

$m = 1$

$c = 7$

1 Suatu garis lurus yang mempunyai kecerunan 1 memotong paksi-y pada (0,7).

74 Garis lurus itu menyentuh lengkung $x^2 + (y-3)^2 = 8$ pada titik K. Cari koordinat titik K. [5 markah]

B3

A straight line with a gradient of 1 cuts the y-axis at (0,7). The straight line touches the curve $x^2 + (y-3)^2 = 8$ at point K. Find the coordinates of point K.

[5 marks]

$y = mx + c$

$y = 1x + 7$ - (1)

$x^2 + (y-3)^2 = 8$ - (2)

Sub $x = -2$ into (1)

$y = -2 + 7$
 $= 5$

K (-2, 5) 4

Sub (1) into (2)

$x^2 + (x+7-3)^2 = 8$

$x^2 + (x+4)^2 - 8 = 0$

$x^2 + x^2 + 8x + 16 - 8 = 0$

$2x^2 + 8x + 8 = 0$

$x^2 + 4x + 4 = 0$

$(x+2)^2 = 0$

$x + 2 = 0$

$x = -2$

∴ 2

2 Penyelesaian secara lukisan berskala **tidak** diterima.

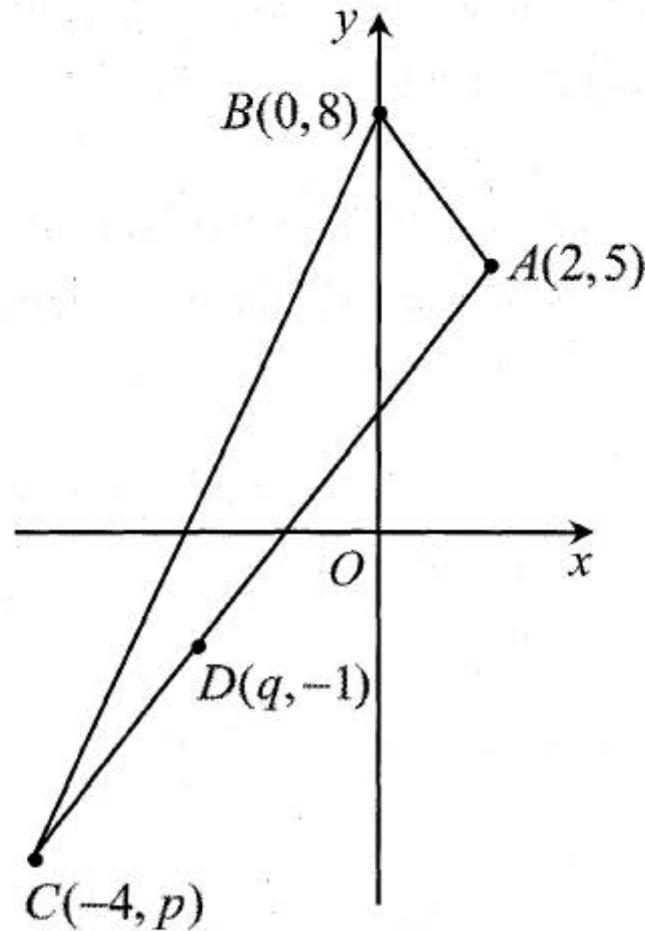
*Solution by scale drawing is **not** accepted.*

74

97

Rajah 1 menunjukkan segitiga ABC . Titik D terletak pada garis AC .

Diagram 1 shows a triangle ABC . Point D lies on the line AC .



$2AD = 3DC$

Rajah 1
Diagram 1

- (a) Titik P bergerak dengan keadaan jaraknya dari titik A sentiasa 4.5 unit. Cari persamaan lokus bagi P . [2 markah]
A point P moves such that its distance from point A is always 4.5 units. Find the equation of the locus of P . [2 marks]
- (b) Diberi $2AD = 3DC$. Cari nilai bagi p dan bagi q . [2 markah]
Given that $2AD = 3DC$. Find the value of p and of q . [2 marks]
- (c) Cari persamaan garis lurus yang melalui titik B dan berserenjang dengan garis AB . [2 markah]
Find the equation of the line passes through point B and perpendicular to the line AB . [2 marks]

a) $PA = 4.5$ $P(x, y), A(2, 5)$

$$4.5^2 = \left(\frac{9}{2}\right)^2 = \frac{81}{4}$$

$$\left(\sqrt{(x-2)^2 + (y-5)^2}\right)^2 = (4.5)^2$$

$$(x^2 - 4x + 4 + y^2 - 10y + 25) = \frac{81}{4}$$

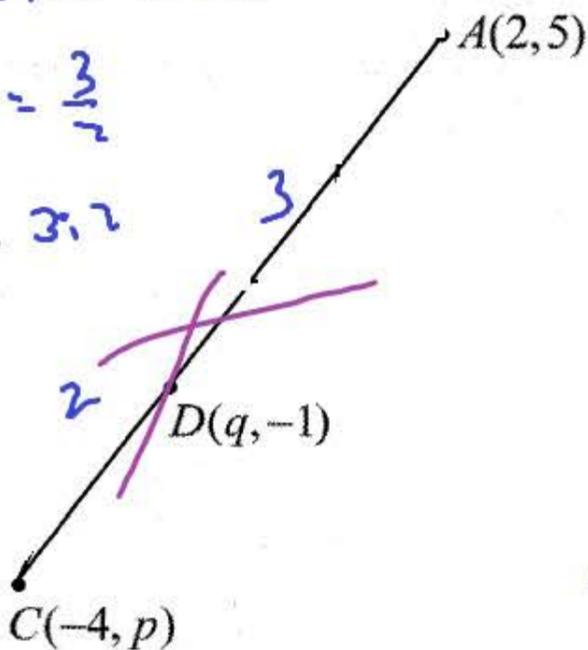
$$4x^2 + 4y^2 - 16x - 40y + 116 - 81 = 0$$

$$4x^2 + 4y^2 - 16x - 40y + 35 = 0$$

b) $2AD = 3DC$

$$\frac{AD}{2} = \frac{3}{2} DC$$

$$AD : DC = 3 : 2$$



$$q = \frac{3(-4) + 2(2)}{3+2}$$

$$-1 = \frac{3(p) + 2(5)}{3+2}$$

$$= -\frac{8}{5}$$

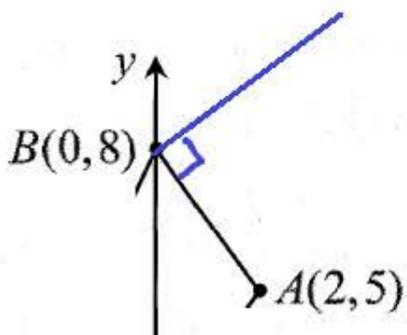
$$-5 = 3p + 10$$

$$-15 = 3p$$

$$p = -5$$

$$\therefore p = -5, \quad q = -\frac{8}{5} = -1.6$$

c)



$$m_{AB} = \frac{5-8}{2-0}$$

$$= -\frac{3}{2}$$

$$m_2 = -\frac{1}{m_{AB}}$$

$$= -\frac{1}{-3/2}$$

$$= \frac{2}{3}$$

$$c = 8$$

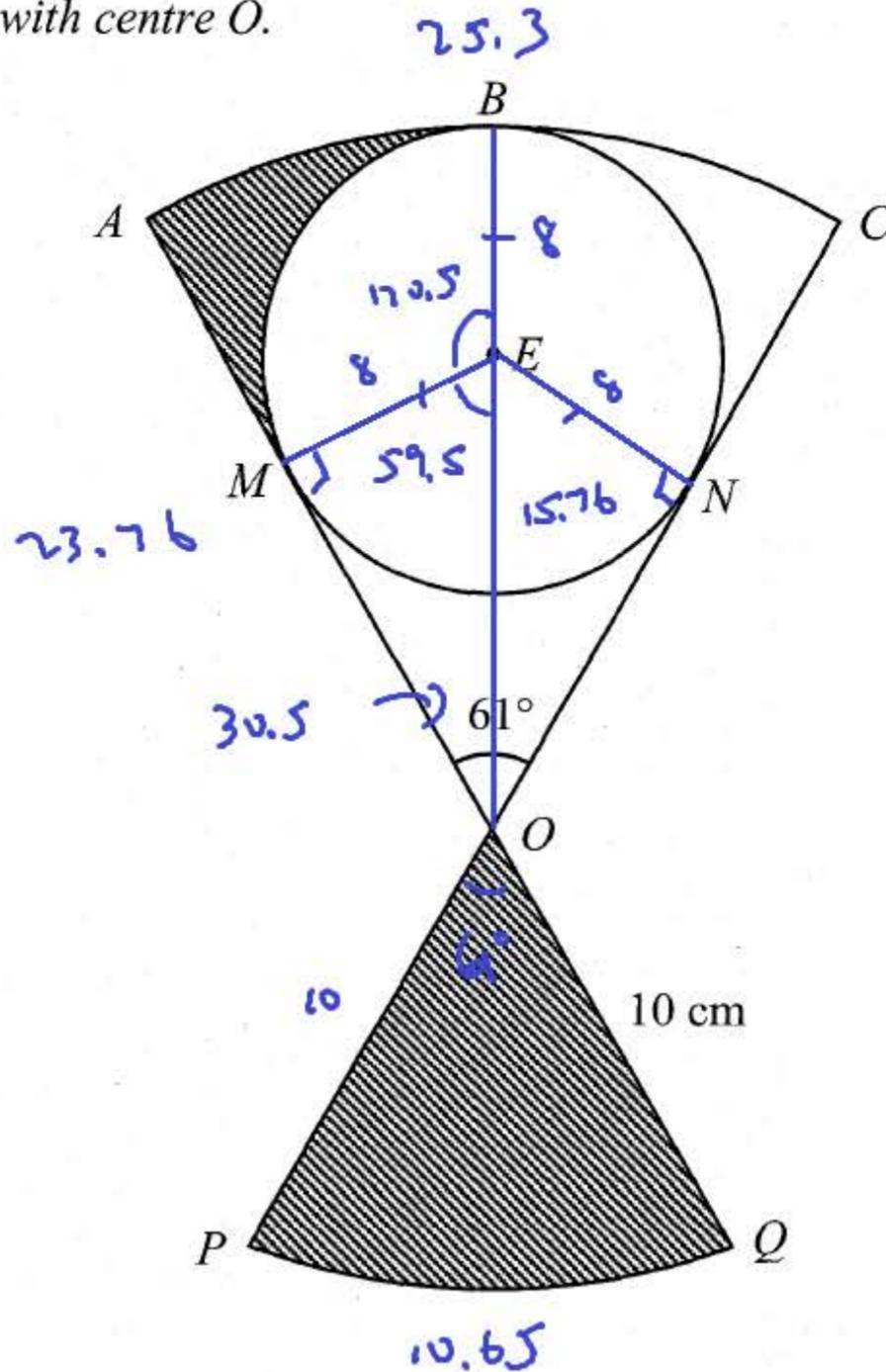
$$y = \frac{2}{3}x + 8$$

TS
31

3 Rajah 2 menunjukkan sebuah wau bulan yang terdiri daripada gabungan dua buah sektor bulatan $OABC$ dan OPQ berpusat di O .
Diagram 2 shows a wau bulan which is the combination of two sectors of a circle $OABC$ and OPQ with centre O .

