000} \times 100 = 132.25$ $Q_{2023} = RM\ 37,030$ $\frac{15}{100} \times 350,000 = RM\ 52,500$ <i>Duit pelaburan RM52,500 cukup untuk menampung kos sebanyak RM37,030 pada tahun 2023</i>	K1 K1 N1		
13ai	$-2t + 8 = 0$ $t = 4$ $v = -\frac{2t^2}{2} + 8t + 20$ atau $v = -t^2 + 8t + 20$ $V_{max} = -4 + 8(4) + 20$ $= 36$	K1 K1 K1 N1	10	
13aaii	$-t^2 + 8t + 20 = 0$ $(t + 2)(t - 10) = 0$ $t = 10$	K1 N1		

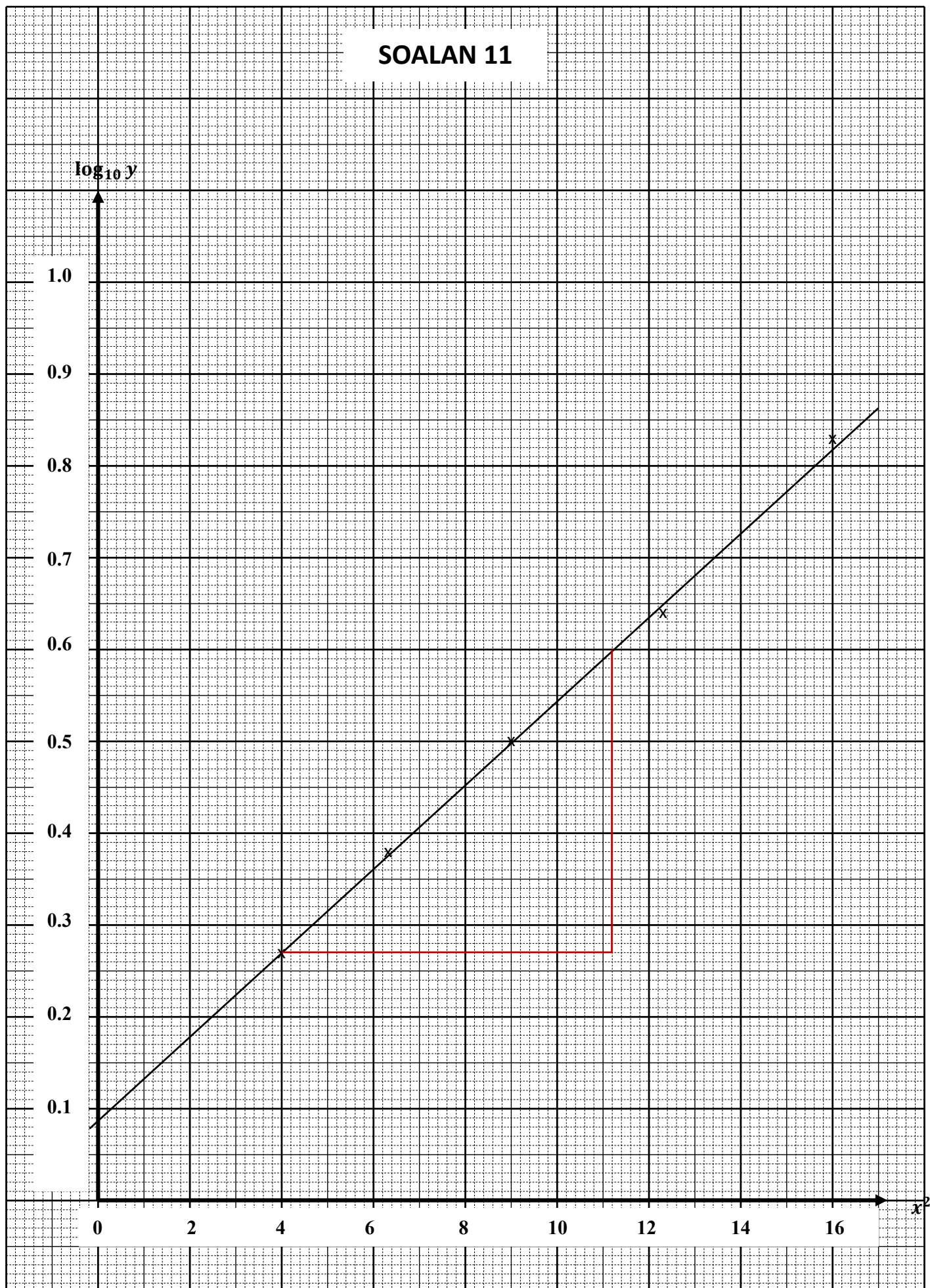
NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
13b	 BENTUK TITIK (4,36) DAN (10,0)	N1 N1		
	<i>Jarak yang dilalui</i> $s = \left[-\frac{t^3}{3} + 4t^2 + 20t \right]_0^{10}$ $s = \left[-\frac{10^3}{3} + 4(10)^2 + 20(10) \right] - 0$ $s = \frac{800}{3} \quad \text{atau} \quad 266.67m$	K1 N1		Kamir betul dan masukkan nilai
14ai	$PR^2 = 25^2 + 21^2 - 2(25)(21) \cos 65^\circ$ $PR = 24.945 \text{ cm}$	K1 N1	10	Terima jawapan akhir $\geq 2tp$ dengan pembundaran yang betul
14aai	$s = \frac{25 + 21 + 24.945}{2}$ $s = 35.473$ <i>luas segitiga PQR</i> $\sqrt{35.473(35.473 - 25)(35.473 - 21)(35.473 - 24.945)}$ $= 237.923 \text{ cm}^2$	K1 N1		
14bi	 PASTIKAN SUDUT S • ADALAH SUDUT CAKAH	N1		

NO	SKEMA PEMARKAHAN	MARKAH	JUMLAH MARKAH	CATATAN
14bii	$\frac{\sin PSR}{24.945} = \frac{\sin 40}{18}$ $\angle PSR = 62.97$ $\text{sudut cakah } PSR = 180 - 62.97$ $= 117.03^\circ$	K1 N1		
biii	$\angle RPS = 180 - 40 - 117.03$ $\angle RPS = 22.97^\circ$ $\text{luas segitiga } PRS$ $= \frac{1}{2}(18)(24.945)\sin 22.97$ $= 87.613 \text{ cm}^2$	P1 K1 N1		
15a	$y \leq 3x$ $y \geq x + 5 \quad \text{atau setara}$	N1 N1	10	
15b	Jumlah kedua-dua tin cat berwarna biru dan merah selebih-lebihnya ialah 40. (maksimum, tidak melebihi)	N1		Tidak terima jawapan ketaksamaan
15c	Lukis dengan betul sekurang-kurangnya satu garis dari ketaksamaan di (a) Lukis dengan betul semua garis lurus dari ketaksamaan di (a) Rantau dilorek dengan betul	K1 K1 N1		
15di	15	N1		
dii	$\text{Titik maksimum} = (10,30)$ $\text{Perbelanjaan maksimum}$ $= 100(10) + 150(30)$ $= RM5500$	N1 K1 N1		

SOALAN 15



SOALAN 11



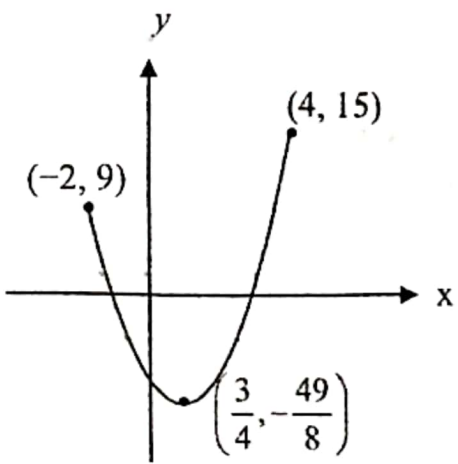
NO	PERATURAN PEMARKAHAN PP NEGERI SEMBILAN K1		MARKAH
1	$m + n = 2$ dan $mn = -3$ ATAU $(x - 3)(x + 1) = 0$		P1
	$-m + (-n) = -2$ dan $-m \times -n = -3$ ATAU $(x + 3)(x - 1) = 0$		K1
	$x^2 + 2x - 3 = 0$		N1
			3 markah
2	(a)	-9	N1
	(b)	$\frac{\sqrt{m+9}}{3} = \pm \frac{1}{2}$	K1
		$-\frac{27}{4} // -6.75$	N1
			3 markah
3	(a)	$\frac{4 - (-2)}{2 - 6}$	K1
		$xy = -\frac{3}{2}x^2 + 7$	K1
		$y = -\frac{3}{2}x + \frac{7}{x}$	N1
	(b)	$X = \frac{1}{x}, Y = \frac{y}{x^2}$	N1N1
			5 markah
4	$pq^{2(5)-1}$ atau $pq^{2(3)-1}$ atau $T_1 = pq^{2(1)-1}$ atau $T_2 = pq^{2(2)-1}$		P1
	$r = \frac{pq^3}{pq}$ atau $pq^9 = 16pq^5$		K1
	$q = 2$		K1
	$r = 4$		N1
			4 markah
5	(a)	$S_{n-1} = 2n^2 - n - 1$	N1
		$T_n = 2n^2 + 3n - (2n^2 - n - 1)$	K1
		$T_n = 4n + 1$	N1
	(b)	5, 9, 13	K1
		$d_1 = 9 - 5 = 4$ dan $d_2 = 13 - 9 = 4$	K1
		$d = 4$ panjang aritmetik	N1
			6 markah

NO	PERATURAN PEMARKAHAN		MARKAH
6	(a)	$2n \text{ atau } \left[\frac{x^2}{2} \right]_1^m$	K1
		$2n - \left[\frac{m^2}{2} - \frac{1}{2} \right] = \frac{37}{2}$	K1
		$m = 2\sqrt{n-9}$	N1
	(b)(i)	$4(16) \text{ atau } 2(2)$	K1
		$4(16) - 2(2) = 60$	N1
	(ii)	$\frac{4x^2}{2} + 5x + c$	K1
		$2 = 2(-2)^2 + 5(-2) + c \text{ dan selesaikan } c$	K1
		$f(x) = 2x^2 + 5x + 4$	N1
			8 markah
7	(a)	$r = 5 \text{ atau } h = \frac{V}{\pi r^2} \text{ atau } h = \frac{175\pi}{\pi r^2}$	P1
		$\frac{dh}{dr} = -2(175) r^{-3}$	K1
		$p = \frac{-2(175)}{5^3} \times \delta r$	K1
		$\delta r = -\frac{5p}{14} \text{ // } \delta r = -0.3571p$	N1
	(b)	$\frac{\left(-\frac{5p}{14} \right)}{5} \times 100$	K1
		Jejari berkurang $\frac{50}{7} p\% \text{ // } 7.143 p\%$	N1
			6 markah
8	(a)	$\frac{10 + 2\sqrt{20} + 2}{\sqrt{5} - 1}$	P1
		$\frac{12 + 4\sqrt{5}}{\sqrt{5} - 1} \times \frac{\sqrt{5} + 1}{\sqrt{5} + 1}$	K1
		$\frac{32 + 16\sqrt{5}}{5 + \sqrt{5} - \sqrt{5} - 1}$	K1
		$4(2 + \sqrt{5})$	N1
	(b)	$m^n = (a^r)^n \text{ atau } \log_a m = x$	K1
		$\log_a m^n = nx \text{ dan } \log_a m^n = n \log_a m$	N1
			6 markah

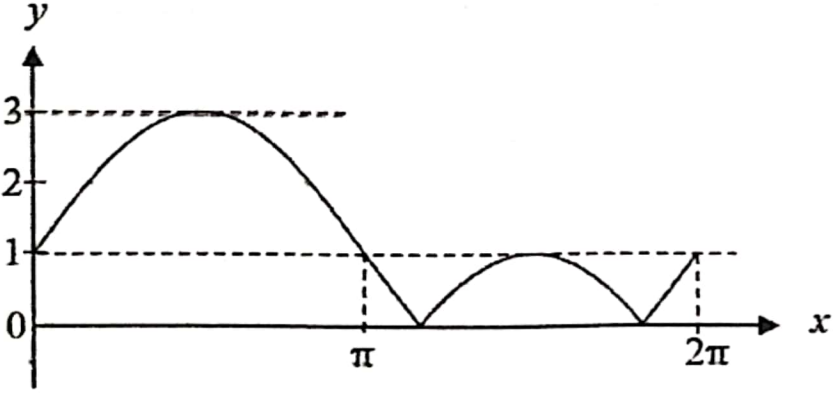
NO	PERATURAN PEMARKAHAN		MARKAH
9	(a)(i)	$({}^{24}C_8) = 735471$	N1
	(ii)	$735471 - {}^9C_8 \times ({}^{15}C_0)$	K1
		735462	N1
	(b)(i)	$\frac{{}^8P_4}{4}$ atau ${}^8C_4 \times (4-1)!$	K1
		420	N1
	(b)(ii)	$2!(7-1)!$	K1
		1440	N1
			7 markah
10	(a)	A(4,0) atau B(0,4) atau C(0,-4) atau lihat pintasan-x atau pintasan-y pada kedudukan yang betul pada rajah.	K1
		$\frac{x}{4} + \frac{y}{-4} = 1 \quad // \quad \frac{x}{4} - \frac{y}{4} = 1$	N1
	(b)	$\frac{1}{2} (0(0) + 4(-6) + 4(-5)) - (4(4) + 0(-5) + 0(-6)) $	K1
		30	N1
	(c)	$m_{AB} \times m_{AD}$ $\frac{4-0}{0-4} \times \frac{-6-0}{-5-4} = -\frac{2}{3}$ atau $-1 \times \frac{2}{3} = -\frac{2}{3}$	K1
		$m_{AB} \times m_{AD} \neq -1$, garis lurus AB tidak berserenjang dengan garis lurus AD.	N1
			6 markah
11	(a)	$f(x) = x - 380$	P1
		$g(x) = 0.25x$	P1
		$gf(x) = 0.25(x - 380)$	N1
	(b)	$0.25(x - 380) \geq 5500$	K1
		$22380 \div 373$	K1
		$x \geq 60$	K1
		60	N1
			7 markah

NO	PERATURAN PEMARKAHAN		MARKAH
12	(a)	$a + b = 0.29$	N1
	(b)	${}^5C_0 \times p^0 \times q^5 = 0.05$	K1
		$q = 0.5493$	N1
			3 markah
13	(a)	$-4 + k + (-1) = 0$ atau $h + (-2) + (-7) = 0$	K1
		$k = 5$ dan $h = 9$	N1
	(b)	$\underline{i} + 7 \underline{j}$	P1
		$\sqrt{(-4+5)^2 + (9-2)^2}$	K1
		$5\sqrt{2}$	N1
	(c)	$F_{\text{new}} = -2\underline{i} + 4\underline{j}$	P1
		$\sqrt{(-2)^2 + 4^2}$ atau $\sqrt{(-2)^2 + 4^2}$	K1
		$\frac{-\underline{i} + 2\underline{j}}{\sqrt{5}}$	N1
			8 markah
14	(a)	$\frac{s}{2\pi r} = \frac{\theta}{2\pi}$	K1
		$s = r\theta$	K1
	(b)	$\frac{\pi}{2}$	P1
		$\frac{1}{2}(1000)^2 \left(\frac{\pi}{2}\right)$ atau $\frac{1}{2}(1000)^2 (\sin 90^\circ)$	K1
		$\frac{1}{2}(1000)^2 \left(\frac{\pi}{2} - \sin 90^\circ\right) \times 2$	K1
		$5707963300 \text{ cm}^2 // 570796.33 \text{ m}^2 // 0.57079633 \text{ km}^2$	N1
		$5707963300 \div 2500 // 570796.33 \div (0.5 \times 0.5) //$ $0.57079633 \div 0.00000025$	K1
		$2\,283\,185 // 2\,283\,186$	N1
			8 markah

NO	PERATURAN PEMARKAHAN		MARKAH
15	(a)	$\frac{2 + \tan B}{1 - 2 \tan B} = -3$	K1
		$\tan B = 1$	N1
	(b)	$1 - \cos^2 x = 1 - \cos x$	K1
		$\cos x (\cos x - 1) = 0$	K1
		$0^\circ, 90^\circ, 270^\circ, 360^\circ$	N1
	(c)	$\cos \theta = -\sqrt{1 - 16k^2}$	K1
		$2\cos^2 \frac{\theta}{2} - 1 = -\sqrt{1 - 16k^2}$	K1
		$\frac{1 - \sqrt{1 - 16k^2}}{2}$	N1
			8 markah

NO	PERATURAN PEMARKAHAN	MARKAH
1	Membentuk mana-mana satu persamaan PP NEGERI SEMBILAN K2 $2x + 5y + 3z = 200$ $x + y + z = 50$ $y - z = 20$ atau setara Ketiga-tiga persamaan betul	P1 P1
	Hapus anu pertama dengan penggantian @ penghapusan Hapus x : $3y + z = 100$ Hapus y : $x + 2z = 30$ @ $3x - 2z = 50$ @ $y = 20 + z$ Hapus z : $x + 2y = 70$ @ $2x + 8y = 260$ @ $x + 2y = 50$	K1
	Hapus anu kedua dengan penggantian @penghapusan	K1
	Bilangan bunga ros = 10 , Bilangan cawan = 30, Bilangan bekas pensel = 10	N1N1N1
		7 markah
2(a)	$2 \left[x^2 - \frac{m}{2}x + \left(\frac{-\frac{m}{2}}{2} \right)^2 - \left(\frac{-\frac{m}{2}}{2} \right)^2 + \frac{n}{2} \right]$	K1
	$2 \left(x - \frac{m}{4} \right)^2 - \frac{m^2}{8} + n$	K1
	$\frac{m}{4} = \frac{3}{4}$ atau $-\frac{m^2}{8} + n = -\frac{49}{8}$	K1
	$m = 3$	N1
	$n = -5$	N1
(b)	 Bentuk  dan titik Min. Titik (-2,9) dan (4, 15)	N1 N1
		7 markah

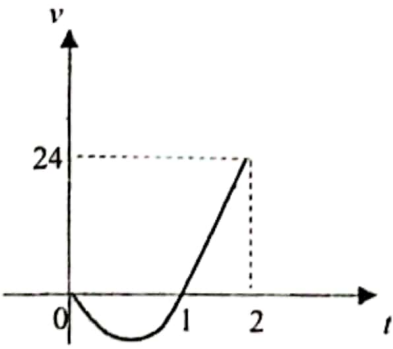
NO	PERATURAN PEMARKAHAN	MARKAH
3 (a)	$\log_2 \left(\frac{y^2}{x} \right) = 4$	K1
	$\frac{y^2}{x} = 2^4$	K1
	$y = 4\sqrt{x}$	N1
(b)	$4^x(4^{-1})$ atau $\frac{4^x}{4}$	K1
	$\left(\frac{5}{4}\right)4^x = 80$ atau $\frac{5}{4}y = 80$	K1
	$x = 3$	N1
		6 markah
4(a)	$y + \delta y = a(x + \delta x)^2$ atau $\frac{a(x + \delta x)^2 - ax^2}{\delta x}$	K1
	$\frac{\delta y}{\delta x} = 2ax + a\delta x$ atau $\lim_{\delta x \rightarrow 0} 2ax + a\delta x$	K1
	$2ax + a(0) = 10x$	K1
	$a = 5$ (tertunjuk)	N1
(b)	$\frac{dy}{dx} = 3x^2 - 2hx$	K1
	$3(2)^2 - 2h(2) = 0$	K1
	$h = 3$	N1
	$0 = 1^3 - 3(1)^2 + k$	K1
	$k = 2$	N1
		9 markah

NO	PERATURAN PEMARKAHAN	MARKAH
5(a)	60° atau 120° dilihat	P1
	$\frac{2\pi}{3}$	N1
5(b)	$\cos 60^\circ = \frac{8}{OA}$ atau $\sin 60^\circ = \frac{AE}{16}$ atau $\tan 60^\circ = \frac{AE}{8}$ atau $OA = 16$	K1
	$AB = 2(16) \sin 60^\circ$ atau $AB^2 = 16^2 + 16^2 - 2(16)(16) \cos 120^\circ$ atau $AB = 2(8) \tan 60^\circ$ atau $AB = 2(16) \sin 60^\circ$ atau $16\left(\frac{2\pi}{3}\right)$	K1
	$2(16) \sin 60^\circ + 16\left(\frac{2\pi}{3}\right)$ atau setara	K1
	$61.22 \leftrightarrow 61.23$	N1
		6 markah
6(a)	$2\left(\frac{\cos x}{\sin x}\right)\left(\frac{\sin^2 x}{\cos x}\right)$	K1
	$2 \sin x$	N1
6(b) (i)	 • Untuk $0 \leq x \leq 2\pi$ • Label 0 dan 2π pada paksi x Lakaran graf sin Graf naik 1 unit ke atas 1 kitaran dan modulus Semua betul	P1 P1 P1 P1
(ii)	$0 < m \leq 1$	N1
		7 markah

NO	PERATURAN PEMARKAHAN	MARKAH
7(a)	$(p+1)\underline{a} + (-2)\underline{a} + (q+1)\underline{b} + (-q)\underline{a} = \left(\frac{p+1}{2}\right)\underline{a} + 2q\underline{b}$ atau setara	K1
	$p+1-2-q = \frac{p+1}{2}$ atau $q+1=2q$ atau setara	K1
	Selesaikan persamaan serentak	K1
	$p=5$ dan $q=1$	N1
7(b)	$\overrightarrow{JM} = \lambda \overrightarrow{JR}$ atau setara $3\underline{a} + 2\underline{b} = \lambda \left(\frac{9}{2}\underline{a} + k\underline{b} \right)$ atau setara	K1
	<u>Bandingkan vektor $\underline{a}$ dan $\underline{b}$ dan selesaikan persamaan serentak</u> $3 = \frac{9}{2}\lambda$ dan $2 = \lambda k$ atau setara	K1
	$k=3$	N1
	$2:1$	N1
		8 markah
8(a)	Lihat lampiran muka surat 10	
(b)(i)	$\log_{10} y = (x-1) \log_{10} q + \log_{10} p$	P1
	$\log_{10} p = *c$ atau $\log_{10} q = *m$ (Nota: $*c$ ialah pintasan-y grafnya dan $*m$ ialah kecerunan grafnya)	K1
	$p = 6.166$ (terima $6.0954 < p < 6.2373$)	N1
	$q = 0.4553$ (terima $0.4571 < q < 0.4677$)	N1
(b)(ii)	1.2882	N1
		10 markah

NO	PERATURAN PEMARKAHAN	MARKAH
9(a)(i)	$n \times \frac{1}{20} = 56$	K1
	1120	N1
(ii)	${}^7C_0 \left(\frac{1}{20}\right)^0 \left(\frac{19}{20}\right)^7$ atau ${}^7C_1 \left(\frac{1}{20}\right)^1 \left(\frac{19}{20}\right)^6$ atau ${}^7C_2 \left(\frac{1}{20}\right)^2 \left(\frac{19}{20}\right)^5$	K1
	${}^7C_0 \left(\frac{1}{20}\right)^0 \left(\frac{19}{20}\right)^7 + {}^7C_1 \left(\frac{1}{20}\right)^1 \left(\frac{19}{20}\right)^6 + {}^7C_2 \left(\frac{1}{20}\right)^2 \left(\frac{19}{20}\right)^5$	K1
	0.9962	N1
(b)(i)	$P(X > 3700) = 0.0765$ atau $z = 1.429$	K1
	$\frac{3700 - 3250}{\sigma} = 1.429$	K1
	314.91	N1
(ii)	$12\,000 \times 0.4235$	K1
	5082	N1
		10 markah
10(a)	$h = -16$	N1
10(b)	$\left[\frac{-16x^{-1}}{-1} \right]$ atau $\left[-\frac{x^3}{3} + \frac{4x^2}{2} \right]$ (untuk bahagian seterusnya)	K1
	$\left(\frac{16}{m}\right) - \left(\frac{16}{2}\right) = -\frac{8}{3}$ atau $\frac{1}{2}(2)(4)$ (m atau sebarang huruf mewakili pemalar)	K1
	$m = 3$	N1
	$\left(-\frac{(*3)^3}{3} + \frac{4(*3)^2}{2} \right) - \left(-\frac{(0)^3}{3} + \frac{4(0)^2}{2} \right)$	K1
	$9 + \frac{20}{3}$	K1
	$\frac{47}{3} // 15.67$	N1
10(c)	$\pi \left[\frac{x^5}{5} - \frac{8x^4}{4} + \frac{16x^3}{3} \right]_0^{*3}$	K1
	$\pi \left[\left(\frac{(*3)^5}{5} - \frac{8(*3)^4}{4} + \frac{16(*3)^3}{3} \right) - \left(\frac{(0)^5}{5} - \frac{8(0)^4}{4} + \frac{16(0)^3}{3} \right) \right]$	K1
	$\frac{153}{5} \pi // 30.6 \pi$	N1
		10 markah

