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Kelas: 5 Arif

PEPERIKSAAN PERCUBAAN SPM 2025
MATEMATIK TAMBAHAN TINGKATAN 5

3472/2

Kertas 2

Dua jam tiga puluh minit

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

- 1. Tulis nama dan kelas anda pada ruang yang disediakan.
- 2. Kertas peperiksaan ini mengandungi tiga bahagian: Bahagian A, Bahagian B dan Bahagian C.
- 3. Jawapan hendaklah ditulis pada ruang jawapan yang disediakan di dalam kertas peperiksaan ini.
- 4. Kertas peperiksaan ini adalah dalam dwibahasa.
- 5. Jawapan boleh ditulis dalam bahasa Melayu atau bahasa Inggeris.
- 6. Rajah yang mengiringi soalan tidak dilukis mengikut skala kecuali dinyatakan.
- 7. Kerja mengira mesti ditunjukkan.
- 8. Kertas peperiksaan ini hendaklah diserahkan kepada pengawas peperiksaan pada akhir peperiksaan.

SOALAN	MARKAH PENUH	MARKAH DIPEROLEH
BAHAGIAN A		
1	6	6
2	7	7
3	8	8
4	8	8
5	8	8
6	7	7
7	6	6
JUMLAH	50	50
BAHAGIAN B		
8	10	✓ 10
9	10	✓ 10
10	10	6
11	10	✓ 10
JUMLAH	30	30
BAHAGIAN C		
12	10	✓ 10
13	10	✓ 10
14	10	8
15	10	9
JUMLAH	20	20
JUMLAH KESELURUHAN MARKAH		100 %

Kertas soalan ini mengandungi 29 halaman bercetak.

Tahniah!!

5
Bahagian A

[50 markah]

Jawab semua soalan.

1 (a) Permudahkan yang berikut sebagai **surd tunggal**

Simplify the following as a single surd

$$\sqrt{12x^2 - 12} - \sqrt{3x^2 - 3}$$

[2 markah / mark]

(b) Diberi **$a = 2^m$** , ungkapkan
Given **$a = 2^m$** , express

(i) dalam **sebutan a**
in terms of a

$$\frac{2}{(\sqrt[3]{64})^m},$$

(ii) dalam **sebutan m**
in terms of m

$$\log_4 \left(\frac{32}{a^2} \right).$$

[4 markah / mark]

Jawapan / Answer:

$$\begin{aligned} \text{a) } \sqrt{4(3x^2 - 3)} - \sqrt{3x^2 - 3} &= \sqrt{4} \sqrt{3x^2 - 3} - \sqrt{3x^2 - 3} \\ &= 2\sqrt{3x^2 - 3} - \sqrt{3x^2 - 3} \\ &= \sqrt{3x^2 - 3} \end{aligned}$$

$$\text{bi) } \frac{2}{(\sqrt[3]{64})^m} = \frac{2}{4^m} = \frac{2}{(2^m)^2} = \frac{2}{a^2}$$

ii) Since $a = 2^m$; $m = \log_2 a$

$$\therefore \log_4 \left(\frac{32}{a^2} \right) = \frac{\log_2 \left(\frac{32}{a^2} \right)}{\log_2 4} = \frac{1}{2} \left(\log_2 \left(\frac{2^5}{a^2} \right) \right)$$

$$= \frac{1}{2} \left(\log_2 2^5 - \log_2 a^2 \right)$$

$$= \frac{1}{2} \left(5 - 2 \log_2 a \right)$$

$$= \frac{1}{2} \left(5 - 2m \right) = \frac{5 - 2m}{2}$$

- 2 Fungsi f ditakrifkan oleh $f: x \rightarrow x^2 - 1$ untuk $0 \leq x \leq 2$.
The function f is defined by $f: x \rightarrow x^2 - 1$ for $0 \leq x \leq 2$.