$180 - 90 - 30.5$	▲
59.5	

$180 - 59.5$	▲
120.5	



Diberi jejari bagi sektor OPQ ialah 10 cm dan $\angle AOC = 61^\circ$. Sebuah bulatan berpusat E yang berjejari 8 cm terterap di dalam sektor $OABC$. Garis lurus OA dan OC adalah tangen kepada bulatan pada titik M dan titik N .

Given that the radius of sector OPQ is 10 cm and $\angle AOC = 61^\circ$. A circle with centre E and radius 8 cm is inscribed in the sector $OABC$. Straight lines OA and OC are tangents to the circle at point M and point N .

[Guna/ Use $\pi = 3.142$]

Hitung
Calculate

- (a) perimeter, dalam cm, bagi seluruh rajah. [5 markah]
the perimeter, in cm, of the whole diagram, [5 marks]
- (b) luas, dalam cm^2 , bagi kawasan berlorek. [4 markah]
the area, in cm^2 , of the shaded region. [4 marks]

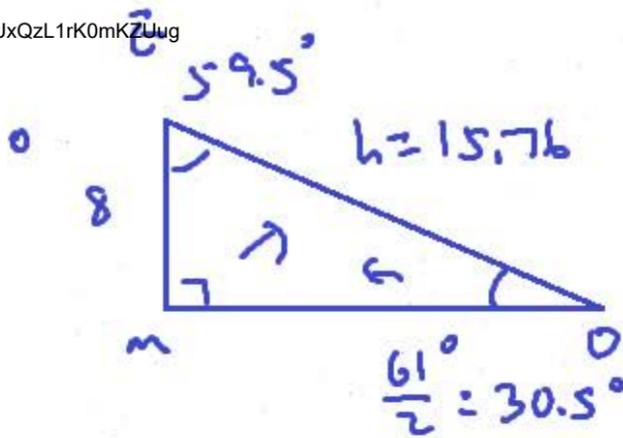
$$\theta = 61^\circ = \frac{61^\circ}{180} \times \pi$$

$$s = r\theta$$

$$\widehat{PQ} = 10 \left(\frac{61^\circ}{180} \times \pi \right)$$

$$= 10.65$$

$$\frac{10 \times \frac{61}{180} \times 3.142}{10.64788889}$$



$$\sin 30.5^\circ = \frac{8}{23.76}$$

$$O\bar{C} = \frac{8}{\sin(30.5)} = 15.76235529$$

$$= 15.76$$

$$r = 15.76 + 8$$

$$= 23.76 = OA = OC$$

$$\widehat{ABC} = 23.76 \left(\frac{61^\circ}{180} \times \pi \right)$$

$$= 25.30$$

$$\frac{23.76 \times \frac{61}{180} \times 3.142}{25.299384}$$

$$P = 25.3 + 2(23.76) + 2(10) + 10.65$$

$$= 103.47 \text{ cm}$$

$$\frac{25.3 + 2 \times 23.76 + 20 + 10.65}{103.47}$$

$$b) A = \frac{1}{2} r^2 \theta$$

$$\frac{0.5 \times 10^2 \times \frac{61}{180} \times 3.142}{53.23944444}$$

$$A_{OPQ} = \frac{1}{2} (10)^2 \left(\frac{61}{180} \pi \right)$$

$$= 53.24$$

$$A_{OAB} = \frac{1}{2} \times 23.76^2 \times \left(\frac{30.5^\circ}{180} \times \pi \right)$$

$$= 150.28$$

$$\frac{0.5 \times 23.76^2 \times \frac{30.5}{180} \times 3.142}{150.278341}$$

$$A_{GBM} = \frac{1}{2} \times 8^2 \times \left(\frac{170.5^\circ}{180} \times \pi \right)$$

$$= 67.31$$

$$\frac{0.5 \times 8^2 \times \frac{170.5}{180} \times 3.142}{67.30862222}$$

$$A_{ABM} = 150.28 - 67.31 - 54.32$$

$$= 28.65$$

$$\frac{150.28 - 67.31 - 54.32}{28.65}$$

$$A_{OCM} = \frac{1}{2} (8)(15.76) \sin 59.5^\circ$$

$$= 54.32$$

$$\frac{0.5 \times 8 \times 15.76 \times \sin(59.5)}{54.31710227}$$

$$A_{sq} = 53.24 + 28.65$$

$$= 81.89 \text{ cm}^2$$

$$\frac{53.24 + 28.65}{81.89}$$

4 (a) Diberi $\frac{d}{dt} \left[\frac{t^2}{2(1-t)} \right] = 2g(t)$. Cari $\int g(t) dt$. [2 markah]

TS
B3
Given that $\frac{d}{dt} \left[\frac{t^2}{2(1-t)} \right] = 2g(t)$. Find $\int g(t) dt$. [2 marks]

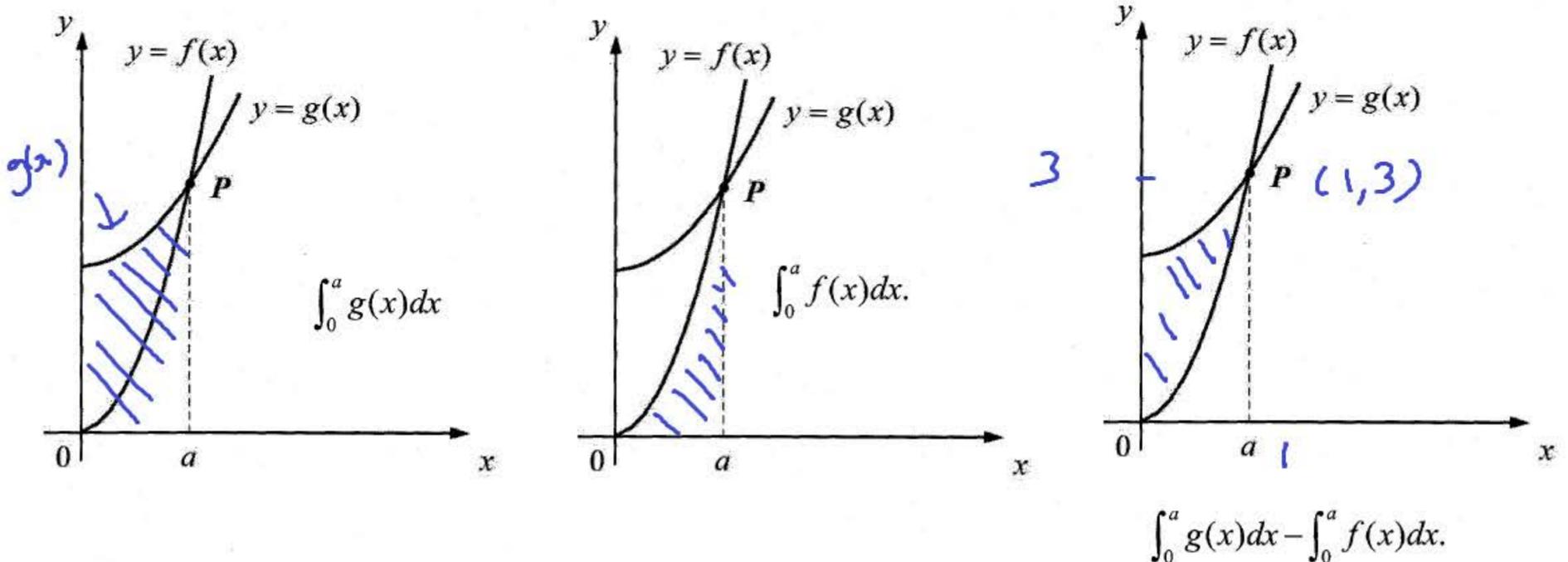
$$\int \frac{d}{dt} \left[\frac{t^2}{2(1-t)} \right] = \int 2g(t) dt$$

$$\frac{t^2}{2 \cdot 2(1-t)} + \frac{k}{2} = \frac{2}{2} \int g(t) dt$$

$$\int g(t) dt = \frac{t^2}{4(1-t)} + c, \quad c = \frac{k}{2}$$

(b) Rajah 3 menunjukkan sebahagian daripada graf bagi lengkung $y = f(x)$ dan $y = g(x)$ yang menyilang pada titik P .

Diagram 3 shows part of the graph for the curve $y = f(x)$ and $y = g(x)$ intersecting at the point P .



Diberi $f(x) = 3x^2$ dan $g(x) = 2x^2 + 1$.

Given $f(x) = 3x^2$ and $g(x) = 2x^2 + 1$.

(i) Pada Rajah 3 di atas, lorekkan rantau yang diwakili oleh

$$\int_0^a g(x) dx - \int_0^a f(x) dx.$$

On Diagram 3 above, shade the region represented by

$$\int_0^a g(x) dx - \int_0^a f(x) dx.$$

(ii) Tentukan koordinat titik P .

Determine the coordinates of point P .

(iii) Cari isipadu janaan dalam sebutan π , apabila rantau yang dibatasi oleh lengkung $y = g(x)$, paksi- y dan garis lurus $y = 5$ dikisarkan melalui 360° pada paksi- y .

Find the volume of revolution in terms of π , when the region bounded by the curve $y = g(x)$, the y -axis and the straight line $y = 5$ is revolved through 360° about the y -axis.

[5 markah]

[5 marks]

b ii)

$f(x) = 3x^2$ dan $g(x) = 2x^2 + 1$.

$y = 3x^2$ - (1)

$y = 2x^2 + 1$ - (2)

Sub (1) into (2)

$3x^2 = 2x^2 + 1$

$x^2 = 1$

$x = \pm\sqrt{1}$, $x > 0$

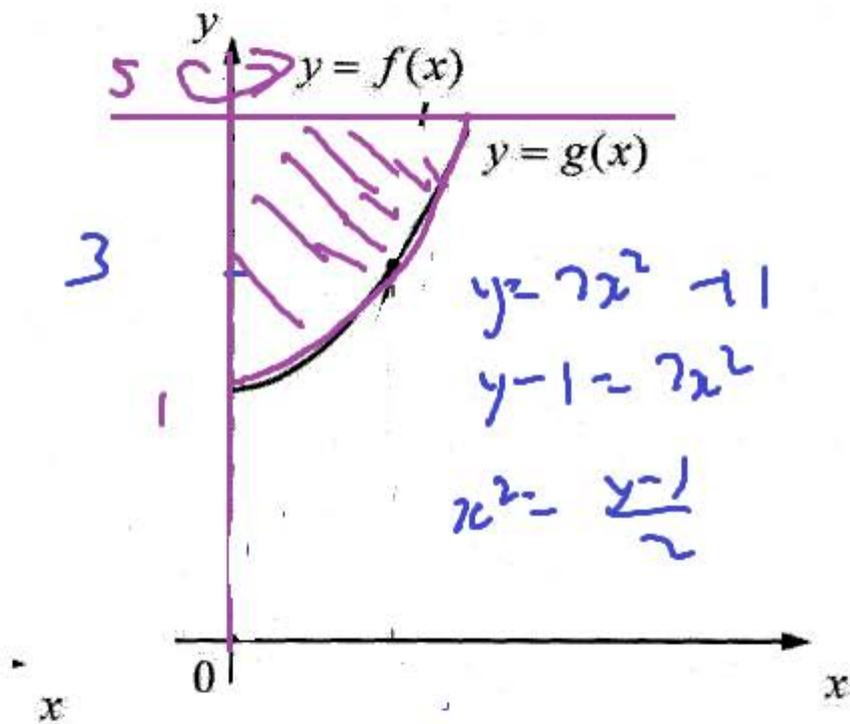
$x = 1$

Sub $x = 1$ into (1)