NO	PERATURAN PEMARKAHAN	MARKAH
11(a)(i)	$\frac{3}{4} \times \left(-\frac{k}{3}\right) = -1$	K1
	$k = 4$	N1
	$3\left(\frac{3}{4}x\right) + 4x = 50$	K1
	$P(8,6)$	N1
11(b)(i)	$\frac{1(x) + 2(8)}{1+2} = 0$ atau $\frac{1(y) + 2(6)}{1+2} = \frac{50}{3}$	K1
	$Q(-16,38)$	N1
	$38 = \frac{3}{4}(-16) + c$ atau $y - 38 = \frac{3}{4}(x - (-16))$	K1
	$y = \frac{3}{4}x + 50$	N1
11(c)	$\sqrt{(x - (-16))^2 + (y - 38)^2} = 4$	K1
	$x^2 + y^2 + 32x - 76y + 1684 = 0$	N1
		10 markah
12(a)(i)	$7.78^2 = 7.22^2 + 5.30^2 - 2(7.22)(5.30)\cos\angle PAQ$	K1
	75.09	N1
12(a)(ii)	$\frac{\sin\angle APQ}{7.22} = \frac{\sin\angle 75.09^\circ}{7.78}$ atau $7.22^2 = 7.78^2 + 5.30^2 - 2(7.78)(5.30)\cos\angle APQ$	K1
	63.74°	N1
12(a)(iii)	$\frac{1}{2}(5.30)(7.22)\sin 75.09^\circ$ atau $\sqrt{10.15(10.15 - 5.30)(10.15 - 7.22)(10.15 - 7.78)}$	K1
	18.49	N1
12(b)(i)	$\left(\frac{5}{3}\right)^2 \times 18.49$ atau $\frac{1}{2} \times 8.833 \times 12.033 \times \sin 75.09^\circ$	K1
	51.36 atau 51.35	N1
12(b)(ii)	$\frac{1}{2} \times h \times \left(\frac{5}{3} \times 7.78\right) = 51.36$ atau $\frac{1}{2} \times 12.97 \times h = 51.35$	K1
	7.922 atau 7.918	N1
		10 markah

NO	PERATURAN PEMARKAHAN	MARKAH
13(a)	$\frac{72.90}{54} \times 100$	K1
	135	N1
(b)	$\frac{98 \times m}{100} = 122.5$ atau setara	K1
	$m=125$	N1
(c)	$h + 20 + 38 + k = 100$ atau $\frac{95(h) + 135(20) + 122.5(38) + 100k}{100} = 114.40$	K1
	Ganti $h = 42 - k$ atau $k = 42 - h$ dan selesaikan	K1
	$k = 19$ dan $h = 23$	N1
(d)	82.94 dilihat	P1
	$\frac{114.40(100 - y)}{100} = 82.94$ atau setara	K1
	$y = 27.5$	N1
		10 markah
14(a)	$s = \frac{pt^3}{3} - \frac{qt^2}{2}$	K1
	$\frac{p(1)^3}{3} - \frac{q(1)^2}{2} = -2$ atau $p(1)^2 - q(1) = 0$	K1
	Selesaikan persamaan serentak secara penggantian atau penghapusan $\frac{p}{3} - \frac{q}{2} = -2$ dan $p - q = 0$	K1
	$p = 12$ dan $q = 12$	N1
(b)(i)	$a = 24(0) - 12$	K1
	$a = -12$	N1
(ii)	 Bentuk $\cup$ berserta paksi-paksi Semua betul	N1 N1
(iii)	$\left \left(4(1)^3 - 6(1)^2 \right) - 0 \right + \left[\left(4(2)^3 - 6(2)^2 \right) - \left(4(1)^3 - 6(1)^2 \right) \right]$ atau setara	K1
	12	N1
		10 markah

NO	PERATURAN PEMARKAHAN	MARKAH
15 (a)	$70x + 40y \leq 4200$	N1
	$50x + 40y \geq 2000$	N1
	$y \leq 2x$	N1
(b)	<u>Lihat lampiran muka surat 11</u>	
	Satu garis lurus betul	K1
	Ketiga-tiga betul	K1
	Rantau berlorek R	N1
(c)	Lukis garis lurus $x = 3y$	K1
	Titik maksimum (50,17)	N1
	Keuntungan maksimum = $30(50) + 20(17)$	K1
	1840	N1
		10 markah

$x - 1$	0.25	0.50	1.20	1.70	2.50	2.70
$\log_{10} y$	0.68	0.64	0.38	0.23	-0.03	-0.15

P1

P1

Graf garis lurus $\log_{10} y$ melawan $x - 1$ dilukis

K1

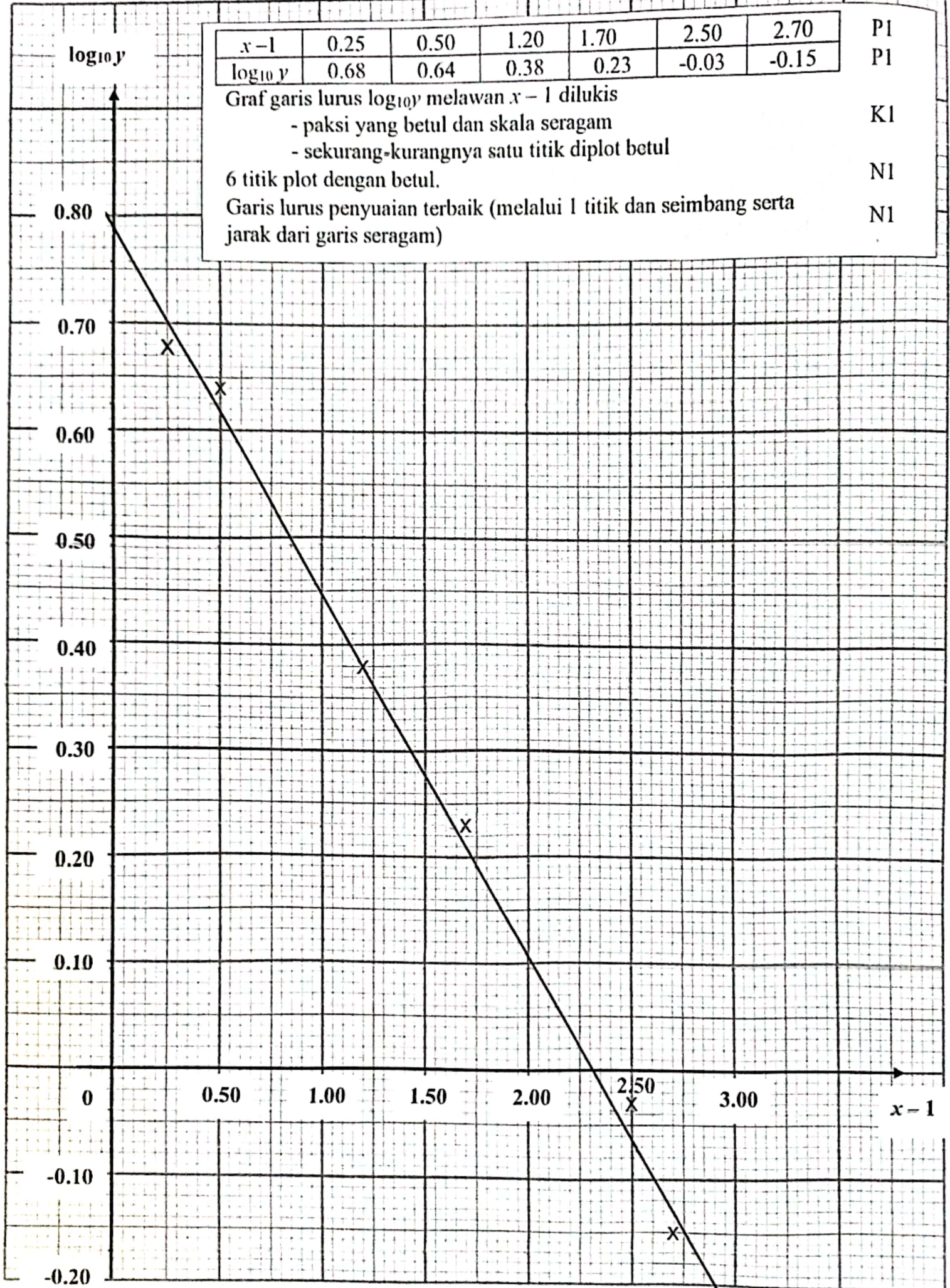
- paksi yang betul dan skala seragam
- sekurang-kurangnya satu titik diplot betul

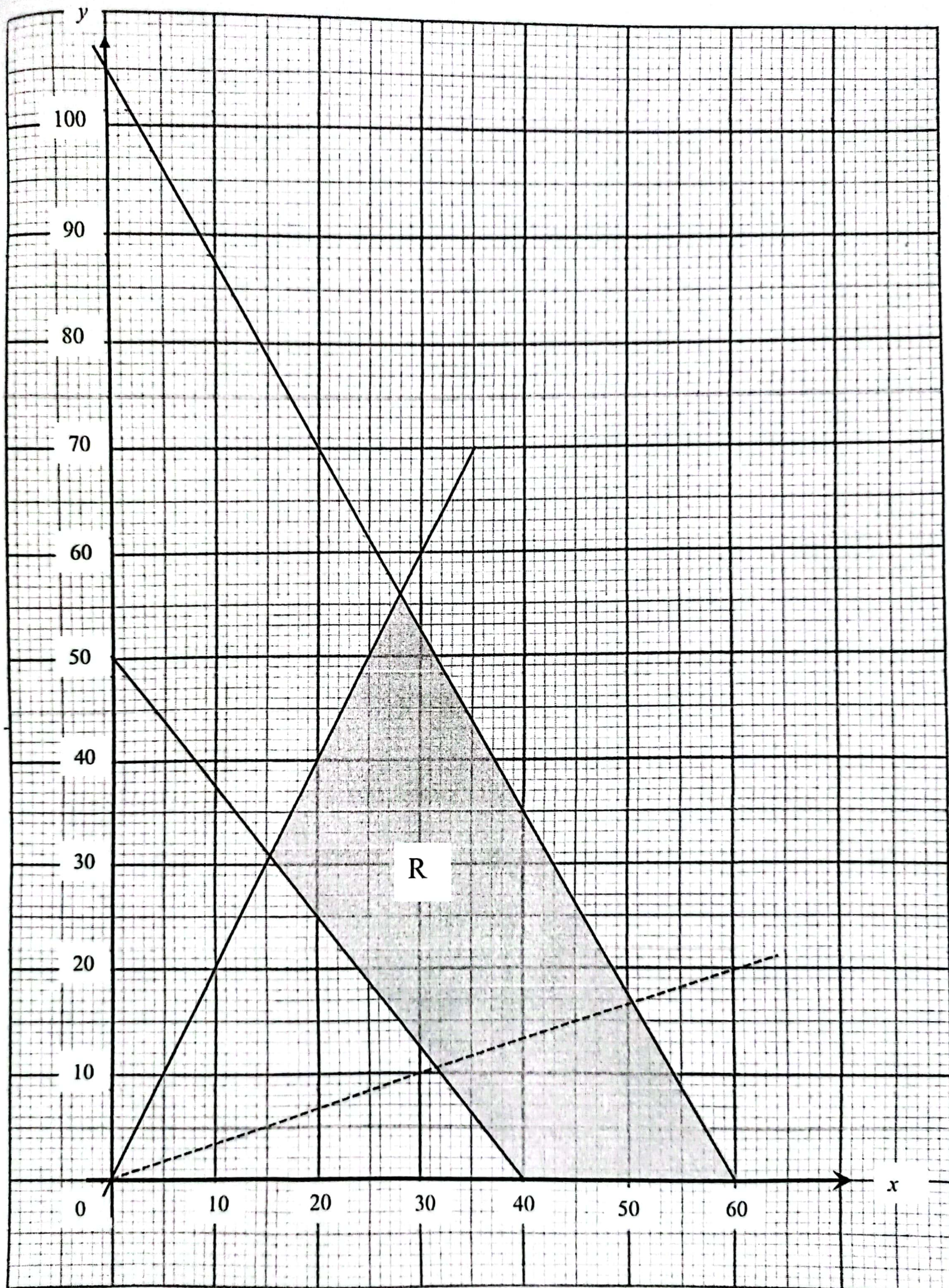
6 titik plot dengan betul.

N1

Garis lurus penyuaian terbaik (melalui 1 titik dan seimbang serta jarak dari garis seragam)

N1





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MATEMATIK TAMBAHAN

Kertas 1

Peraturan Pemarkahan

November

UNTUK KEGUNAAN PEMERIKSA SAHAJA

Peraturan pemarkahan ini mengandungi halaman bercetak

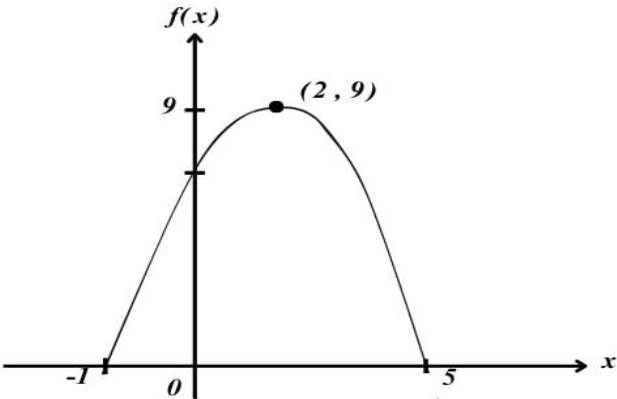
No.	Solution and Mark Scheme	Sub Marks	Total Marks
1			
(a)	$f^{-1}(x) = \frac{x+5}{8}$ N1	1	
(b)	$g(8x - 5) = 24x + 5$ atau P1 $gf(x) = 24x + 5$ $g(x) = 24 * \left(\frac{x+5}{8}\right) + 15$ K1 $g(x) = 3x + 30$ N1	3	4

No.	Solution and Mark Scheme	Sub Marks	Total Marks
2	a) $x + y = 2z$ atau N1 $x + y - 2z = 0$ K1	1	5
	b) <u>Hapuskan 2 pembolehubah</u> $3z = 45$		
	$z = 15$ N1		
	$y = 20$ N1 $x = 10$ N1	4	

No.	Solution and Mark Scheme	Sub Marks	Total Marks
3			
(a)	$\frac{dv}{dr} = 2\pi r^2$ $= 2\pi (15)^2$ $\delta V = 2\pi (15)^2 \times 0.02$ $= 9\pi$ K1 K1 N1	3	
(b)	$\frac{dv}{dt} = -5.4\pi$ $\frac{dr}{dt} = \frac{1}{450\pi} \times (-5.4\pi)$ $- 0.012$ K1 K1 N1	3	6

No.	Solution and Mark Scheme	Sub Marks	Total Marks
4			
a)	$\log_a x = p$ atau $\log_a y = q$ P1 $\frac{x}{y} = a^{p-q}$ K1 $\log_a \frac{x}{y} = \log_a x - \log_a y$ N1	3	
b)	<u>Guna hukum bahagi / tukar asas</u> K1 $\log_4 P - \log_4 Q$ atau $\log_2 \frac{P}{Q}$ atau $\frac{\log_2 \frac{P}{Q}}{\log_2 4}$ atau $\frac{\log_4 \frac{P}{Q}}{\log_4 2}$ <u>Guna hukum kuasa</u> K1 $2 \log_4 \frac{P}{Q}$ N1	3	6

No.	Solution and Mark Scheme	Sub Marks	Total Marks
5 (a)	${}^6C_6 \times {}^5C_1 \text{ or } {}^6C_5 \times {}^5C_2 \text{ or } {}^6C_4 \times {}^5C_3$ P1 ${}^6C_6 \times {}^5C_1 + {}^6C_5 \times {}^5C_2 + {}^6C_4 \times {}^5C_3$ K1 215 N1	3	
(b)	4! P1 $4! \times 4!$ K1 576 N1	3	6

No.	Solution and Mark Scheme	Sub Marks	Total Marks
6 (a)	 Bentuk graf Titik Maksimum (2,9) Pintasan-x P1 P1 P1	3	
(b)	$f(x) = (x - 2)^2 - 9$ atau Setara N1	1	4

No.	Solution and Mark Scheme	Sub Marks	Total Marks
7			
(a)	$\frac{CD}{DE} = \frac{AP}{PB}$ P1 (Rujuk label pada Rajah 7) $n(x - x_1) = m(x_2 - x)$ K1 $x = \frac{nx_1 + mx_2}{m + n}$ N1	3	
(b)	$h = \frac{2(2) + 3(12)}{3 + 2}$ atau $5 = \frac{2(2) + 3k}{3 + 2}$ K1 $h = 8$ N1 $k = 7$ N1	3	6

No.	Solution and Mark Scheme	Sub Marks	Total Marks
8			
(a)	$rS_n = ar + ar^2 + ar^3 + ar^4 + \cdots \dots + ar^{n-1} + ar^n$ P1 Guna $S_n - rS_n$ K1 $S_n - rS_n = ar - ar^n$ $S_n = \frac{a(1-r^n)}{1-r}$ N1	3	
(b)	$-1 < r < 1$ N1	1	4

No.	Solution and Mark Scheme	Sub Marks	Total Marks
9			
(a)	$3 \int_3^5 f(x) dx - 3 \int_3^5 qx dx = 6$ K1 $3 [10 - [\frac{qx^2}{2}]_3^5] = 6$ K1 $q = 1$ N1	3	
(b)	$\frac{1}{2} (-10) + 10$ K1 5 N1	2	5

No.	Solution and Mark Scheme	Sub Marks	Total Marks
10	Guna		
(a)	$\cos x \cos y + \sin x \sin y$ atau $\cos x \cos y - \sin x \sin y$ (K1)		
(i)	$\frac{5}{8}$ (N1)		
(ii)	$-\frac{1}{8}$ (N1)	3	
(b)	$x - y = 51.32^\circ$ atau $x + y = 97.18^\circ$ (N1)		
	<u>Selesaikan persamaan serentak</u> (K1)		
	$2y = 45.86^\circ$ atau $2x = 148.50^\circ$		
	$x = 74.25^\circ$ dan $y = 22.93^\circ$ (N1)	3	6

No.	Solution and Mark Scheme	Sub Marks	Total Marks
11			
(a)			
(i)	15i − 8j N1		
	$\sqrt{15^2 + (-8)^2}$ K1		
	17 meter N1		
(ii)	$\frac{15}{17} \underset{\sim}{i} - \frac{8}{17} \underset{\sim}{j}$ N1	4	
(b)			
(i)	$\underset{\sim}{V} + \underset{\sim}{U}$ N1		
(ii)	$\frac{x-x'}{15} = \frac{2}{3}$ K1		
	10 meter N1	3	7

No.	Solution and Mark Scheme	Sub Marks	Total Marks
12			
(a)	$\mu = 10$ P1 $\frac{15-10}{\sigma} = 0.539$ K1 $\sigma = 9.276$ N1	3	
(b)	$\frac{7-10}{*9.276} \leq Z \leq \frac{15-10}{*9.276}$ K1 $- 0.3234 \leq Z \leq 0.5390$ $0.3316 \quad \text{atau} \quad 0.3319$ N1	2	5

No.	Solution and Mark Scheme	Sub Marks	Total Marks
13			
(a)	$r - 6$ P1 $(r - 6)^2 + 8^2 = r^2$ K1 $r = 8.333$ N1	3	
(b)	$2 [\sin^{-1} (\frac{8}{*8.333})]$ K1 147.50° N1 2.574 rad N1	3	
(c)	$\frac{1}{2} (*8.333)^2 [*2.574 - \sin *147.50^\circ]$ K1 70.71 cm^2 N1	2	8

No.	Solution and Mark Scheme	Sub Marks	Total Marks
14			
(a)	$\frac{dy}{dx} = 12(1) - 3(1)^2$$= 9$ K1 N1 $y - 10 = 9(x - 1) \text{ atau } 10 = 9(1) + c$ K1 $y = 9x + 1$ N1	4	
(b)	$\frac{dy}{dx} = 12x - 3x^2 = 0$$3x(4 - x) = 0$$x = 0, \quad x = 4$ K1 N1 $(0, 5) \quad (4, 37)$ N1 N1	4	8

No.	Solution and Mark Scheme	Sub Marks	Total Marks
15			
(a)	$\frac{y}{x} = 2\left(\frac{1}{x^2}\right) + q$ P1 $\frac{p-5}{3-1} = 2$ atau $5 = 2(1) + q$ K1 $p = 9$ N1 $q = 3$ N1	4	
(b)	$\log \frac{y}{k\sqrt{x}} = \log p$ P1 $\log y = (\log k)\sqrt{x} + \log p$ K1 $Y = \log y, \ X = \sqrt{x}, \ m = \log k, \ C = \log p$ N2 semua betul N1 3 betul	4	8

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MATEMATIK TAMBAHAN

Kertas 2

Peraturan Pemarkahan

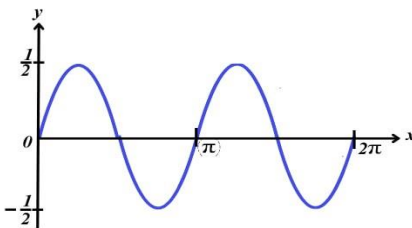
Oktober

UNTUK KEGUNAAN PEMERIKSA SAHAJA

Peraturan pemarkahan ini mengandungi 18 halaman bercetak

No.	Peraturan Permarkahan	Markah	Jumlah Markah
1	$n + 9 + m = 32$ P1 P1 $\frac{5}{n} = \frac{m}{9+n}$ $m = 23 - n$ @ $m = \frac{45}{n - 5}$ @ $n = \frac{45 + 5m}{m}$ P1 Hapus satu anu (melibatkan satu persamaan linear dan satu persamaan <u>tak linear dalam sebutan m dan n</u>) $45 + 5n = n(23 - n)$ K1 Selesaikan persamaan kuadratik <u>$ax^2 + bx + c = 0$ for $b \neq 0$</u> K1 Pemfaktoran $(n - 5)(n - 9) = 0$ Rumus $p = \frac{-(-18) \pm \sqrt{(-18)^2 - 4(1)(45)}}{2(1)}$ N1 $n = 5$ or $n = 9$ N1 $m = 18$ or $m = 14$		7

No.	Peraturan Permarkahan	Markah	Jumlah Markah
2			
(a)	$x + 6y = 210 \quad \text{atau} \quad \frac{9}{2}[2y + 8y] = 1440 \quad \boxed{\text{P1}}$ <u>Selesaikan persamaan linear serentak</u> $\bigcirc \text{K1}$ $2y = 50$ $y = 25 \quad \boxed{\text{N1}}$ $x = 60 \quad \bigcirc \text{K1}$	4	
(b)	$60^* + (n - 1)^*25 \quad \text{atau} \quad 95 + (n - 1)20 \quad \boxed{\text{P1}}$ $60 + (n - 1)25 = 95 + (n - 1)20 \quad \bigcirc \text{K1}$ $n = 10 \quad \boxed{\text{N1}}$	3	
			7

No.	Peraturan Permarkahan	Markah	Jumlah Markah
4	(a) Guna $\frac{\cos x}{\sin x}$ (K1)	2	
	(N1) $\sin 2x$		
	(b) $\sin 2x = \frac{1}{2}$ (K1)	3	
	Sudut rujukan = $\frac{\pi}{6}$ atau 30° (N1)		
$x = \frac{\pi}{12}, \frac{5}{12}\pi, \frac{13}{12}\pi, \frac{17}{16}\pi$ (N1)	3		
(c) $y = \frac{1}{2}\sin 2x$ (N1)		3	
	3		
Graf bentuk sin (P1)		8	
2 kalaan untuk $0 \leq x \leq 2\pi$ dan	3		
Amplitude $\frac{1}{2}$		8	

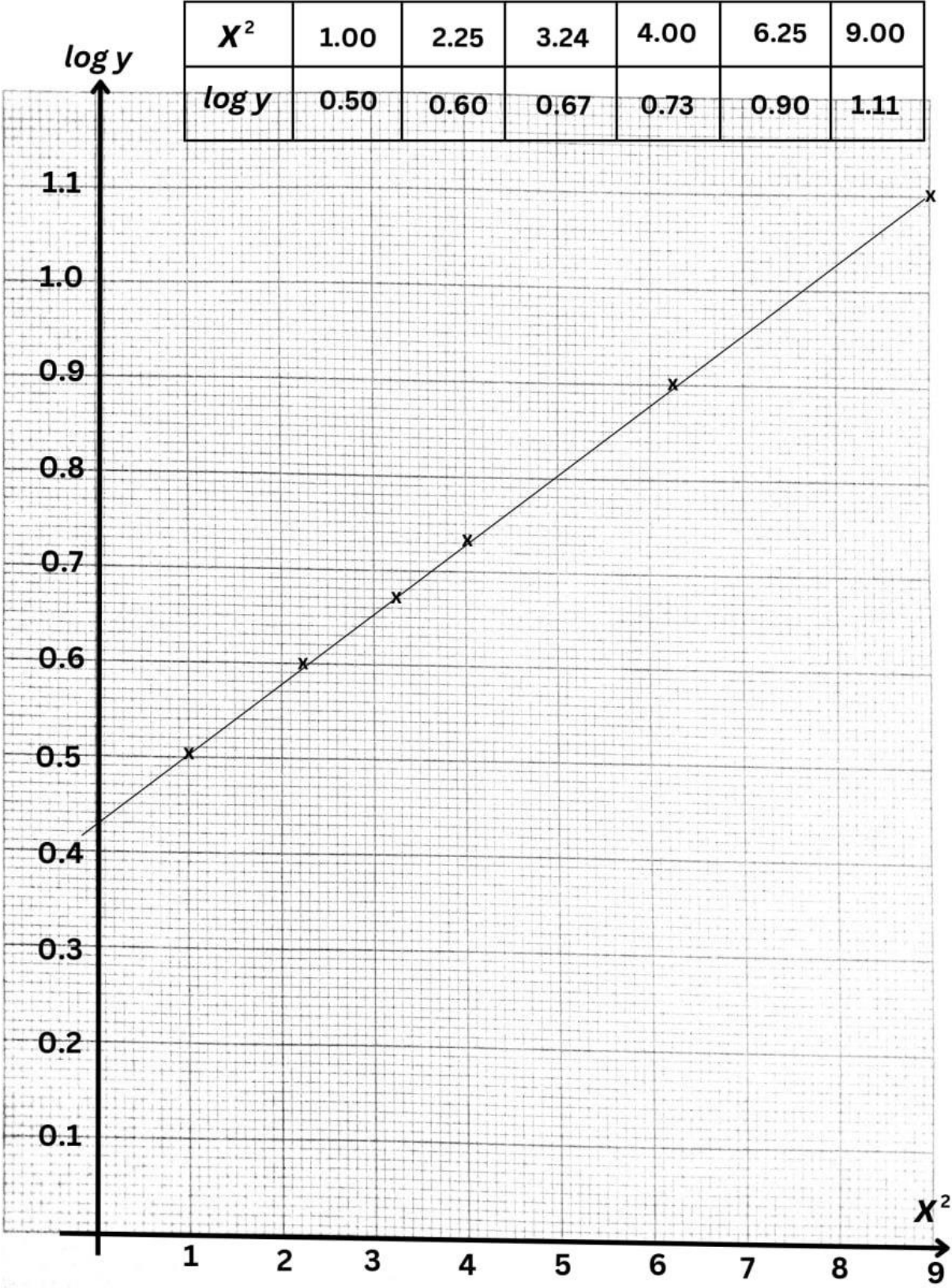
No.	Peraturan Permarkahan	Markah	Jumlah Markah
5			
(a)	$\cos^{-1}\left(\frac{40}{50}\right)$ P1 $\left[\cos^{-1}\left(\frac{40}{50}\right)\right] \times \frac{\pi}{180}$ K1 0.6435 rad N1	3	
(b)	$50 \left(0.6435 \times 2\right)$ K1 64.35 cm N1	2	
(c)	$\frac{1}{2}(50^2)(1.287 - \sin 73.74^\circ)$ K1 408.75 cm^2 N1	2	
			7