- 7 (a) Rajah 2(a) di ruang jawapan menunjukkan graf $y = f(x)$. Menggunakan paksi-paksi yang sama lakarkan graf $y = f^{-1}(x)$.
Diagram 2(a) in the answer space shows the graph of $y = f(x)$. Using the same axes, sketch the graphs of $y = f^{-1}(x)$

- (b) Nyatakan domain bagi $y = f^{-1}(x)$.
State the domain of $y = f^{-1}(x)$.

- (c) Cari fungsi
Find the function

- (i) f^2 ,
(ii) f^{-1} .

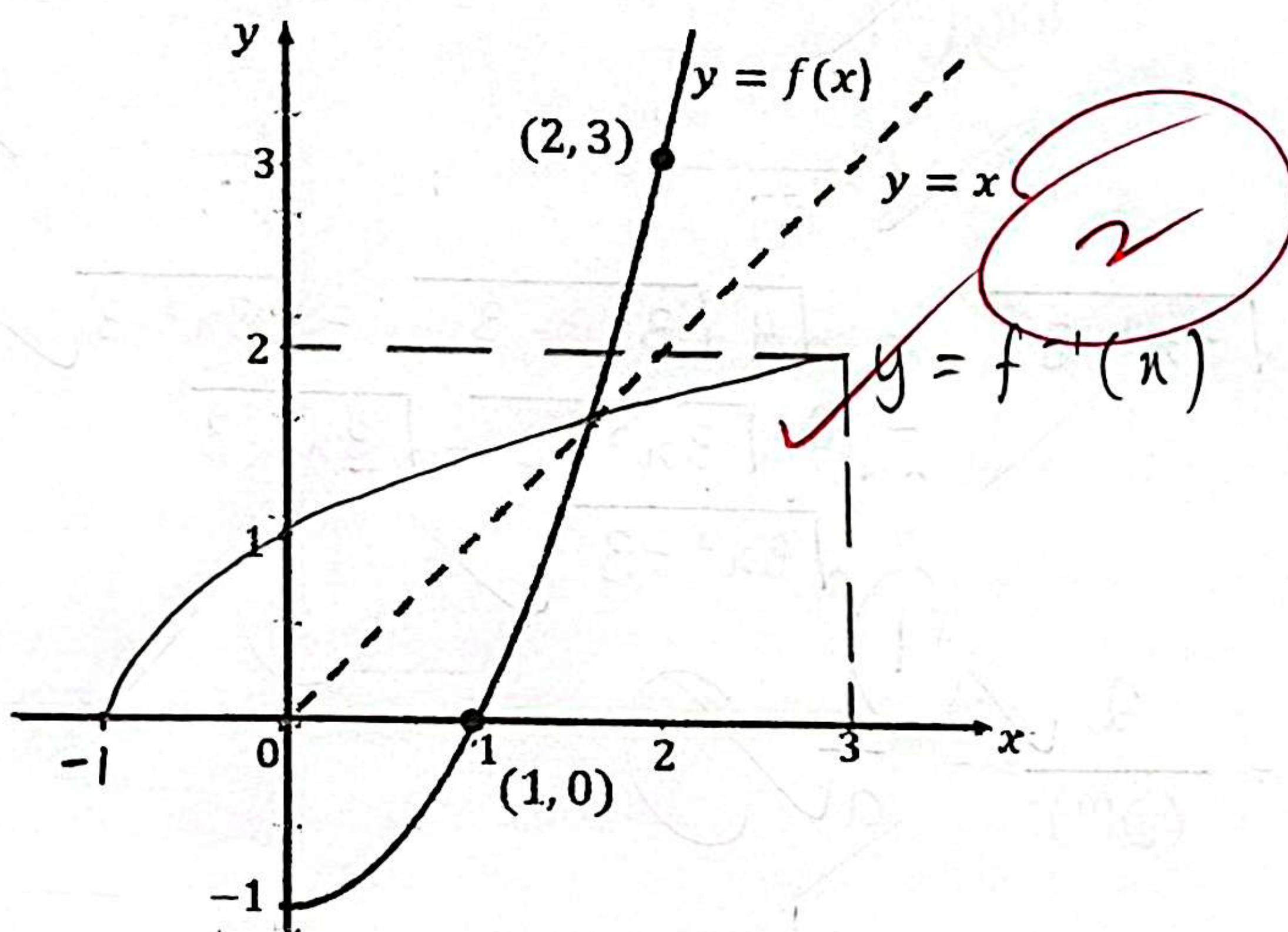
[2 markah / marks]