$y = 3(1)^2 = 3$

$P(1, 3)$

iii)



$V = \pi \int_1^5 x^2 dy$

$= \pi \int_1^5 \frac{y-1}{2} dy$

$= \frac{\pi}{2} \int_1^5 (y-1) dy$

$= \frac{\pi}{2} \left[\frac{y^2}{2} - y \right]_1^5$

$= \frac{\pi}{2} \left[\left(\frac{5^2}{2} - 5 \right) - \left(\frac{1^2}{2} - 1 \right) \right]$

$= \frac{\pi}{2} \left[\frac{25}{2} - 5 - \frac{1}{2} + 1 \right]$

$= 4\pi \text{ units}^3$

skema $\frac{15}{4} \pi$

$\int_1^5 \frac{x-1}{2} dx$

$\int_1^5 x-1 dx$

(iii)

Mr Lim SPM Mathematics Youtube : <https://www.youtube.com/channel/UCn32UaWXUxQzL1rK0mKZUug>

$$\pi \left[\frac{y^2}{4} - \frac{1}{2}y \right]_1^5$$

K1

$$\pi \left[\left(\frac{(5)^2}{4} - \frac{1}{2}(5) \right) - \left(\frac{(1)^2}{4} - \frac{1}{2}(1) \right) \right]$$

K1

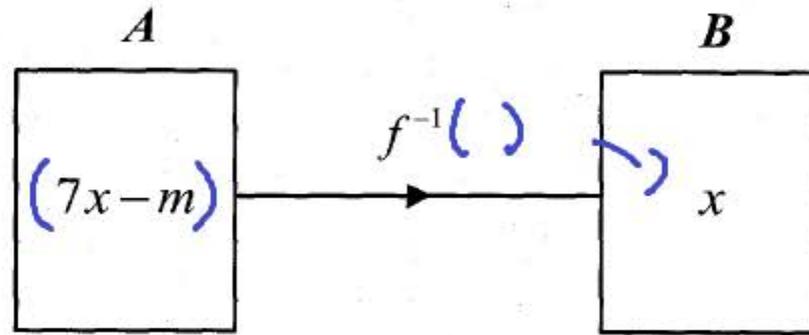
$$\frac{15}{4}\pi$$

N1

5 Rajah 4 menunjukkan fungsi f^{-1} memetakan set A kepada set B .

74 Diagram 4 shows the function f^{-1} maps set A to set B .

B1



Rajah 4
Diagram 4

Diberi bahawa $f(4) = 8m + 1$, dengan keadaan m ialah pemalar.

It is given that $f(4) = 8m + 1$, such that m is a constant.

(a) Cari
Find

(i) nilai m ,
the value of m ,

(ii) $f^{-1}(x)$.

[4 markah]

[4 marks]

(b) Diberi bahawa fungsi g yang memetakan set B kepada set C ialah

$$g(x) = \frac{x+6}{5}$$

Tulis fungsi yang memetakan set A kepada set C melalui set B dalam sebutan x .

[3 markah]

It is given that the function g that maps set B to set C is $g(x) = \frac{x+6}{5}$.

Write the function that maps set A to set C through set B in terms of x .

[3 marks]

a:) $f^{-1}(7x - m) = x$

$$7x - m = f(x)$$

$$f(x) = 7x - m$$

$$f(4) = 8m + 1$$

$$7(4) - m = 8m + 1$$

$$28 - 1 = 8m + m$$

$$27 = 9m$$

$$m = \frac{27}{9}$$

$$m = 3$$

ii) $f(x) = 7x - 3$

let $f(y) = x$ then $f^{-1}(x) = y$

$$7y - 3 = x$$

$$7y = x + 3$$

$$y = \frac{x + 3}{7}$$

$$\therefore f^{-1}(x) = \frac{x + 3}{7}$$

b)

$$A \xrightarrow{f^{-1}} B \xrightarrow{g} C$$

$$(x) \quad (y) \quad (z)$$

$$y = f^{-1}(x)$$

$$g(y) = z$$

$$g f^{-1}(x) = z$$

$$f^{-1}(x) = \frac{x + 3}{7}$$

$$g(x) = \frac{x + 6}{5}$$

$$g f^{-1}(x) = g\left(\frac{x + 3}{7}\right)$$

$$= \frac{\left(\frac{x + 3}{7} + 6\right) \times 7}{5 \times 7}$$

$$= \frac{x + 3 + 42}{35}$$

$$g f^{-1}(x) = \frac{x + 45}{35}$$

6
T5
B6

(a) Terbitkan rumus $\sin 2x = 2 \sin x \cos x$.

[2 markah]

Derive the formula of $\sin 2x = 2 \sin x \cos x$.

[2 marks]

$$\sin 2x = \sin (x+x)$$

$$= \sin x \cos x + \cos x \sin x$$

$$= 2 \sin x \cos x$$

$$\sin (x+y) = \sin x \cos y + \cos x \sin y$$

(b) Selesaikan persamaan $\sin 2x = \cos x$ untuk $0 \leq x \leq \pi$.

[3 markah]

Solve the equation $\sin 2x = \cos x$ for $0 \leq x \leq \pi$.

[3 marks]

$$\sin 2x = \cos x$$

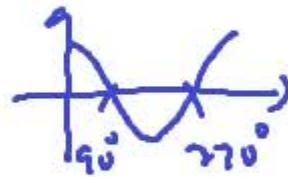
$$2 \sin x \cos x - \cos x = 0$$

$$\cos x (2 \sin x - 1) = 0$$

$$\cos x = 0$$

$$x = 90^\circ, \cancel{270^\circ}$$

$$= \frac{\pi}{2}, \cancel{\frac{3\pi}{2}}$$



$$\therefore x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6} \quad \square$$

$$2 \sin x - 1 = 0$$

$$\sin x = \frac{1}{2}$$

$$\text{basic } \angle = \sin^{-1}\left(\frac{1}{2}\right) = 30^\circ$$

$$x = 30^\circ, 150^\circ \\ = \frac{\pi}{6}, \frac{5\pi}{6}$$

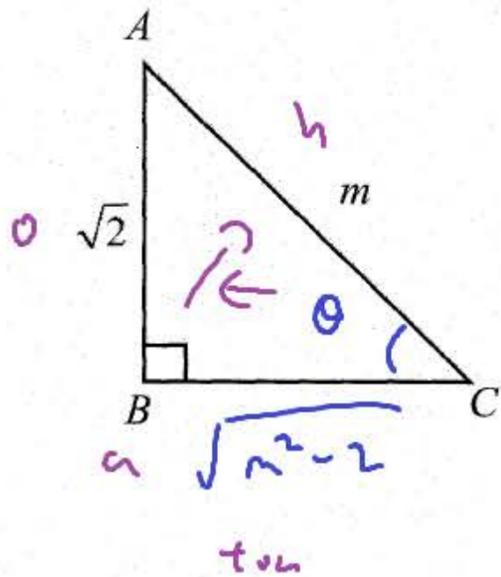
$$180^\circ \quad \square$$



$$\leftarrow 180^\circ - 30^\circ$$

(c) Rajah 5 menunjukkan sebuah segi tiga bersudut tegak ABC.

Diagram 5 shows a right-angled triangle ABC.



$$BC^2 = m^2 - \sqrt{2}^2$$

$$BC = \sqrt{m^2 - 2}$$

$$\left(\tan \angle ACB \right)^2 = \left(\frac{\sqrt{2}}{\sqrt{m^2 - 2}} \right)^2$$

$$\tan^2 \angle ACB = \frac{2}{m^2 - 2}$$

Ungkapkan $\tan^2 \angle ACB$ dalam sebutan m .

Express $\tan^2 \angle ACB$ in terms of m .

Seterusnya, cari nilai $\angle ACB$ jika $m = 2$.

Hence, the value of $\angle ACB$ if $m = 2$.

$$m = 2$$

[3 markah]

[3 marks]

$$\tan^2 \angle ACB = \frac{2}{2^2 - 2}$$

$$= 1$$

$$\tan \angle ACB = \pm \sqrt{1}$$

$$= 1$$

$$\angle ACB = \tan^{-1} 1$$

$$= 45^\circ$$

✓

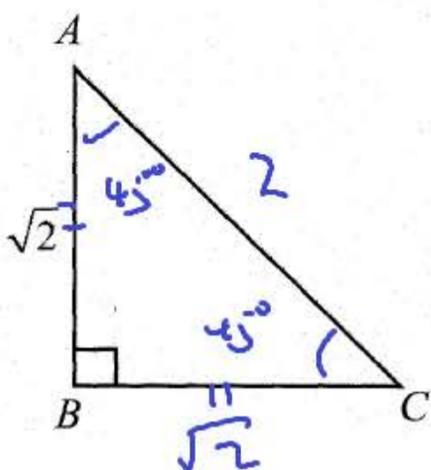
$\tan^{-1}(1)$	45
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S	A	tan
±	±	(+ve)

$$0 < \angle ACB < 90^\circ$$

$$\tan \angle ACB = +ve$$

out of box



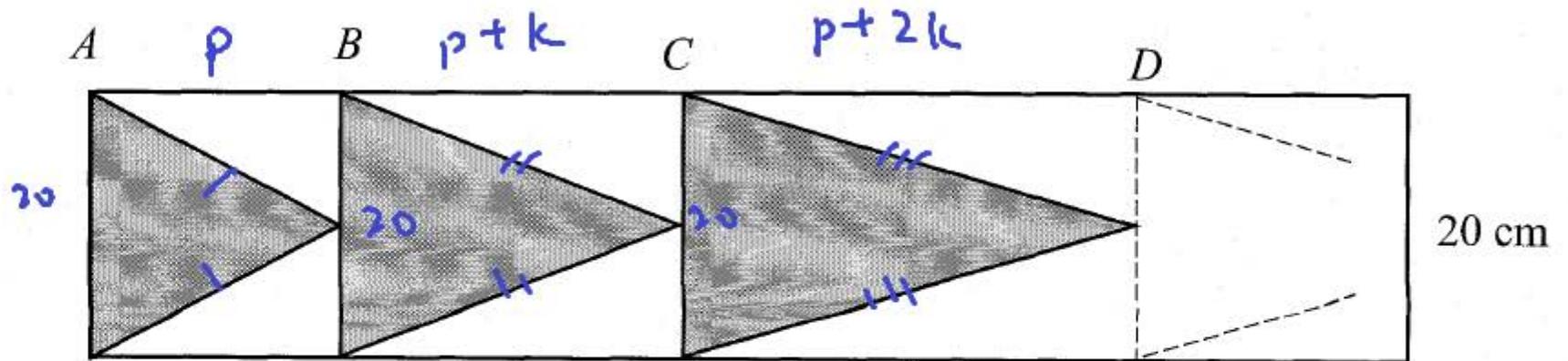
$$BC^2 = 2^2 - (\sqrt{2})^2$$

$$= 2$$

$$BC = \sqrt{2}$$

7
T4
B5
A.P.

Rajah 6 menunjukkan beberapa corak berbentuk segi tiga sama kaki berwarna kelabu yang dilukis pada bentangan segulung kertas berbentuk segi empat tepat. Diagram 6 shows a few of grey coloured isosceles triangle pattern drawn on a net of a rectangle roll of paper.



Rajah 6
Diagram 6

Diberi bahawa panjang $AB = p$ cm, $BC = (p+k)$ cm, $CD = (p+2k)$ cm dan seterusnya.

It is given that the length of $AB = p$ cm, $BC = (p+k)$ cm, $CD = (p+2k)$ cm and subsequently.