No.	Peraturan Permarkahan	Markah	Jumlah Markah
6			
(a)	$\alpha + \beta = -\frac{5}{2}$ atau $\alpha\beta = \frac{-12+p}{2}$ (P1) <u>Selesaikan persamaan linear serentak</u> (K1) $5\beta = -\frac{5}{2}$ $\beta = -\frac{1}{2}$ (N1) $p = 14$ (N1)	4	
(b)	 (K1) $-2 < x < -\frac{1}{2}$ (N1)	2	
			6

No.	Peraturan Permarkahan	Markah	Jumlah Markah
7			
(a)	<u>Guna hukum kuasa</u> $\log_3 3^3$ atau $\log_3 x^2$ K1		
	<u>Guna hukum bahagi</u> $\log_3 \frac{3^3}{x^2}$ K1		
(b)	$y = \frac{27}{x^2}$ N1		
	$3^{3x} \times 3^{-2y} = 3^5$ atau $2^{x-1} \times 2^{2y} = 2^6$ P1	3	
	$3x - 2y = 5$ atau $x - 1 + 2y = 6$ P1		
	<u>Selesaikan persamaan linear serentak</u> $3x = 12$ $x = 4$ N1 $y = \frac{3}{2}$ N1 K1	5	
			8

No.	Peraturan Permarkahan	Markah	Jumlah Markah														
8																	
(a)	<table><tr><td>x^2</td><td>1.00</td><td>2.25</td><td>3.24</td><td>4.00</td><td>6.25</td><td>9.00</td></tr><tr><td>$\log_{10} y$</td><td>0.50</td><td>0.60</td><td>0.67</td><td>0.73</td><td>0.90</td><td>1.11</td></tr></table> N1 N1	x^2	1.00	2.25	3.24	4.00	6.25	9.00	$\log_{10} y$	0.50	0.60	0.67	0.73	0.90	1.11	2	
x^2	1.00	2.25	3.24	4.00	6.25	9.00											
$\log_{10} y$	0.50	0.60	0.67	0.73	0.90	1.11											
(b)	Plot $\log_{10} y$ melawan x^2 (paksi betul dan skala seragam) K1 6 titik diplot dengan betul N1 Garis lurus penyuaian terbaik N1	3															
(c)	$\log_{10} y = (\log_{10} p)(x^2) + \log_{10} q$ P1 $* c = -\log_{10} q$ K1 K1 $* m = \log_{10} p$ $q = 0.3802$ N1 N1 $p = 1.1918$	5															
			10														

Graf soalan 8(b)



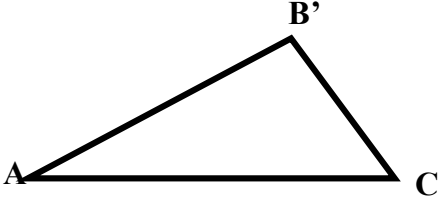
No.	Peraturan Permarkahan	Markah	Jumlah Markah
9			
(a)	<u>Selesaikan persamaan serentak</u> (K1) $(x - 6)(x + 2) = 0$ $A = (-2, 4) \quad \text{N1}$	2	
(b)			
(i)	<u>Cari luas segitiga</u> atau <u>gantikan had</u> $\int_{-2}^0 \frac{x^2}{4} + 3dx$ (K1) $A_1 = \frac{1}{2}(4)(*4) \qquad A_2 = [\frac{(-2)^3}{12} + 3(-2)]$ Kamirkan $\int \frac{x^2}{4} + 3dx$ (K1) $[\frac{x^3}{4(3)} + 3x]$ $* A_1 + * A_2 \quad \text{(K1)}$ $\frac{44}{3} \quad \text{N1}$	4	
(ii)	$x^2 = 4y - 12$ P1 Kamirkan $\int \pi x^2 dy$ (K1) $\pi [\frac{4y^2}{2} - 12y]$ Guna had $\int_3^4$ kedalam $[\frac{4y^2}{2} - 12y]$ (K1) $\pi [(\frac{4(4)^2}{2} - 12(4)) - (\frac{4(3)^2}{2} - 12(3))]$ $\text{N1} \qquad 2\pi \text{ unit}^2$	4	10

No.	Peraturan Permarkahan	Markah	Jumlah Markah
10			
(a)	$. 7(2) - 2k = 0$ K1 $k = 7$ N1	2	
(b)	$\frac{2(2)+1(x)}{1+2} = 5 \quad \text{atau} \quad \frac{2(7)+1(y)}{1+2} = 3$ K1 $\frac{2(2)+1(x)}{1+2} = 5 \quad \text{dan} \quad \frac{2(7)+1(y)}{1+2} = 3$ K1 $(11, -5)$ N1	3	
(c)	$\frac{1}{2} [0(*7) + 2(*-5) + *11(0)] - [0(2) + *7(*11) + (*-5)(0)] $ K1 43.5 N1	2	
(d)	$-\frac{4}{3} \times m_2 = -1$ K1 $m_2 = \frac{3}{4}$ $3 = \frac{3}{4}(5) + C \quad \text{atau} \quad y - 3 = \frac{3}{4}(x - 5)$ K1 $y = \frac{3}{4}x - \frac{3}{4}$ N1	3	
			10

No.	Peraturan Permarkahan	Markah	Jumlah Markah
11			
(a)	$P\left(Z > \frac{2.5-1.936}{\sigma}\right) = 0.0735$ P1		
(i)	$\frac{2.5-1.936}{\sigma} = 1.45$ K1		
	$\sigma = 0.3890$ N1	3	
(ii)			
	$P\left(Z < \frac{1.5-1.936}{*0.3890}\right)$ K1		
	$P(z < -1.1208)$		
	0.1312 N1	2	
(b)			
(i)	$p = 0.84$ dan $q = 0.16$ P1		
	$P(X = 6) = {}^8C_6 \times 0.84^6 \times 0.16^2$ K1		
	0.2518 N1	3	
(ii)	$P(X \leq 7)$		
	$1 - P(X = 8)$ P1 $P(X = 0) + P(X = 1) + + P(X = 7)$		
	$1 - {}^8C_8 \times 0.84^8 \times 0.16^0$		
	0.7521 N1	2	10

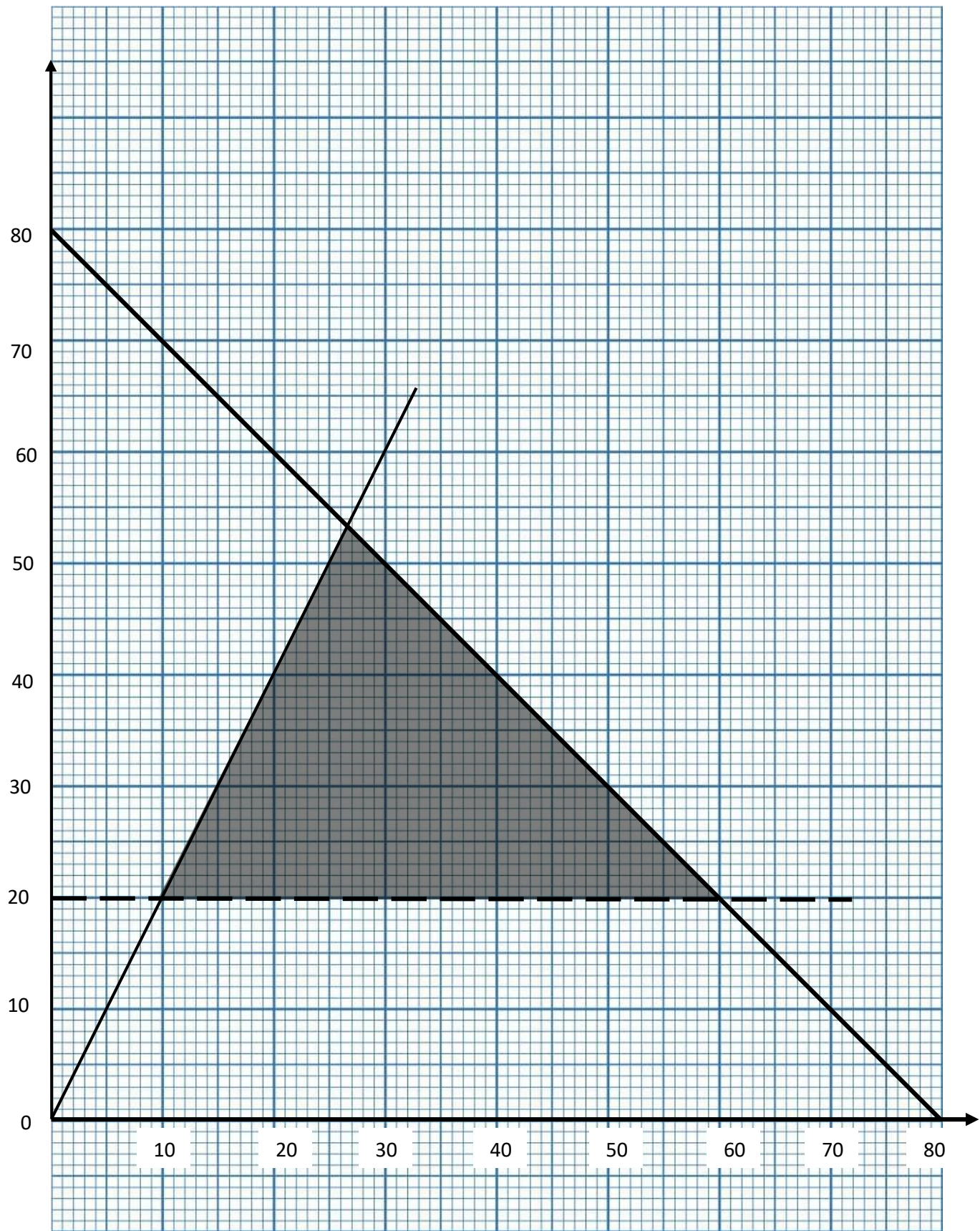
No.	Peraturan Permarkahan	Markah	Jumlah Markah
12			
(a)	$v = (4)^2 - 2(4) - 24$ (K1) $v = -16$ (N1)	2	
(b)	$t^2 - 2t - 24 < 0$ $(t - 6)(t + 4) < 0$ (K1) $0 \leq t < 6$ (N1)	2	
(c)	$2t - 2 = 0$ (K1) $t = 1$ $v = (1)^2 - 2(1) - 24$ (K1) $v = -25$ (N1)	3	
(d)	$\int_0^4 (t^2 - 2t - 24)dt$ (K1) $[\frac{t^3}{3} - t^2 - 24t]_0^4$ $[\frac{(4)^3}{3} - (4)^2 - 24(4)] - [\frac{(0)^3}{3} - (0)t^2 - 24(0)]$ (K1) 90.67 (N1)	3	10

No.	Peraturan Permarkahan	Markah	Jumlah Markah
13	$\frac{12.60}{10.50} \times 100 = h$ atau $\frac{P_{2022}}{10.50} \times 100 = 140$ (K1)		
(a)			
(i)	$h = 120$ (N1)		
(ii)	14.70 (N1)	3	
(b)			
(i)	Guna $\frac{114(2)+130(5)+140(2k)}{2+5+2k} = 129.8$ (K1)		
	$k = 1.5$ (N1)	2	
(ii)	$\frac{150}{P_{2018}} \times 100 = 129.8$ (K1)		
	115.56 (N1)	2	
(iii)	$114 \times \frac{100}{120}$ $130 \times \frac{100}{130}$ $140 \times \frac{100}{120}$ (K1)		
	Guna $\frac{95(2)+100(5)+116.67(3)}{2+5+3}$ (K1)		
	104 // 104.001 (N1)	3	
			10

No.	Peraturan Permarkahan	Markah	Jumlah Markah
14			
(a)			
(i)	$\frac{\sin \angle ABC}{15} = \frac{\sin 30^\circ}{9}$ (K1) 56.44° (N1)	2	
(ii)	$15^2 = 10^2 + 8^2 - 2(10)(8)\cos \angle ADC$ (K1) 112.41° (N1)	2	
(iii)	$\angle ACB = 180^\circ - 30^\circ - 56.44^\circ$ (P1) $A_1 = \frac{1}{2}(8)(10) \sin * 112.41^\circ$ atau (K1) $A_2 = \frac{1}{2}(15)(9) \sin * 93.56^\circ$ *A ₁ + *A ₂ (K1) 104.35 cm ² (N1)	4	
(b)			
(i)	 (N1) $\angle AB'C$ sudut cakah NMA	1	
(ii)	123.56° (N1)	1	
			10

No.	Peraturan Permarkahan	Markah	Jumlah Markah
15			
(a)	$x + y \leq 80$ N1 $y \leq 2x$ N1 $y > 20$ N1	3	
(b)	Lukis dengan betul sekurang-kurangnya satu garis lurus dari ketaksamaan yang melibatkan x dan y K1 Lukis dengan betul semua garis lurus K1 Rantau dilorek dengan betul N1	3	
(c)		1	
(i)	$20 < y \leq 50$ N1		
(ii)	$(27, 53)$ N1 Ganti mana-mana titik di dalam rantau berlorek dalam prs $60x + 70y$ $60(27) + 70(53)$ K1 5350 N1	3	10

Graf soalan 15(b)





PENTAKSIRAN DIAGNOSTIK AKADEMIK SEKOLAH BERASRAMA PENUH 2023

**PEPERIKSAAN PERCUBAAN SIJIL PELAJARAN MALAYSIA
MATEMATIK TAMBAHAN**

3472/1

**Kertas 1
Oktober 2023**

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN KERTAS 1

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini **SULIT** dan **Hak Cipta Sekolah Berasrama Penuh**. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa. Peraturan pemarkahan ini tidak boleh dikeluarkan dalam apa-apa jua bentuk penulisan dan percetakan.

NAMA PEMERIKSA	:	
NAMA SEKOLAH	:	
TANDA TANGAN PENERIMAAN PERATURAN PERMARKAHAN	:	
TARIKH	:	
COP SEKOLAH	:	

Peraturan Pemarkahan ini mengandungi 14 halaman bercetak.

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
1	$m = \frac{8-2}{3-6}$ K1 <u>Selesaikan untuk c</u> $2 = -2(6) + c$ @ setara K1 $xy = -2(x+y) + 14$ @ setara K1 $y = \frac{14-2x}{2+x}$ N1	4	4
2	<u>Guna $b^2 - 4ac = 0$</u> $(2q)^2 - 4(p+1)(3) = 0$ K1 $p = \frac{q^2-3}{3}$ @ $p = \frac{q^2}{3} - 1$ N1	2	2

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
3(a)	$\alpha \left(\frac{1}{\alpha} \right) = \frac{3m+2}{m} \quad \text{K1}$ $m = -1 \quad \text{N1}$	2	
(b)(i)	<u>Guna kaedah penyempurnaan kuasa dua</u> $f(x) = - \left[x^2 - 2px + \left(\frac{-2p}{2} \right)^2 - \left(\frac{-2p}{2} \right)^2 + 5p \right] \quad \text{K1}$ <u>Samakan dengan nilai maksimum 6</u> $p^2 - 5p = 6 \quad \text{K1}$ $p = 6, p = -1 \quad \text{N1}$	4	
(ii)	$f(x) = (x-6)^2 - 6 \quad @ \quad f(x) = x^2 - 12x + 30 \quad \text{N1}$		6

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
4(a)	Mencari kecerunan BC & guna $m_1 \times m_2 = -1$ K1 $m_{AB} \times \left(\frac{6-0}{0-3} \right) = -1$ $\frac{6-0}{0-x} = \frac{1}{2} \quad @ \quad \frac{0-y}{*-12-0} = -2$ K1 $A(-12,0) , D(0,-24)$ N1	3	
(b)	$\sqrt{(x-0)^2 + (y-0)^2} = 10$ @ setara K1 $x^2 + y^2 - 100 = 0$ N1	2	5
5(a)(i)	$k = 1$ N1	2	
(ii)	$h(x) = x+1 $ N1		
(b)(i)	$m = 3$ N1	2	
(ii)	$f(x) \geq 1$ N1		4

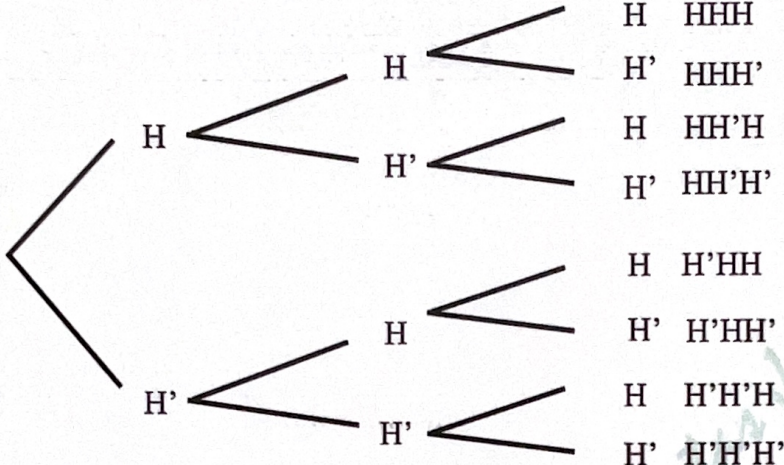
No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
6(a)	<u>Guna hukum segi tiga vektor</u> $\overline{OP} = \overline{OQ} + \overline{QP}$ K1 $P(-3, -4)$ N1	2	6
(b)	<u>Mencari magnitud</u> $\sqrt{(-3)^2 + (-4)^2}$ K1 boleh tersirat $\frac{-3i-4j}{5}$ @ $\frac{-3i}{5} - \frac{4j}{5}$ @ setara N1	2	
(c)	$\overline{RS} = \lambda \overline{PQ}$ K1 $k = \frac{25}{7}$ N1	2	
7(a)	$KD(p)$ @ $DK(p)$ dilihat K1 (i) $KD(p) = 0.85p - 20$ N1 (ii) $DK(p) = 0.85(p - 20)$ @ $DK(p) = 0.85p - 17$ N1	3	5
(b)	$*KD(1899) = 0.85(1899) - 20$ K1 RM 1 594.00 N1	2	

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
8(a)	Guna $S_n = T_1 + T_2 + T_3 + \dots + T_{n-1} + T_n$ & $T_n = a + (n-1)d$ K1 $S_{n1} = a + (a + d) + (a + 2d) + \dots + [a + (n-2)d] + [a + (n-1)d]$ @ $S_{n2} = [a + (n-1)d] + [a + (n-2)d] + \dots + (a + 2d) + (a + d) + a$ $S_{n1} + S_{n2}$ K1 $2S_n = [2a + (n-1)d] + [2a + (n-1)d] + \dots$ $S_n = \frac{n}{2} [2a + (n-1)d]$ N1	3	
(b)	$S_7 = \frac{7}{2} [2(400) + (7-1)(-8)]$ K1 $T_8 = 352 + 352$ or $T_7 = 400 + (7-1)(-8)$ K1 $S_7 + T_8$ K1 3 336 N1	4	
			7

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
9(a)	Bezakan $y = 2x^2 + x + 1$ terhadap x & Ganti $x = 2$ $\frac{dy}{dx} = 4(2) + 1$ K1 Guna $m_1 \times m_2 = -1$ $m = -\frac{1}{9}$ K1 Guna $y - y_1 = m(x - x_1)$ ATAU Guna $y = mx + c$ & selesaikan untuk c $y - 11 = -\frac{1}{9}(x - 2)$ $11 = -\frac{1}{9}(2) + c$ K1 $y = -\frac{1}{9}x + \frac{101}{9}$ N1	4	
(b)	Menyamakan persamaan $-\frac{1}{9}x + \frac{101}{9} = 2x^2 + x + 1$ K1 $\left(-\frac{23}{9}, 11\frac{41}{81}\right)$ @ setara N1	2	
			6

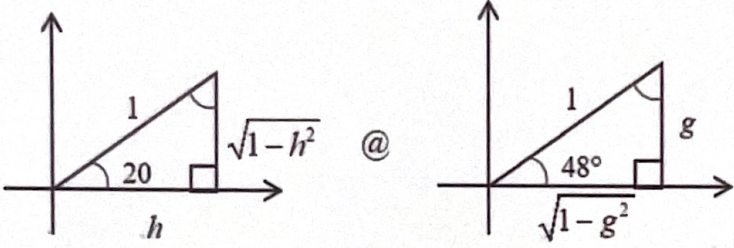
No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
10(a)(i)	$-1\frac{5}{12}$ N1	5	
(ii)	Guna $\int_a^b f(x)dx - \int_a^b g(x)dx$ $\int_0^1 3f(x)dx - \int_0^1 kdx = 12$ K1		
	Kamirkan $\int_0^1 kdx$ $3\int_0^1 f(x)dx - [kx]_0^1 = 12$ K1		
	Guna had $\int_0^1$ ke dalam hasil kamiran $3\left(1\frac{5}{12}\right) - [k(1) - k(0)] = 12$ K1		
	$k = -\frac{31}{4}$ N1		
(b)	$y = x^3 - 4x^2 + 5x$ N1	1	6

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
11(a)(i)	${}^5C_5 \times {}^7C_1 + {}^5C_4 \times {}^7C_2$ 112 N1 K1	4	
(ii)	${}^7C_4 \times {}^5C_2 + {}^7C_5 \times {}^5C_1 + {}^7C_6 \times {}^5C_0$ 462 N1 K1		
(b)	$\frac{6!}{2!4!} @ \frac{7!}{3!4!}$ K1 $\frac{6!}{2!4!} \times \frac{7!}{3!4!}$ K1	3	
	525 N1		7

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
12(a)(i)	 Rajah yang lengkap K1 Tunjukkan semua kesudahan N1	3	
(ii)	$X = \{0, 1, 2, 3\}$, boleh dibilang N1	3	
(b)	$q = 1 - p$ P1 $12p(1 - p) = \frac{5}{3}$ K1 $p = \frac{1}{6}$, $p = \frac{5}{6}$ N1		6

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
13(a)	<u>Menukar asas</u> $(3^{-2})^{y-1}, 3^4 @ 2^{3x}, 2^6$ dilihat K1 <u>Guna hukum indeks</u> $3^{4x-2y+2} = 3^4 @ 2^{3x-y} = 2^6$ K1 <u>Menyelesaikan *persamaan serentak</u> K1 $x = 5, y = 9$ N1	4	
(b)	$\tan \angle BAC = \frac{3+2\sqrt{5}}{2+3\sqrt{5}}$ P1 $* \left(\frac{3+2\sqrt{5}}{2+3\sqrt{5}} \right) \times \frac{2-3\sqrt{5}}{2-3\sqrt{5}} @$ setara K1 $\frac{6-9\sqrt{5}+4\sqrt{5}-30}{4-45} @ \frac{6-9\sqrt{5}+4\sqrt{5}-30}{4-45} @$ setara K1	4	8

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
	$\frac{24 + 5\sqrt{5}}{41} \quad \text{N1}$		
14(a)	$\frac{r}{\sin \theta} \text{ dilihat} \quad \text{K1}$	2	
	$R = r \left(1 + \frac{1}{\sin \theta} \right) \quad \text{N1}$		
(b)	$\text{Luas sektor} = \frac{1}{2} (3r)^2 \left(\frac{\pi}{3} \right) = \frac{3}{2} \pi r^2 \quad \text{K1}$	3	
	$\frac{\pi r^2}{\frac{3}{2} \pi r^2} \quad \text{K1}$		
	$\frac{2}{3} \quad \text{N1}$		
(c)	$\text{Panjang lengkok} = 5 \left(\frac{2\pi}{3} \right) @ \frac{5}{\tan 30^\circ} \quad \text{K1}$	3	
	$\frac{10\pi}{3} + 2(5\sqrt{3}) \quad \text{K1}$		
	$27.79\text{m} \quad \text{N1}$		8

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
15(a)	 $\sqrt{1-h^2}$ @ $\sqrt{1-g^2}$ @ gh K1 $\sqrt{(\sqrt{1-h^2})(\sqrt{1-g^2})} + gh$ N1	3	
(b)	$4 \cot^2 \theta - (1 + \cot^2 \theta) = 2$ @ $4(\operatorname{cosec}^2 \theta - 1) - \operatorname{cosec}^2 \theta = 2$ K1 $\tan^2 \theta = 1$ @ $\sin^2 \theta = \frac{1}{2}$ K1 $\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ$ N1	3	
(c)	$\frac{\sqrt{3}}{2} = 2 \cos^2 15^\circ - 1$ K1	2	8

No	Peraturan Pemarkahan	Sub Markah	Jumlah Markah
	$\cos 15^\circ = \frac{\sqrt{2+\sqrt{3}}}{2}$ N1		

PERATURAN PEMARKAHAN TAMAT

Untuk Kegunaan Pemeriksa Kertas Jawapan
(Guru SBD Sahaja)



PENTAKSIRAN DIAGNOSTIK AKADEMIK SEKOLAH BERASRAMA PENUH 2023

**PEPERIKSAAN PERCUBAAN SIJIL PELAJARAN MALAYSIA
MATEMATIK TAMBAHAN**

3472/2

Kertas 2

Oktober 2023

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN KERTAS 2

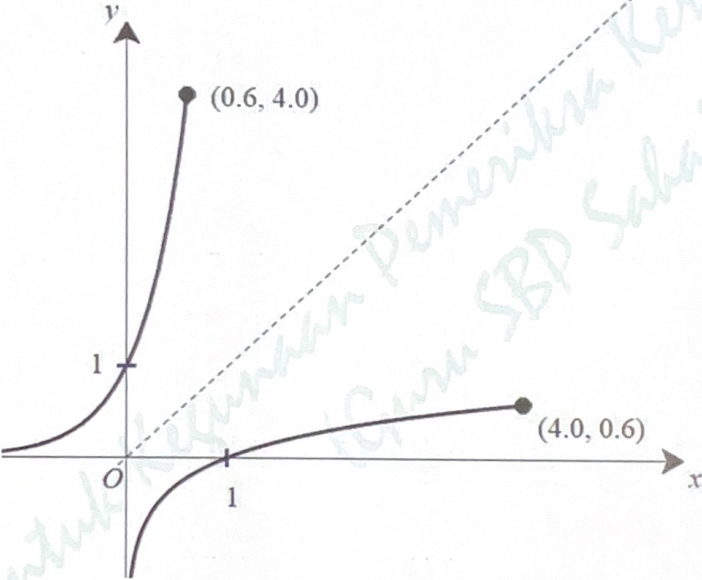
UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini **SULIT** dan **Hak Cipta Sekolah Berasrama Penuh**. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa. Peraturan pemarkahan ini tidak boleh dikeluarkan dalam apa-apa jua bentuk penulisan dan percetakan.