[1 markah / marks]

[4 markah / marks]

Jawapan / Answer:

(a)



Rajah 2(a)
Diagram 2(a)

b) $\{-1 \leq x \leq 3\}$

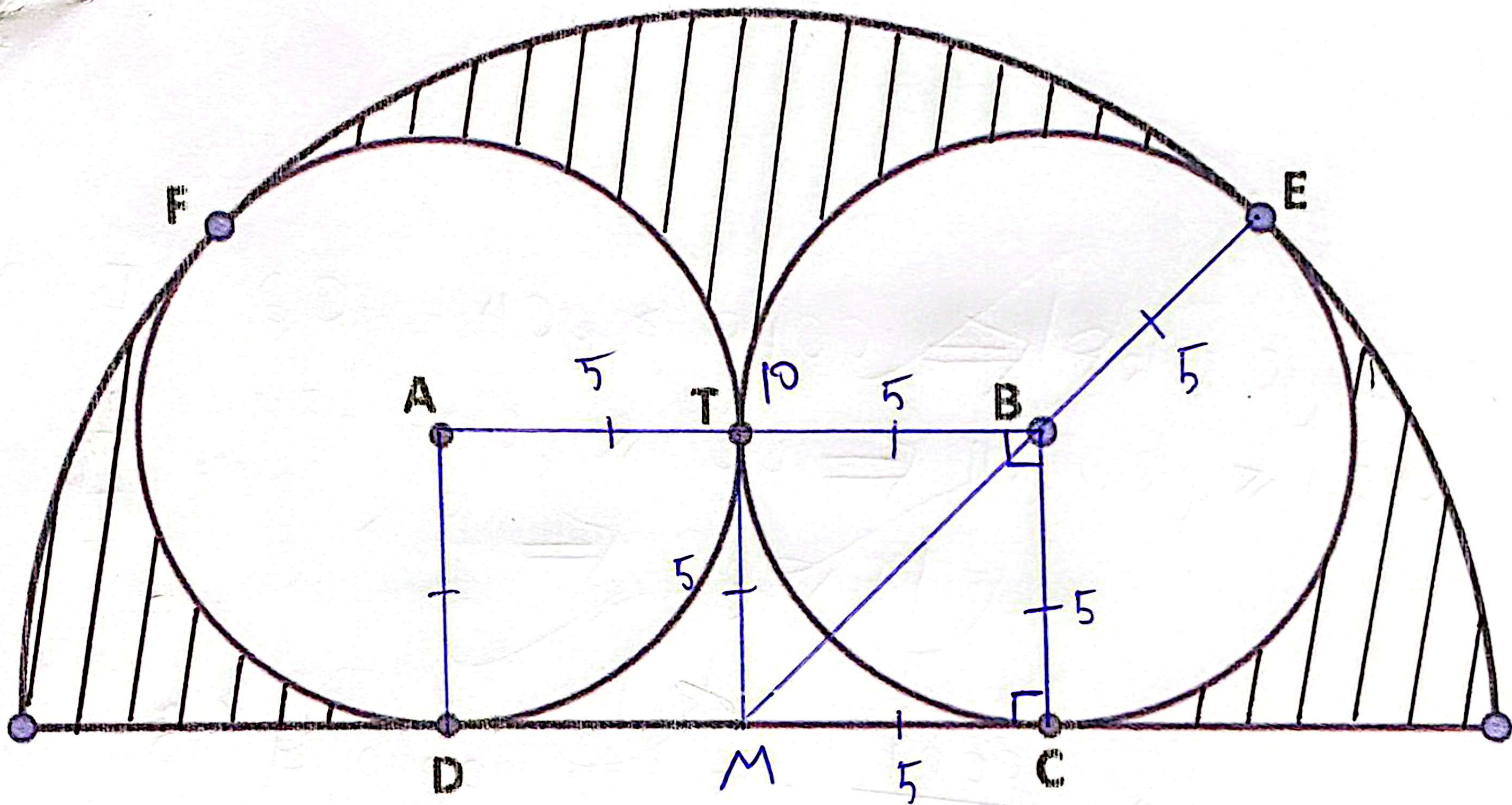
c) $f^2(x) = (x^2 - 1)^2 - 1 = x^4 - 2x^2 + 1 - 1 = x^4 - 2x^2$