- (a) Ungkapkan luas segi tiga sama kaki kedua dalam sebutan p dan k . [1 markah]

Express the area of the second isosceles triangle in terms of p and k .

[1 mark]

- (b) Diberi luas segi tiga sama kaki ke-15 dan ke-30 masing-masing ialah 700 cm^2 dan 1300 cm^2 .

Cari nilai p dan nilai k . [3 markah]

Given the area of the 15th and 30th isosceles is 700 cm^2 and 1300 cm^2 respectively.

Find the value of p and of k . [3 marks]

- (c) Sebotol cat poster boleh mewarnai seluas 600 cm^2 . Jika harga sebotol cat poster itu ialah RM2.50, hitung kos yang diperlukan untuk membeli cat poster bagi mewarnai kesemua 30 buah segi tiga sama kaki tersebut.

[4 markah]

A bottle of poster paint can colour an area of 600 cm^2 . If the cost of a bottle of poster paint is RM2.50, calculate the cost needed to buy the poster paint to colour the whole 30 isosceles triangles. [4 marks]

$$a) A_{15} = \frac{1}{2}(20)(p+k)$$

$$A_2 = 10p + 10k$$

$$a = 10p, \quad d = 10p + 10k - 10p = 10k$$

$$A_{15} = 700$$

$$10p + 14(10k) = 700$$

$$p + 14k = 70 \quad - (1)$$

$$(2) - (1) \quad 15k = 60$$

$$k = \frac{60}{15} = 4$$

$$\therefore k = 4, \quad p = 14$$

$$A_1 = \frac{1}{2}(20)(p) = 10p$$

$$A_3 = \frac{1}{2}(20)(p+2k) = 10p + 20k$$

$$T_n = a + (n-1)d$$

$$A_{30} = 1300$$

$$10p + 29(10k) = 1300$$

$$p + 29k = 130 \quad - (2)$$

$$\text{Sub } k = 4 \text{ into } (1)$$

$$p + 14(4) = 70$$

$$p = 70 - 56 = 14$$

c) RM 2.50, 600 cm²

$$S_{30}$$

$$a = 10(14) = 140$$

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

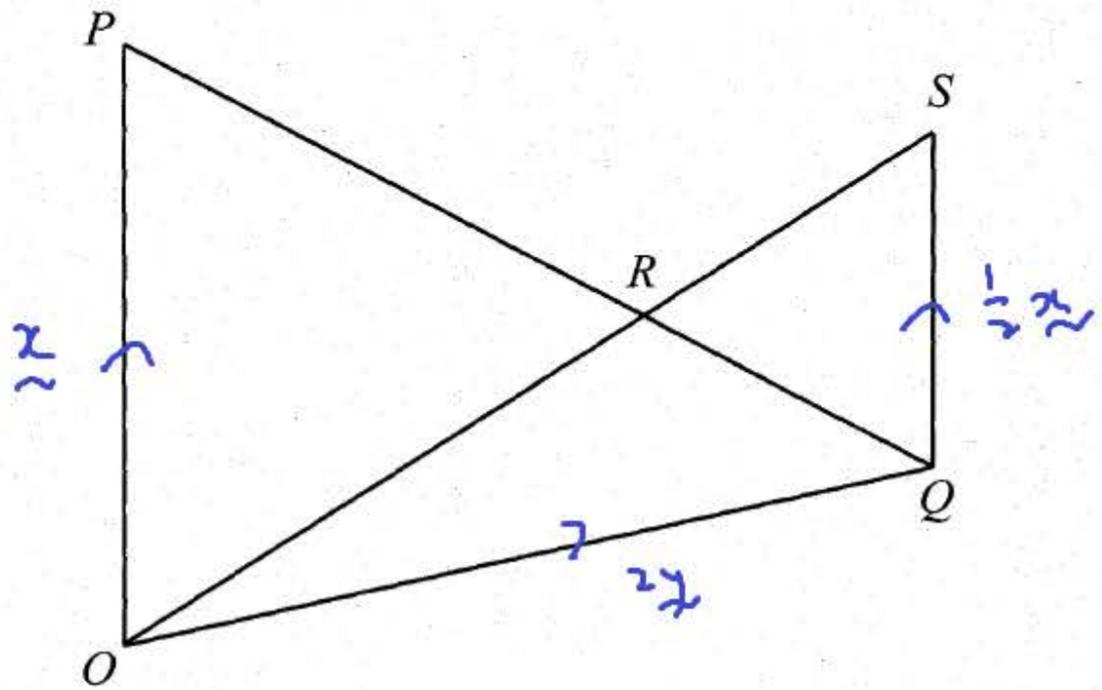
$$d = 10(4) = 40$$

$$S_{30} = \frac{30}{2} [2(140) + (30-1)(40)] = 21600 \text{ cm}^2$$

$$\text{Jumlah cost} = \frac{21600}{600} \times 2.50 = \text{RM } 90$$

Rajah 7 menunjukkan dua buah segitiga POQ dan SOQ . Garis lurus OS bersilang dengan garis lurus PQ pada titik R .

Diagram 7 shows two triangles POQ and SOQ . Straight line OS intersects the straight line PQ at point R .



Diberi bahawa $\overline{OP} = x$, $\overline{OQ} = 2y$ dan $\overline{OP} = 2\overline{OS}$.

Given that $\overline{OP} = x$, $\overline{OQ} = 2y$ and $\overline{OP} = 2\overline{OS}$.

(a) Ungkapkan dalam sebutan x dan/atau y

Express in terms of x and/or y

- (i) \overline{OS} ,
- (ii) \overline{PQ} .

[3 markah]

[3 marks]

(b) Diberi bahawa $\overline{OR} = m\overline{OS}$ dan $\overline{PR} = n\overline{PQ}$, ungkapkan \overline{OR} dalam sebutan

Given that $\overline{OR} = m\overline{OS}$ and $\overline{PR} = n\overline{PQ}$, express \overline{OR} in terms of

- (i) m , x dan/atau y ,
 m , x and/or y ,
- (ii) n , x dan/atau y .
 n , x and/or y .

Seterusnya, cari nilai-nilai m dan n .

Hence, find the values of m and n .

[5 markah]

[5 marks]

(c) Diberi bahawa $|x| = 3$ unit dan $|y| = 5$ unit, cari $|\overline{PQ}|$.

[2 markah]

Given that $|x| = 3$ unit and $|y| = 5$ unit, find $|\overline{PQ}|$.

[2 marks]

$OP = 2QS$

$\underline{x} = 2\vec{QS}$

$\vec{QS} = \frac{1}{2}\underline{x}$

(i)

$\vec{OS} = \vec{OQ} + \vec{QS}$
 $= 2y + \frac{1}{2}\underline{x}$

(ii) $\vec{PQ} = \vec{PO} + \vec{OQ}$
 $= -\underline{x} + 2y$

b) i) $\vec{OR} = m\vec{OS}$

$= m(2y + \frac{1}{2}\underline{x})$

$= \frac{m}{2}\underline{x} + 2my$

ii) $\vec{PR} = n\vec{PQ}$

$= n(-\underline{x} + 2y)$

$\vec{OR} = \vec{OP} + \vec{PR}$
 $= -\underline{x} + 2ny$

$= \underline{x} + (-n\underline{x} + 2ny)$

$= (1-n)\underline{x} + 2ny$

$\frac{m}{2} = 1-n$

$2m = 2n$

$m = 2 - 2n$
 - (1)

$m = n$
 - (2)

Sub (2) into (1)

Sub $n = \frac{2}{3}$ into (2)

$\vec{OR} = \frac{2}{3}\vec{OS}$

$n = 2 - 2n$

$m = \frac{2}{3}$

$\vec{PR} = \frac{2}{3}\vec{PQ}$

$3n = 2$

$\therefore m = \frac{2}{3}, n = \frac{2}{3}$

$n = \frac{2}{3}$

c) $\vec{PQ} = -\underline{x} + 2y$

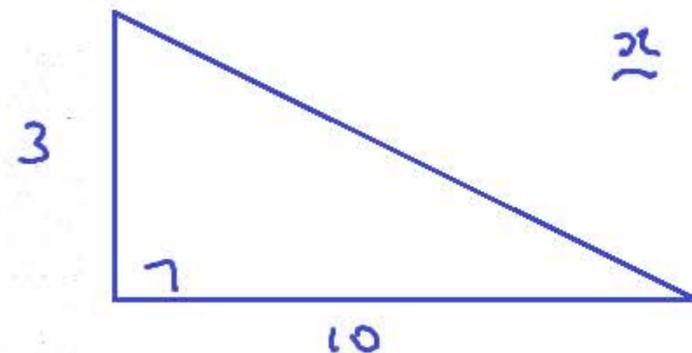
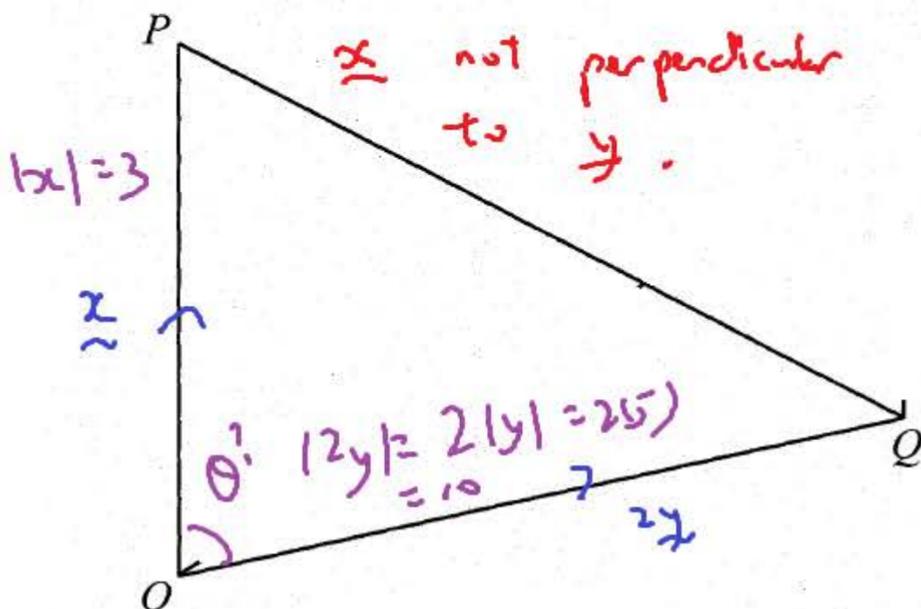
$|x| = 3$ unit dan $|y| = 5$ unit

can't find $|\vec{PQ}|$

\underline{x} not perpendicular to y .

Assume

$\underline{x} \perp y$



$|\vec{PQ}| = \sqrt{3^2 + 10^2}$
 $= 10.44$ units

(c)

$$|PQ| = \sqrt{(-3)^2 + [2(5)]^2}$$

$$= 10.44$$

N1

N1

2

Mr Lim SPM Mathematics Youtube : <https://www.youtube.com/channel/UCn32UaWXUxQzL1rK0mKZUug>

9 Jadual 1 menunjukkan nilai-nilai bagi dua pemboleh ubah, x dan y , yang diperoleh daripada suatu eksperimen. Pemboleh ubah x dan y dihubungkan oleh persamaan

74
36 $y = \frac{a}{b^{x+1}}$, dengan keadaan a dan b adalah pemalar.