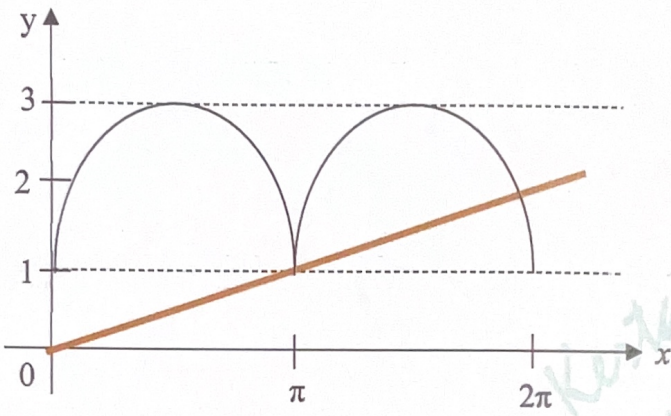
NAMA PEMERIKSA	:	
NAMA SEKOLAH	:	
TANDA TANGAN PENERIMAAN PERATURAN PERMARKAHAN	:	
TARIKH	:	
COP SEKOLAH	:	

Peraturan Pemarkahan ini mengandungi **16** halaman bercetak.

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
1	$A + B + C = 140$ $3A + 5B + 6C = 630$ $2.5A + 4B + 5C = 515$ P2, P1, P0 Hapus anu pertama dengan penggantian atau penghapusan K1 Hapus anu kedua dengan penggantian atau penghapusan K1 $A = 60, B = 30, C = 50$ N1, N1, N1	7	7
2(a)(i)	 Bersimetri pada $y = x$ dan melalui titik $(1,0)$ P1	2	
(a)(ii)	$y = \log_a x$ ialah fungsi songsang bagi $y = a^x$ N1		

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
(b)(i)	<u>Tukar asas</u> $\frac{\log x^2}{\log 9} \quad \text{K1}$ <u>Guna hukum kuasa</u> $\frac{2 \log x}{2} \quad \text{K1}$ $\log_3 \frac{(3x-1)}{x} \quad \text{N1}$	5	
(b)(ii)	<u>Menyelesaikan persamaan</u> $* \left(\frac{3x-1}{x} \right) = \frac{1}{3} \quad \text{K1}$ $\frac{3}{8} \quad \text{N1}$		
			7

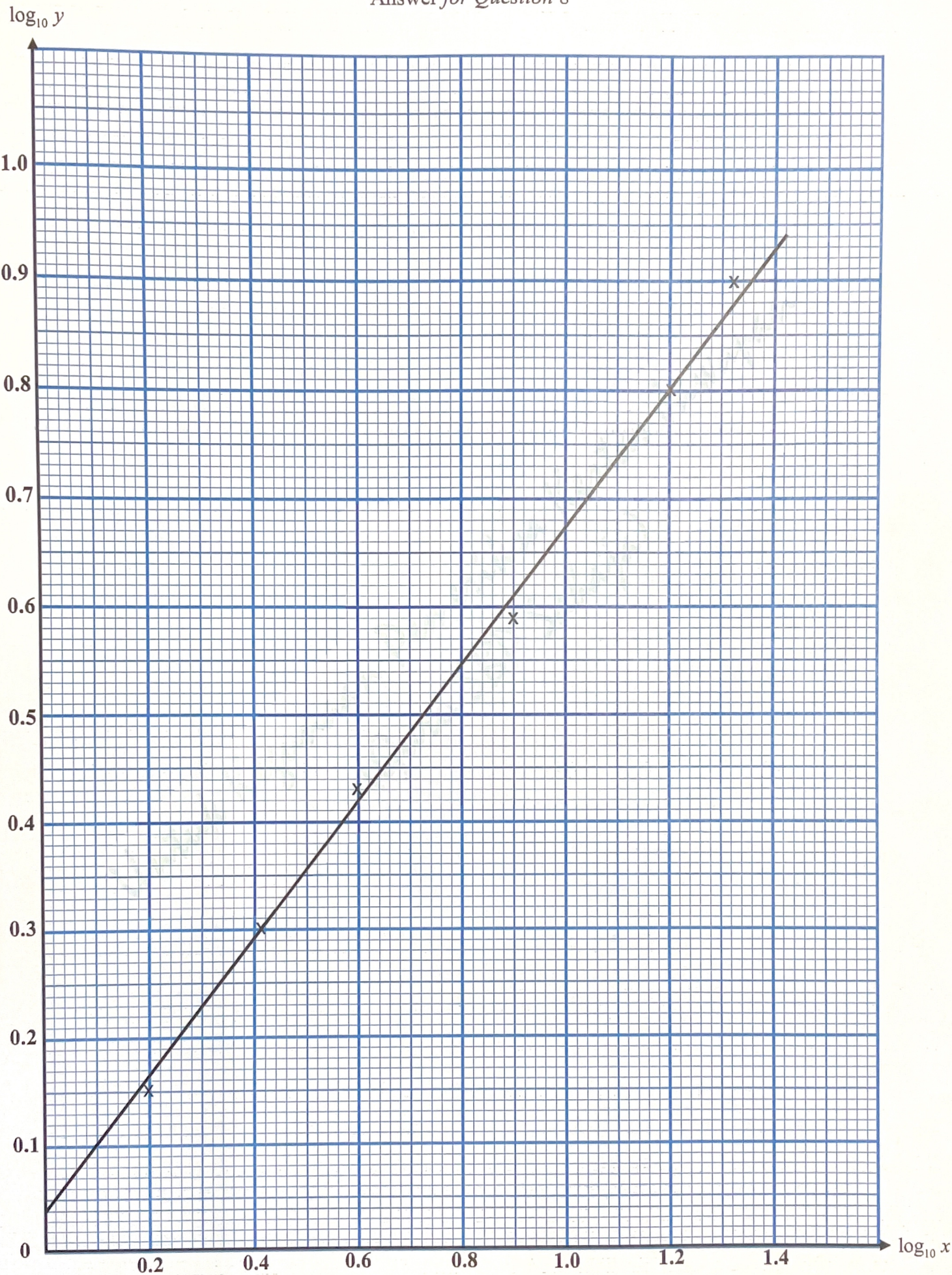
No	Skema Pemarkahan	Sub Markah	Jumlah Markah
3(a)	<u>Tulis hukum segi tiga</u> $\overline{PT} = \overline{PR} + \overline{RT} \quad @ \quad \overline{RU} = \overline{RP} + \overline{PU} \quad \text{P1}$ $\overline{PT} = x + \frac{4}{5}(y-x) \quad @ \quad \overline{RU} = -x + 2\left(\frac{x}{5} + \frac{4y}{5}\right) \quad \text{K1}$ $\overline{PT} = \frac{x}{5} + \frac{4y}{5} \quad \text{N1}$ $\overline{RU} = -\frac{3x}{5} + \frac{8y}{5} \quad \text{N1}$	4	
(b)	$\overline{RQ} = -\frac{3kx}{5} + \frac{8ky}{5} \quad @ \quad \overline{RQ} = -x + hy \quad \text{N1}$ Banding *pekali bagi x dan y $-1 = -\frac{3k}{5} \quad @ \quad h = \frac{8k}{5} \quad \text{K1}$ $k = \frac{5}{3} \quad \text{dan} \quad h = \frac{8}{3} \quad \text{N1}$	3	
4(a)(i)	$f(x) = a\left(x - \frac{7}{2}\right)^2 + \frac{15}{2} \quad \text{K1}$ $10 = a\left(0 - \frac{7}{2}\right)^2 + \frac{15}{2} \quad \text{K1}$ $f(x) = \frac{10}{49}\left(x - \frac{7}{2}\right)^2 + \frac{15}{2} \quad \text{N1}$	3	
(a)(ii)	$f(x) = \frac{10}{49}\left(6 - \frac{7}{2}\right)^2 + \frac{15}{2} \quad \text{K1}$ 8.776 N1 paksi simetri $@ \quad x = \frac{7}{2} \quad \text{N1}$	3	
			7
			6

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
5(a)(i)	$\frac{1 - (1 - 2\sin^2 x) - 2\sin x \cos x}{\cos x - \sin x}$ $1 - 2\sin^2 x$ @ $2\sin x \cos x$ (dilihat) K1 $2\sin x$ N1	2	
(b)(i)	 Bentuk graf sin N1 1 kitaran N1 Amplitud (maks 3, min 1) N1 Mutlak dan anjakan 1 unit ke atas N1 $y = \frac{x}{\pi}$ N1 Lakar garis lurus $y = \frac{x}{\pi}$ N1 Bilangan penyelesaian = 2 N1	4	
6(a)	$ar + ar^2 = 30$ OR $ar = a - 9$ K1 Selesaikan persamaan serentak K1 $r = \frac{2}{3}$ N1 $a = 27$ N1	3	9
(b)	$27\left(\frac{2}{3}\right)^{n-1} = \frac{150}{81}$ K1 $n = 6.61$ N1 Bukan integer N1	3	7

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
7(a)	Kaedah 1 <u>Kamir dengan had yang betul</u> $\left[\frac{(y-4)^3}{3(1)} \right]_4 \quad \text{K1}$ Guna had yang betul @ Cari luas segi tiga $\frac{1}{3}[(6-4)^3 - (4-4)^3] \quad @ \quad \frac{1}{2}(22-6)(4) \quad \text{K1}$ $\left(\frac{1}{3}[(6-4)^3 - (4-4)^3] \right) + \left(\frac{1}{2}(22-6)(4) \right) \quad \text{K1}$ $34\frac{2}{3} \text{ unit}^2 \quad \text{N1}$ Kaedah 2 <u>Kamir dengan had yang betul</u> $\left[\frac{\frac{3}{2}x^2}{\frac{3}{2}} + 4x \right]_0^4 \quad \text{K1}$ Guna had yang betul @ Cari luas trapezium $\left[\frac{(4)^{\frac{3}{2}}}{\frac{3}{2}} + 4(4) \right] - 0 \quad @ \quad \frac{1}{2}(4)(6+22) \quad \text{K1}$ $\left(\left[\frac{(4)^{\frac{3}{2}}}{\frac{3}{2}} + 4(4) \right] - 0 \right) - \left(\frac{1}{2}(4)(6+22) \right) \quad \text{K1}$ $34\frac{2}{3} \text{ unit}^2 \quad \text{N1}$	4	
(b)	Kamirkan $\int \pi((y-4)^2)^2 dy$ $V = \pi \left(\frac{(y-4)^5}{5(1)} \right) \quad \text{K1}$ Guna had $\int_4^6$ ke dalam *V $V = \pi \left[\frac{(6-4)^5}{5} - \frac{(4-4)^5}{5} \right] \quad \text{K1}$ $\frac{32}{5}\pi \quad \text{N1}$	3	
			7

No	Skema Pemarkahan	Sub Markah	Jumlah Markah																
8(a)	<table><tr><td>$\log_{10} x$</td><td>0.20</td><td>0.41</td><td>0.60</td><td>0.90</td><td>1.20</td><td>1.32</td><td>N1</td></tr><tr><td>$\log_{10} y$</td><td>0.15</td><td>0.30</td><td>0.43</td><td>0.59</td><td>0.80</td><td>0.90</td><td>N1</td></tr></table> Paksi betul dan skala seragam bagi garis lurus K1 Semua titik diplot betul N1 Garis lurus penyuaian terbaik N1	$\log_{10} x$	0.20	0.41	0.60	0.90	1.20	1.32	N1	$\log_{10} y$	0.15	0.30	0.43	0.59	0.80	0.90	N1	5	
$\log_{10} x$	0.20	0.41	0.60	0.90	1.20	1.32	N1												
$\log_{10} y$	0.15	0.30	0.43	0.59	0.80	0.90	N1												
(b)	$\log_{10} y = -\frac{1}{r} \log_{10} x + \log_{10} s$ P1	5																	
(i)	Guna $*m = -\frac{1}{r}$ $-\frac{1}{r} = \frac{0.80 - 0.30}{1.20 - 0.41}$ K1 $r = -1.58$ N1																		
(ii)	Guna $*c = \log_{10} s$ Syarat: $0.03 \leq c \leq 0.04$ $\log_{10} s = 0.04$ K1 $s = 1.096$ N1																		
			10																

Jawapan untuk Soalan 8
Answer for Question 8



No	Skema Pemarkahan	Sub Markah	Jumlah Markah
9(a)(i)	$y - (-2) = -1(x - 0)$ @ $-2 = -1(0) + c$ & selesaikan untuk c K1 $y = -x - 2$ N1	2	
(a)(ii)	<u>Mencari kecerunan PQ & guna $m_1 \times m_2 = -1$</u> $m \times \left(\frac{-1 - (-2)}{3 - 0} \right) = -1$ K1 $y - 3 = * - 3(x - (-1))$ @ $-3 = * - 3(-1) + c$ & selesaikan untuk c K1 $y = -3x$ N1	3	
(b)	$\left(\frac{m-1}{2}, \frac{3+n}{2} \right)$ N1	1	
(c)	<u>Guna rumus luas segi tiga</u> $\frac{1}{2} (-1(-1) + 3(-2) + 0(3)) - (3(3) + (-1)(0) + (-2)(-1)) $ K1 8 N1 $4 * (8)$ N1 32 N1	4	
			10

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
10(a)	$2x = 100 - 6y - 2\pi y$ P1 $\pi y^2 + 2y(100 - 6y - 2\pi y)$ K1 $y(200 - 3\pi y - 12y)$ N1	3	
(b)	$\frac{dL}{dy} = 200 - 24y - 6\pi y$ dan $200 - 24y - 6\pi y = 0$ K1 $y = 4.667$ N1 $L = 200(4.667) - 12(4.667)^2 - 3\pi(4.667)$ K1 466.72 N1	4	
(c)	$\frac{dL}{dt} = (200 - 24y - 6\pi y) \times 0.7$ K1 $(200 - 24(12) - 6\pi(12)) \times 0.7$ K1 -219.96 N1	3	
			10

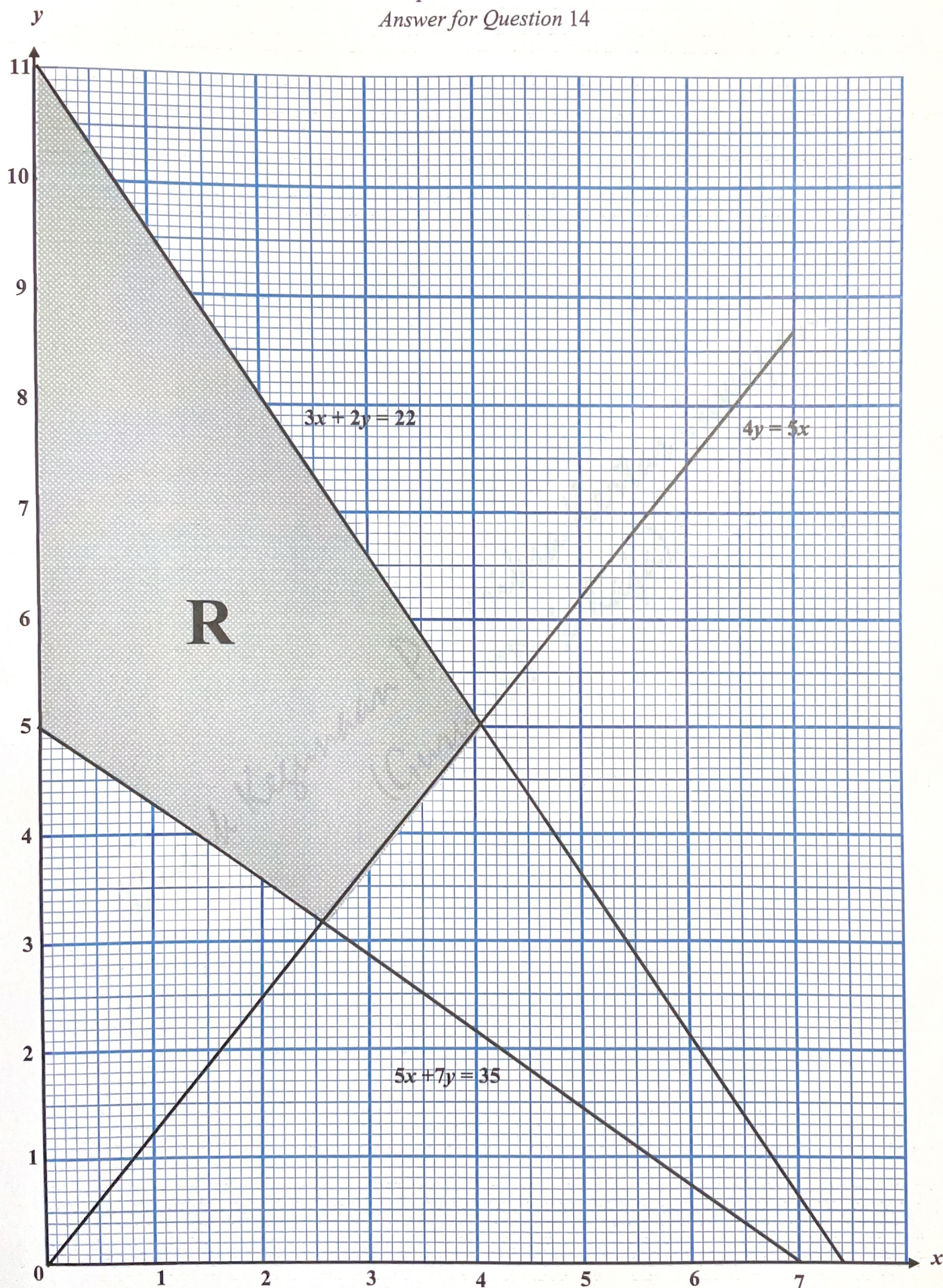
No	Skema Pemarkahan	Sub Markah	Jumlah Markah
11(a)	${}^5C_5(0.9452)^5(0.0548)^0$ K1 0.7544 N1	2	
(b)	$P(X > 2) = P(X = 3) + P(X = 4)$ K1 ${}^4C_3(0.7544)^3(0.2456)^1 @ {}^4C_4(0.7544)^4(0.2456)^0$ K1 0.7457 // 0.7456 N1	3	
(c)(i)	$P(Z < \frac{2-1.2}{\sigma}) = 0.9452 @ P(Z > \frac{0.8}{\sigma}) = 0.0548$ K1 $\frac{2-1.2}{\sigma} = 1.60$ N1 $\sigma = 0.5$ N1	3	
(c)(ii)	$P(Z > \frac{1.5-1.2}{0.5})$ K1 0.2743 N1	2	
			10

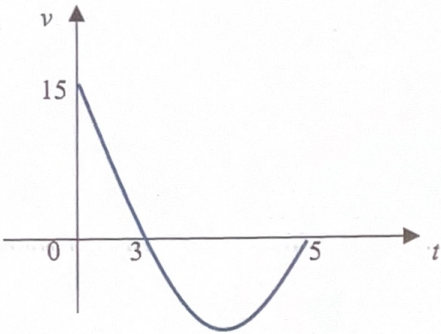
No	Skema Pemarkahan	Sub Markah	Jumlah Markah
12(a)	$x = \frac{6}{4.80} \times 100$ @ $109 = \frac{3}{y} \times 100$ K1 $x = 125$ N1 $y = 2.75$ N1	3	
(b)	$\frac{125(150) + 109(150) + 105(100) + 120(m)}{150 + 150 + 100 + m}$ K1 $\frac{125(150) + 109(150) + 105(100) + 120(m)}{150 + 150 + 100 + m} = 116$ K1 $m = 200$ N1	3	
(c)	$\frac{116}{100} \times 116$ @ $\frac{Q_{22}}{11} \times 100 = 116$ K1 $\frac{x}{11} \times 100 = 134.56$ @ $\frac{116 \times 12.76}{100}$ K1 14.80 N1 14.80×1.25 18.50 N1	4	
			10

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
13(a)	$(\sqrt{m})^2 = (21)^2 + (19.5)^2 - 2(21)(19.5)\cos 64$ K1 462.22 N1	2	
(b)	$\frac{\sin \angle RSQ}{19.5} = \frac{\sin 64}{21.50}$ K1 54.61 N1	2	
(c)	$ST^2 = 12^2 + 5^2$ @ $QT^2 = 10^2 + 5^2$ K1 Kaedah 1 <u>Guna rumus luas</u> $\sqrt{462.22} = (13)^2 + (11.18)^2 - 2(13)(11.18)\cos \angle STQ$ K1 $\frac{1}{2}(13)(11.18)\sin 125.37$ K1 59.26 N1 Kaedah 2 <u>Guna rumus Heron</u> $s = \frac{13 + 11.18 + 21.50}{2}$ P1 $\sqrt{(22.84*)(22.84*-13)(22.84*-11.18)(22.84*-21.50)}$ K1 59.26 N1	4	
(d)	$\frac{1}{2}(h)(21.50) = 59.26$ K1 5.513 N1	2	
			10

No	Skema Pemarkahan	Sub Markah	Jumlah Markah
14(a)	$I : 45x + 30y \leq 330$ N1 $II : 50x + 70y \geq 350$ N1 $III: y \geq \frac{5}{4}x$ N1	3	
(b)	Lukis sekurang-kurangnya satu garis lurus dengan betul K1 Lukis semua garis lurus dengan betul N1 Lorek rantau dengan betul N1	3	
(c)(i)	$4 \leq y \leq 6$ N1	1	
(c)(ii)	$(4,5)$ P1 $16(4) + 10(5)$ K1 RM114 N1	3	
			10

Jawapan untuk Soalan 14
Answer for Question 14



No	Skema Pemarkahan	Sub Markah	Jumlah Markah
15(a)(i)	Ganti dan samakan dengan 4 $2(6) - p = 4$ K1 $p = 8$ N1	2	
(a)(ii)	$(t - 3)(t - 5) = 0$ K1 $t = 3 \quad t = 5$ N1	2	
(b)	 Bentuk N1 Titik persilangan $(0,15), (3,0)$ dan $(5,0)$ N1 <u>Kamir dengan had yang betul</u> $\int_0^3 t^2 - 8t + 15 \, dt$ @ $\int_3^5 t^2 - 8t + 15 \, dt$ K1 $\left[\frac{t^3}{3} - \frac{8t^2}{2} + 15t \right]_0^3$ @ $\left[\frac{t^3}{3} - \frac{8t^2}{2} + 15t \right]_3^5$ <u>Guna nilai had yang betul</u> $\left[\frac{(3)^3}{3} - \frac{8(3)^2}{2} + 15(3) \right] - \left[\frac{(0)^3}{3} - \frac{8(0)^2}{2} + 15(0) \right]$ @ $\left[\frac{(5)^3}{3} - \frac{8(5)^2}{2} + 15(5) \right] - \left[\frac{(3)^3}{3} - \frac{8(3)^2}{2} + 15(3) \right]$ K1 $18 + \left -\frac{4}{3} \right $ K1 $\frac{58}{3}$ N1	6	