ii) $y = x^2 - 1$

$x = \pm \sqrt{y+1}$, $\therefore f^{-1}(x) = \pm \sqrt{x+1}$, $x \geq -1$

From the graph, $f^{-1}(x) \geq 0$

$\therefore f^{-1}(x) = \sqrt{x+1}$, $x \geq -1$

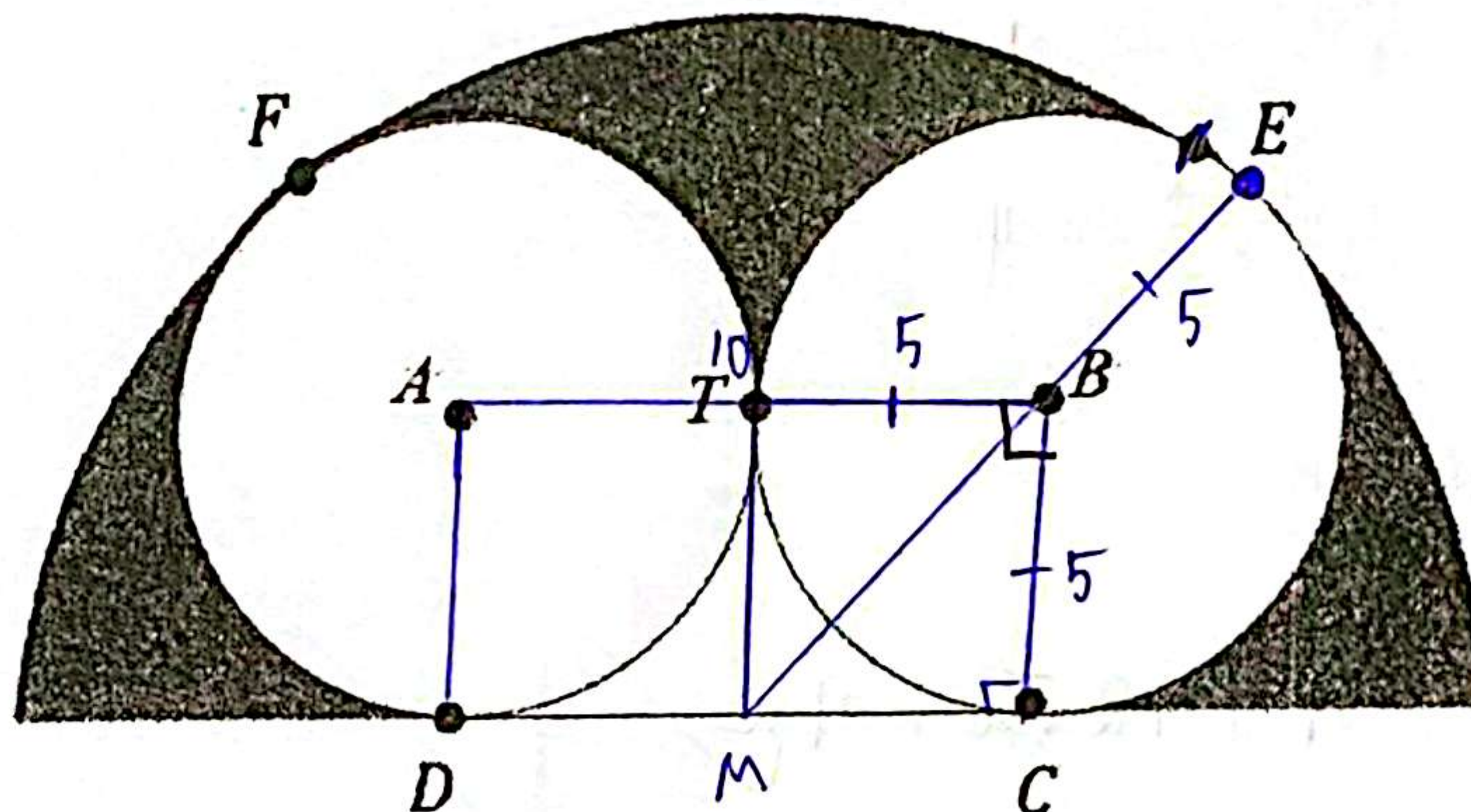


PEMBETULAN RAJAH 3 (MS 7)

3 Rajah 3 menunjukkan dua bulatan berpusat A dan B , berjajari 5 cm yang menyentuh satu sama lain di titik T . Kedua-dua bulatan itu terterap di dalam sebuah semibulatan. Kedua-dua bulatan itu menyentuh jejari semibulatan di titik C dan D dan menyentuh lilitan semibulatan di titik E dan F .

Diagram 3 shows two circles with centres A and B , of radius 5 cm touching each other at point T . The two circles are inscribed in a semicircle. The two circles touch the radius of the semicircle at points C and D and touch the circumference of the semicircle at points E and F .

[Guna / Use: $\pi = 3.142$]



Rajah 3
Diagram 3

- (a) Tunjukkan bahawa $\angle EBC = \frac{3\pi}{4}$ radian.

Show that $\angle EBC = \frac{3\pi}{4}$ radian.

[2 ~~markah~~ / marks]

- (b) Cari
Find

- (i) jejari semibulatan tersebut,
the radius of the semicircle,
- (ii) luas kawasan berlorek.