Table 1 shows the values of two variables, x and y , obtained from an experiment. The variables x and y are related by the equation $y = \frac{a}{b^{x+1}}$, such that a and b are constants.

x	1	2	3	4	5	6
y	4.0	5.7	8.7	13.2	20.0	28.8

Jadual 1
Table 1

(a) Plot $\log_{10} y$ melawan $(x+1)$, dengan menggunakan skala 2 cm kepada 1 unit pada paksi- $(x+1)$ dan 2 cm kepada 0.2 unit pada paksi- $\log_{10} y$.

Seterusnya, lukis garis lurus penyuaian terbaik. [5 markah]

Plot $\log_{10} y$ against $(x+1)$, using a scale of 2 cm to 1 unit on the $(x+1)$ -axis and 2 cm to 0.2 unit on the $\log_{10} y$ -axis.

Hence, draw the line of best fit. [5 marks]

(b) Menggunakan graf di 9(a), tulis $y = \frac{a}{b^{x+1}}$, dalam bentuk linear, seterusnya cari nilai a dan nilai b . [5 markah]

Using the graph in 9(a), write $y = \frac{a}{b^{x+1}}$, in linear form, hence, find the value of a and of b . [5 marks]

$$y = \frac{a}{b^{x+1}}$$

$$(6.5, 1.38), (0, 0.25)$$

$$\lg y = \lg \left(\frac{a}{b^{x+1}} \right)$$

$$m = \frac{1.38 - 0.25}{6.5 - 0}$$

$\frac{1.38 - 0.25}{6.5 - 0}$
0.1738461538

$$= \lg a - (x+1) \lg b$$

$$- \lg b = 0.1738$$

$$\lg y = (-\lg b)(x+1) + \lg a$$

\uparrow
 m
 \times
 C

$$\lg b = -0.1738$$

$$b = 10^{-0.1738}$$

$10^{-0.1738}$
0.6701931737

$$= 0.6702$$

$\log_{10} a = 0.26$ K1

$a = 1.820$ N1

$$\lg a = 0.25$$

$$a = 10^{0.25}$$

$10^{0.25}$
1.77827941

Guna $*m = -\log_{10} b$ $m = \frac{1.46 - 0.60}{7 - 2}$ K1

$$= 1.778$$

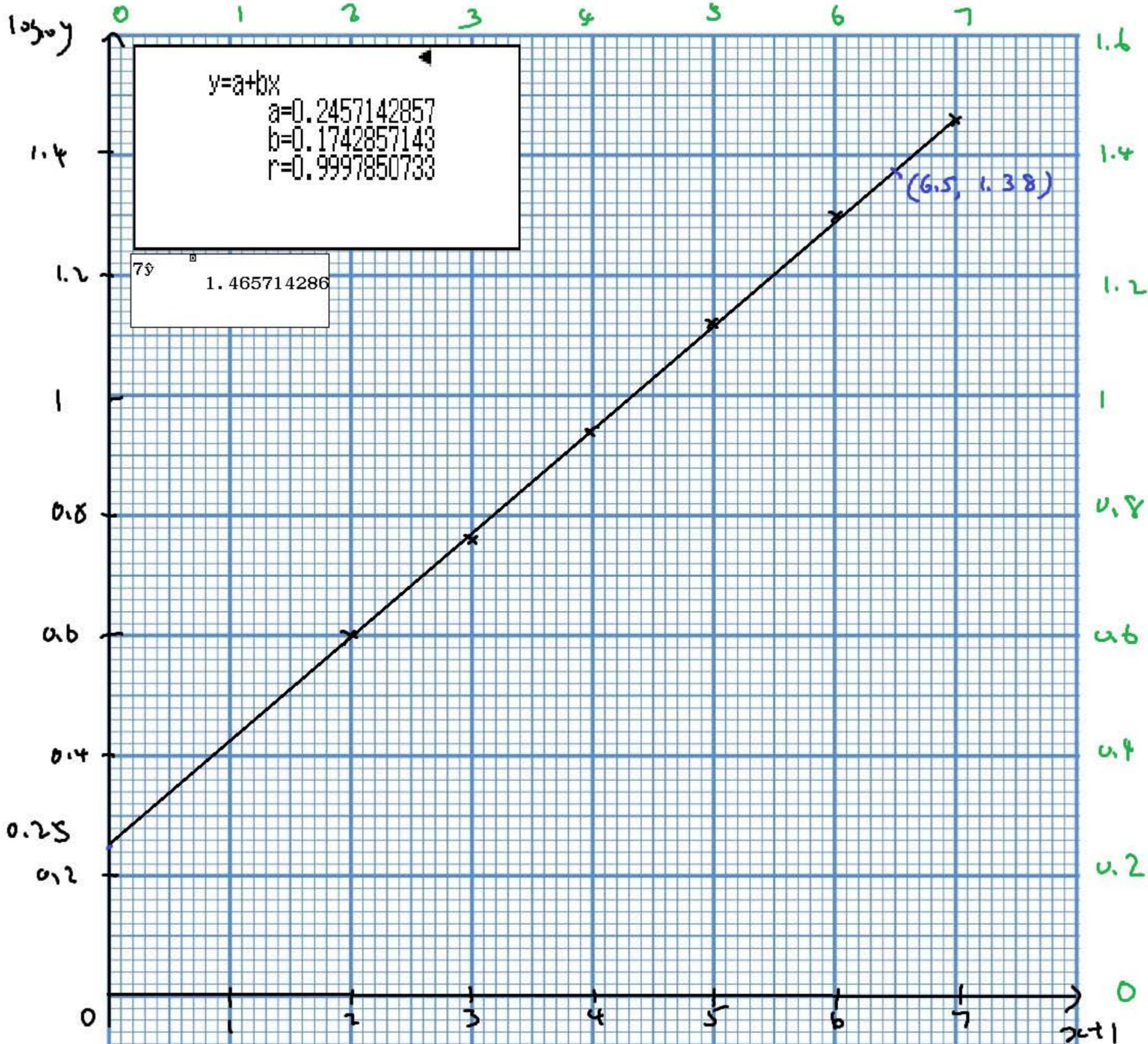
$b = 0.6730$ N1

$$\therefore a = 1.778, b = 0.6702$$

	1	2	3	4	5	6
y	4.0	5.7	8.7	13.2	20.0	28.8

$x+1$ 2 3 4 5 6 7
 $\lg y$ 0.60 0.76 0.94 1.12 1.30 1.46

$\log(4)$	$\log(5.7)$	$\log(8.7)$	$\log(13.2)$	$\log(20)$	$\log(28.8)$
0.6020599913	0.7558748557	0.9395192526	1.120573931	1.301029996	1.459392488

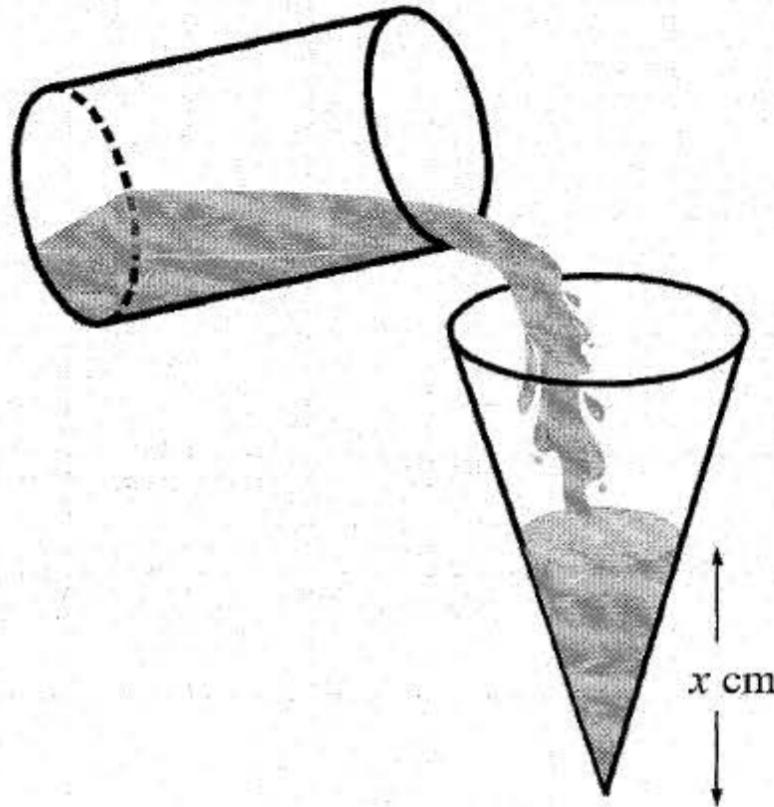


T 5
B 2

10 Rajah 8 menunjukkan sebuah silinder yang berjajari 4 cm mengandungi air yang parasnya setinggi 6 cm dituangkan dengan kadar yang malar ke dalam sebuah kon. Pada t saat, tinggi paras air dalam kon ialah x cm dan isipadu air dalam kon diberi oleh $V = \frac{1}{3}\pi x^3 \text{ cm}^3$.

Diagram 8 shows a cylinder with a radius of 4 cm containing water up to a height of 6 cm being poured at a constant rate into a cone. At t seconds, the height of the water level in the cone is x cm, and the volume of water in the cone is given by

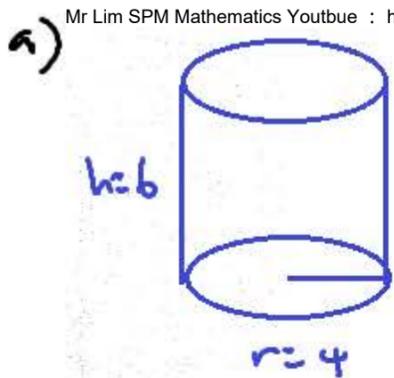
$$V = \frac{1}{3}\pi x^3 \text{ cm}^3.$$



Rajah 8
Diagram 8

Jika semua air dituangkan ke dalam kon dalam masa 4 saat, cari
If all the water is poured into the cone in 4 seconds, find

- (a) isipadu asal air dalam silinder, [1 markah]
the original volume of water in the cylinder, [1 mark]
- (b) kadar perubahan tinggi kon pada ketika tingginya ialah 3 cm, [4 markah]
the rate of change of the cone's height when its height is 3 cm, [4 marks]
- (c) isipadu air dalam silinder pada masa 3 saat. [2 markah]
the volume of water in the cylinder at 3 seconds. [2 marks]
- (d) masa yang diperlukan untuk ketinggian air dalam kon mencapai 5 cm. [3 markah]
the time required for the height of the water in the cone to reach 5 cm. [3 marks]



$$V = \pi r^2 h$$

$$= \pi (4)^2 (6)$$

$$= 96\pi \text{ cm}^3$$

b)

$$V = \frac{1}{3} \pi x^3$$

$$\frac{dV}{dx} = \frac{1}{3} (3) \pi x^2$$

$$= \pi x^2$$

$$\left. \frac{dV}{dx} \right|_{x=3} = \pi (3)^2$$

$$= 9\pi$$

$$(\text{cm}^2)$$

$$\frac{dV}{dt} = \frac{96\pi}{4}$$

$$= 24\pi$$

$$(\text{cm}^3/\text{s})$$

$$\frac{dx}{dt} = \frac{dx}{dV} \frac{dV}{dt}$$

$$= \frac{1}{9\pi} (24\pi)$$

$$= \frac{8}{3} \text{ cm/s}$$

c)

$$\frac{dV}{dt} = \frac{96\pi}{4}$$

$$= 24\pi$$

$$(\text{cm}^3/\text{s})$$

$$V_{\text{total}} = 96\pi \text{ cm}^3$$

$$V_{t=3} = 96\pi - 3(24\pi)$$

$$= 24\pi$$

d) $x=5$

$$V = \frac{1}{3} \pi x^3, \quad x=5$$

$$V = \frac{1}{3} \pi (5)^3$$

$$= \frac{125}{3} \pi$$

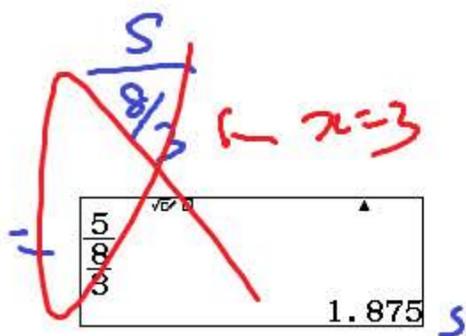
$$t = \frac{\frac{125}{3} \pi}{24\pi}$$

$$= \frac{125}{3 \times 24}$$

$$= 1.736 \text{ s}$$

$$= 1.736 \text{ s}$$

$\frac{125}{3 \times 24}$
1.736111111



11 (a) Sebuah syarikat pembekal buah-buahan telah menghantar buah jambu ke dewan makan sebuah sekolah. Didapati bahawa 5% daripada jambu tersebut telah rosak.

