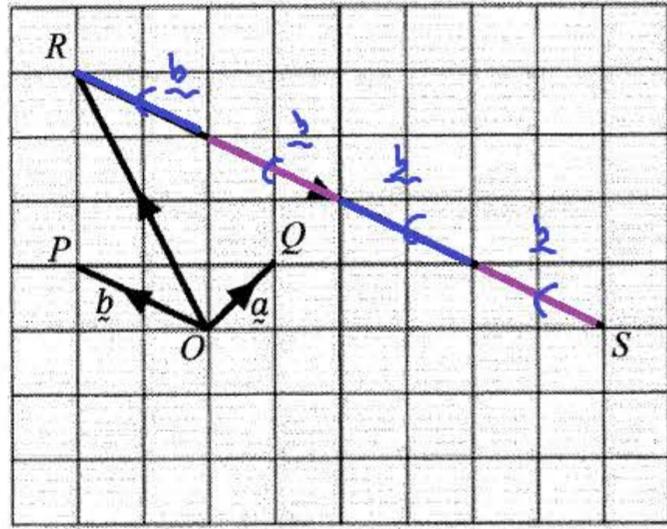
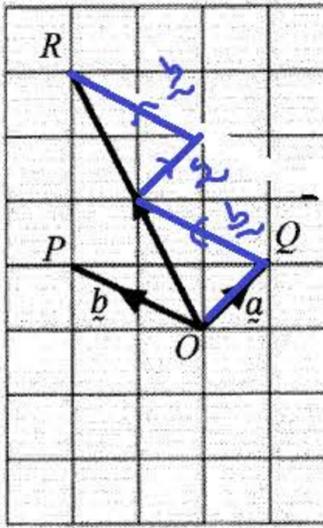


1 Rajah 1 menunjukkan $\overline{OQ} = \underline{a}$ dan $\overline{OP} = \underline{b}$ di atas grid bersisi 1 unit.

74
38

Diagram 1 shows $\overline{OQ} = \underline{a}$ and $\overline{OP} = \underline{b}$ on a square grid of sides 1 unit.



Ungkapkan dalam sebutan \underline{a} dan/atau \underline{b} .

Express in the terms of \underline{a} and/or of \underline{b} .

(a) $\overline{OR} = 2\underline{a} + 2\underline{b}$

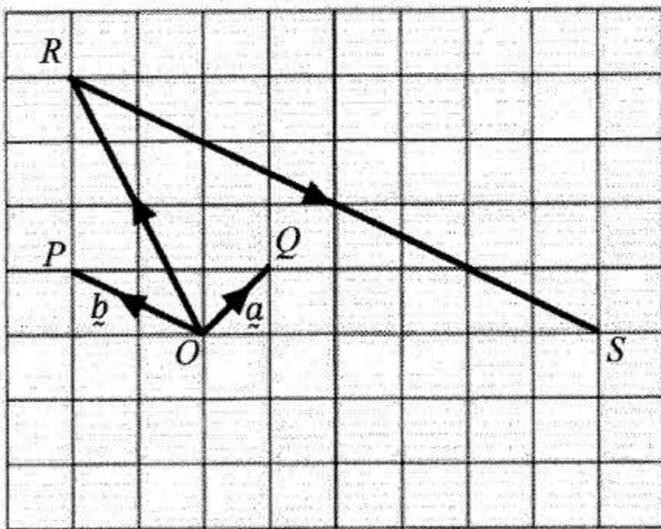
[1 markah]

[1 mark]

(b) $\overline{RS} = -4\underline{b}$

[1 markah]

[1 mark]



$\therefore \overline{OR} = 2\underline{a} + 2\underline{b}$

$$\underline{a} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \quad \underline{b} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

$$\overline{OR} = \begin{pmatrix} -2 \\ 4 \end{pmatrix} = m \begin{pmatrix} 1 \\ 1 \end{pmatrix} + n \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

$$-2 = m - 2n \quad \text{--- (1)}$$

$$4 = m + n \quad \text{--- (2)}$$

$$\text{(2) - (1)}$$

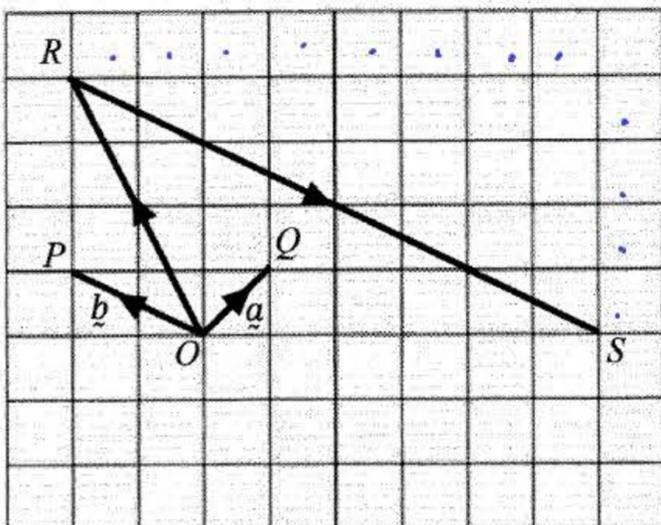
$$6 = 3n$$

$$n = 2$$

Sub $n=2$ into (2)

$$4 = m + 2$$

$$m = 2$$



$\therefore \overline{RS} = 0\underline{a} - 4\underline{b}$
 $= -4\underline{b}$

$$\underline{a} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \quad \underline{b} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

$$\overline{RS} = \begin{pmatrix} 8 \\ -4 \end{pmatrix} = p\underline{a} + q\underline{b}$$

$$\begin{pmatrix} 8 \\ -4 \end{pmatrix} = p \begin{pmatrix} 1 \\ 1 \end{pmatrix} + q \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

(2) - (1)

$$8 = p - 2q \quad \text{--- (1)}$$

$$-4 = p + q \quad \text{--- (2)}$$

$$-12 = 3q$$

$$q = -4$$

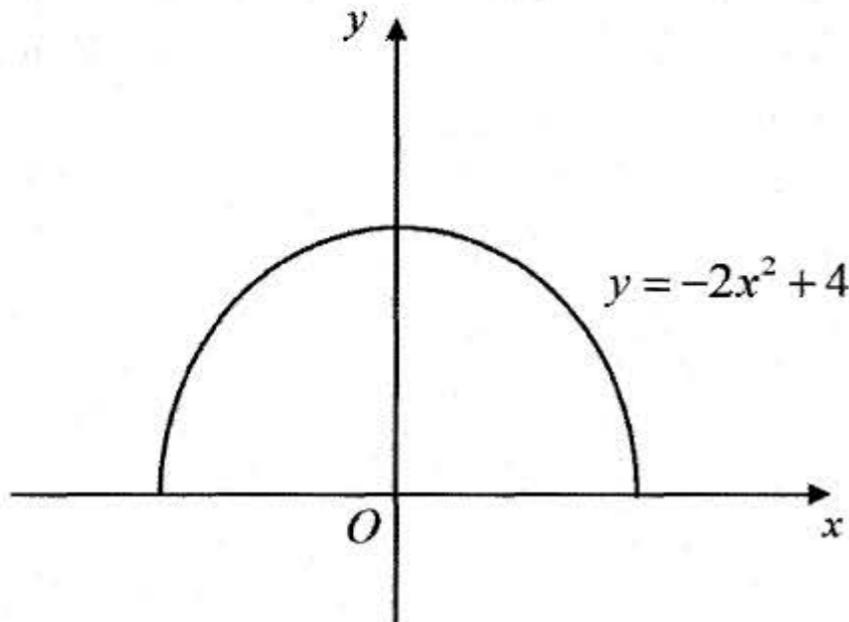
Sub $q = -4$ into (2)