the area of the shaded region.

~~[6 markah / marks]~~

Jawapan / Answer:

$$\begin{aligned} \text{a) } \angle EBC &= \left(\frac{360^\circ - 90^\circ}{2} \right) \left(\frac{\pi}{180} \right) \\ &= \frac{3\pi}{4} \text{ radian (Shown!)} \end{aligned}$$

$$\begin{aligned} \text{bi) } ME &= MB + BE \\ &= \sqrt{5^2 + 5^2} + 5 \\ &= 12.07 \end{aligned}$$

ii) ~~Dues~~ $\Delta = \frac{1}{2} \pi (12.07)^2$
 $= 228.87$ ✓

$$\square = 5(10) = 50$$

$$2 \times \nabla = 2 \times \frac{1}{2} (5)^2 \left(\frac{3\pi}{4} \times 2 \right)$$
$$= 117.825$$

$$\begin{aligned} \text{Area of shaded region} &= 228.87 - 50 - 117.825 \\ &= 61.045 \end{aligned}$$

- 4 (a) Bezakan $(2 + 3\sqrt{x})^2$ terhadap x .
Differentiate $(2 + 3\sqrt{x})^2$ with respect to x .

[3 markah / marks]

- (b) Diberi $\int_2^6 f(x) dx = 20$, carikan

Given $\int_2^6 f(x) dx = 20$, find

(i) $\int_6^2 3f(x) dx$ 1

(ii) $\int_2^6 \frac{f(x)-4}{2} dx$ 4

Jawapan / Answer:

[5 markah / marks]

a) $(2 + 3\sqrt{x})^2 = 4 + 12\sqrt{x} + 9x$ 1

$$\frac{d}{dx} (2 + 3\sqrt{x})^2 = \frac{1}{2}(12)x^{\frac{1}{2}-1} + 9(1)x^{1-1}$$