PERATURAN PEMARKAHAN TAMAT



MODUL PINTAS
TINGKATAN 5

3472/1

MATEMATIK TAMBAHAN
Kertas 1

2 jam

Dua jam

SKEMA JAWAPAN
MATEMATIK TAMBAHAN KI
3472/1

NO SOALAN			JAWAPAN	MARKAH	
BAHAGIAN A					
1	(a)		(1,3)	N1	
	(b)		Guna $y - y_1 = m(x - x_1)$ $g: x \rightarrow 2x - 5$	K1 N1	
					3
2	(a)		$f(n) = (5.30 - 4.50)n - 120$ $f(n) = 0.8n - 120$	K1 N1	
	(b)		$0.8n - 120 = 0$ 150	K1 N1	
					4
3	(a)		Tukar 6^{k+2} kepada $6^k(6^2)$ atau 6^{k+1} kepada $6^k(6^1)$ $6^k(6^2 + 6 - 18)$ $6^k(24)$	K1 K1 N1	
	(b)		Alternatif 1: Gunakan mana-mana hukum log dengan betul $\frac{\log_5 t}{\log_5 25} @ \log_{25} s^2 - \log_{25} t - \log_{25} 5 @ \log_5 s @$ $\log_5 t @ \frac{\log_5 5}{\log_5 25} @ \frac{\log_5 s^2}{\log_5 25}$ Tukar asas $-\frac{\log_5 5}{\log_5 25} + \frac{2 \log_5 s}{\log_5 25} - \frac{\log_5 t}{\log_5 25}$ $-\frac{1}{2} + a - \frac{b}{2}$ atau $\frac{2a-1-b}{2}$ Alternatif 2: Tukar kepada bentuk log $a = \log_5 s, b = \log_5 t$ $\log_{25} \frac{s^2}{5t}$ $2\log_{25} s - \log_{25} 5t$ $2\left(\frac{\log_5 s}{\log_5 5^2}\right) - \frac{\log_5 5 + \log_5 t}{\log_5 5^2}$ $\frac{2a - 1 - b}{2}$	K1 K1 N1 K1 N1	
					6
4	(a)	(i)	$\frac{8!}{2(8)} @ \frac{(8-1)!}{2}$ 2520	K1 N1	
		(ii)	$\frac{{}^8P_5}{2(5)}$ 672	K1 N1	

NO SOALAN			JAWAPAN	MARKAH	
	(b)		${}^6C_3 \times {}^8C_3 \times {}^3C_2$ 3360	K1 N1	
					6
5	(a)		$(3, -4)$	N1	
	(b)		$x = 5$	N1	
	(c)		$m = 3$ $1 - n = 4$ $n = -3$	N1 K1 N1	
					5
6			$2SD = 3DG$ $\frac{SD}{DG} = \frac{3}{2}$ $D = \left(\frac{1(12) + 2(3)}{1 + 2}, \frac{1(7) + 2(1)}{1 + 2} \right)$ $(6, 3)$ $SD = \sqrt{(6 - 3)^2 + (3 - 1)^2}$ $\sqrt{13}$ atau 3.6055	K1 N1 K1 N1	
					4
7			$\mu = 5.5, \sigma = 2$ $P(1 < x < 3)$ $P\left(\frac{1 - 5.5}{2} < Z < \frac{3 - 5.5}{2}\right)$ $P(-2.25 < Z < -1.25)$ $P(Z < -1.25) - P(Z < -2.25)$ $P(Z > 1.25) - P(Z > 2.25)$ $0.1056 - 0.0122$ 0.0934	K1 K1 N1	
					3
8			$x^2y = -2x + p$ $p = 4$ $\frac{y}{x} = \frac{p}{x^3} - 2$ $q = -2$	P1 N1 P1 N1	
					4
9	(a)		Bezakan menggunakan petua hasil bahagi $\frac{dy}{dx} = \frac{3(4x-1)-4(3x+2)}{(4x-1)^2}$ atau $p = 3(4x - 1) - 4(3x + 2)$ -11	K1 N1	
	(b)	(i)	$-\frac{k}{5}$	N1	
		(ii)	$k - \left[\frac{kx^2}{2} \right]_1^3 = 3$ -1	K1 N1	
	(c)		$\left[\frac{6k^3}{3} \right]_0^3 = 54$	K1	

NO SOALAN			JAWAPAN	MARKAH	
	(b)		$21 = (1.1 + x)0.7071$; x merujuk pada $UW @ SV$ $21 + \frac{21}{27} + 2(29.7 - 1.1)$ 78.98	K1 K1 N1	
	(c)		$21 = ST (0.7071)$ $ST = 29.7 \text{ m}$ $A = \frac{1}{2}(29.7)^2(0.7071) - \frac{1}{2}(1.1)^2(0.7071)$ 311.44	K1 K1 N1	
					8
BAHAGIAN B					
13	(a)	(i)	Guna petua rantai $\frac{dL}{dt} = 4 - 2t, \frac{dx}{dt} = 6$ $\frac{dL}{dx} = (4 - 2t) \left(\frac{1}{6} \right)$ $\frac{2 - t}{3}$	K1 K1 N1	
		(ii)	$-\frac{2}{3}$	N1	
	(b)		$\frac{\delta L}{L} \times 100\%, \delta x = 0.1$ Apabila $x = 9, 9 = 3 + 6t$ $t = 1, L = 3$ Gunakan $\frac{dL}{dx} \approx \frac{\delta L}{\delta x}$ $\delta L = \frac{1}{3}$ $\frac{1/3}{3} \times 100\%$ 11.11%	P1 K1 K1 N1	
					8
14	(a)		<u>Guna rumus sudut majmuk</u> $\frac{\cos(x - y) - \cos(x + y)}{\sin(x - y) + \sin(x + y)}$ $\frac{\cos x \cos y + \sin x \sin y - [\cos x \cos y - \sin x \sin y]}{\sin x \cos y - \cos x \sin y + \sin x \cos y + \cos x \sin y}$ Guna rumus $\cos(x - y) @ \cos(x + y) @ \sin(x - y) @ \sin(x + y)$ dengan betul $\frac{2 \sin x \sin y}{2 \sin x \cos y}$ $\tan y$	P1 P1 K1 N1	
	(b)	(i)	$b = 2$ $c = 3$	P1 P1	
		(ii)	Menggantikan nilai x dan y dari koordinat $\left(\frac{\pi}{8}, 7\right)$ ke dalam persamaan $y = a \tan bx + c$. $a = 4$	K1 N1	
					8

NO SOALAN			JAWAPAN	MARKAH	
15	(a)		$4\sqrt{3} - 2(3) + 4 - 2\sqrt{3}$ $2\sqrt{3} - 2$	K1 N1	
	(b)	(i)	30	P1	
		(ii)	$30\left(\frac{4}{5}\right)^t = 15.36$ $t \log_{10}\left(\frac{4}{5}\right) = \log_{10}\left(\frac{15.36}{30}\right)$ $t = \frac{\log \frac{15.36}{30}}{\log \frac{4}{5}}$ $t = 3$	K1 N1	
		(iii)	$30\left(\frac{4}{5}\right)^t < 5$ $t \log_{10} 0.8 < \log_{10} \frac{1}{6}$ $t > 8.0296$ $t = 9$	K1 K1 N1	
					8



**MODUL PINTAS
TINGKATAN5**

3472/1

**MATEMATIK TAMBAHAN
Kertas 1**

2 jam

Dua jam

**SKEMA JAWAPAN
MATEMATIK TAMBAHAN KI
3472/1
(ERATA JAWAPAN
SOALAN 5c & 13b)**

NO SOALAN			JAWAPAN	MARKAH	
5	(c)		$m = 3$ $1 - n = -4$ $n = 5$	N1 K1 N1	
13	(b)		$\frac{\delta x}{9} \times 100\% = 10\%$ $\delta x = 0.9$ Gunakan $\frac{dL}{dx} \approx \frac{\delta L}{\delta x}$ $\delta L = 0.3$ $\frac{0.3}{3} \times 100\%$ 10%	K1 K1 K1 N1	



**MODUL PINTAS
TINGKATAN 5**

3472/2

**MATEMATIK TAMBAHAN
Kertas 2**

$2\frac{1}{2}$ jam

Dua jam tiga puluh minit

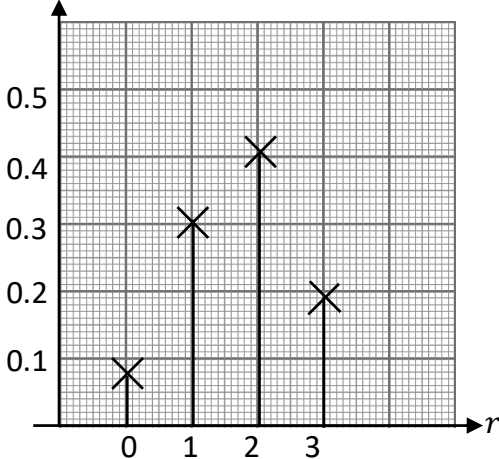
**PERATURAN PEMARKAHAN
MATEMATIK TAMBAHAN K2
3472/2**

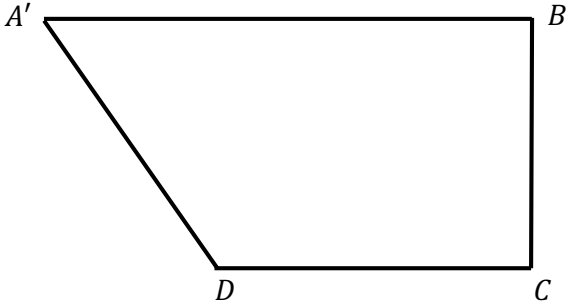
NO SOALAN		JAWAPAN	MARKAH	
BAHAGIAN A				
1		Katakan harga lukisan $X = x, Y = y$ dan $Z = z$. $x + y + z = 1240$ $0.1x + 0.2y + 0.3z = 276$ $z = 2x$ *Hapus anu pertama dengan penggantian @ penghapusan $3x + 3y + 3z = 3720$ $-(x + 2y + 3z) = 960$ $2x + y = 960$ *Hapus anu kedua dengan penggantian @ penghapusan $4x + 2y = 1920$ $-(7x + 2y) = 2760$ $-3x = -840$ $x = 280 @ y = 400 @ z = 560$ $x = 280, y = 400, z = 560$ *kaedah setara yang betul	N1 N1 N1 K1 K1 N1 N1	
2	(a)	Guna $\cos(A + A) = \cos A \cos A - \sin A \sin A \text{ \&}$ $\cos 2A = \cos^2 A - \sin^2 A$	K1 N1	7
	(b)	Bentuk graf kosinus Mak: 1, Min: 0 Anjakan $\frac{1}{2}$ unit ke atas $y = \frac{x}{270^\circ}$	P1 P1 P1 K1 K1	

NO SOALAN			JAWAPAN	MARKAH	
			Lihat Garis Lurus $y = \frac{x}{270^\circ}$ Bilangan Penyelesaian: 3	N1	
					8
3	(a)		$\frac{64x^8y^6}{16x^5y}$ $4x^3y^5$	K1 N1	
	(b)		$2^{4x-1} = 2^4$ $4x - 1 = 4$ $x = \frac{5}{4}$	K1 K1 N1	
					5
4	(a)	(i)	$\left(\frac{3x+11}{1+3}, \frac{3y+10}{1+3}\right) = (2,4)$ $\frac{3x+11}{4} = 2$ atau $\frac{3y+10}{1+3} = 4$ $x = -1$ $y = 2$ $A(-1,2)$	K1 N1	
		(ii)	$\frac{1}{2} \begin{vmatrix} 0 & 15 & 14 & -5 & 0 \\ 0 & 1 & 18 & 3 & 0 \end{vmatrix}$ $\frac{1}{2} ((0)(1) + (15)(18) + (14)(3) + (-5)(0)) - ((15)(0) + (14)(1) + (-5)(18) + (0)(3)) $ $\frac{1}{2} 388 $ 194	K2 N1	
	(b)		$\sqrt{(x-11)^2 + (y-10)^2} = 3$ $(x-11)^2 + (y-10)^2 = 9$ $x^2 + y^2 - 22x - 20y + 212 = 0$	K1 N1	
					7
5	(a)		<u>Bezakan s terhadap t</u> $\frac{ds}{dt} = t^2 - 6t + 8$ Ganti $t = 2.4$ ke dalam pembezaan $(2.4)^2 - 6(2.4) + 8$ $-0.64 // -\frac{16}{25}$	K1 N1	
	(b)		$\frac{ds}{dt} = 0$ Selesaikan persamaan kuadratik secara pemfaktoran atau formula $t^2 - 6t + 8 = 0$ $t = 2,4$ Gantikan $t = 2, 4$ ke dalam s $s = \frac{38}{3} @ \frac{124}{3}$ Kedudukan paling rendah $\frac{38}{3}$ & Puncak bukit $\frac{124}{3}$	K1 K1 N1	
	(c)		<u>Bezakan $\frac{ds}{dt}$ terhadap t</u> $\frac{d^2s}{dt^2} = 2t - 6$ Apabila $t = 2$, $\frac{d^2s}{dt^2} = -2 < 0$ & Apabila $t = 4$, $\frac{d^2s}{dt^2} = 2 > 0$	K1 K1	

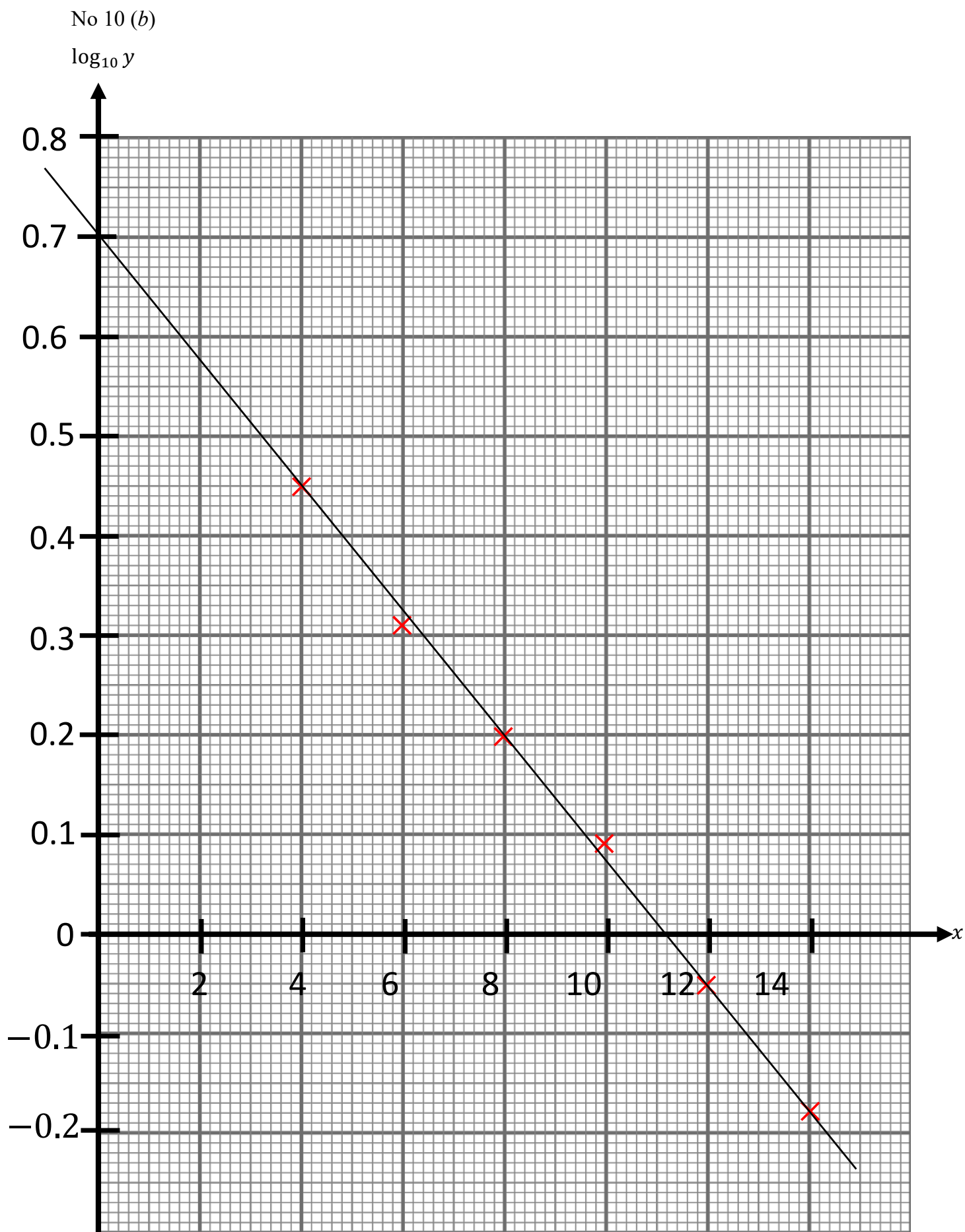
NO SOALAN			JAWAPAN	MARKAH	
			$\frac{38}{3}$ kedudukan maksimum	N1	
			$\frac{124}{3}$ kedudukan minimum	N1	
					9
6	(a)		Guna ar^{n-1} $T_5 = 4T_3$ $ar^4 = 4ar^2$ $\frac{r^4}{r^2} = 4$ $r = \pm 2$ $\therefore r = 2$	K1 N1	
	(b)	(i)	Guna $S_n = \frac{a(r^n-1)}{r-1}$ $\frac{3(2^n-1)}{2-1} = 1533$ Selesaikan $2^n = 2^9$ $n = 9$	K1 K1 N1	
		(ii)	Guna $T_n = ar^8$ $T_9 = (3)(2)^8$ RM768.00	K1 N1	
					7
7	(a)		Luas segi empat tepat – Luas segi empat sama $3y(2y) - y^2 \geq y^2 + 4$ Selesaikan ketaksamaan kuadratik secara kaedah lakaran graf / jadual / garis nombor $y \leq -1$ atau $y \geq 1$ $\therefore y \geq 1$ ($y > 0$, panjang)	K1 K1 K1 N1	
	(b)		$2x^2 + 6x - 3 = 0$ $\alpha + \beta = \frac{-6}{2}$ & $\alpha\beta = \frac{-3}{2}$ Guna $\alpha + \beta$ & $\alpha\beta$ ke dalam $\alpha^2 + \beta^2$ $\alpha^2 + \beta^2 = (-3)^2 - 2\left(\frac{-3}{2}\right)$ 12	K1 K1 N1	
					7
BAHAGIAN B					
8	(a)	(i)	Guna hukum segi tiga vector untuk mencari $\overrightarrow{AB}$ @ $\overrightarrow{AC}$ $\overrightarrow{AB} = -3\underline{i} + 2\underline{j} // \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\overrightarrow{AC} = -7\underline{i} + 5\underline{j} // \begin{pmatrix} -7 \\ 5 \end{pmatrix}$	K1 N1 N1	
		(ii)	$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$ $\overrightarrow{BC} = (3\underline{i} - 2\underline{j}) + (-7\underline{i} + 5\underline{j})$ $\overrightarrow{BC} = -4\underline{i} + 3\underline{j}$ $ \overrightarrow{BC} = \sqrt{(-4)^2 + (3)^2} = 5$ Vektor unit dalam arah $\overrightarrow{BC}$ $= \frac{-4\underline{i} + 3\underline{j}}{5} // \frac{1}{5}(-4\underline{i} + 3\underline{j})$ atau setara	K1 N1 K1 N1	

NO SOALAN		JAWAPAN	MARKAH	
	(b)	$\overrightarrow{AD} \parallel \overrightarrow{BC}$ $\overrightarrow{AD} = \lambda \overrightarrow{BC}$ Banding pekali bagi $\underline{i}$ dan $\underline{j}$ $k\underline{i} - 15\underline{j} = \lambda(-4\underline{i} + 3\underline{j})$ $3\lambda = -15$ dan $k = -4\lambda$ Selesaikan persamaan linear λ dan k $\lambda = -5$, $k = 20$	K1 K1 N1	
				10
9	(a)	$X = \{0, 1, 2, 3\}$	P1	
	(b)	Lukis dengan betul sekurang-kurangnya 1 dahan betul Lukis semua dengan betul <u>Kesudahan</u> $X = r$ $\frac{4}{7}$ P $\frac{4}{7}$ P {PPP} 0 $\frac{4}{7}$ P $\frac{3}{7}$ Q $\frac{4}{7}$ P {PPQ} 1 $\frac{4}{7}$ P $\frac{3}{7}$ Q $\frac{3}{7}$ Q {PQP} 1 $\frac{4}{7}$ P $\frac{3}{7}$ Q $\frac{3}{7}$ Q {PQQ} 2 $\frac{3}{7}$ Q $\frac{4}{7}$ P $\frac{4}{7}$ P {QPP} 1 $\frac{3}{7}$ Q $\frac{4}{7}$ P $\frac{3}{7}$ Q {QPQ} 2 $\frac{3}{7}$ Q $\frac{3}{7}$ Q $\frac{4}{7}$ P {QQP} 2 $\frac{3}{7}$ Q $\frac{3}{7}$ Q $\frac{3}{7}$ Q {QQQ} 3	K1 N1	
		Senaraikan semua kesudahan dengan betul Senaraikan semua $X = r$	P1 P1	
	(c)	Dilihat $P = \frac{4}{7}$ dan $Q = \frac{3}{7}$ Mencari sekurang-kurangnya 1 kebarangkalian kesudahan dengan betul Senaraikan semua kesudahan kebarangkalian dengan betul $P(X = 0) \rightarrow \frac{3}{7} \times \frac{3}{7} \times \frac{3}{7} = \frac{27}{343} // 0.08$ $P(X = 1) \rightarrow 3 \left(\frac{3}{7} \times \frac{4}{7} \times \frac{3}{7} \right) = \frac{108}{343} // 0.31$ $P(X = 2) \rightarrow 3 \left(\frac{3}{7} \times \frac{4}{7} \times \frac{4}{7} \right) = \frac{144}{343} // 0.42$ $P(X = 3) \rightarrow \frac{4}{7} \times \frac{4}{7} \times \frac{4}{7} = \frac{64}{343} // 0.19$	P1 K1 N1	
			K1	

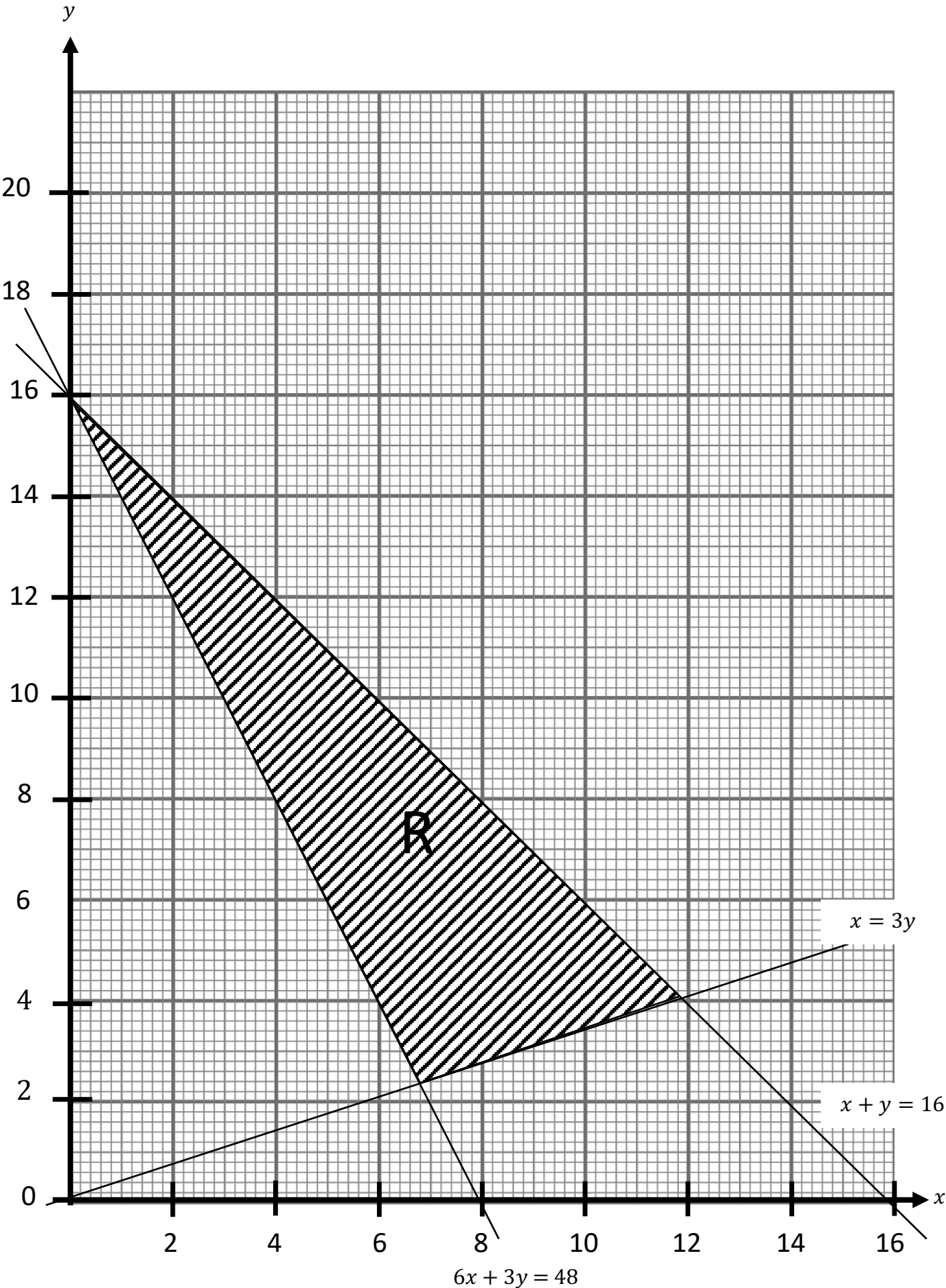
NO SOALAN			JAWAPAN	MARKAH								
			Lukis dengan betul sekurang-kurangnya 1 betul Lukis semua dengan betul $P(X = r)$ 	N1								
					10							
10	(a)		<table border="1"><tr><td>y</td><td>2.82</td><td>2.04</td><td>1.58</td><td>1.23</td><td>0.89</td><td>0.66</td></tr></table>	y	2.82	2.04	1.58	1.23	0.89	0.66	P1	
y	2.82	2.04	1.58	1.23	0.89	0.66						
	(b)	Graf garis lurus $\log_{10} y$ melawan x dilukis - Paksi-paksi betul dan skala seragam dari titik pertama hingga titik-titik terakhir - Sekurang-kurangnya satu titik diplot betul Garis lurus penyuaian terbaik *6 titik diplot dengan betul	K1 N1 N1									
	(c)	$\log_{10} y = -x \log_{10} q + \log_{10} p$ Guna *$m = -\log_{10} q$ @ Guna *$c = \log_{10} p$ $q = 1.151$ $p = 5.012$ <u>Syarat:</u> $0.65 \leq c \leq 0.75$	P1 K1 N1 N1									
	(d)	$\log_{10} y = -\frac{29}{475}(20) + 0.7$ $\log_{10} y = -0.5211$ <u>Syarat:</u> $-0.55 \leq c \leq -0.51$	K1 N1									
					10							
11	(a)	(4,0) Kamirkan $\int x^2 + 2$ @ $\int 4 - x$ $A_1 = \frac{x^3}{3} + 2x$ $A_2 = 4x - \frac{x^2}{2}$ Guna had $\int_0^1$ ke *A_1 $A_2 = \frac{1}{2}(3)(3)$ @ $\int_1^4 4x - \frac{x^2}{2}$ *$A_1 +$ *A_2 $\frac{41}{6}$	P1 K1 K1 K1 K1 N1									
	(b)	$B(0,2)$ Kamirkan x^2 terhadap y	P1 K1									