$$-4 = p + (-4)$$

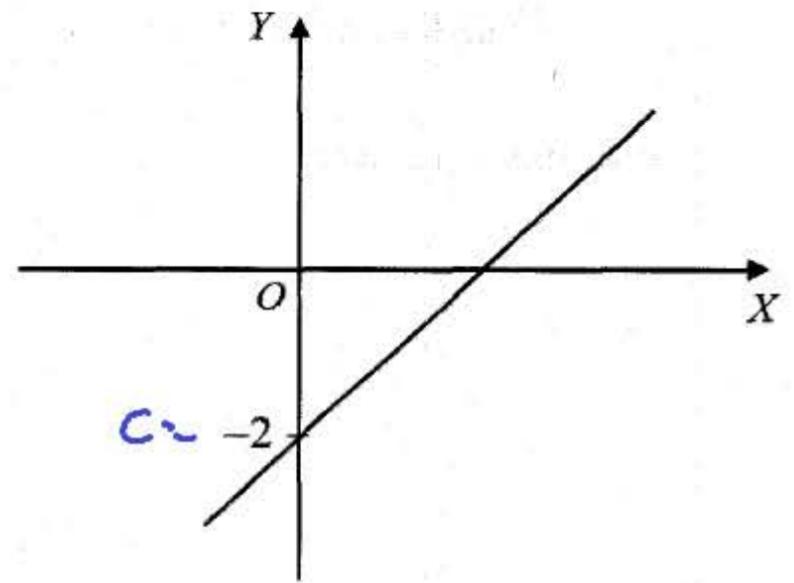
$$p = 0$$

- 74
36
- 2 Rajah 2(a) menunjukkan graf lengkung $y = -2x^2 + 4$. Rajah 2(b) menunjukkan graf garis lurus yang diperolehi apabila $y = -2x^2 + 4$ diungkap dalam bentuk linear $Y = 4X + c$.

Diagram 2(a) shows the curve $y = -2x^2 + 4$. Diagram 2(b) shows the straight line graph obtained when $y = -2x^2 + 4$ is expressed in the linear form $Y = 4X + c$.



Rajah 2(a)
Diagram 2(a)



Rajah 2(b)
Diagram 2(b)

- (a) Ungkapkan X dan Y dalam sebutan x dan/atau y . [3 markah]
[3 marks]
Express X and Y in terms of x and/or y .
- (b) Cari kecerunan graf pada Rajah 2(b). [1 markah]
[1 mark]
Find the gradient of the graph in Diagram 2(b).

$$y = -2x^2 + 4 \qquad Y = 4X + c$$

$\frac{y}{x^2} = \frac{-2}{x^2} + \frac{4}{x^2}$

(a) $\therefore Y = \frac{y}{x^2}$

$$\frac{y}{x^2} = -2 + 4\left(\frac{1}{x^2}\right)$$

$$X = \frac{1}{x^2}$$

$$\frac{y}{x^2} = 4\left(\frac{1}{x^2}\right) - 2$$

(b) $m = 4$

$$Y = mX + c$$

3 (a) Tiga sebutan berturutan bagi suatu jangjang aritmetik ialah p , q dan r .

Nyatakan hubungan antara p , q dan r . [2 markah]

Three consecutive terms of an arithmetic progression are p , q and r .

State the relation between p , q and r . [2 marks]

$$\begin{aligned}d &= T_2 - T_1 \\ &= T_3 - T_2 \\ &= T_n - T_{n-1}\end{aligned}$$

$$q - p = r - q$$

$$2q = r + p$$

$$2q = p + r$$

(b) Tiga sebutan pertama yang [positif] bagi suatu jangjang geometri ialah $x-4$, x , $5x-12$. Cari nilai x . [3 markah]

The first three positive terms of a geometric progression are $x-4$, x , $5x-12$.

Find the value of x . [3 marks]

$$\frac{x}{x-4} = \frac{5x-12}{x}$$

$$x^2 = (5x-12)(x-4)$$

$$x^2 = 5x^2 - 20x - 12x + 48$$

check:

$x=2$	$x=6$
$x-4, x, 5x-12$	$x-4, x, 5x-12$
$-2, 2, -2$	$2, 6, 18$

$$4x^2 - 32x + 48 = 0$$

$$x^2 - 8x + 12 = 0$$

$$(x-2)(x-6) = 0$$

$$x=2$$

$$x=6$$

(rejected)

$$\therefore x=6$$

$$r_1 = \frac{6}{2} = 3$$

$$r_2 = \frac{18}{6} = 3$$

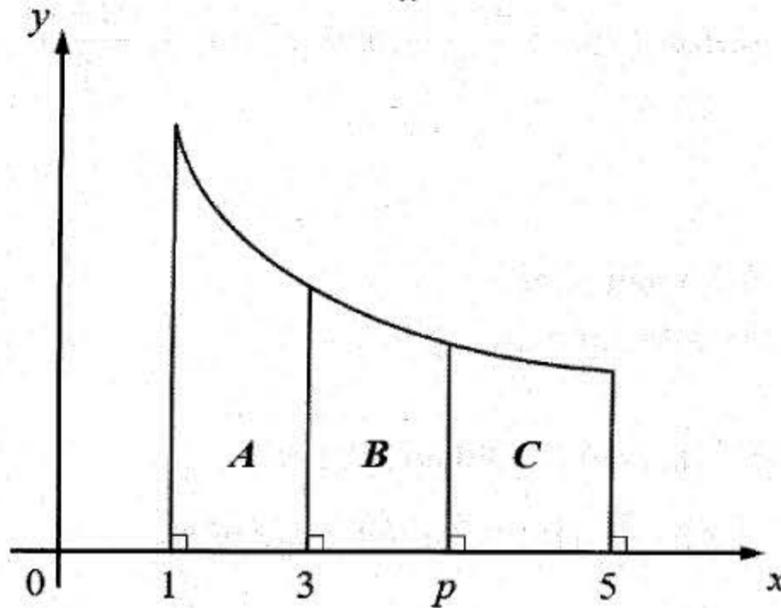
$$r = \frac{T_2}{T_1}$$

$$= \frac{T_3}{T_2}$$

4 Rajah 3 menunjukkan sebahagian daripada lengkung $y = \frac{12}{x^2}$.

T5
B3

Diagram 3 shows a part of the curve $y = \frac{12}{x^2}$.



Rajah 3
Diagram 3

Cari

Find

- (a) luas kawasan A, [2 markah]
the area of region A, [2 marks]
- (b) nilai p dengan keadaan kawasan B dan C mempunyai luas yang sama. [3 markah]
the value of p such that the regions B and C have the same area. [3 marks]

$$\begin{aligned}
 a) \quad A_A &= \int_1^3 \frac{12}{x^2} dx &= \left[-\frac{12}{x} \right]_1^3 \\
 &= \int_1^3 12x^{-2} dx &= -\frac{12^4}{3} - \left(-\frac{12}{1} \right) \\
 &= \left[\frac{12x^{-1}}{-1} \right]_1^3 &= 8
 \end{aligned}$$

$$b) \quad \int_3^p \frac{12}{x^2} dx = \int_p^5 \frac{12}{x^2} dx$$

$$\begin{aligned}
 \left[-\frac{12}{x} \right]_3^p &= \left[-\frac{12}{x} \right]_p^5 & \frac{32}{5} &= \frac{24}{p} \\
 -\frac{12}{p} + \left(\frac{12}{3} \right) &= -\frac{12}{5} - \left(-\frac{12}{p} \right) & 32p &= 24 \times 5 \\
 4 + \frac{12}{5} &= \frac{12}{p} + \frac{12}{p} & p &= \frac{24 \times 5}{32} \\
 & & &= 3.75
 \end{aligned}$$

5. Diberi bahawa fungsi $f : x \rightarrow \frac{4x+a}{5}$ dan $f^{-1} : x \rightarrow \frac{bx+14}{8}$, dengan keadaan a dan b

ialah pemalar.