$$= \frac{6}{\sqrt{x}} + 9 = \frac{6 + 9\sqrt{x}}{\sqrt{x}}$$
 1

bi) $\int_6^2 3f(x) dx = -3 \int_2^6 f(x) dx = -3(20)$ 1
 $= -60$

ii) $\int_2^6 \frac{f(x)-4}{2} dx$ 1

$$\hookrightarrow = \int_2^6 \frac{f(x)}{2} dx - \int_2^6 \frac{4}{2} dx$$

$$= \frac{1}{2} \int_2^6 f(x) dx - \left[\frac{2x}{1} \right]_2^6$$
 1

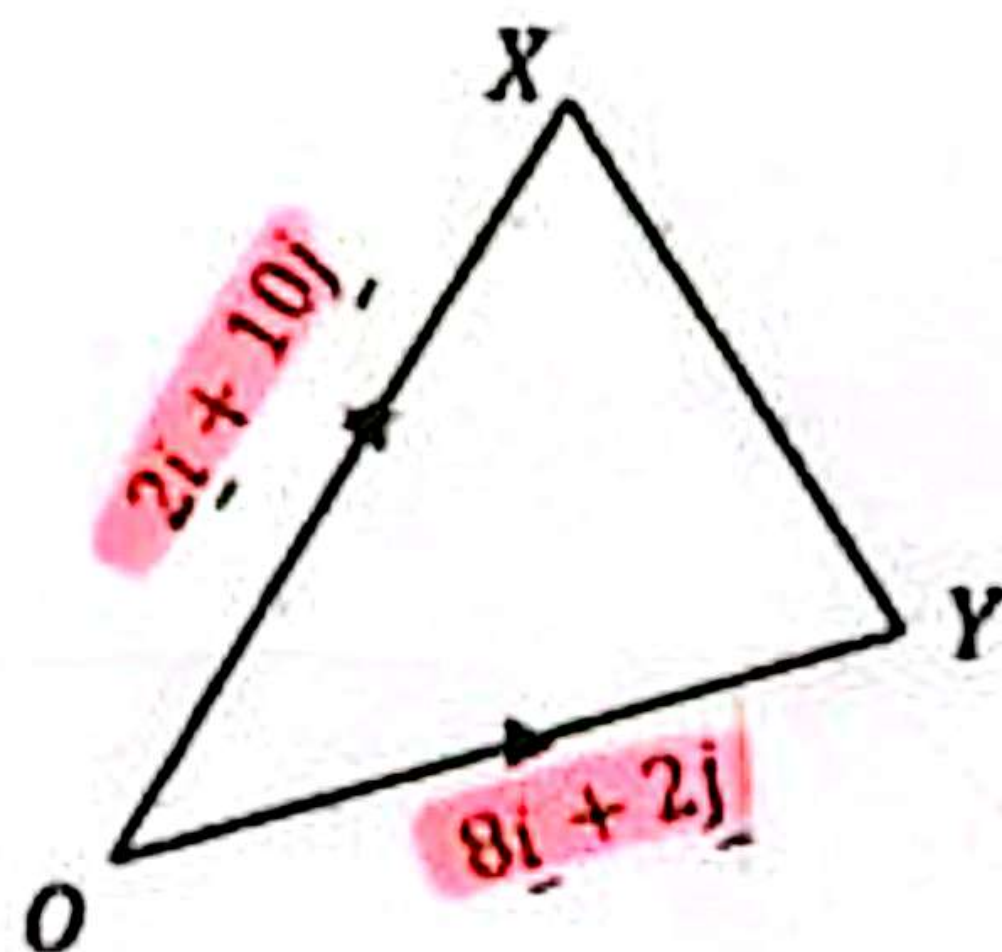
$$= \frac{1}{2} (20) - [2(6) - 2(2)]$$
 1

$$= 2$$
 1

- (a) Vektor $\begin{pmatrix} p \\ q \end{pmatrix}$ mempunyai magnitud 5 dan selari dengan vektor $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$. Cari nilai p dan nilai q dengan keadaan $p > 0$.
 Vector $\begin{pmatrix} p \\ q \end{pmatrix}$ has magnitude 5 and is parallel with the vector $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$. Find the value of p and the value of q such that $p > 0$.

[3 markah / marks]

- (b) Rajah 5 menunjukkan vektor kedudukan bagi titik X dan titik Y relatif kepada O .
 Diagram 5 shows the position vectors of point X and point Y relative to O .