T5
B5

A fruit supplier company has delivered guavas to a dining hall of a school. It was found that 5% of the guavas were rotten.

$$\begin{aligned}
 P - P(\text{elok}) &= 100\% - 5\% \\
 &= 95\% \\
 &= \frac{95}{100} \\
 P &= 0.95
 \end{aligned}$$

(i) Jika suatu sampel 10 biji buah jambu dipilih secara rawak, cari kebarangkalian tepat 9 biji adalah elok.

If a random sample of 10 guavas is chosen, find the probability that 9 of them are good.

(ii) Cari bilangan minimum jambu yang perlu dipilih supaya kebarangkalian untuk sekurang-kurangnya sebiji jambu rosak adalah lebih daripada 0.85.

Find the minimum number of guavas required to ensure the probability of having at least one rotten guava is more than 0.85.

[5 markah]

[5 marks]

(i) $X \sim B(10, 0.95)$, $n=10$, $p=0.95$

$$\begin{aligned}
 P(X=9) &= {}^{10}C_9 (0.95)^9 (0.05)^1 \\
 &= 0.3151
 \end{aligned}$$

$ {}^{10}C_9 \times 0.95^9 \times 0.05 $
$ 0.3151247049 $

(ii) $1 - P(X=n) > 0.85$, $X \sim N(n, 0.95)$

$$1 - {}^n C_n (0.95)^n (0.05)^0 > 0.85$$

$$1 - 0.85 > 0.95^n$$

$$0.95^n < 0.15$$

$$\begin{aligned}
 n \ln 0.95 &< \ln 0.15 \\
 n &> \frac{\ln 0.15}{\ln 0.95}
 \end{aligned}$$

$ \frac{\ln(0.15)}{\ln(0.95)} $
$ 36.98573093 $

$\therefore n = 37$

□

11 (b) Jisim sebuah buah jambu tersebut adalah bertabur secara normal dengan min 320 g dan varians 225 g². Cari kebarangkalian buah jambu yang dipilih secara rawak mempunyai jisim

15
BS

The weight of a guava is normally distributed with a mean of 320 g and a variance of 225 g². Find the probability of the weight of a randomly selected guava

- (i) lebih daripada 330 g,
more than 330 g,
- (ii) cari nilai h dengan keadaan 90% daripada jambu tersebut mempunyai jisim lebih daripada h g.
find the value of h such that 90% of the guavas have a weight greater than h g.

[5 markah]

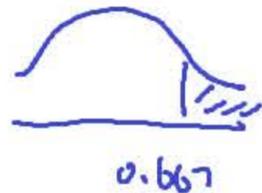
[5 marks]

$$X \sim N(320, 225)$$

$$\mu = 320$$

$$\sigma^2 = 225$$

$$\sigma = \sqrt{225} = 15$$



$$P(X > 330) = P\left(Z > \frac{330 - 320}{15}\right)$$

$$= P(Z > 0.667)$$

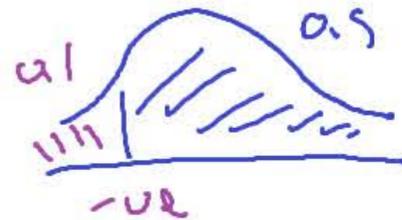
$$= 0.2523$$

2546-23
2523

$$\therefore P(X > h) = 0.9$$

$$P\left(Z > \frac{h - 320}{15}\right) = 0.9$$

$$P(Z > -1.282) = 0.9$$



$$\frac{h - 320}{15} = -1.282 \quad \text{or}$$

$$\frac{h - 320}{15} = -1.281$$

$$h = -1.282 \times 15 + 320$$

300.77

$$h = -1.281 \times 15 + 320$$

300.785

$$\therefore h = 300.77 \text{ g}$$

$$= 300.79 \text{ g}$$

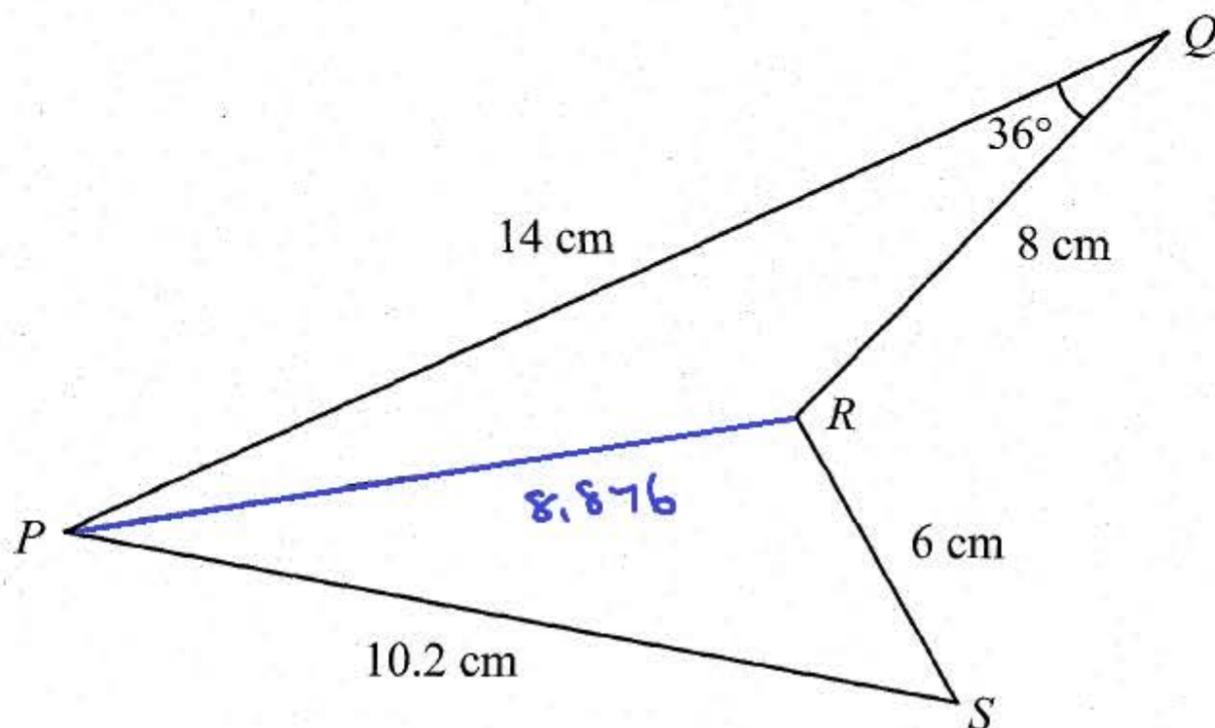
z	0	1	2	3	4	5	6	7	8	9	Minus / Tolak								
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641	4	8	12	16	20	24	28	32	36
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247	4	8	12	16	20	24	28	32	36
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859	4	8	12	15	19	23	27	31	35
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483	4	7	11	15	19	22	26	30	34
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121	4	7	11	15	18	22	25	29	32
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776	3	7	10	14	17	20	24	27	31
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451	3	7	10	13	16	19	23	26	29
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148	3	6	9	12	15	18	21	24	27
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867	3	5	8	11	14	16	19	22	25
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611	3	5	8	10	13	15	18	20	23
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379	2	5	7	9	12	14	16	19	21
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170	2	4	6	8	10	12	14	16	18
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985	2	4	6	7	9	11	13	15	17
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823	2	3	5	6	8	10	11	13	14

Mr Lim SPM Mathematics Youtube : <https://www.youtube.com/channel/UCn32UaWXUxQzL1rK0mKZUug>
12 Penyelesaian secara lukisan berskala **tidak** diterima.

74 Solution by scale drawing is **not** accepted.

89 Rajah 9 menunjukkan sebuah sisi empat PQRS.

Diagram 9 shows a quadrilateral PQRS.



Rajah 9
Diagram 9

(a) Cari
Find

(i) panjang, dalam cm, bagi PR,
the length, in cm, of PR,

(ii) $\angle PRQ$.

[4 markah]

[4 marks]

(b) (i) Dengan menggunakan rumus Heron, hitung luas, dalam cm^2 , segi tiga PRS.

By using Heron's formula, calculate the area, in cm^2 , of the triangle PRS.

(ii) Cari jarak terdekat, dalam cm, dari titik R ke garis lurus PS.

Find the shortest distance, in cm, from point R to straight line PS.

[4 markah]

[4 marks]

(c) Lakarkan $\Delta P'Q'R'$ yang mempunyai bentuk berbeza dari ΔPQR , dengan keadaan $QR' = QR$, $QP' = QP$ dan $\angle QPR' = \angle QPR$.

Seterusnya, nyatakan nilai bagi $\angle P'R'Q'$.

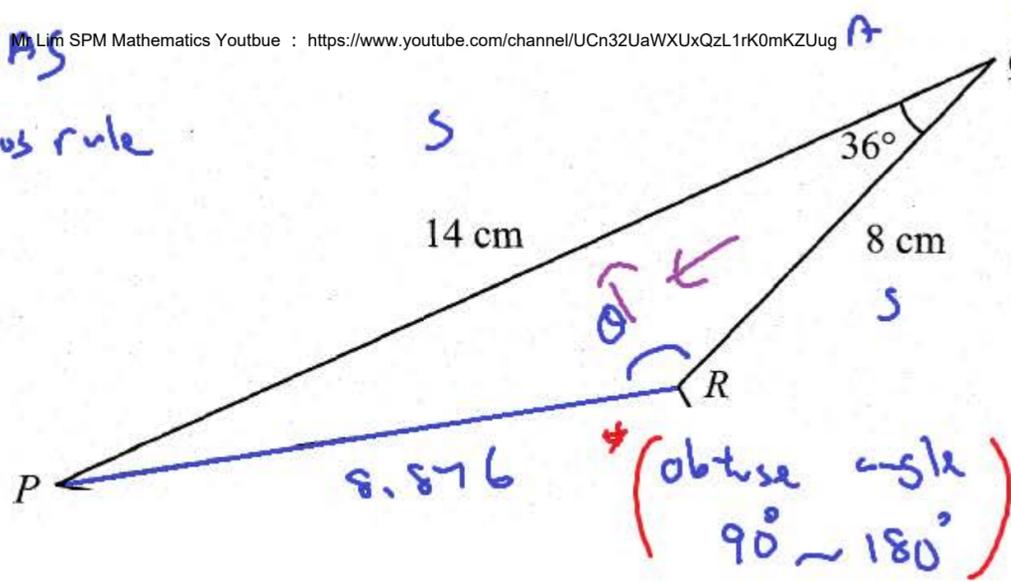
[2 markah]

Sketch $\Delta P'Q'R'$ which has a different shape from ΔPQR , such that $QR' = QR$, $QP' = QP$ and $\angle QPR' = \angle QPR$.