NO SOALAN			JAWAPAN	MARKAH	
			Guna had $\int_2^3$ ke dalam hasil kamiran $\pi * \left[\frac{y^2}{2} - 2y \right]$ $\frac{1}{2}\pi$	K1 N1	
					10
BAHAGIAN C					
12	(a)		-8 ms^{-2}	N1	
	(b)		Kamirkan a terhadap t $v = t^2 - 8t + 15$ $a = 0, t = 4$ $(4)^2 - 8(4) + 15$ -1	K1 K1 N1	
	(c)		$v = 0$ $t^2 - 8t + 15 = 0$ Selesaikan persamaan kuadratik $t = 3,5$	K1 N1	
	(d)		Kamirkan v terhadap t $s = \frac{t^3}{3} - 4t^2 + 15t$ Guna $\int_0^3 v \, dt + \left \int_3^5 v \, dt \right $ $\left(\left(\frac{(3)^3}{3} - 4(3)^2 + 15(3) \right) - 0 \right)$ $+ \left \left(\frac{(5)^3}{3} - 4(5)^2 + 15(5) \right) - \left(\frac{(3)^3}{3} - 4(3)^2 + 15(3) \right) \right $ $18 + \left -\frac{4}{3} \right $ $\frac{58}{3}$	K1 K1 K1 N1	
					10
13	(a)	(i)	$(5)^2 = (4)^2 + (7)^2 - 2(4)(7) \cos \angle ABD$ 44.42°	K1 N1	
		(ii)	$\frac{BC}{\sin 44.42^\circ} = \frac{7}{\sin 110^\circ}$ 5.214	K1 N1	
	(b)	(i)		N1	
		(ii)	$\frac{\sin \angle BAD}{7} = \frac{\sin 44.42^\circ}{5} \quad @ \quad \cos^{-1} \left(\frac{4^2 + 5^2 - 7^2}{2(4)(5)} \right)$ 78.49° $\angle BAD = 180^\circ - 78.49^\circ = 101.51^\circ \quad @ \quad 101.54^\circ$ $\angle A'DA = 23.02^\circ \quad @ \quad 23.07^\circ$	K1 N1 K1	

NO SOALAN			JAWAPAN	MARKAH	
			$\Delta AA'D = \frac{1}{2} \times 5 \times 5 \times \sin 23.02^\circ$ 4.898 @ 4.899	K1 N1	
					10
14	(a)	(i)	$\frac{8.40}{P_{20}} \times 100 = 140$ @ $\frac{P_{22}}{4.50} \times 100 = 130$ $P_{20} = 6.00$	K1 N1	
		(ii)	$P_{22} = 5.85$	N1	
	(b)		Indeks gubahan = 132 $\frac{(112)(1) + (140)(4) + (k)(2) + (130)(3)}{1 + 4 + 2 + 3} = 132$ $k = 129$	K1 N1	
	(c)		$P_Q = 126$ @ $P_S = 136.5$ Indeks gubahan $\bar{I} = \frac{(112)(1) + (126)(4) + (129)(2) + (136.5)(3)}{1 + 4 + 2 + 3}$ 128.35	P1 K1 N1	
	(d)		$\frac{P_{23}}{20} \times 100 = 128.35$ 25.67	K1 N1	
					10
15	(a)		$x + y \leq 16$ $x \leq 3y$ $6x + 3y \geq 48$	N1 N1 N1	
	(b)		Lukis dengan betul sekurang-kurangnya satu garis lurus dari *ketaksamaan yang melibatkan x dan y Lukis dengan betul semua *garis lurus dari *ketaksamaan yang melibatkan x dan y Rantau dilorek dengan betul	K1 N1 N1	
	(c)	(i)	3	N1	
		(ii)	Titik Maksimum (12,4) Gantikan titik (12,4) dalam *rantau ke dalam $4x + 2y$ $4(12) + 2(4)$ RM56.00	N1 K1 N1	
					10



No 15 (b)





**MODUL PINTAS
TINGKATAN 5**

3472/2

**MATEMATIK TAMBAHAN
Kertas 2**

$2\frac{1}{2}$ jam

Dua jam tiga puluh minit

**PERATURAN PEMARKAHAN
MATEMATIK TAMBAHAN K2
3472/2
(ERATA JAWAPAN SOALAN
5b & 5c)**

NO SOALAN			JAWAPAN	MARKAH	
5	(b)		$\frac{ds}{dt} = 0$ Selesaikan persamaan kuadratik secara pemfaktoran atau formula $t^2 - 6t + 8 = 0$ $t = 2, 4$ Gantikan $t = 2, 4$ ke dalam s $s = \frac{20}{3} @ \frac{16}{3}$ Kedudukan paling rendah $\frac{16}{3}$ & Puncak bukit $\frac{20}{3}$	K1	
				K1	
				N1	
	(c)		Bezakan $\frac{ds}{dt}$ terhadap t $\frac{d^2s}{dt^2} = 2t - 6$ Apabila $t = 2, \frac{d^2s}{dt^2} = -2 < 0$ & Apabila $t = 4, \frac{d^2s}{dt^2} = 2 > 0$ $\frac{20}{3}$ kedudukan maksimum $\frac{16}{3}$ kedudukan minimum	K1	
				K1	
				N1	
				N1	



PP SELANGOR SET 2 K1

**MODUL PINTAS
TINGKATAN 5**

3472/1

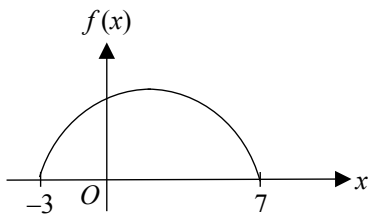
**MATEMATIK TAMBAHAN
Kertas 1**

2 jam

Dua jam

PERATURAN PEMARKAHAN MATEMATIK TAMBAHAN K1 3472/1

NO SOALAN		JAWAPAN	MARKAH
BAHAGIAN A			
1		$\sqrt{8pq} = \frac{4}{3}$ Selesaikan $\sqrt{8p(1-p)} = \frac{4}{3}$ sehingga pemfaktoran $(3p-1)(3p-2) = 0$ $p = \frac{1}{3}$	P1 K1 N1
			3
2		$m = \frac{9-0}{4-(-2)}$ $\log_2 y = \frac{3}{2} \log_2 x + c$ $9 = \frac{3}{2}(4) + c \quad @ \quad (9-c) = \frac{3}{2}(4-0)$ $c = 3$ $\log_2 y = \frac{3}{2} \log_2 x + 3$ $\log_2 y = \frac{3}{2} \log_2 x + \log_2 2^3$ $y = 8x^{\frac{3}{2}}$	K1 P1 K1 N1
			4
3	(a)	$a + (32-1)d = 105$ $a + (a+d) + (a+2d) = 45 \quad @ \quad \frac{3}{2}[2a + (3-1)d] = 45$ <u>Selesaikan persamaan serentak (hapus satu anu)</u> $30d = 90 \quad @ \quad 30a = 360$ $a = 12$	K1 K1 K1 N1
	(b)	$d = 3$ $\frac{32}{2} [*12 + 105] \quad @ \quad \frac{32}{2} [2(*12) + (32-1)(*3)]$ 1872	K1 N1
			6
4	(a)	Lihat $2^3 @ 2^5$ Guna $(a^m)^n = a^{mn} \text{ \& } a^m \div a^n = a^{m-n}$ $2^{3(x-1)-5x}$ $\frac{1}{8(2^{2x})}$	P1 K1 N1
	(b)	Kembang $(\sqrt{2}-1)^2 @ (7+5\sqrt{2}) \times (3-2\sqrt{2})$ dalam <u>4</u> <u>sebutan</u> $h = (7+5\sqrt{2}) \times (3-2\sqrt{2})$ $1 + \sqrt{2}$	K1 K1 N1
			6

NO SOALAN			JAWAPAN	MARKAH	
5			$mx - m = 2x^2 + 3x - 3$ $2x^2 + (3 - m)x + m - 3 = 0$ <u>Guna $b^2 - 4ac > 0$</u> $(3 - m)^2 - 4(2)(m - 3) > 0$ <u>Pemfaktoran ketaksamaan quadartik & lakaran graf @ garis nombor @ jadual</u> $(m - 3)(m - 11) > 0$ &  $m < 3, m > 11$	K1 K1 K1 N1	
				4	
6	(a)		<u>Alternatif A</u> $-3 + 7 = -\frac{p}{-\frac{1}{2}}$ @ $(-3)(7) = \frac{2q}{-\frac{1}{2}}$ $p = 2$ dan $q = \frac{21}{4}$	<u>Alternatif B</u> Ganti $(-3, 0)$ dan $(7, 0)$ ke dalam $f(x)$ 	P1 N1
	(b)		$x = \frac{-3+7}{2}$ $x = 2$ $f(2) = -\frac{1}{2}(2)^2 + *2x + 2 * \left(\frac{21}{4}\right)$ $= \frac{25}{2}$	 K1 N1	
				4	
7			$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$ @ $\overrightarrow{CA} = \overrightarrow{CO} + \overrightarrow{OA}$ @ mana-mana segi tiga yang setara $\overrightarrow{AC} = (k\underline{i} - \underline{j}) - (-4\underline{i} + k\underline{j})$ @ $\overrightarrow{CA} = -(k\underline{i} - \underline{j}) + (-4\underline{i} + k\underline{j})$ $= (k + 4)\underline{i} + (-1 - k)\underline{j}$ $= (-k - 4)\underline{i} + (1 + k)\underline{j}$ $ \overrightarrow{AC} = \sqrt{(k + 4)^2 + (-1 - k)^2}$ $= \sqrt{2k^2 + 10k + 17}$	P1 K1 N1	
				3	
8	(a)		$\angle QSR = 1.2 \text{ rad.}$ $(8)(1.2)$ 9.6	K1 N1	
	(b)		$\frac{1}{2}(8)^2(1.2)$ @ $\frac{1}{2}(13.21)^2(0.6)$ @ $\frac{1}{2}(8)(13.21) \sin 0.6$ $L = \frac{1}{2}(8)^2(1.2) + \frac{1}{2}(8)(13.21) \sin 0.6 - \frac{1}{2}(13.21)^2(0.6)$ $= 15.88 \text{ cm}^2$ @ 15.87 cm^2	K1 K1 N1	
				5	

NO SOALAN			JAWAPAN	MARKAH
9	(a)		$f'(x) = (1)(x^2 - 9) + 2x(x - 3) @ \text{ kembang}$ $= 3x^2 - 6x - 9$	K1 N1
	(b)		$0 = 3(x - 3)(x + 1)$ $x = 3, x = -1$ $y = 0, y = 32$ $f''(x) = 6x - 6$ $f''(3) = 6(3) - 6$ atau $f''(-1) = 6(-1) - 6$ $= 12 > 0$ $= -12 < 0$ $(3, 0)$ ialah titik minimum dan $(-1, 32)$ ialah titik maksimum. <i>(3, 0) is a minimum point and (-1, 32) is a maximum point.</i>	K1 K1 N1
	(c)		$f(1) = 16, \delta x = 0.001$ $f'(1) = 3(1 - 3)(1 + 1)$ $= -12$ $\frac{\delta f(x)}{0.001} \approx -12$ $f(1.001) = 16 + *(-0.012)$ $= 15.988$	K1 K1 N1
				8
10	(a)		$8 = a(5^2)$ $a = \frac{8}{25}$	K1 N1
	(b)		<u>Alternatif A</u> $\int_0^8 \frac{5\sqrt{y}}{\sqrt{8}} dy = \left[\frac{5y^{\frac{3}{2}}}{\sqrt{8}(\frac{3}{2})} \right]_0^8$ $\frac{1}{2}(12 + 8)(8) - 2 \times \int_0^8 \frac{5\sqrt{y}}{\sqrt{8}} dy$ $= 80 - 2 \times \left[\frac{5(8)^{\frac{3}{2}}}{\sqrt{8}(\frac{3}{2})} - \frac{5(0)^{\frac{3}{2}}}{\sqrt{8}(\frac{3}{2})} \right]$ $= 26\frac{2}{3}$ <u>Alternatif B</u> $\int_0^5 \frac{8x^2}{25} dx = \left[\frac{8x^3}{25(3)} \right]_0^5$ $2 \times \left[\int_0^5 \frac{8x^2}{25} dx - \frac{1}{2}(1)(4) + \frac{1}{2}(1)(4) \right]$ $= 2 \times \left[\frac{8(5)^3}{25(3)} - \frac{8(0)^3}{25(3)} \right]$ $= 26\frac{2}{3}$	K1 K1 K1 N1 K1 K1 N1
	(c)		$V = \pi \int_0^8 \frac{25y}{8} dy$ $= \pi \left[\frac{25}{8} \left(\frac{y^2}{2} \right) \right]_0^8$ $= \pi \left[\frac{25}{8} \left(\frac{8^2}{2} \right) - \frac{25}{8} \left(\frac{0^2}{2} \right) \right]$ $= 100\pi$	K1 N1
				8

NO SOALAN			JAWAPAN	MARKAH
11	(a)		$BD:DC = 1:3$	P1
			$\frac{1(9)+3x}{1+3} = 3 @ \frac{1(1)+3y}{1+3} = -2$	K1
			$B(1, -3)$	N1
	(b)		$\frac{y-(-2)}{x-3} \times \frac{y-1}{x-9} = -1$	K1
			$x^2 + y^2 - 12x + y + 25 = 0$	N1
				5
12	(a)		$r + r + 4 = 30 @ \text{ setara}$	P1
			$r = 13$	N1
	(b)		${}^3C_1 \times {}^5C_2 @ {}^3C_2 \times {}^5C_1 @ {}^3C_2 \times {}^4C_2$	K1
			${}^3C_1 \times {}^5C_2 + {}^3C_2 \times {}^5C_1 + {}^3C_2 \times {}^4C_2$	K1
			$= 63$	N1
	(c)		${}^2P_1 \times {}^4P_2 \times {}^3P_1 @ {}^2P_1 \times {}^4P_2 \times {}^2P_1$	K1
			${}^2P_1 \times {}^4P_2 \times {}^3P_1 + {}^2P_1 \times {}^4P_2 \times {}^2P_1$	K1
			$= 120$	N1
				8
BAHAGIAN B				
13	(a)	(i)	$x = \cos \theta, y = \sin \theta$	P1
			$y^2 + x^2 = 1 \text{ (Dilihat)}$	
			$\sin^2 \theta + \cos^2 \theta = 1$	N1
		(ii)	$\cos \theta = 0.1736$	
			$2(0.1736)^2 - 1$	K1
			$= -0.9397$	N1
	(b)	(i)	$\cot A = \frac{1}{3}$	P1
		(ii)	$\frac{\tan A - \tan B}{1 + \tan A \tan B} = \frac{2}{3}$	P1
			$\frac{3 - \tan B}{1 + 3 \tan B} = \frac{2}{3}$	K1
			$\tan B = \frac{7}{9}$	N1
				8
14	(a)	(i)	0	N1
		(ii)	Guna hukum segi tiga cari $\overrightarrow{OQ}$	P1
			$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$	
			$\overrightarrow{PQ} = \overrightarrow{PR} + \overrightarrow{RQ}$	
			$= \begin{pmatrix} -1 \\ -15 \end{pmatrix} + \begin{pmatrix} 5 \\ 12 \end{pmatrix} @ \text{ setara}$	K1
			$= \begin{pmatrix} 4 \\ -3 \end{pmatrix}$	
			$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$	
			$= \begin{pmatrix} 5 \\ 12 \end{pmatrix} + \begin{pmatrix} 4 \\ -3 \end{pmatrix} @ \text{ setara}$	K1
			$= \begin{pmatrix} 9 \\ 9 \end{pmatrix}$	
			$Q(9, 9)$	N1

NO SOALAN			JAWAPAN	MARKAH
	(b)	(i)	$(2 - 5)\underline{i} + (6 - 12)\underline{j} = t(-5\underline{i} + w\underline{j})$	P1
		(ii)	$-3 = -5t \quad @ \quad -6 = tw$ $t = \frac{3}{5} \quad \& \quad w = -10$	K1 N1
				8
15	(a)	(i)	$gf(x) = z$	P1
		(ii)	-2	P1
	(b)	(i)	$\frac{2(-2)+3}{(-2)-2} = a$ $a = \frac{1}{4}$	K1 N1
		(ii)	$f^{-1}(x) = \frac{2x+3}{x-2}$ $y = \frac{2x+3}{x-2}$ $y(x-2) = 2x+3$ $x = \frac{2y+3}{y-2}$ $f(x) = \frac{2x+3}{x-2}, x \neq 2$ $g\left(\frac{2x+3}{x-2}\right) = 3x-6$ $g(y) = 3\left(\frac{2y+3}{y-2}\right) - 6$ $g(x) = \frac{21}{x-2}, x \neq 2$	K1 N1 K1 N1
				8



PP SELANGOR SRT 2 K2

**MODUL PINTAS
TINGKATAN 5**

3472/2

**MATEMATIK TAMBAHAN
Kertas 2**

$2\frac{1}{2}$ jam

Dua jam tiga puluh minit

**PERATURAN PEMARKAHAN
MATEMATIK TAMBAHAN K2
3472/2**

NO SOALAN		JAWAPAN	MARKAH
BAHAGIAN A			
1	(a)	$\log_m \left(k \times \frac{1}{k} \right) = t$ $m^t = 1$ $t = 0$	K1 K1 N1
	(b)	Guna $\log_a b = \frac{\log_c b}{\log_c a}$ $\log_2(2x + 1) - \frac{\log_2 x^{10}}{\log_2 4} + \log_2 x^4.$ Guna hukum $\log_a m^n = n \log_a m$ $\log_2(2x + 1) - \log_2 x^5 + \log_2 x^4.$ Guna hukum $\log_a mn = \log_a m + \log_a n$ & $\log_a \frac{m}{n} = \log_a m - \log_a n$ $\log_2 \frac{(2x + 1)x^4}{x^5}$ $\log_2 \left(2 + \frac{1}{x} \right) @ \log_2 \frac{2x+1}{x}$	K1 K1 K1 N1
			7
2	(a)	$\int_3^1 2f(y) dy = (-2) \times (-5)$ 10	P1 N1
	(b)	Kamirkan $\int px^2 - 2x dx$ $y = \frac{px^3}{3} - x^2 + c$ Ganti (1,6) @ (-2, -15) dalam $*y = \frac{px^3}{3} - x^2 + c$ $6 = \frac{p(1)^3}{3} - (1)^2 + c @ -15 = \frac{p(-2)^3}{3} - (-2)^2 + c$ <u>Selesaikan untuk p @ c</u> $p = 6 @ c = 5$ $y = 2x^3 - x^2 + 5$	K1 K1 K1 N1

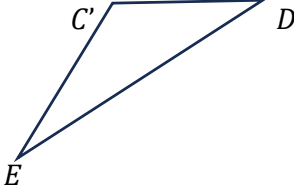
NO SOALAN		JAWAPAN	MARKAH
			7
3	(a)	Guna $a = 27$ dan $r = \frac{2}{3}$ ke dalam $T_n = a \times r$, sekurang2nya 3 sebutan $T_1 = 27$ $T_2 = 27 \times \frac{2}{3}$ $T_3 = 27 \times \frac{2}{3} \times \frac{2}{3}$ $T_4 = 27 \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$ Guna $T_n = ar^{n-1}$, sekurang2nya 3 sebutan $T_1 = 27 \times \left(\frac{2}{3}\right)^{1-1}$ $T_2 = 27 \times \left(\frac{2}{3}\right)^{2-1}$ $T_3 = 27 \times \left(\frac{2}{3}\right)^{3-1}$ $T_4 = 27 \times \left(\frac{2}{3}\right)^{4-1}$ Tulis, $T_1 = ar^{1-1}$ $T_2 = ar^{2-1}$ $T_3 = ar^{3-1}$ $T_4 = ar^{4-1}$ $T_n = ar^{n-1}$	K1 K1 P1 N1
	(b)	$S_\infty = \frac{27}{1-\frac{2}{3}}$ $= 81$	K1 N1
			6
4	(a)	$p(px + q) + q$ Bandingkan, $p^2x + pq + q$ dengan $4x - 3$ Selesaikan $p^2 = 4$ $p = 2$ Ganti $p = 2$ ke dalam $pq + q = -3$ & selesaikan $q = -1$	K1 K1 N1 N1
	(b)	$2(4x - 3) - 1$ $f^3(x) = 8x - 7$	K1 N1
	(c)	Dilihat,	

NO SOALAN		JAWAPAN	MARKAH
		$f(x) = 2x - 1$ $f^2(x) = 4x - 3$ $f^3(x) = 8x - 7$ $f^n(x) = 2^n x - 2^n + 1$	N1
			7
5	(a)	Guna $\sin^2 x = 1 - \cos^2 x$ @ $\sin^2 y = 1 - \cos^2 y$ ke dalam $2\cos^2 x + \sin^2 y = 1$ @ $\sin^2 x = 4\cos^2 y$ $2(1 - 4\cos^2 y) + (1 - \cos^2 y) = 1$ $y = 61.87^\circ$ $1 - \cos^2 x = 4\cos^2 y$ $x = 70.53^\circ$	K1 <

NO SOALAN		JAWAPAN	MARKAH
		$\frac{16}{3}n - 8 = -8\lambda \quad @ \quad \frac{10}{3}n = 6\lambda$ $n = \frac{9}{11}$	N1
			9
7		$y = \frac{10-x}{2} \quad @ \quad x = 10 - 2y$ Hapuskan y atau x (melibatkan satu persamaan linear dan satu persamaan tak linear dalam sebutan x dan y) $5x^2 - 2x\left(\frac{10-x}{2}\right) = 24 \quad @$ $5(10 - 2y)^2 - 2y(10 - 2y) = 24$ Selesaikan persamaan kuadratik untuk $b \neq 0$ $x = 3 \quad \& \quad x = -\frac{4}{3}$ $@$ $y = \frac{7}{2} \quad \& \quad y = \frac{17}{3}$ $(3, \frac{7}{2}) \quad \& \quad (-\frac{4}{3}, \frac{17}{3})$	P1 K1 K1 N1 N1
			5
BAHAGIAN B			
8	(a)	$h = \frac{256}{r^2}$ Ganti $*h$ ke dalam $A = 2\pi rh + 4\pi r^2$ $A = 4\pi r^2 + \frac{512\pi}{r}$	P1 K1 N1
	(b)	Guna $\frac{dA}{dr} = 0$ & selesaikan *persamaan kubik. $8\pi r - \frac{512\pi}{r^2} = 0$ $r = 4$ $A = 4\pi(*4)^2 + \frac{512\pi}{*4}$ $= 192\pi$	K1 N1 K1 N1
	(c)	$\frac{dA}{dt} = 84\pi$ Guna $\frac{dA}{dt} = \frac{dA}{dr} \times \frac{dr}{dt}$ $84\pi = 8\pi(8) - \frac{512\pi}{8^2} \times \frac{dr}{dt}$	P1 K1 N1