Rajah 5
Diagram 5

Diberi $\overrightarrow{OX} = 2\mathbf{i} + 10\mathbf{j}$ dan $\overrightarrow{OY} = 8\mathbf{i} + 2\mathbf{j}$, Titik Z terletak di atas XY dengan keadaan $\overrightarrow{XZ}$ ialah vektor unit pada arah $\overrightarrow{XY}$.
 Given $\overrightarrow{OX} = 2\mathbf{i} + 10\mathbf{j}$ and $\overrightarrow{OY} = 8\mathbf{i} + 2\mathbf{j}$. Point Z is on XY such that $\overrightarrow{XZ}$ is a unit vector in the direction of $\overrightarrow{XY}$.

Cari
Find

- vektor $\overrightarrow{XY}$,
vector $\overrightarrow{XY}$,
- vektor kedudukan bagi Z relatif kepada O .
the position vector of Z relative to O .

$\overrightarrow{OZ}$

Jawapan / Answer:

[5 markah / marks]

Jawapan / Answer:

$$5a) \quad 5 = \sqrt{p^2 + q^2} \quad \text{①}$$

$$p^2 + q^2 = 25 \quad \text{①}$$

$$\begin{pmatrix} p \\ q \end{pmatrix} = \lambda \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} \lambda \\ 2\lambda \end{pmatrix}$$

$$p = \lambda, \quad q = 2\lambda = 2p \quad \text{②}$$

$$\text{②} \rightarrow \text{①}: \quad p^2 + (2p)^2 = 25$$

$$5p^2 = 25 \quad \text{①}$$

$$p^2 = 5$$

$$p = \pm \sqrt{5}, \quad p > 0$$

$$\therefore p = \sqrt{5}, \quad q = 2\sqrt{5} \quad \text{①}$$

$$bi) \quad \vec{xy} = \vec{x0} + \vec{0y} \quad \text{①}$$

$$= \begin{pmatrix} -2 \\ -10 \end{pmatrix} + \begin{pmatrix} 8 \\ 2 \end{pmatrix} = \begin{pmatrix} 6 \\ -8 \end{pmatrix} \quad \text{①}$$

$$ii) \quad \vec{xy} = 6\hat{i} - 8\hat{j} \quad \text{③}$$

$$\vec{xz} = \frac{6\hat{i} - 8\hat{j}}{\sqrt{6^2 + (-8)^2}} = \frac{3}{5}\hat{i} - \frac{4}{5}\hat{j} = \begin{pmatrix} \frac{3}{5} \\ -\frac{4}{5} \end{pmatrix} \quad \text{①}$$

$$\vec{0z} = \vec{0x} + \vec{xz} \quad \text{①}$$

$$= \begin{pmatrix} 2 \\ 10 \end{pmatrix} + \begin{pmatrix} \frac{3}{5} \\ -\frac{4}{5} \end{pmatrix} \quad \text{①}$$

$$= \begin{pmatrix} \frac{13}{5} \\ \frac{46}{5} \end{pmatrix} \quad \text{①}$$

- 6 (a) Jumlah S_n bagi n sebutan pertama suatu jangjang tertentu diberi oleh
The sum S_n for the first n terms of a certain progression is given by

$$S_n = \frac{2n^2 + 3n}{2}$$

Cari sebutan ke-7 bagi jangjang tersebut.
Find the 7th term of the progression.

$$T_7 = S_7 - S_6$$

[3 markah / marks]

- (b) Maklumat dalam Jadual 6 merujuk kepada sebutan-sebutan positif dalam suatu jangjang aritmetik dan jangjang geometri dengan keadaan p dan q adalah pemalar
The information in Table 6 refers to the positive terms in an arithmetic progression and a geometric progression such that p and q are constants.

Jangjang Aritmetik Arithmetic Progression	$T_1 = 1$ $T_2 = p = a + (2-1)d = a + d$ $T_{14} = q = a + (14-1)d = a + 13d$
Jangjang Geometri Geometric Progression	$\dots p, 9, q \dots$ adalah tiga sebutan berturutan. are three consecutive terms.