Given that the function $f : x \rightarrow \frac{4x+a}{5}$ and $f^{-1} : x \rightarrow \frac{bx+14}{8}$, such that a and b are constants.

(a) (i) Cari nilai a dan nilai b .
Find the value of a and of b .

(ii) Jika $ff^{-1}(m) = 4$, tentukan nilai m .
If $ff^{-1}(m) = 4$, determine the value of m .

[4 markah]
[4 marks]

$$f : x \rightarrow \frac{4x+a}{5} \text{ dan } f^{-1} : x \rightarrow \frac{bx+14}{8}$$

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

$$\therefore f^{-1}(2) = \frac{(5x-9) \times 2}{4 \times 2}$$

$$\frac{4y+a}{5} = x$$

$$4y = 5x - a$$

$$= \frac{10x - 2a}{8}$$

$$4y + a = 5x$$

$$y = \frac{5x - a}{4}$$

$$\therefore -2a = 14$$

$$a = -7$$

$$b = 10$$

(ii) Jika $ff^{-1}(m) = 4$

$$m = 4$$

$$(ff^{-1}(2) = f^{-1}f(2) = 2)$$

(b) Diberi fungsi $f : x \rightarrow \frac{4}{x}, x \neq 0$ dan $g : x \rightarrow 2x - 5$. Ungkapkan $\frac{4}{2x-5}, x \neq \frac{5}{2}$ dalam sebutan f dan/atau g . Seterusnya, berikan justifikasi anda. [2 markah]

Given the function $f : x \rightarrow \frac{4}{x}, x \neq 0$ and $g : x \rightarrow 2x - 5$. Express $\frac{4}{2x-5}, x \neq \frac{5}{2}$ in terms of f and/or g . Hence, give your justification. [2 marks]

$$fg(x) = f(2x-5)$$

$$= \frac{4}{2x-5}$$

$$f(g(x)) = \frac{4}{g(x)}$$

6 Maklumat berikut adalah berkaitan dengan vektor \underline{m} dan vektor \underline{n} .

14

138

The following information refers to the vectors \underline{m} and \underline{n} .

$$\underline{m} = \begin{pmatrix} 2 \\ k \end{pmatrix}, \quad \underline{n} = \begin{pmatrix} 3 \\ 11 \end{pmatrix}$$

Cari nilai k jika vektor $2\underline{m} + \underline{n}$ adalah selari dengan $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$. [3 markah]

Find the value of k if vector $2\underline{m} + \underline{n}$ is parallel to $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$. [3 marks]

$$2\underline{m} + \underline{n} = \lambda \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

$$\underline{m} = \begin{pmatrix} 2 \\ k \end{pmatrix}, \quad \underline{n} = \begin{pmatrix} 3 \\ 11 \end{pmatrix}$$

$$2 \begin{pmatrix} 2 \\ k \end{pmatrix} + \begin{pmatrix} 3 \\ 11 \end{pmatrix} = \lambda \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

$$2(2) + 3 = \lambda$$

$$\lambda = 7$$

$$2k + 11 = 7(-1)$$

$$2k = -18$$

$$k = -9 \quad \#$$

7 Suatu fungsi kuadratik diberi oleh $f(x) = 4x^2 - 16x + k$, dengan keadaan k ialah pemalar.

T4
B4

A quadratic function is given by $f(x) = 4x^2 - 16x + k$, such that k is a constant.

(a) Cari nilai terkecil k dengan keadaan $f(x) > 0$ dan k ialah integer. [2 markah]

Find the smallest value of k such that $f(x) > 0$ and k is an integer. [2 marks]

$$f(x) = 4x^2 - 16x + k$$

$$a = 4, \quad b = -16, \quad c = k$$

$$(-16)^2 - 4(4)(k) < 0$$

$$256 < 16k$$

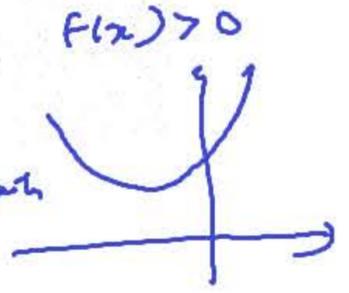
$$16 < k$$

Tinda Punca Nyata

$$b^2 - 4ac < 0$$

$$\therefore k > 16$$

$$k = 17$$



(b) Punca-punca bagi persamaan kuadratik apabila $f(x) = 0$ ialah α dan β .

The roots of the quadratic equation when $f(x) = 0$ are α and β .

(i) Jika β melebihi α sebanyak 1, tentukan nilai k yang memenuhi persamaan tersebut.

If β exceeds α by 1, determine the value of k that satisfies the equation.

(ii) Jika hasil darab punca ialah $2\alpha + 5$. Ungkapkan nilai α dalam sebutan k .

If the product of roots is $2\alpha + 5$. Express the value of α in terms of k .

$$f(x) = 4x^2 - 16x + k$$

$$\beta = \alpha + 1$$

[5 markah]

[5 marks]