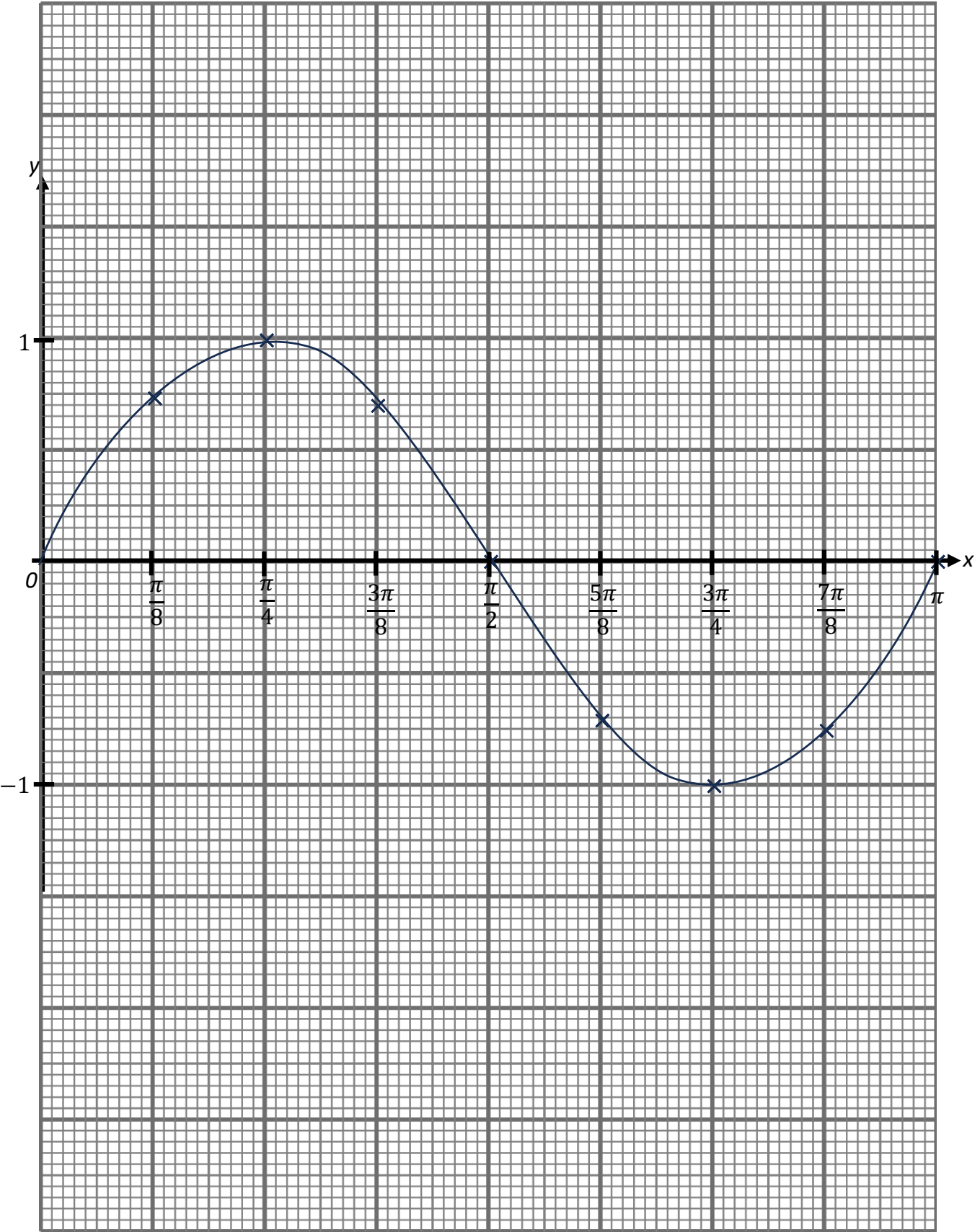
NO SOALAN		JAWAPAN	MARKAH
		1.5	
			10
9	(a) (i)	Guna $m_1 \times m_2 = -1$ $-\frac{1}{3} \times m_2 = -1$ Guna $y - y_1 = m(x - x_1)$ $y - 4 = 3(x - 6)$ @ Guna $y = mx + c$ & selesaikan untuk c $4 = 3(6) + c, c = -14$ $y = 3x - 14$	K1 K1 N1
	(ii)	Selesaikan persamaan serentak $\frac{2}{3}x + 6$ dan $*(3x - 14)$ $\left(\frac{60}{7}, \frac{82}{7}\right)$	K1 N1
	(b)	Guna rumus pembahagi tembereng $\frac{0(3)+2x}{5} = 9 \quad @ \quad \frac{6(3)+2y}{5} = 6$ $\left(\frac{45}{2}, 6\right)$	K1 N1
	(c)	$C(12, 2)$ Luas $AGC = \frac{1}{2} \left \left((0 \times 6) + \left(\frac{45}{2} \times 2\right) + (12 \times 6) \right) - \left(\left(6 \times \frac{45}{2}\right) + (6 \times 12) + (2 \times 0) \right) \right$ 45	P1 K1 N1
			10
10	(a) (i)	$2.25 = \frac{16.5-12}{\sigma}$ $\sigma = 2$	K1 N1
	(ii)	0.567 @ 0.566 $\frac{k-12}{2} = -0.567 @ -0.566$ $k = 10.87$	P1 K1 N1
	(b) (i)	${}^6C_0 \left(\frac{3}{7}\right)^0 \left(\frac{4}{7}\right)^6$	K1

NO SOALAN		JAWAPAN								MARKAH
		0.03482								N1
	(ii)	Tulis $1 - P(X = 0) - P(X = 1) - P(X = 2)$ @ $P(X = 3) + P(X = 4) + P(X = 5) + P(X = 6)$ $1 - {}^6C_0\left(\frac{3}{7}\right)^0\left(\frac{4}{7}\right)^6 - {}^6C_1\left(\frac{3}{7}\right)^1\left(\frac{4}{7}\right)^5 - {}^6C_2\left(\frac{3}{7}\right)^2\left(\frac{4}{7}\right)^4$ @ ${}^6C_3\left(\frac{3}{7}\right)^3\left(\frac{4}{7}\right)^3 + {}^6C_4\left(\frac{3}{7}\right)^4\left(\frac{4}{7}\right)^2 + {}^6C_5\left(\frac{3}{7}\right)^5\left(\frac{4}{7}\right)^1 + {}^6C_6\left(\frac{3}{7}\right)^6\left(\frac{4}{7}\right)^0$ 0.5147 // 0.5148								P1 K1 N1
										10
11	(a)	xy	6.0	9.9	12	14	16.2	20		N1
	(b)	- Graf garis lurus xy melawan x dilukis: - Paksi-paksi betul dan skala seragam dari titik pertama hingga titik terakhir. - Sekurang-kurangnya satu titik diplot dengan betul 6 *titik diplot dengan betul - Garis lurus penyuaian terbaik Sekurang-kurangnya 5 *titik diplot dengan betul.								K1 N1 N1
	(c) (i)	$xy = \frac{p}{2}x - 3q$ $xy = 18$ $y = 2.571$								P1 N1
	(ii)	Guna * $m = \frac{p}{2}$ $p = 4$								K1 N1
		Guna * $c = -3q$ $q = -1.3$								K1 N1
										10
BAHAGIAN C										
12	(a) (i)	$AB^2 = 5.280^2 + 4.916^2 - (2 \times 5.280 \times 4.916 \times \cos 50.52^\circ)$ $AB = 4.363$								K1 N1
	(ii)	$\frac{\sin \angle BAC}{5.280} = \frac{\sin 50.52^\circ}{4.363}$ @ $\frac{\sin \angle ABC}{4.916} = \frac{\sin 50.52^\circ}{4.363}$								K1

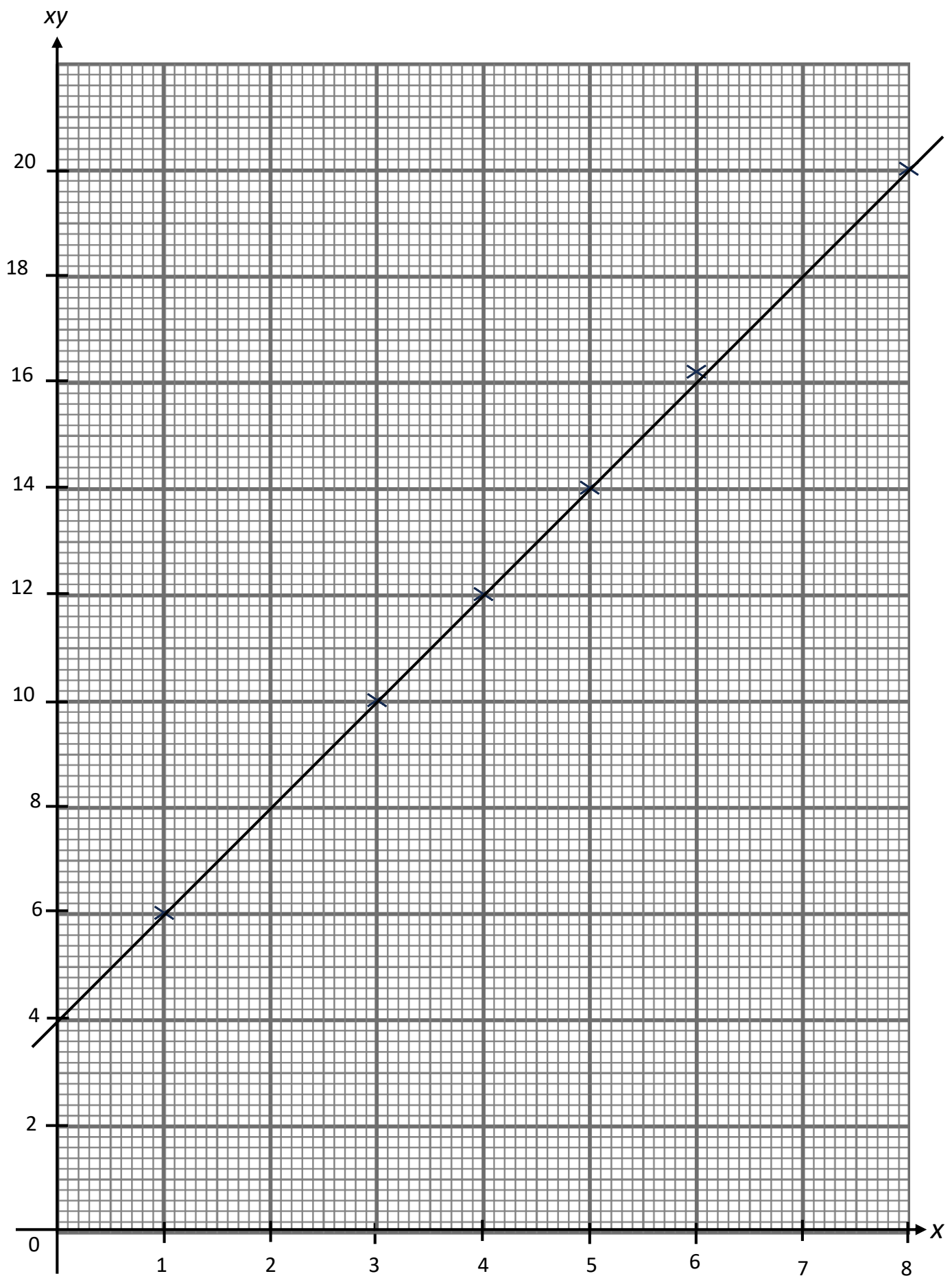
NO SOALAN		JAWAPAN	MARKAH
		$\angle BAC = 69.08^\circ$ $\angle DCE = 180^\circ - 50.52^\circ - 69.08^\circ$ $60.40^\circ @ 60.42^\circ$	N1
	(iii)	$\angle DEC = 180^\circ - 60.40^\circ - 44.89^\circ$ 74.71° $\frac{CE}{\sin 44.89^\circ} = \frac{6.025}{\sin 60.40^\circ}$ $CE = 4.890$ $\text{Luas } \triangle DCE = \frac{1}{2} \times 4.890 \times 6.025 \times \sin 74.71^\circ$ 14.21	K1 K1 K1 N1
	(b) (i)	 Nota: 1. $\angle DC'E$ adalah cakah 2. Sisi-sisi dilakar	N1 (NMA)
	(ii)	$\angle DC'E = 180^\circ - 60.40^\circ$ $119.60^\circ @ 119.58^\circ$	N1 (NMA)
			10
13	(a)	$\frac{P_{23}}{45} \times 100 = 120 @ \frac{54}{P_{21}} \times 100 = 135$ $@ \frac{45}{P_{21}} \times 100 = 112.5$ $P_{23} = 54$ $P_{21} = 40$	K1 N1 N1
	(b) (i)	$I_P = \frac{105}{70} \times 100 @ I_Q = \frac{100}{80} \times 100 @$ $I_R = \frac{67.50}{60} \times 100$ $I_P = 150$ $I_Q = 125$ $I_R = 112.5$	K1 N1 (salah satu betul) N1 (semua betul)
		$140 = \frac{150y + 125x + (112.5)(2x)}{y + x + 2x}$ Selesaikan *persamaan linear serentak yang melibatkan x dan y. $x = 10 @ y = 70$ $y = 70 \& x = 10$	K1 K1 N1 N1
			10
14	(a)	$100x + 60y \leq 6600 @ \text{setara}$	N1

NO SOALAN		JAWAPAN	MARKAH
		$80x + 120y \geq 4800$ @ setara $y \geq 2x$	N1 N1
	(b)	- Lukis dengan betul sekurang-kurangnya satu garis lurus dari *ketaksamaan yang melibatkan x dan y pada paksi-paksi yang bermula dengan asalan. - Lukis semua *garis lurus dengan betul dari semua *ketaksamaan yang melibatkan x dan y (terima garisan putus-putus dan garis padu). - Rantau dilorek dengan betul.	K1 N1 N1
	(c) (i)	$30 \leq y \leq 85$	N1
	(ii)	$(30, 60)$ Ganti mana2 titik integer dalam *rantau ke dalam $50x + 25y$ 3000	N1 K1 N1
			10
15	(a)	<u>Kamirkan v terhadap t</u> $s = -4t^3 + 12t^2 + 15t$ <u>Bezakan v terhadap t</u> <u>$[a = -24t + 24]$</u> <u>Guna $a = 0$</u> <u>$t = 1$</u> 23	K1 K1 K1 N1
	(b)	<u>Guna $v > 0$</u> $-12t^2 + 24t + 15 > 0$ <u>Selesaikan *ketaksamaan kubik</u> $-3(2t + 1)(2t - 5) > 0$ $0 < t < \frac{5}{2}$	K1 K1 N1

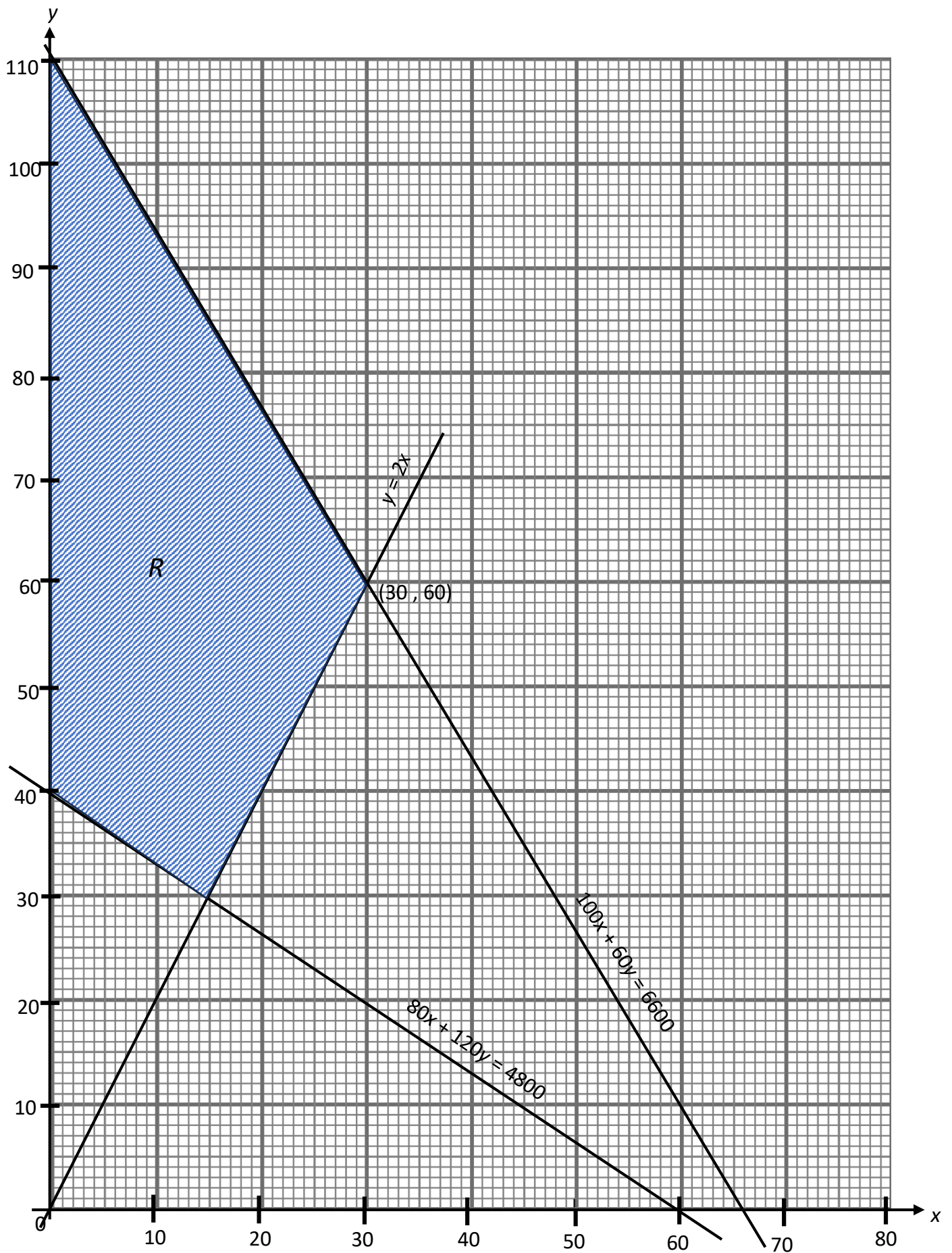
NO SOALAN	JAWAPAN	MARKAH
(c)	ALTERNATIF A Guna $\int_1^{\frac{5}{2}} v \, dt$ & $\int_{\frac{5}{2}}^4 v \, dt$ @ Guna $\int_1^{\frac{5}{2}} v \, dt + \left \int_{\frac{5}{2}}^4 v \, dt \right$ $= \left[\left(-4 \left(\frac{5}{2} \right)^3 + 12 \left(\frac{5}{2} \right)^2 + 15 \left(\frac{5}{2} \right) \right) - (-4(1)^3 + 12(1)^2 + 15(1)) \right] + \left[\left(-4(4)^3 + 12(4)^2 + 15(4) \right) - \left(-4 \left(\frac{5}{2} \right)^3 + 12 \left(\frac{5}{2} \right)^2 + 15 \left(\frac{5}{2} \right) \right) \right] \Bigg $ 27 + 54 81 ALTERNATIF B Ganti $t = \frac{5}{2}$ @ $t = 4$ dalam s. $s = -4 \left(\frac{5}{2} \right)^3 + 12 \left(\frac{5}{2} \right)^2 + 15 \left(\frac{5}{2} \right)$ @ $s = -4(4)^3 + 12(4)^2 + 15(4)$ Jumlah jarak = $(50 - 23) + (50 + 4)$ 81	K1 K1 N1 K1 K1 N1
		10



Soalan 11



Soalan 14



SULIT
3472/1
Matematik
Tambahan
Kertas 1
November
2023
2 jam



MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR

SIJIL PENDIDIKAN MRSMA 2023

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN

Kertas 1

Dua jam

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

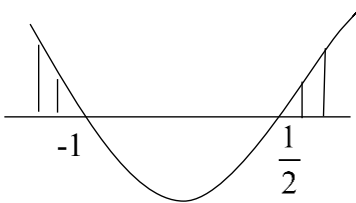
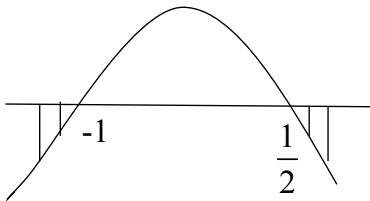
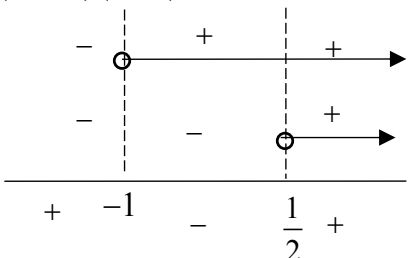
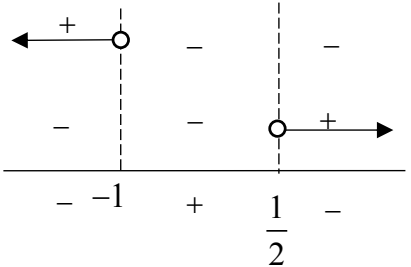
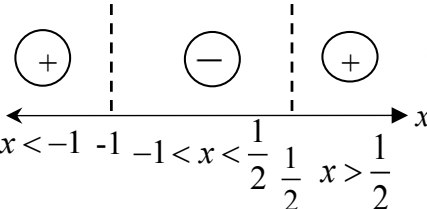
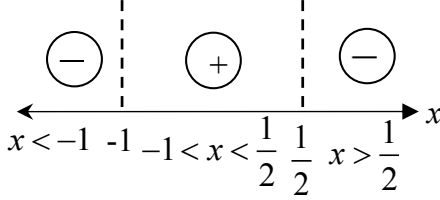
Peraturan pemarkahan ini **SULIT** dan Hak Cipta Bahagian Pendidikan Menengah MARA. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa.

Dokumen ini mengandungi 14 halaman bercetak

ANSWER SCHEME

No.	Marking Scheme	Sub marks	Marks
1	$\frac{5-(-3)}{0-4} \text{ OR } -3 = m(4) + 5$ $\frac{y}{x} = ^*(-2)x^2 + 5$ $y = -2x^3 + 5x$	K1 K1 N1	3
2	$\frac{1}{2}(12.5)^2 (2(3.142) - 5.02)$ 98.75 // 98.69	K1 N1	2
3(a)	Differentiate $y = -2x^2 + 10x + 12$ and substitute $x = 4$ $-4(4) + 10$ -6	K1 N1	5
(b)	Use $m_1 \times m_2 = -1$ $-6 \times m_2 = -1$ Use $y - y_1 = m(x - x_1)$ $\left[y - 20 = ^*\left(\frac{1}{6}\right)(x - 4) \right]$ OR Use $y = mx + c$ and solve for c $\left[20 = ^*\left(\frac{1}{6}\right)(4) + c, c = \frac{58}{3} \right]$ $y = \frac{1}{6}x + \frac{58}{3} \text{ or equivalent}$	K1 K1 K1	
		N1	

No.	Marking Scheme	Sub marks	Marks
4(a)	$\left[\frac{3(2^n - 1)}{2 - 1} \right] > 12\,000$	K1	
	12	N1	
(b)	ALTERNATIVE A S_{*12-1} Seen or implied $\left(\frac{3(2^{*11} - 1)}{2 - 1} \right)$ 6141 ALTERNATIVE B Use $T_{*12} = 3(2)^{*12-1}$ AND $S_{*12} = \frac{3(2^{*12} - 1)}{2 - 1}$ $S_{*12} - T_{*12}$ $\frac{3(2^{*12} - 1)}{2 - 1} - 3(2)^{*12-1}$ 6141	P1 K1 N1 K1 K1 N1	5 5

No.	Marking Scheme	Sub marks	Marks																							
5(a)	$2x^2 + x - 1 > 0$ or $-2x^2 - x + 1 < 0$ or equivalent  or  OR $(2x - 1)(x + 1) > 0$  or $(1 - 2x)(x + 1) < 0$  OR $(2x - 1)(x + 1) > 0$  or $-(2x - 1)(x + 1) < 0$  OR <table><tr><td></td><td>-1</td><td>$\frac{1}{2}$</td></tr><tr><td>$(2x - 1)$</td><td>-</td><td>+</td></tr><tr><td>$(x + 1)$</td><td>-</td><td>+</td></tr><tr><td>$(2x - 1)(x + 1)$</td><td>+</td><td>+</td></tr></table> or <table><tr><td></td><td>-1</td><td>$\frac{1}{2}$</td></tr><tr><td>$(1 - 2x)$</td><td>+</td><td>-</td></tr><tr><td>$(x + 1)$</td><td>-</td><td>+</td></tr><tr><td>$(1 - 2x)(x + 1)$</td><td>-</td><td>-</td></tr></table> $x < -1, x > \frac{1}{2}$ <u>Notes:</u> For number line and table, must include factorization. For graph, no factorization is needed.		-1	$\frac{1}{2}$	$(2x - 1)$	-	+	$(x + 1)$	-	+	$(2x - 1)(x + 1)$	+	+		-1	$\frac{1}{2}$	$(1 - 2x)$	+	-	$(x + 1)$	-	+	$(1 - 2x)(x + 1)$	-	-	P1 K1
	-1	$\frac{1}{2}$																								
$(2x - 1)$	-	+																								
$(x + 1)$	-	+																								
$(2x - 1)(x + 1)$	+	+																								
	-1	$\frac{1}{2}$																								
$(1 - 2x)$	+	-																								
$(x + 1)$	-	+																								
$(1 - 2x)(x + 1)$	-	-																								

No.	Marking Scheme	Sub marks	Marks
(b)	$\left[a \left\{ x^2 + \frac{b}{a}x + \left(\frac{\left(\frac{b}{a} \right)^2}{2} \right) - \left(\frac{\left(\frac{b}{a} \right)^2}{2} \right) + \frac{c}{a} \right\} \right] = 0$ Notes : $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\left(x + \frac{b}{2a} \right)^2 = \frac{b^2 - 4ac}{4a^2}$ must be seen	K1 N1	5
6(a)	method to find angle AOB $\cos^{-1} \frac{4}{7}$ OR Sine Rule OR $\sin \theta = \frac{\sqrt{33}}{7}$ OR Cosine Rule or any valid method 0.963	K1 N1	
(b)	0.963r $2r \sin \left(\frac{55.15}{2} \right)$ OR $\sqrt{r^2 + r^2 - 2r^2 \cos 55.15^\circ}$ OR $\sqrt{7^2 - 4^2}$ or $7 \sin 55.15^\circ$ or $4 \tan 55.15^\circ$ OR Sine Rule OR Cosine Rule or any valid method to find AB or chord PR $0.963r + 2r \sin \frac{55.15}{2} < 7 + 4 + \sqrt{7^2 - 4^2}$ $7 < r < 8.865$	K1 K1 K1 N1	6

7(a)	6	P1	
(b)	$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$ OR $\overrightarrow{OQ} = \overrightarrow{OR} + \overrightarrow{RQ}$ OR $\overrightarrow{RN} = \overrightarrow{RQ} + \overrightarrow{QN}$ OR $\overrightarrow{RN} = \overrightarrow{RO} + \overrightarrow{ON}$ $\vec{p} + \vec{r}$ $\frac{1}{2}\vec{p} - \frac{1}{2}\vec{r}$	K1	
		N1	
		N1	
(c)	$\sqrt{2^2 - 1^2}$ or $2 \cos 30^\circ$ or $2 \sin 60^\circ$ $3.464 // 2\sqrt{3}$	K1	
		N1	6
8		N1	
(a)(i)	24		
(ii)	${}^2C_1 \times {}^7C_2$ or ${}^2C_2 \times {}^7C_1$ OR 9C_3 or 7C_3 ${}^2C_1 \times {}^7C_2 + {}^2C_2 \times {}^7C_1$ OR ${}^9C_3 - {}^7C_3$ 49	K1	
		K1	
		N1	