Hence, state the value of $\angle P'R'Q'$.

[2 marks]

cos rule



$$PR^2 = 8^2 + 14^2 - 2(8)(14)\cos 36^\circ$$

$$= 8^2 + 14^2 - 2 \times 8 \times 14 \cos 36^\circ$$

$$= 78.78019326$$

$$PR = \sqrt{78.78}$$

$$= 8.876 \text{ cm}$$

$$\sqrt{\text{Ans}}$$

$$= 8.875820709$$

ii)

$$\frac{\sin \theta}{14} = \frac{\sin 36^\circ}{8.876}$$

$$\sin \theta = \frac{\sin(36^\circ) \times 14}{8.876}$$

$$= 0.9271060762$$

$$\text{basic } \angle = \sin^{-1} 0.9271$$

$$= \sin^{-1}(\text{Ans})$$

$$= 67.98810691$$

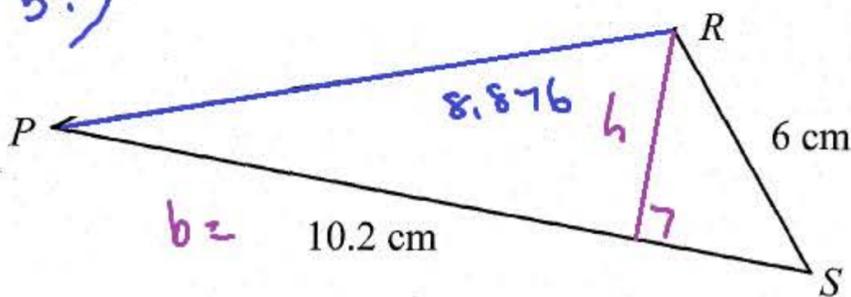
$$\theta = 180^\circ - 67.99^\circ$$

$$= 112.01^\circ$$

$$180 - \text{Ans}$$

$$= 112.0118931$$

b:)



$$s = \frac{6 + 8.876 + 10.2}{2}$$

$$= \frac{6 + 8.876 + 10.2}{2}$$

$$= 12.538$$

$$= 12.54$$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{12.54(12.54-6)(12.54-8.876)(12.54-10.2)}$$

$$= 26.49 \text{ cm}^2$$

$$\sqrt{\text{Ans}(\text{Ans}-6)(\text{Ans}-8.876)}$$

$$= 26.49219934$$

iii)

$$A = \frac{1}{2} b \times h$$

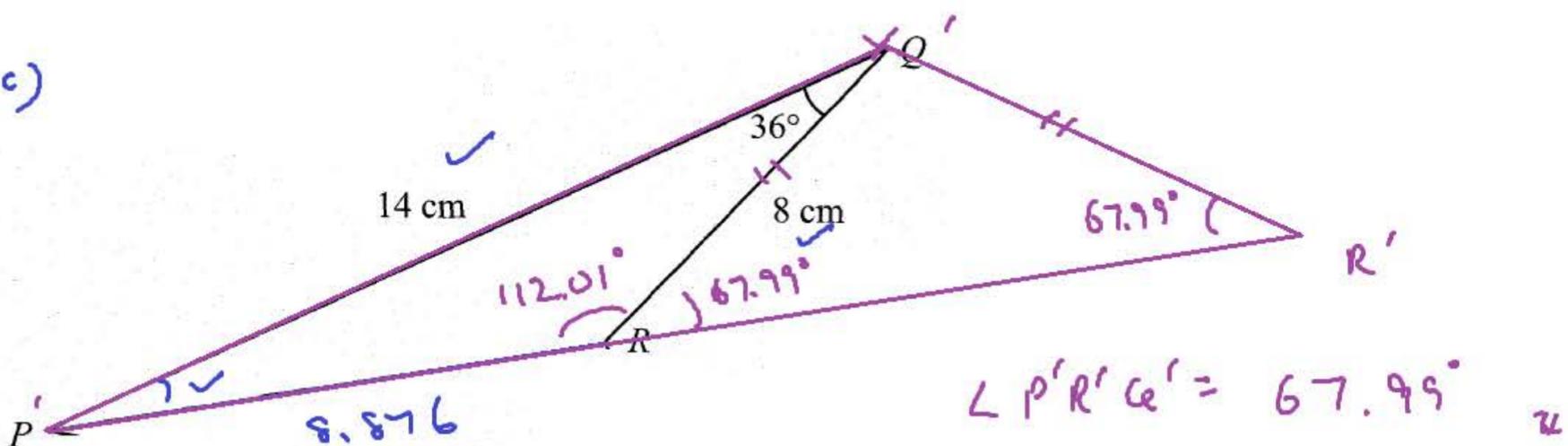
$$26.49 = \frac{1}{2} \times 10.2 \times h$$

$$h = \frac{26.49 \times 2}{10.2}$$

$$= 5.194117647$$

$$= 5.194 \text{ cm}$$

c)



$$\angle P'R'Q' = 67.99^\circ$$

13

Jadual 2 menunjukkan maklumat berkaitan empat bahan utama dan sukatan yang digunakan oleh Cik Normah untuk membuat kuih boko ubi.

Table 2 shows information related to the four main ingredients and the amount used by Ms Normah to make kuih boko ubi.

T4
B10

Bahan Ingredient	Harga per kg (RM) Price per kg (RM)		Indeks harga pada tahun 2024 berasaskan tahun 2021 Price index in the year 2024 based on the year 2021	Sukatan yang digunakan (cawan) Amount used (cup)
	2021	2024		
Santan Coconut milk	10.00	13.05	130.5	7
Ubi kayu Tapioca	2.50	3.00	120	m
Gula melaka Brown sugar	20.00	x	108	2
Tepung beras Rice flour	y	4.80	150	1

$$\bar{I} = 125.3$$

- (a) Cari nilai bagi x dan y . [3 markah]
Find the value of x and of y . [3 marks]
- (b) Indeks gubahan untuk kos membuat kuih boko ubi pada tahun 2024 dengan tahun 2021 sebagai tahun asas ialah 125.3.
Cari nilai bagi m . [3 markah]
The composite index for the cost of making kuih boko ubi in the year 2024 based on the year 2021 is 125.3.
Find the value of m . [3 marks]
- (c) Kos untuk membuat sedozen bekas kuih boko ubi itu meningkat sebanyak 35% dari tahun 2024 ke tahun 2026. Harga jualan sedozen bekas kuih boko itu ialah RM72 dengan keuntungan sebanyak RM24 pada tahun 2026.
Hitung harga kos pembuatan bagi sedozen bekas kuih boko ubi pada tahun 2021. [4 markah]
The cost for making a dozen packs of kuih boko ubi increases by 35% from the year 2024 to the year 2026. The selling price of a dozen packs of kuih boko ubi is RM72 with a profit of RM24 in the year 2026.
Calculate the cost of making a dozen packs of kuih boko ubi in the year 2021. [4 marks]

a) $\frac{x}{20} \times 100 = 108$

$$x = \frac{108 \times 20}{100} = 21.6$$

= RM 21.60

$\frac{y}{10} \times 100 = 150$

$$y = \frac{4.8 \times 100}{150} = 3.2$$

= RM 3.20

b)

$I_{24/21}$	w
130.5	7
120	m (s)
108	2
150	1

$\bar{I} = 125.3$, $\bar{I} = \frac{\sum Iw}{\sum w}$

$$\frac{130.5(7) + 120m + 108(2) + 150(1)}{7 + m + 2 + 1} = 125.3$$

$$1279.5 + 120m = 125.3(10 + m)$$

$$1279.5 + 120m = 1253 + 125.3m$$

$$1279.5 - 1253 = 125.3m - 120m$$

$$26.5 = 5.3m$$

$$m = \frac{26.5}{5.3} = 5$$

c) $\bar{I}_{26/24} = 135$

$\leftarrow 100\% + 35\% = 135\%$

$$P_{26} = 72 - 24 = 48$$

$$P_{26} \downarrow \bar{I}_{26/21} = \frac{135 \times 125.3}{100} = 169.155$$

$\frac{48}{P_{21}} \rightarrow$

$$\frac{135 \times 125.3}{100} = 169.155$$

$$P_{21} = \frac{48 \times 100}{169.155} = 28.37634123$$

= RM 28.38 34

	24	26
21	125.3	?
24	100	135

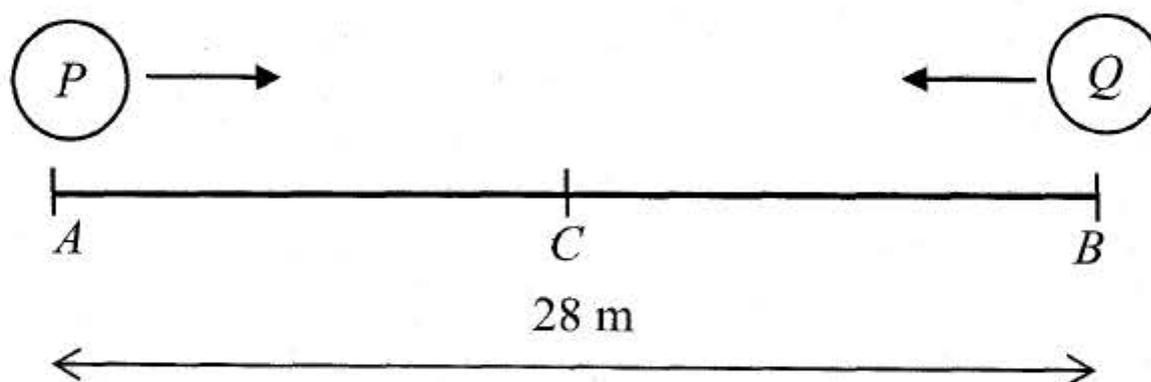
14 Penyelesaian secara lakaran graf **tidak** diterima.

TS
BS

Solution by graph sketching is **not** accepted.

Rajah 10 menunjukkan kedudukan awal dan arah pergerakan zarah P dan zarah Q. Kedua-dua zarah mula bergerak serentak.

Diagram 10 shows the initial position and direction of motion of particle P and particle Q. Both particles start moving simultaneously.



Rajah 10
Diagram 10

Halaju bagi zarah P, $v_P \text{ ms}^{-1}$, diberi oleh $v_P = 3 + 5t - 2t^2$ dengan keadaan t ialah masa dalam saat selepas zarah P melalui titik A manakala zarah Q bergerak dengan halaju malar -4 ms^{-1} . Zarah P berhenti seketika pada titik C. Jarak di antara titik A dan titik B ialah 28 m.

The velocity of particle P, $v_P \text{ ms}^{-1}$, is given by $v_P = 3 + 5t - 2t^2$, where t is time in seconds after particle P passes through point A while particle Q moves with a constant velocity of -4 ms^{-1} . Particle P stops instantaneously at point C. The distance between point A and point B is 28 m.