$$S.O.R. = -\frac{b}{a}$$

$$P.O.R. = \frac{c}{a}$$

$$\alpha + (\alpha + 1) = -\frac{-16}{4}$$

$$\frac{3}{2} \left(\frac{3}{2} + 1 \right) = \frac{k}{4}$$

$$2\alpha = 4 - 1$$

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

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

$$k = 15$$

i) $f(x) = 4x^2 - 16x + k$, α , β ,

P.O.R. = $2\alpha + 5$, $\alpha = f(k)$

$$2\alpha + 5 = \frac{k}{4}$$

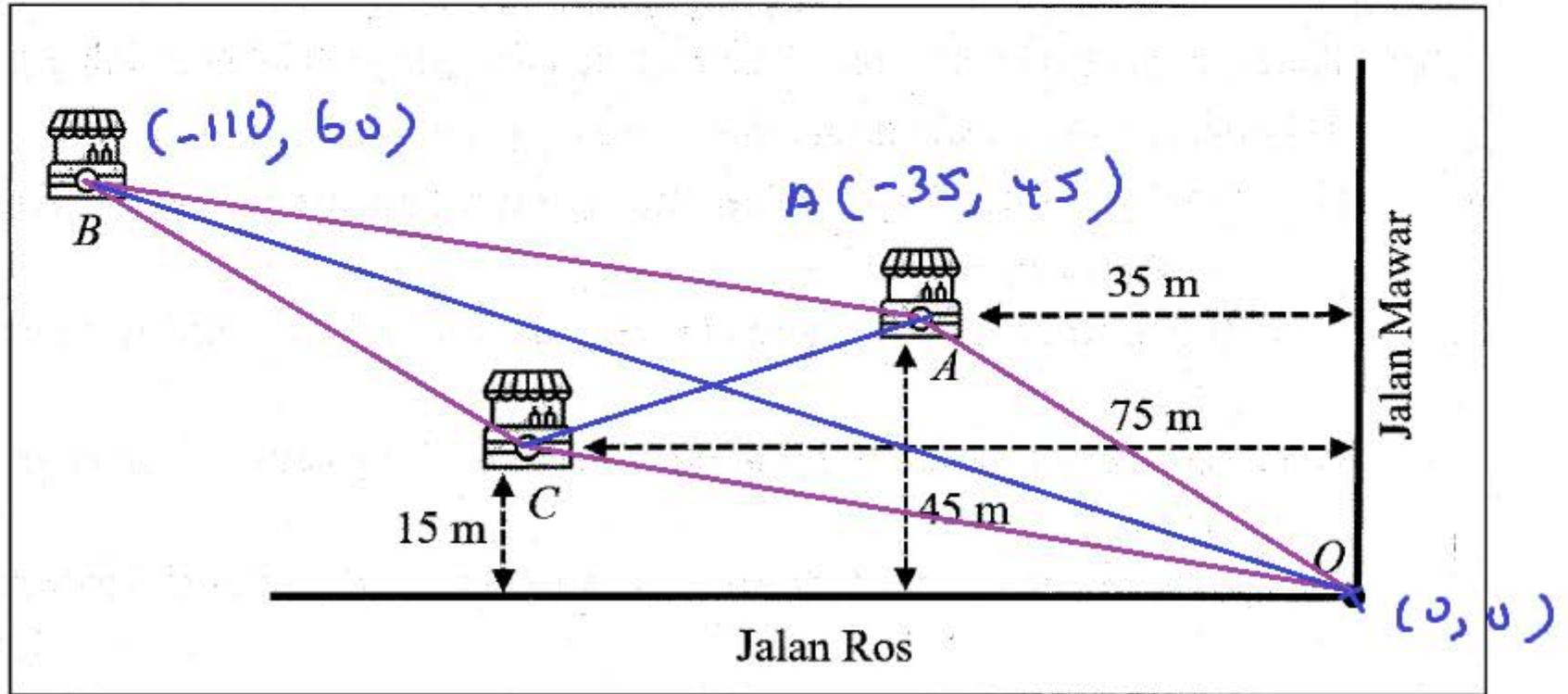
$$R.O.R. = \frac{c}{a}$$

$$2\alpha = \frac{k}{4} - 5$$

$$\alpha = \frac{k}{8} - \frac{5}{2}$$

8 Rajah 4 menunjukkan persilangan Jalan Mawar dan Jalan Ros dalam sebuah pekan kecil. Terdapat warung A, B dan C di kawasan tersebut yang terletak berdekatan di antara satu sama lain seperti yang ditunjukkan dalam gambar rajah di bawah.

Diagram 4 shows the intersection of Jalan Mawar and Jalan Ros in a small town. There are stalls A, B and C in the area that are located close to each other as shown in the diagram below.



C (-75, 15)

Rajah 4
Diagram 4

Diberi $OABC$ adalah sebuah segi empat selari.

Given that $OABC$ is a parallelogram.

- Jika kedudukan tempat pertemuan Jalan Mawar dan Jalan Ros ialah O dan diwakili oleh $(0, 0)$, nyatakan kedudukan warung B dan warung C. [2 markah]
If the position of the meeting place of Jalan Mawar and Jalan Ros is O and is represented by $(0, 0)$, state the position of stall B and stall C. [2 marks]
- Cari jarak terdekat di antara tempat persilangan Jalan Mawar dengan Jalan Ros, O dan kedudukan warung A. [3 markah]
Find the shortest distance between the intersection of Jalan Mawar and Jalan Ros, O and the position of stall A. [3 marks]
- Satu lagi warung D dibuka dengan keadaan jaraknya dari warung A adalah 2 kali jaraknya dari warung C. Cari kedudukan warung D. [2 markah]
Another stall D is opened such that its distance from stall A is 2 times its distance from stall C. Find the position of stall D. [2 marks]

a) $B(x, y)$

$$\frac{x+0}{2} = \frac{-35+(-75)}{2}$$

$$\frac{y+0}{2} = \frac{45+15}{2}$$

$$x = -110$$

$$y = 60$$

$$B(-110, 60), C(-75, 15)$$

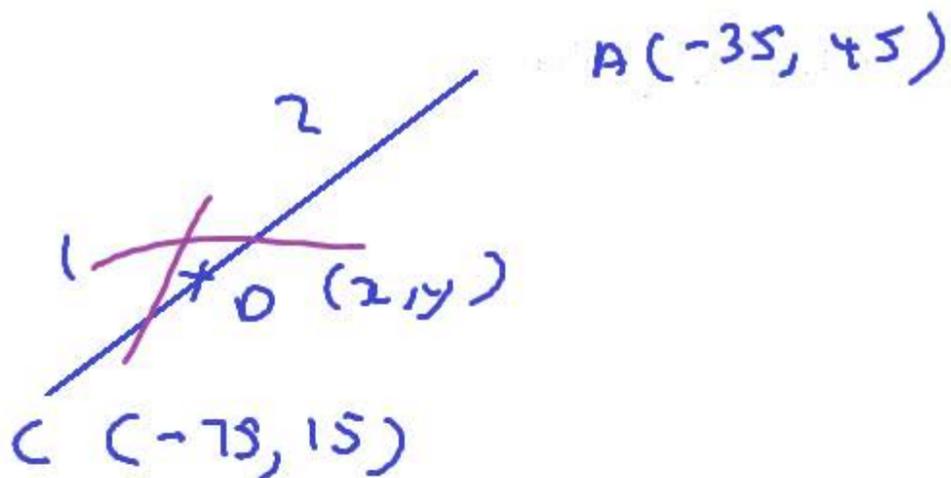
b) $A(-35, 45), O(0, 0)$

$$AO = \sqrt{(-35-0)^2 + (45-0)^2}$$

$$= 57.01 \text{ m}$$

$\sqrt{35^2+45^2}$ 57.00877125

c)



$$OA = 2 OC$$

$$\frac{OA}{OC} = \frac{2}{1}$$

$$OA : OC = 2 : 1$$

$$x = \frac{2(-75) + 1(-35)}{2+1}$$

$$= -\frac{185}{3}$$

$$D\left(-\frac{185}{3}, 25\right)$$

✦

$$y = \frac{2(0) + 1(45)}{2+1}$$

$$= 25$$

(c) Guna $\left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n} \right)$ **K1**

$$\left(\frac{2(-75) + 1(-35)}{2+1}, \frac{2(15) + 1(45)}{2+1} \right)$$

$$\left(\frac{-185}{3}, 25 \right) \quad \text{N1}$$

9

(a) Rajah 5 menunjukkan sebuah silinder.

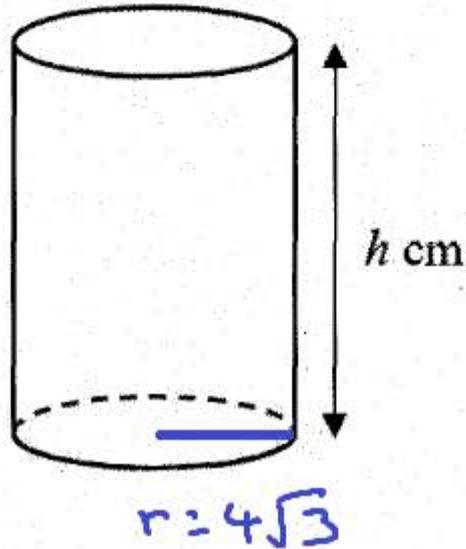
Mr Lim SPM Mathematics Youtube : <https://www.youtube.com/channel/UCn32UawXUxQZL1rK0mKZUug>

T4

B4

surd.