(b)(i)	1320	N1	8
(ii)	${}^4P_1 \times 3!$ or ${}^3P_2 \times {}^9P_1 \times 8$ or ${}^4C_1 \times {}^3C_1 \times (2 \times {}^9P_1)$ or ${}^4P_3 \times {}^3P_1 \times {}^3P_1 \times {}^3P_1$ $1320 - {}^4P_1 \times 3! - {}^3P_2 \times {}^9P_1 \times 8$ OR ${}^4C_1 \times {}^3C_1 \times (2 \times {}^9P_1) + {}^4P_3 \times {}^3P_1 \times {}^3P_1 \times {}^3P_1$ 864	K1 K1 N1	
9(a)	$y = -x^3 - x^2 + 2x$ (b) $-x^3 - x^2 + 2x = 0$ $x = 0, -2, 1$ Integrate y wrt x and use limit $\int_{-2}^0$ or $\int_0^1$ $ I_1 + I_2 ; I_1 < 0$ $\left -\frac{8}{3} \right + \frac{5}{12}$ $\frac{37}{12}$	N1 K1 K1 K1 N1	

No.	Marking Scheme	Sub marks	Marks
10(a)	3:1	P1	
	$\left(\frac{1(-4)+3(8)}{3+1}, \frac{1(4)+3(-12)}{3+1} \right)$	K1	
	(5, -8)	N1	
(b)	Find gradient PQ or *SP or *SQ and use $m_1 \times m_2 = -1$	K1	
	Use $y - y_1 = m(x - x_1)$	K1	
	$\left[y - ^*(-8) = \left(\frac{3}{4} \right) (x - ^*5) \right]$		
	OR		
	Use $y = mx + c$ and solve for c		
	$\left[-8 = \left(\frac{3}{4} \right) (5) + c \right], c = -\frac{47}{4}$		
	$y = \frac{3}{4}x - \frac{47}{4}$ or equivalent	N1	6

No.	Marking Scheme	Sub marks	Marks
11(a)	Arithmetic progression is a sequence of numbers such that each term is obtained by <u>adding</u> a constant to the term before it. Janjang aritmetik ialah suatu jujukan nombor dengan setiap sebutan diperoleh dengan <u>menambahkan</u> satu pemalar kepada sebutan sebelumnya.	P1	8
(b)(i)	$\frac{15}{2}[2a + (15-1)d] = 360 \text{ or } \frac{15}{2}(a + 38) = 360$ and $a + (15-1)d = 38$ M₁ $a = 10$ and $d = 2$ M₂ $d = 2$ M₃ $d = 2$ M₁ $360 - \left[\frac{10}{2} \left((2) \cdot (10) + (10-1) \cdot (2) \right) \right]$ OR M₂ $\frac{5}{2} [2(38) + (5-1)(-2)]$ or $\frac{5}{2} [2(30) + (5-1)(2)]$ OR M₃ $[30 + 32 + 34 + 36 + 38]$ 170	K1 N1 K1 N1	
(ii)	$\frac{15}{2}[2a + 14d] = 360$	K1	
	$d = 1 \text{ \& } a = 17 \qquad d = 3 \text{ \& } a = 3$	N1 N1	

No.	Marking Scheme	Sub marks	Marks
12(a)	Use ${}^3C_3 p^3 (1 - p)^0 = 512s$ or ${}^3C_0 p^0 (1 - p)^3 = 8s$	K1	
	$8\sqrt[3]{s}$	N1	
	(b) $8\sqrt[3]{s} = 1 - 2\sqrt[3]{s}$ and solve for s	K1	
	${}^3C_2 \left(8\sqrt[3]{0.001}\right)^2 \left(1 - 8\sqrt[3]{0.001}\right)$ OR ${}^3C_2 \left(1 - 2\sqrt[3]{0.001}\right)^2 \left(1 - \left(1 - 2\sqrt[3]{0.001}\right)\right)$ or equivalent	K1	
	0.384	N1	5

No.	Marking Scheme	Sub marks	Marks
13			
(a)(i)	17	N1	
(ii)	3	N1	
(iii)	$\frac{x+4}{3} = x$	K1	
	$x = 2$	N1	
(b)	$g^{-1}(x) = 3x - 4$ & $f(x) = \frac{18}{17 - (3x - 4)}$ OR $f(y) = \frac{18}{17 - (3y - 4)}$	K1	
	$\frac{6}{7-x}, \{x \neq 7\}$	N1	
(c)	$^*\left(\frac{6}{7 - \left(7 - \frac{6}{x}\right)}\right)$ OR $7 - ^*\left(\frac{6}{7-x}\right)$	K1	
	$fh(x) = hf(x) = x$	N1	8

No.	Marking Scheme	Sub marks	Marks
14(a)	$\pi \left(\frac{1}{\sqrt{3}+1} \right)^2 (\sqrt{3}-1)$ $\pi \left(\frac{\sqrt{3}-1}{4+2\sqrt{3}} \right) \times \left(\frac{4-2\sqrt{3}}{4-2\sqrt{3}} \right)^*$ $\pi \left(\frac{4\sqrt{3}-2(3)-4+2\sqrt{3}}{16-12} \right)^*$ $\left(-\frac{5}{2} + \frac{3}{2}\sqrt{3} \right) \pi$ <u>Notes:</u> 1. The numerator and denominator must contain at least 2 terms with a surd 2. If there is only 1 term in numerator, K0N0	P1 K1 K1 N1	
(b)	$r = \frac{1}{2} \left(\ln \frac{339000000}{33200000} \right)$ 1.043	K1 N1	
(c)	Use $(a^m)^n = a^{mn}$ $(5^p)^r$ or $(3^q)^r$ Notes: $p \times r = 300$, $q \times r = 500$ where p, q and $r \in \mathbb{R}$ Hazwan, $5^p < 3^q$	K1 N1	8

15(a)	$21(1 - \sin^2 x) = 8 \sin x + 16$	K1	
	$(3 \sin x - 1)(7 \sin x + 5) = 0$	K1	
	$19.47^\circ, 45.58^\circ \quad // \quad 19^\circ 28', 45^\circ 35'$	N1	
	$19.47^\circ, 160.53^\circ, 225.58^\circ, 314.42^\circ //$ $19^\circ 28', 160^\circ 32', 225^\circ 35', 314^\circ 25'$	N1	
	(b) ALTERNATIVE A		
	$\tan 50^\circ = \frac{h}{p}$	P1	
	$\left[\frac{h}{p} \right] \frac{2 \tan 25^\circ}{1 - \tan^2 25^\circ}$	K1	
	$\frac{-2p \pm \sqrt{(2p)^2 - 4(h)(-h)}}{2h}$ OR	K1	
	$\tan^2 25^\circ + \frac{2p}{h} \tan 25^\circ + \left(\frac{\frac{2p}{h}}{2} \right)^2 - \left(\frac{\frac{2p}{h}}{2} \right)^2 - 1 = 0$		
	$\frac{-p + \sqrt{p^2 + h^2}}{h}$	N1	

No.	Marking Scheme	Sub marks	Marks
	ALTERNATIVE B $\sqrt{p^2 + h^2}$ $\cos 50^\circ = \frac{p}{\sqrt{p^2 + h^2}}$ $\frac{\sqrt{\frac{1 - \cos 50^\circ}{2}}}{\sqrt{\frac{\cos 50^\circ + 1}{2}}} \quad \text{or} \quad \frac{\sqrt{1 - \frac{p}{\sqrt{h^2 + p^2}}}}{\sqrt{1 + \frac{p}{\sqrt{h^2 + p^2}}}}$ $\frac{-p + \sqrt{p^2 + h^2}}{h}$ ALTERNATIVE C $\sqrt{p^2 + h^2}$ $\cos 50^\circ = \frac{p}{\sqrt{p^2 + h^2}} \quad \text{or} \quad \sin 50^\circ = \frac{h}{\sqrt{p^2 + h^2}}$ $\frac{\frac{h}{\sqrt{h^2 + p^2}}}{1 + \frac{p}{\sqrt{h^2 + p^2}}}$ $\frac{-p + \sqrt{p^2 + h^2}}{h}$	P1 K1 K1 N1 P1 K1 K1 N1	8 8

SULIT
3472/2
Matematik
Tambahan
Kertas 2
November
2023
 $2\frac{1}{2}$ jam



MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR

SIJIL PENDIDIKAN MRSM 2023

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN

Kertas 2

Dua jam tiga puluh minit

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini **SULIT** dan Hak Cipta Bahagian Pendidikan Menengah MARA. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa.

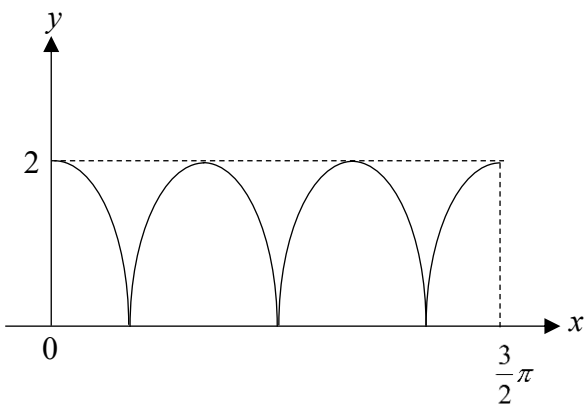
Dokumen ini mengandungi 22 halaman bercetak

Additional Mathematics Paper 2
SPMRSM 2023
ANSWER SCHEME

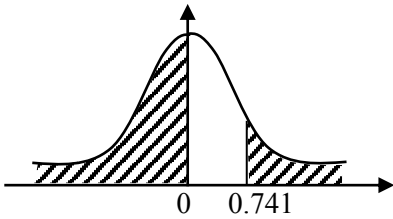
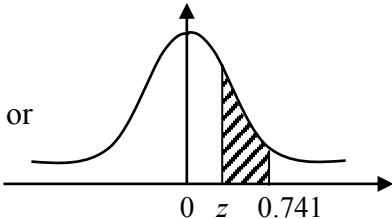
No	Marking Scheme	Sub Marks	Marks
1. (a)	Method 1: $3^{4x} = 3^5$ $x = \frac{5}{4}$ $9^{2\left(\frac{5}{4}\right)-1}$ $= 27$ Method 2: $9^{2x} = 243$ $9^{2x-1} = \frac{9^{2x}}{9}$ $= \frac{243}{9}$ $= 27$ Method 3: $9^{2x} = 9 \times 27$ $\frac{9^{2x}}{9} = 27$ $9^{2x-1} = 27$	K1 N1 K1 N1 K1 N1	2 2 2

(b)	(i) $\log_a b = \frac{\log_b b}{\log_b a}$	K1	2
	$\log_a b = \frac{1}{\log_b a}$	N1	
	(ii) $\frac{1}{2\log_a b}$ or $\frac{3}{2}\log_b a$	K1	3
	$\frac{3}{2}\log_b a - \frac{1}{2}\log_b a$	K1	
	$\log_b a$	N1	

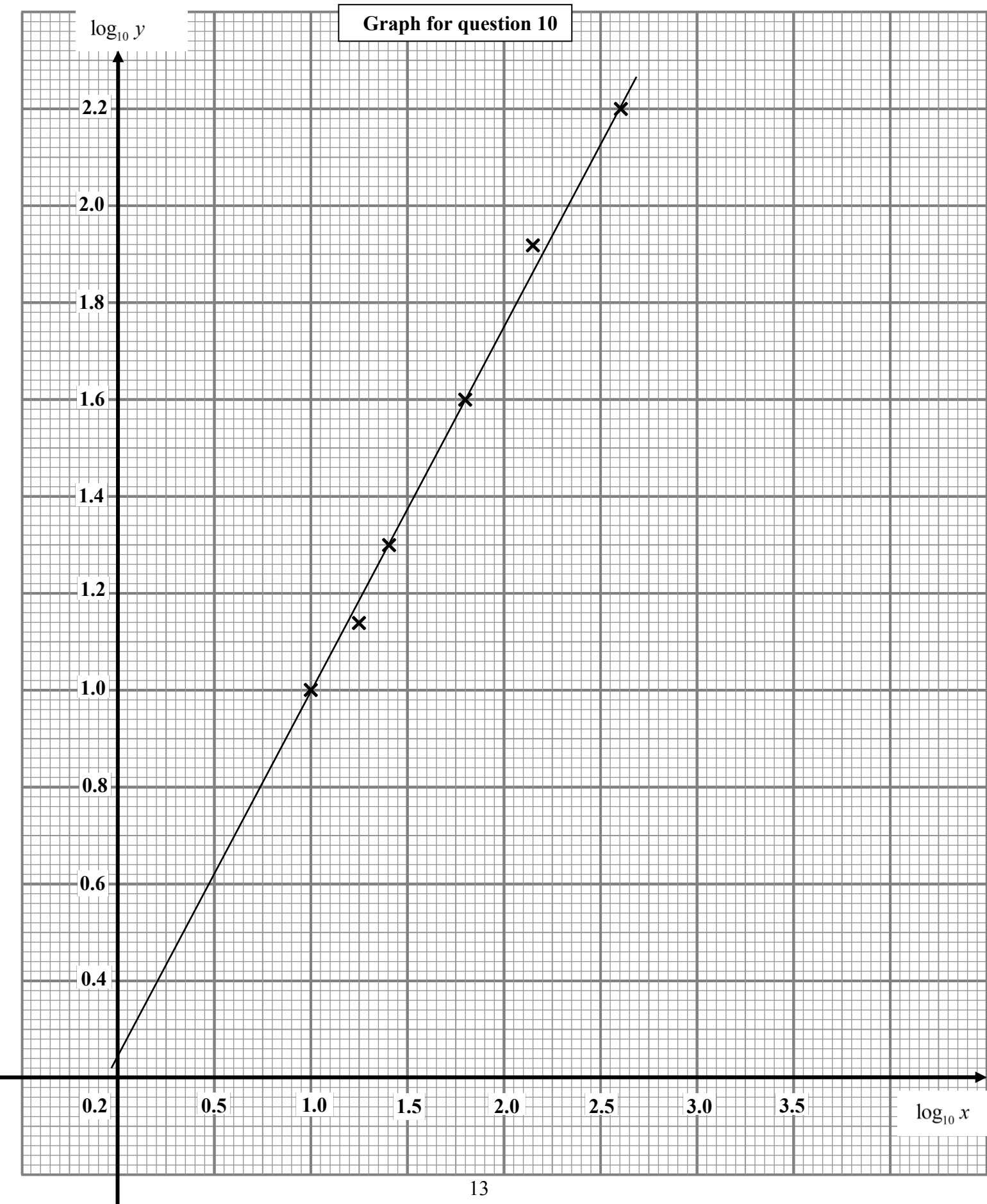
5	(a) (i) $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$ $= \tilde{x} + 4\tilde{y}$ (ii) $\overrightarrow{DB} = \overrightarrow{DC} + \overrightarrow{CB}$ $= 5\tilde{x} - 4\tilde{y}$ (b) (i) $\overrightarrow{CE} = h\overrightarrow{CA}$ $\overrightarrow{CE} = -h\tilde{x} - 4h\tilde{y}$ (ii) $\overrightarrow{CE} = \overrightarrow{CD} + k\overrightarrow{DB}$ $= -5\tilde{x} + k(-4\tilde{y} + 5\tilde{x})$ $= (-5 + 5k)\tilde{x} - 4k\tilde{y}$ $-h = -5 + 5k \text{ or } -4h = -4k$ $h = \frac{5}{6}, k = \frac{5}{6}$		K1 N1 N1 N1 N1 Compare the coefficient for $\tilde{x}$ and $\tilde{y}$ Solve simultaneous linear equations that involve h and k N1		2 1 1 4
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6			
(a)	(i) $\sin x \cos 90^\circ + \cos x \sin 90^\circ$ or $\sin x \cos 90^\circ - \cos x \sin 90^\circ$ $2(\cos x)(-\cos x) + 1$ $-\cos 2x$ (ii) $\cos 2x = -\frac{1}{2}$ Reference angle = 60° or $2x = 120$ $60^\circ, 120^\circ, 240^\circ, 300^\circ$	Use addition formulae LHS = RHS <u>Note:</u> Cannot redo	K1 N1 2 N1 N1 3
(b)		Shape of cosine graph. Accept at least one cycle. Complete 1.5 cycle and $0^\circ \leq x \leq \frac{3}{2}\pi$ Amplitude 2 and absolute	P1 P1 P1 3

7				
(a)	$-\frac{2x^2}{2} + c$ $6 = -(2)^2 + c$ $y = -x^2 + 10 \text{ or } g(x) = -x^2 + 10$	Integrate $y = -2x$ w.r.t.x Substitute (2, 6) to find c	K1 K1 N1	3
(b)	$\pi \int_1^6 (10 - y) dy$ $V_1 = \pi \left[10y - \frac{y^2}{2} \right]$	Integrate $\pi \int (10 - y) dy$	K1	
	$*V_1 = \pi \left[\left(10(6) - \frac{(6)^2}{2} \right) - \left(10(1) - \frac{(1)^2}{2} \right) \right]$ or $V_2 = \frac{1}{3} \pi (2)^2 (5) \text{ or } V_2 = \frac{4}{25} \pi \left[\frac{(6-1)^3}{3} - \frac{(1-1)^3}{3} \right]$	Use limit $\int_1^6$ into $*V_1$ or volume of cone or $\pi \int_1^6 \frac{4}{25} (y-1)^2 dy$	K1	
	$* \frac{65}{2} \pi - * \frac{20}{3} \pi$	Subtract $*V_1 - *V_2$ Note: $V_1 > V_2$	K1	4
	$\frac{155}{6} \pi // 25 \frac{5}{6} \pi // 25.83\pi$		N1	

8	(i) Continuous random variable	P1	2
	(ii) $X \sim N(50, 40.5^2)$ or $X \sim N(50, 1640.25)$	P1	
	(b) Method 1:	P1	
	Write $P\left(Z > \frac{80-50}{40.5}\right)$ or $P\left(Z < \frac{50-50}{40.5}\right)$ or $P\left(\frac{q-50}{40.5} < Z < \frac{80-50}{40.5}\right)$		
	$P(Z < 0) + P(Z > 0.741)$ and $0.5 + 0.2293$		
	or	K1	
	Shade and label on the sketching of normal graph		
			
	and $0.5 + 0.2293$		
	0.7293	N1	
(c)	0.7293×200 or equivalent	K1	
	145 // 146	N1	5
		K1	
	and $0.15 + 0.2293$		
	$\frac{q-50}{40.5} = 0.307 // 0.308$	K1	
	62.43 // 62.47	N1	3

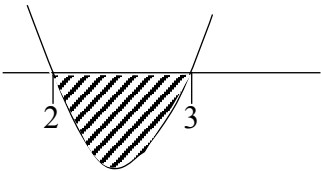
9				
(a)	$\frac{3(x)+7(1)}{1+3}=1 \quad \text{or} \quad \frac{3(y)+10(1)}{1+3}=4$ Use divisor of line segment formula. (*cannot be simplified) K1			
	$A(-1,2)$		N1	2
(b)	$\frac{2}{3}x + \frac{26}{3} = 6$ Equate to 6 and solve for x. K1			
	$m_{OP} \times m_{PQ} = \left(\frac{2}{3}\right)\left(-\frac{3}{2}\right)$ Use $m_1 \times m_2 = -1$ K1			
	$= -1$		N1	3
(c)	$\frac{2}{3}v + \frac{26}{3} = w \quad \text{or equivalent}$		P1	
	$\frac{1}{2} \left[\left[(-4 \times w) + (v \times 2) + (10 \times 0) + (0 \times 6) \right] - \left[(6 \times v) + (10 \times w) + (2 \times 0) + (0 \times -4) \right] \right] = 114$ Use $\frac{1}{2} \left \begin{pmatrix} & \\ & \end{pmatrix} - \begin{pmatrix} & \\ & \end{pmatrix} \right$ and equate 114 K1			
		Solve simultaneous equation to find v or w	K1	
	$w = 14 \quad \text{or} \quad v = 8$		N1	
	$v = 8 \quad \text{or} \quad w = 14$		N1	5



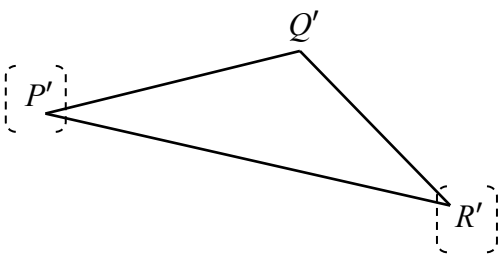
11				
(a)	(i) $h = \frac{96-2x^2}{4x}$ $V = x^2 \left(\frac{96-2x^2}{4x} \right) + \frac{1}{3} x^2 \left(\frac{96-2x^2}{4x} \right)$ $V = 32x - \frac{2}{3} x^3$ (ii) $32 - 2x^2 = 0$ $x = 4$ $32 \cdot (4) - \frac{2}{3} \cdot (4)^3$ $\frac{256}{3}$	Seen or implied Substitute * $h = \frac{96-2x^2}{4x}$ into V <u>Note:</u> Must show the simplifying process Differentiate V w.r.t. x, equate to 0 and solve. Substitute *x into V	P1 K1 N1 K1 N1 K1 N1	3 4
(b)	$0.84 = \left[32 - 2(3)^2 \right] \times \delta x$ $\frac{0.06}{3} \times 100$ 2% <u>Note:</u> Do not accept without %		K1 K1 N1	3

12				
(a)	$\frac{x}{13} \times 100 = 120 \quad \text{or} \quad \frac{8.75}{7.00} \times 100$ $x = 15.60$ $y = 125$	K1 N1 N1	3	
(b)	(i) $\frac{120(2) + 145(p) + 140(2p) + *125(3)}{2 + p + 2p + 3} = 135$ Use $\frac{\sum I_w}{\sum w}$ Equate $\frac{\sum I_w}{\sum w}$ to 135 and solve $p = 3$ (ii) <u>Method 1:</u> $\frac{100}{125} \times 162 \quad \text{or} \quad \frac{135 \times 125}{100}$ $Q_{22} = \text{RM}129.60$ $\bar{I}_{21}^{23} = 168.75$ $\frac{100}{135} \times 129.60 \quad \text{or} \quad \frac{100}{168.75} \times 162$ 96 RM80	K1 K1 N1 K1 N1 N1	3 4	

	<u>Method 2:</u> $\frac{125}{100} \times 135$ 168.75 $\frac{162 \times 100}{120}$ 135 $\frac{*135 \times 100}{*168.75}$	K1 K1 K1 NI	
80			

13				
(a)	$2t - m$ $2(4) - m = 3$ 5	Differentiate v to find a Substitute $t = 4$ into $*a$, equate 3 and solve.	K1 K1 N1	3
(b)	$t^2 - *5t + 6 < 0$ $(t - 2)(t + 3) < 0$ and  $2 < t < 3$	Use $*v < 0$ and solve	K1 N1	
(c)	(i) $\left \frac{5^3}{3} - 5^2 - 8(5) \right + 10$ or $\frac{5^3}{3} - 5^2 - 8(5) - 10$ $33\frac{1}{3}$		K1 N1	2
	(ii) $S_A = \frac{t^3}{3} - \frac{5t^2}{2} + 6t$ $* \left(\frac{t^3}{3} - \frac{5t^2}{2} + 6t \right) = \frac{t^3}{3} - t^2 - 8t - 10$ $3t^2 - 28t - 20 = 0$ $(t - 10)(3t + 2) = 0$ 10	Integrate V_A to find S_A Equate $S_A = S_B$ and solve $*quadratic$ equation.	K1 K1 N1	
				3

14				
(a)	(i) $\frac{1}{2} \times 16 \times 7.3 \times \sin \angle PRQ = 32.5$ 146.19° (ii) $7.3^2 + 16^2 - 2(7.3)(16) \cos *146.19^\circ$ 22.44 (iii) $\frac{\sin \angle RPQ}{7.3} = \frac{\sin *146.19^\circ}{*22.44}$ or $7.3^2 = 16^2 + *22.44^2 - 2(16)(*22.44) \cos P$ or $\frac{1}{2} \times *22.44 \times 16 \times \sin P = 32.5$ 10.43° // 10.41°	Use $\frac{1}{2} ab \sin c$ Use $a^2 = b^2 + c^2 - 2bc \cos A$ Use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ or $a^2 = b^2 + c^2 - 2bc \cos A$ or $\frac{1}{2} ab \sin C = 32.5$	K1 N1 K1 N1 K1 N1	2 2 2

(b)	(i)  (ii) $12.95^\circ // 12.97^\circ$ (iii) $\frac{1}{2} \times 7.3 \times 16 \times \sin 12.95^\circ$ 13.09 // 13.11	NMA <u>Note:</u> 1. $\angle P'Q'R'$ is an obtuse angle 2. Use ruler NMA Use $\frac{1}{2}ab \sin R'$ or equivalent N1	1 1 2
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15				
(a)	$x + y \leq 70$ $y \leq 4x$ $y - x \geq 10$	N1 N1 N1	3	
(b)	Graph (Attachment) Draw correctly at least one straight line from *inequalities x and y Draw correctly all the *straight line from *inequalities x and/or y <u>Note:</u> accept dotted line and solid line Correct shaded region.	K1 N1 N1	3	
(c)	(i) $35 \leq y \leq 45$ Integer only (ii) (30, 40) $80(*30) + 40(*40)$ RM4 000	N1 N1 K1 N1	1 3	
	<u>Note:</u> SS-1 once if (i) In (a) more than 3 inequalities given @ x and y not use at all (ii) In (b) does not use given scale @ axis interchange			

Graph for question 15