[Anggapkan gerakan ke arah kanan sebagai positif]
[Assume motion to the right is positive]

→
 $v = +ve$

- (a) Hitung halaju maksimum bagi zarah P, ms^{-1} . [3 markah]
Calculate the maximum velocity of particle P, ms^{-1} . [3 marks]
- (b) Hitung jarak, dalam m, di antara zarah P dan zarah Q pada ketika zarah P berada di titik C. [5 markah]
Calculate the distance, in m, between particle P and particle Q when particle P at point C. [5 marks]
- (c) Bentukkan persamaan dalam sebutan t , apabila zarah P dan zarah Q bertemu. [2 markah]
Form the equation in terms of t , when particle P and particle Q meets. [2 marks]

$$t = \frac{5}{4}$$

$$v = 3 + 5\left(\frac{5}{4}\right) - 2\left(\frac{5}{4}\right)^2 = 6.125 \text{ m/s}$$

$$\text{or } \frac{49}{8} \text{ m/s}$$

$$\frac{dv}{dt} = 5 - 4t$$

$$\frac{dv}{dt} = 0$$

$$5 - 4t = 0$$

$$5 = 4t$$

$$t = \frac{5}{4}$$

b) at C, $v_p = 0$

$$3 + 5t - 2t^2 = 0$$

$$2t^2 - 5t - 3 = 0$$

$$(t - 3)(2t + 1) = 0$$

$$t = 3, \quad t = -\frac{1}{2}$$

(rejected)

$$d_p = \int_0^3 (3 + 5t - 2t^2) dt$$

$$= \left[3t + \frac{5t^2}{2} - \frac{2t^3}{3} \right]_0^3$$

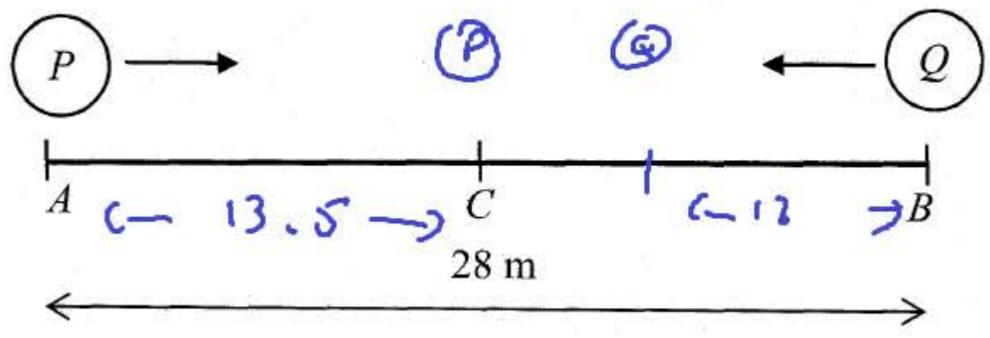
$$= 3(3) + \frac{5(3)^2}{2} - \frac{2(3)^3}{3} = 13.5$$

$3x + \frac{5x^2}{2} - \frac{2x^3}{3}$	13.5
--	------

$\int_0^3 3 + 5x - 2x^2 dx$	13.5
-----------------------------	------

$$d_q = 3 \times (-4) = -12 \text{ m}$$

$$d_{pq} = \frac{28 - 13.5 - 12}{2.5} = 2.5 \text{ m}$$



c)

$$s_p = 3t + \frac{5t^2}{2} - \frac{2t^3}{3}$$

$$v_q = -4$$

$$s_q = \int (-4) dt$$

$$= -4t + C$$

$$t = 0, \quad s = 28 \Rightarrow C = 28$$

$$s_q = -4t + 28$$

$$s_p = s_q$$

$$3t + \frac{5t^2}{2} - \frac{2t^3}{3} = -4t + 28$$

$$18t + 15t^2 - 4t^3 = -24t + 168$$

$$4t^3 - 15t^2 - 42t + 168 = 0$$

* no sol
or akan bertemu.

$ax^3 + bx^2 + cx + d = 0$ $x_1 =$
-3.297344496

$ax^3 + bx^2 + cx + d = 0$ $x_2 =$
48 + 0.5667949149i

$ax^3 + bx^2 + cx + d = 0$ $x_3 =$
3.523672248 - 0.5667949149i

15 Mr Lim @PM Mathematics Youtube : <https://www.youtube.com/channel/UCn32UaWXUxQz1rK0mKZUug>
 Satu pusat tuisyen menawarkan dua pakej, A dan K, untuk murid tingkatan empat.

TS
 BS
 Bilangan murid untuk pakej A dan K ialah masing-masing x orang dan y orang.
 Pengambilan murid adalah berdasarkan kepada kekangan berikut:

A tuition centre offers two different packages, A and K, for form 4 pupils. The number of pupils for package A and K are x and y respectively. The intake of the pupils is based on the following constraints:

I Jumlah bilangan murid yang mendaftar pakej A dan K tidak lebih daripada P orang.

The total number of pupils total number of pupils enrolled for package A and K is not more than P .

II Bilangan murid untuk pakej A tidak lebih daripada dua kali bilangan murid untuk pakej K.

The number of pupils for package A is not more than twice the number of pupils for package K.

III Bilangan murid untuk pakej K mesti melebihi bilangan murid untuk pakej A sebanyak lebih-lebihnya 10 orang.

The number of pupils for package K must exceed the number of pupils for package A by at most 10 pupils.

$$46 + 24 = 70 \leq 70$$

$$x + y \leq P$$

$$46 \leq 2(24) = 48$$

$$x \leq 2y$$

$$24 - 46 = -22 \leq 10$$

$$y - x \leq 10$$

(a) Tulis tiga ketaksamaan, selain daripada $x \geq 0$ dan $y \geq 0$, yang memenuhi semua kekangan di atas. [3 markah]

Write three inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all the above constraints. [3 marks]

(b) Kekangan yang pertama diwakili oleh garis lurus dalam graf yang ditunjukkan. Nyatakan nilai P . [1 markah]

The first constraint is represented by the straight line in the graph shown. State the value of P . [1 mark]

b)
 $P=70$

(c) Pada graf, bina dan lorek rantau R yang memenuhi ketiga-tiga kekangan itu. [2 markah]

On the graph, construct and shade the region R which satisfies all of the three constraints. [2 marks]

(d) Menggunakan graf yang dibina di 15(c), cari
 Using the graph constructed in 15(c), find

(i) julat bilangan murid pakej K jika bilangan murid pakej A ialah 20 orang.
 the range of the number of students for package K if the number of students for package A is 20,

(ii) jumlah yuran maksimum sebulan yang boleh dikutip jika yuran sebulan untuk pakej A dan K masing-masing adalah RM120 dan RM100.
 the maximum total fees per month that can be collected if the fees per month for package A and K are RM120 and RM100 respectively.

[4 markah]

[4 marks]

di) $x = 20$

$$10 \leq y \leq 30$$

ii) Total Fees = $120x + 100y$

$$1200 = 120x + 100y$$

(46, 24) = $120(46) + 100(24)$

$$x=0, y=12$$

skema (46, 23)

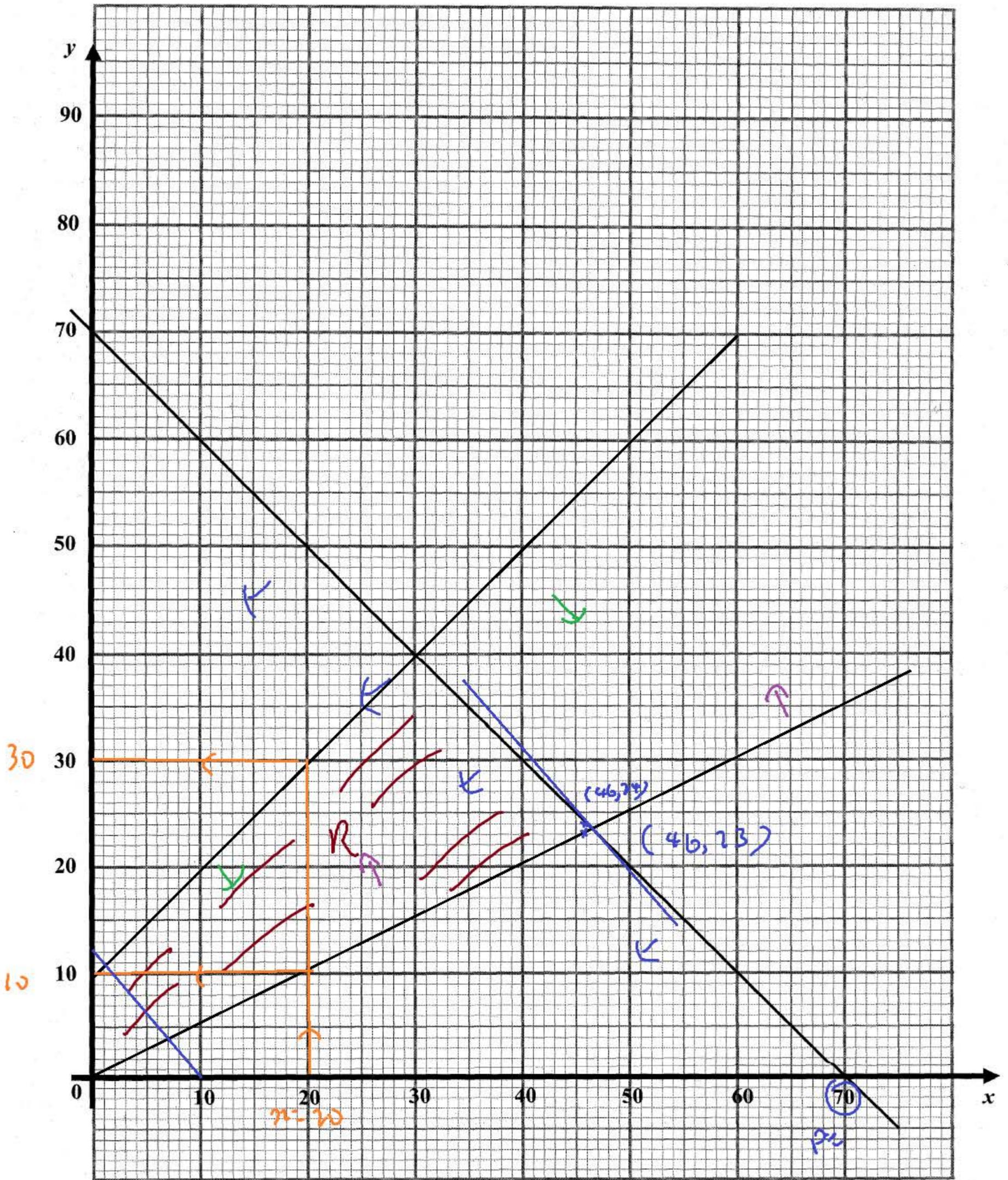
$$= \text{RM } 7920$$

$$y=0, x=10$$

$120 \times 46 + 2400$
7920

$$(\text{RM } 7820)$$

Kertas graf untuk Soalan 15
Graph paper for Question 15



$$x \leq 2y$$

$$y - x \leq 10$$

$$\frac{1}{2}x \leq y$$

$$x=0, \quad y=10$$

$$y \geq \frac{1}{2}x$$

$$x=60, \quad y-60=10$$

$$y=70$$

$$x=0, \quad y=0$$

$$x=60, \quad y = \frac{1}{2}(60) = 30$$

(ii)

(46, 23)

N1

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$$120(46) + 100(23)$$

dan garis fungsi optimum dilihat.

K1

RM7 820

N1

3