Diagram 5 shows a cylinder.



$$S.A. = 56\pi\sqrt{6}$$

$$S.A. = 2\pi r^2 + 2\pi rh$$

$$2\pi (4\sqrt{3})^2 + 2\pi (4\sqrt{3})h = 56\pi\sqrt{6}$$

$$\frac{8\pi\sqrt{3}h}{8\pi\sqrt{3}} = \frac{56\pi\sqrt{6}}{8\pi\sqrt{3}} - \frac{96\pi}{8\pi\sqrt{3}}$$

$$h = 7\frac{\sqrt{2}\cdot\sqrt{3}}{\sqrt{3}} - \frac{12\times\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$$

$$= 7\sqrt{2} - \frac{12\sqrt{3}}{3}$$

Diberi bahawa jejari bagi silinder itu ialah $4\sqrt{3}$ cm, tinggi h cm dan jumlah luas permukaan $56\pi\sqrt{6}$ cm². Ungkapkan h dalam bentuk $m\sqrt{2} + n\sqrt{3}$, dengan keadaan m dan n ialah pemalar. [3 markah]

$$\therefore h = 7\sqrt{2} - 4\sqrt{3}$$

It is given that the radius of the cylinder is $4\sqrt{3}$ cm, the height of h cm and the total of surface area is $56\pi\sqrt{6}$ cm². Express h in the form $m\sqrt{2} + n\sqrt{3}$, such that m and n are constants. [3 marks]

9 (b) Diberi bahawa $\log_p k = a$ dan $\log_q k = b$, tunjukkan bahawa

$$\log_k pq = \frac{a+b}{ab}$$

[2 markah]

Given that $\log_p k = a$ and $\log_q k = b$, show that $\log_k pq = \frac{a+b}{ab}$. [2 marks]

$$\log_k pq = \log_k p + \log_k q$$

$$\log_p k = a \text{ and } \log_q k = b$$

$$= \frac{1}{\log_p k} + \frac{1}{\log_q k}$$

$$= \frac{1 \times b}{a \times b} + \frac{1}{b} \times a$$

$$= \frac{a+b}{ab}$$

(shown)

$$\log_k pq = \frac{a+b}{ab}$$

9 (c) Selesaikan :

Solve :

$$\ln\left(\frac{1}{x}\right) = 3$$

$$\ln a = \log_e a$$

$$e^x = y \quad (\Leftrightarrow) \quad x = \ln y$$

T4
B4

Beri jawapan betul kepada empat angka bererti.

[2 markah]

Give the answer correct to four significant figures.

[2 marks]

$$\ln\left(\frac{1}{x}\right) = 3$$

$$\rightarrow \log_e\left(\frac{1}{x}\right) = 3$$

$$\frac{1}{x} = e^3$$

$$\frac{1}{e^3} = x$$

$$x = 0.04979 \quad 4$$



1/e³ = 0.04978706837

10. Seorang peserta kuiz Matematik menjawab 40 soalan objektif dengan keadaan setiap soalan mempunyai empat pilihan jawapan dengan satu daripadanya adalah betul. Peserta tersebut mengetahui jawapan untuk 35 soalan sahaja dan meneka jawapan bagi soalan yang lain. Anggapkan peserta tersebut menjawab 35 soalan dengan betul.

TS
BS

A participant in a Mathematics quiz answered 40 multiple choice questions such that each question has four choices, one of which is correct. The participant knew the answers to 35 questions and guessed the answers to the remaining questions. Assume the participant answered the 35 known questions correctly.

(a) Cari kebarangkalian peserta tersebut meneka semua jawapan dengan betul.

[2 markah]

Find the probability that the participant guessed all the answers correctly.

[2 marks]

(b) Anggarkan bilangan soalan yang dijawab dengan betul oleh peserta tersebut dan terangkan jawapan anda.

[3 markah]

Estimate the number of questions correctly answered by the participant and explain your answer.

[3 marks]

$$35 + 1.25 = 36.25$$

\therefore 36 soalan. Dijawab betul 1.25 daripada 5 soalan.

$$p = \frac{1}{4}$$

$$40 - 35 = 5$$

$$x \sim B\left(5, \frac{1}{4}\right)$$

$$\begin{aligned} \text{a) } P(x=5) &= \binom{5}{5} \left(\frac{1}{4}\right)^5 \left(\frac{3}{4}\right)^0 \\ &= \frac{1}{1024} \end{aligned}$$

$$= \frac{1}{1024}$$

$$\begin{aligned} \text{b) } \mu &= np \\ &= 5 \left(\frac{1}{4}\right) \\ &= 1.25 \end{aligned}$$

11 (a) Kad berlabel dengan 7 huruf konsonan dan 5 huruf vokal diletakkan di atas sebuah meja. Cari

Cards labelled with 7 consonant letters and 5 vowel letters placed on a table.

Find

$${}^7C_5 \times {}^5C_5 = 21$$

(i) bilangan cara pemilihan 10 huruf boleh dibuat jika bilangan huruf konsonan mesti sama dengan bilangan huruf vokal.

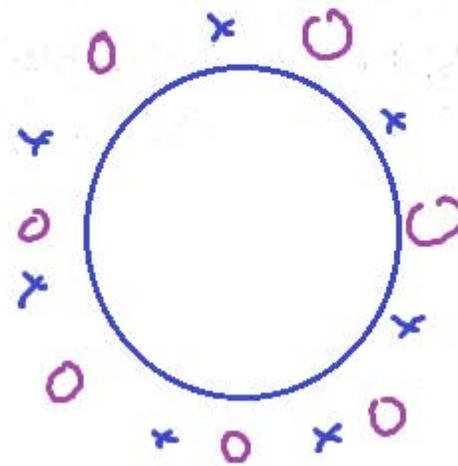
the number of ways to choose 10 letters if the number of consonants must be equal to the number of vowels.

(ii) bilangan susunan yang mungkin jika semua 12 huruf tersebut perlu disusun dalam satu bulatan dengan keadaan huruf vokal disusun berasingan.

the number of possible arrangements if all 12 letters need to be arranged in a circle such that the vowels are in separated arrangement.

$$(7-1)! \times {}^7P_5$$

$6! \times {}^7P_5$ 1814400



[4 markah]

[4 marks]

C
V

(ii)

$$\frac{8!}{8}$$

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

$$\frac{8!}{8} \times {}^7P_5$$

@

$$(8-1)! \times {}^7P_5 \quad \text{ATAU}$$

$$\frac{8!}{8} \times {}^7C_5 \times 5!$$

@

$$(8-1)! \times {}^7C_5 \times 5! \quad \text{K1}$$

12700800

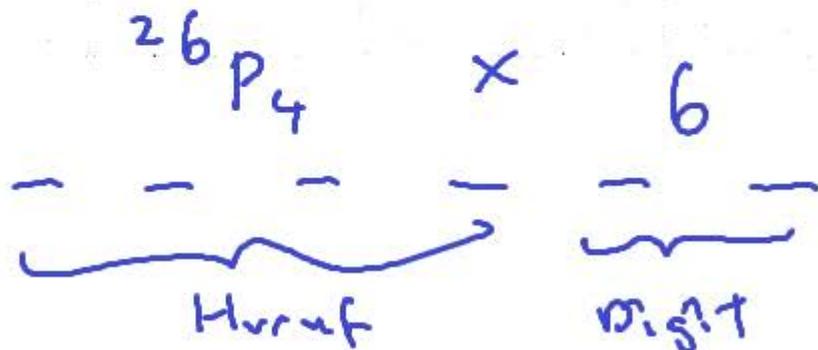
N1

11 (b) Cari bilangan kata laluan yang terdiri daripada 4 huruf dan diikuti dengan 2 digit, tanpa ulangan, yang boleh dibentuk jika [hasil tambah digit-digit ialah 5.] [3 markah]

75
64

Find the number of passwords consisting of 4 letters and followed by 2 digits, without repetition, that can be formed if the sum of the digits must be 5.

[3 marks]



$$26 \times 25 \times 24 \times 23 \times 6$$

$$26P_4 \times 6$$

2152800

$$26 \times 25 \times 24 \times 23 \times 6$$

2152800

- 05 0+5
- 50 5+0
- 14 1+4
- 41 4+1
- 23 2+3
- 32 3+2

12 (a) Penyelesaian yang menggunakan selain daripada kalkulus adalah **tidak** diterima.

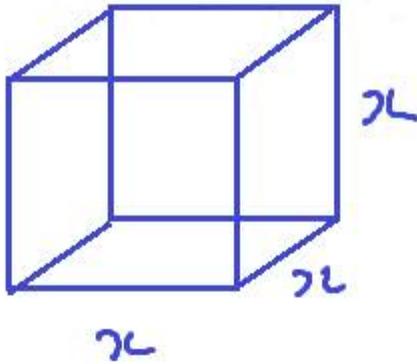
Solutions using other than calculus are not accepted. $\rightarrow \frac{dy}{dx}, \int$

T5

B2

Cari perubahan kecil dalam isipadu sebuah kubus apabila setiap sisinya bertambah daripada 2 cm kepada 2.02 cm. [3 markah]

Find the small change in the volume of a cube when each of its sides increases from 2 cm to 2.02 cm. [3 marks]



$$x: 2 \rightarrow 2.02$$

$$x=2, \quad \delta x = 0.02$$

$$V = x^3$$

$$\frac{dV}{dx} = 3x^2$$

$$\frac{\delta V}{\delta x} \approx \frac{dV}{dx}$$

$$\delta V \approx \frac{dV}{dx} \cdot \delta x$$

$$\delta V \approx 3x^2 (0.02)$$

$$= 3(2)^2 (0.02)$$

$$= 0.24 \text{ cm}^3$$

$2.02^3 - 2^3$
0.242408

74

- 12 (b) Dania cuba mencari terbitan pertama bagi $y = x^2 - 2x - 3$ dengan menggunakan [prinsip pertama] tetapi tidak dapat meneruskan jalan kerjanya.

TS
BZ

Dania tried to find the first derivative of $y = x^2 - 2x - 3$ using the first principles but was unable to continue her work.

$$y = x^2 - 2x - 3$$

$$y + \delta y = (x + \delta x)^2 - 2(x + \delta x) - 3$$

$$y + \delta y = x^2 + 2x(\delta x) + (\delta x)^2 - 2x - 2\delta x - 3$$

....

Bantu Dania menjawab soalan tersebut.

[3 markah]

Help Dania answer the question.

[3 marks]

$$y = x^2 - 2x - 3 \quad , \quad \left(\frac{dy}{dx} = 2x - 2 \right) \quad \text{check:}$$

$$\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{(y + \delta y) - y}{\delta x}$$

$$y + \delta y - y = \cancel{x^2} + 2x(\delta x) + (\delta x)^2 - \cancel{2x} - 2\delta x - \cancel{3} - (\cancel{x^2} - \cancel{2x} - \cancel{3})$$

$$\delta y = 2x\delta x + (\delta x)^2 - 2\delta x$$

$$\frac{\delta y}{\delta x} = 2x + \delta x - 2$$

$$\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x} = \lim_{\delta x \rightarrow 0} (2x + \delta x - 2)$$

$$= 2x - 2$$

13 (a) Dengan menggunakan kaedah penyempurnaan kuasa dua, ungkapkan

T4
B2
 $f(x) = 8 - 6x - x^2$ dalam bentuk $f(x) = a - (x+b)^2$. Seterusnya, cari julat $f(x)$ tersebut. [3 markah]

By using completing the square method, express $f(x) = 8 - 6x - x^2$ in the form $f(x) = a - (x+b)^2$. Hence, find the range of $f(x)$. [3 marks]

$$f(x) = 8 - 6x - x^2$$

$$= -x^2 - 6x + 8$$

$$= -(x^2 + 6x - 8)$$

$$= -(x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 - 8)$$

$$= -[(x+3)^2 - 9 - 8]$$

$$= -[(x+3)^2 - 17]$$

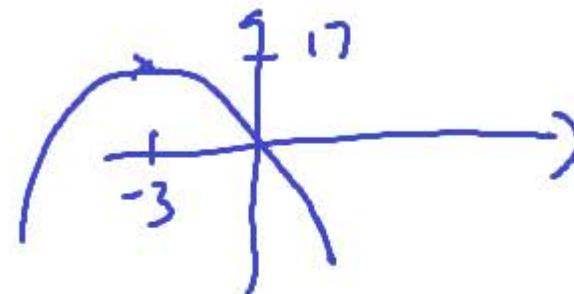
$$= -(x+3)^2 + 17$$

$$= 17 - (x+3)^2$$

∴ jkt : $f(x) \leq 17$

$$a = -1 \quad \cap$$

$$(-3, 17)$$



$$(x+3)^2 \geq 0$$

$$-(x+3)^2 \leq 0$$

$$17 - (x+3)^2 \leq 17$$

$$f(x) \leq 17$$

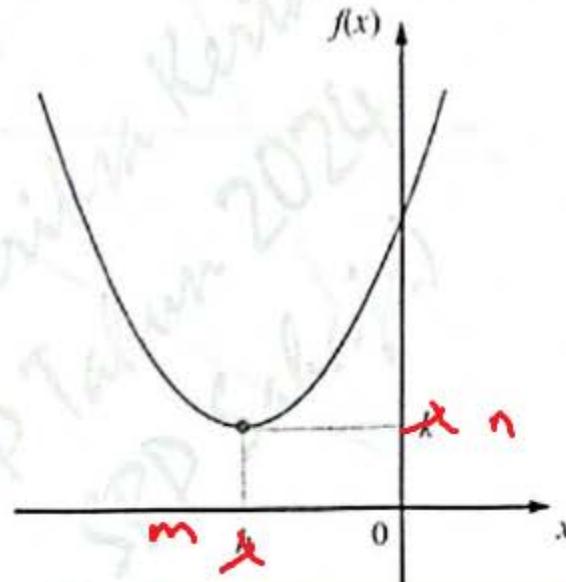
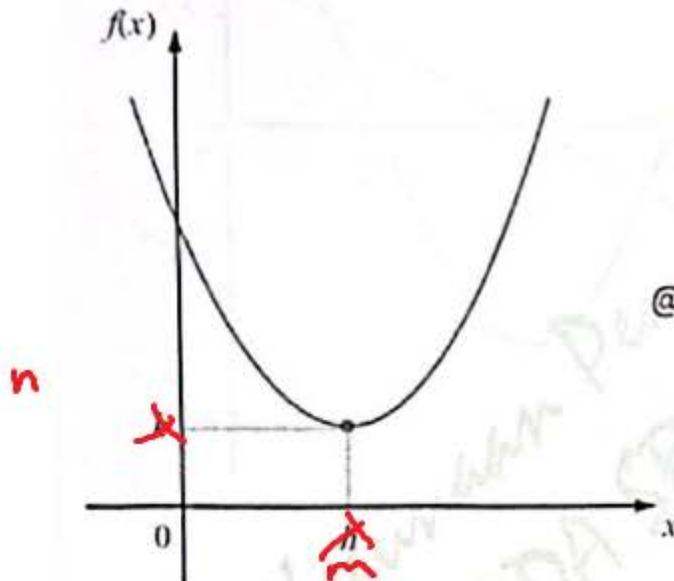
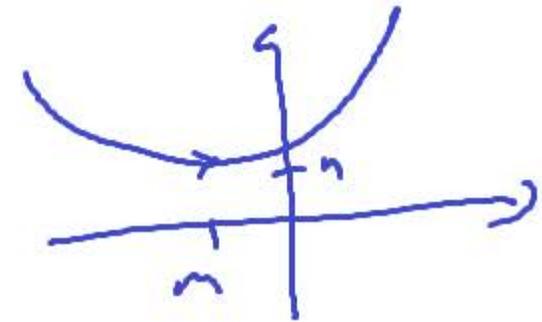
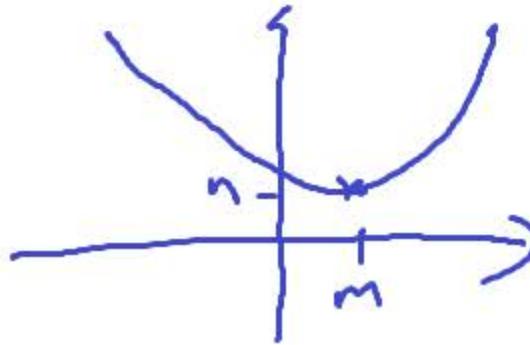
13
T4
B2

(b) Diberi bahawa fungsi kuadratik $f(x) = a(x-m)^2 + n$, di mana $a > 0$ mempunyai nilai pembezaan negatif. Lakarkan graf yang mungkin bagi fungsi kuadratik tersebut. [2 markah]



It is given that a quadratic function $f(x) = a(x-m)^2 + n$, where $a > 0$ has a negative (discriminant value). Sketch the possible quadratic graph. [2 marks]

$b^2 - 4ac < 0$
no real roots



$$f(x) = a(x-m)^2 + n$$

$$x-m=0$$

$$x=m$$

(m, n)

Bentuk betul P1

Titik minimum betul P1

Nota: Paksi dilukis dengan pembaris.

13 (c) Cari julat nilai x bagi $(1-x)^2 + 2x \geq 17$ dengan menggunakan kaedah garis nombor. [3 markah]

T4

B2

Find the range of values of x for $(1-x)^2 + 2x \geq 17$ by using number line method.

[3 marks]

$$(1-x)^2 + 2x \geq 17$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$1 - 2x + x^2 + 2x - 17 \geq 0$$

$$x^2 - 16 \geq 0$$

$$(x+4)(x-4) \geq 0$$

$$x+4 \geq 0$$

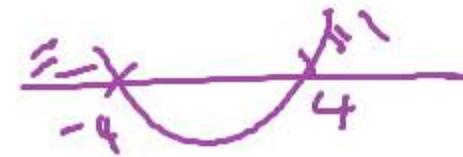
$$x \geq -4$$

$$x-4 \geq 0$$

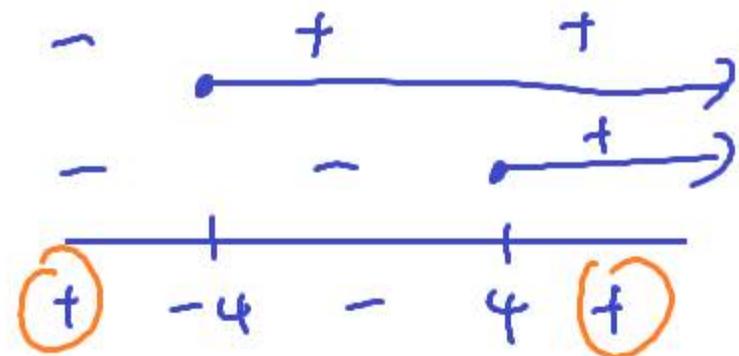
$$x \geq 4$$

$$\therefore x \leq -4, \quad x \geq 4$$

C.V. $x = -4, x = 4$



$$x \leq -4, \quad x \geq 4$$



	$x < -4$	$-4 < x < 4$	$x > 4$
$x - 4$	-ve	-ve	+ve
$x + 4$	-ve	+ve	+ve
$(x-4)(x+4)$	+ve	-ve	+ve

14 (a) Diberi $f(\theta) = 5 \sin X\theta + Y$ bagi $0^\circ \leq \theta \leq 360^\circ$ (Kala bagi graf) itu ialah 180° $x = \frac{360^\circ}{180^\circ}$

75

dan nilai minimum bagi $f(\theta)$ ialah -1 .

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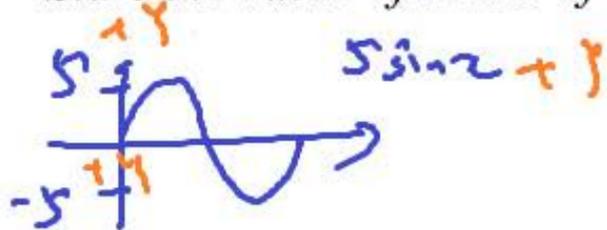
Nyatakan nilai X dan nilai Y .

$$\text{kala} = \frac{360^\circ}{x}$$

[2 markah] $x = 2$

Given $f(\theta) = 5 \sin X\theta + Y$ for $0^\circ \leq \theta \leq 360^\circ$. The period of the graph is 180° and the minimum value of $f(\theta)$ is -1 .

State the value of X and of Y .



$$-5 + Y = -1$$

[2 marks]

$$Y = -1 + 5 \\ = 4$$

$$\therefore x = 2, Y = 4$$

14 (b) Lakarkan graf $y = \cos 2x$ bagi $0 \leq x \leq \frac{3\pi}{2}$. Pada paksi yang sama, lakarkan garis

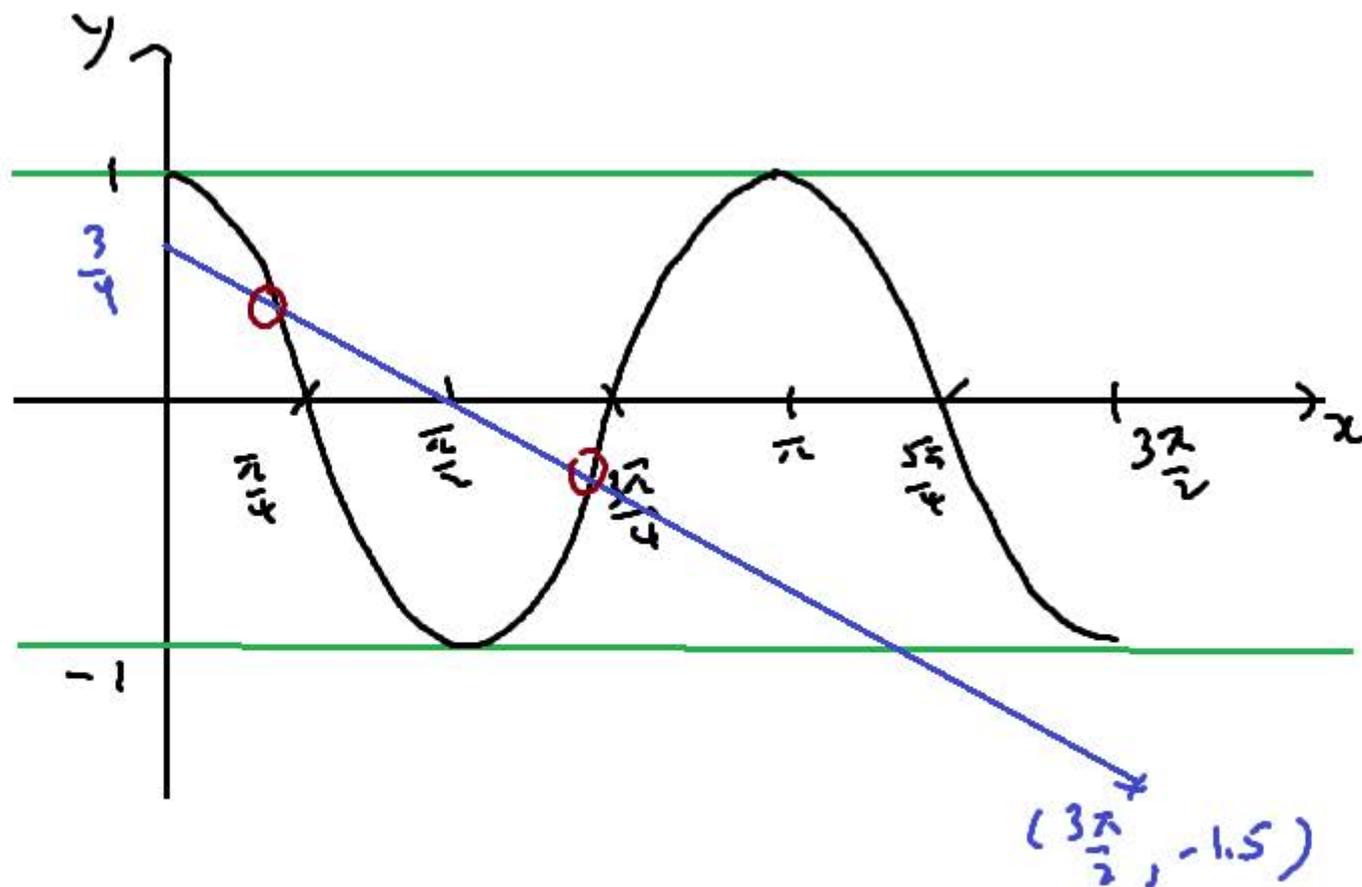
75
36

lurus yang bersesuaian untuk mencari bilangan penyelesaian bagi persamaan $\frac{6x}{\pi} + 4\cos 2x = 3$. Seterusnya, nyatakan bilangan penyelesaian tersebut.

[6 markah]

Sketch the graph of $y = \cos 2x$ for $0 \leq x \leq \frac{3\pi}{2}$. On the same axis, sketch a suitable straight line to find the number of solutions for the equation $\frac{6x}{\pi} + 4\cos 2x = 3$. Hence, state the number of solutions.

[6 marks]



\therefore 2 penyelesaian

$$y = \cos 2x$$

$$\frac{6x}{\pi} + 4\cos 2x = 3$$

$$\frac{4}{4}y = \frac{3}{4} - \frac{6x}{\pi \times 4}$$

$$y = \frac{3}{4} - \frac{3x}{2\pi}$$

$$x=0, y = \frac{3}{4}$$

$$x = \frac{3\pi}{2}, y = \frac{3}{4} - \frac{3}{2\pi} \left(\frac{3\pi}{2} \right)$$

$$3$$

$$9 = 3^2$$

$$27 = 3^3$$

$$81 = 3^4$$

15 (a) Diberi bahawa $81\sqrt{3\sqrt{27}} = 9^k$. Cari nilai k .

[2 markah]

[2 marks]

T4 B4

Given that $81\sqrt{3\sqrt{27}} = 9^k$. Find the value of k .

(m1)

$$81\sqrt{3\sqrt{27}} = 9^k$$

$$3^4 (3^1 (3^3)^{\frac{1}{2}})^{\frac{1}{2}} = 3^{2k}$$

$$3^4 (3^{1+\frac{3}{2}})^{\frac{1}{2}} = 3^{2k}$$

$$3^{4+\frac{5}{2}} = 3^{2k}$$

$$\frac{21}{4} = 2k$$

$$k = \frac{21}{8}$$

□

(m2)

$$81\sqrt{3\sqrt{27}} = 9^k$$

$$\left(\sqrt{3\sqrt{3^3}}\right)^2 = \left(\frac{3^{2k}}{3^4}\right)^2$$

$$3\sqrt{3^3} = \left(3^{2k-4}\right)^2$$

$$\sqrt{3^3} = \frac{3^{2(2k-4)}}{3^1}$$

$$\sqrt{3^3} = 3^{4k-8-1}$$

$$\left(\sqrt{3^3}\right)^2 = \left(3^{4k-9}\right)^2$$

$$3^3 = 3^{2(4k-9)}$$

$$3 = 8k - 18$$

$$8k = 21$$

$$k = \frac{21}{8}$$

□

15 (b) Penyelesaian secara penyenaaran tidak diterima.

Solution by listing is not accepted.

T4

B4

Indeks

125

Selepas t tahun, harga bagi kereta yang dibeli oleh Nik ialah $\text{RM}78\,000(0.8)^t$.

After t years, the price of the car that was bought by Nik is $\text{RM}78\,000(0.8)^t$.

- (i) Tentukan harga kereta tersebut selepas 6 tahun. $t=6$
Determine the price of the car after 6 years.
- (ii) Cari bilangan minimum tahun yang akan diambil untuk harga kereta kurang daripada $\text{RM}30\,000$.
Find the minimum number of years that it will take for the price of the car less than $\text{RM}30\,000$.
- (iii) Bermula tahun ketujuh dan seterusnya, harga kereta tersebut mengalami susut nilai sebanyak 65%.
Jika Nik membeli kereta itu pada tahun 2018, kira nilai harga bagi kereta Nik pada tahun 2027.

Starting from the seventh year and onwards, the car's value depreciates by 65%.

If Nik bought the car in 2018, calculate the value of Nik's car in 2027.

[6 markah]

[6 marks]

(i) $\text{RM}78\,000(0.8)^t, t=6$

78000×0.8^6
20447.232

$78000(0.8)^6 = \text{RM } 20\,447.23$

(ii) $78\,000(0.8)^t < 30000$

$0.8^t < \frac{5}{13}$

$t \ln 0.8 < \ln\left(\frac{5}{13}\right)$

$\ln(0.8)$
-0.2231435513

check

$t > \frac{\ln\left(\frac{5}{13}\right)}{\ln(0.8)}$

$\frac{\ln\left(\frac{5}{13}\right)}{\ln(0.8)}$
4.282048212

$\therefore 5$ tahun,

78000×0.8^4
$t=4$
31948.8

78000×0.8^5
$t=5$
25559.04

> 30000

< 30000

t_0
2018 19 20 21 22 23 24 26

$100\% - 35\% = 65\%$

$= \frac{65}{100}$

$= 0.65$

$78\,000(0.8)^t$

78000×0.8^6
20447.232

1
25

2
26

3
27

$20\,447.23 \times 0.65^t$

20447.23×0.65^3
5615.320539

$20\,447.23 \times 0.65^3 = \text{RM } 5\,615.32$