Jadual 6

Table 6

Cari nilai p dan nilai q .
Find the value of p and of q .

[4 markah / marks]

Jawapan / jawaban:

$$p > 0$$

$$1 + d > 0, \therefore d > -1$$

$$\textcircled{1}, \textcircled{2} \rightarrow \textcircled{3};$$

$$(1+d)(1+13d) = 81$$

$$13d^2 + 14d - 80 = 0$$

$$(13d + 40)(d - 2) = 0$$

$$d = -\frac{40}{13}, d = 2$$

$$\text{Ignore } d \leq -1$$

$$\therefore d = 2$$

$$p = 1 + (2) = 3$$

$$q = 1 + 13(2) = 27$$

$$a) T_7 = S_7 - S_6$$

$$= \frac{2(7)^2 + 3(7)}{2} - \frac{2(6)^2 + 3(6)}{2}$$

$$= \frac{29}{2}$$

$$b) p = a + d = 1 + d \textcircled{1}$$

$$q = a + 13d = 1 + 13d \textcircled{2}$$

$$\frac{q}{p} = \frac{q}{p}$$

$$pq = 81 \textcircled{2}$$

(pasar)

$$12 \quad 820 < X < 850$$

- 7 Jisim durian di sebuah dusun mengikut taburan normal dengan min 840 g dan sisihan piawai 10 g. Durian yang jisimnya antara 820 g dan 850 g dijual di pasar manakala yang berjisim 820 g atau kurang dihantar ke kilang untuk dijadikan bahan makanan berperisa durian.

The mass of durians in an orchard follows a normal distribution with a mean of 840 g and a standard deviation of 10 g. Durians with a mass between 820 g and 850 g are sold in the market while those with a mass of 820 g or less are sent to the factory to be used as ingredients in durian-flavoured food.

Cari
Find

$$\mu = 840, \sigma = 10$$

$$X \leq 820$$

(kilang)

- (a) kebarangkalian bahawa sebiji durian yang dipilih secara rawak dari dusun itu akan dijual di pasar, the probability that a durian chosen at random from the orchard will be sold in the market, [3 markah / marks]
- (b) (bilangan durian) yang tidak dijual di pasar dan tidak dihantar ke kilang, jika dusun itu menghasilkan 1 600 biji durian. the number of durians that are not sold in the market and not sent to the factory, if the orchard produces 1 600 durians. [3 markah / marks]

Jawapan / Answer:

$$\begin{aligned} a) P(820 < X < 850) &= P\left(\frac{820-840}{10} < Z < \frac{850-840}{10}\right) = P(-2 < Z < 1) \\ &= 1 - P(Z \leq -2) - P(Z \geq 1) = 1 - P(Z \geq 2) - P(Z \geq 1) \\ &= 1 - 0.0228 - 0.1587 \\ &= 0.8185 \end{aligned}$$

$$b) P(X \geq 850) = P\left(Z \geq \frac{850-840}{10}\right) = P(Z \geq 1) = 0.1587$$

$$\begin{aligned} \text{Bilangan} &= 0.1587 (1600) = 253.92 \\ &= 253 \end{aligned}$$

Bahagian B

[30 markah]

Bahagian ini mengandungi empat soalan. Jawab tiga soalan.

8

- (a)
- Buktikan**
- identiti berikut:

Prove the following identity:

$$\frac{\sin A - \csc A}{\cos A - \sec A} = \cot^3 A$$

[3 ~~markah~~ / marks]

- (b) Selesaikan persamaan berikut untuk
- $0^\circ \leq x \leq 180^\circ$
- .

Solve the following equation for $0^\circ \leq x \leq 180^\circ$.

$$\sin(2x - 30^\circ) - \cos 55^\circ = 0$$

[3 ~~markah~~ / marks]

- (c) (i) Pada
- rajah yang sama**
- , lakarkan
- graf $y = |\sin x|$**
- dan
- $y = 1 + \cos 2x$**
- untuk
- $0 \leq x \leq 2\pi$
- .
- 3
-
- On the same diagram, sketch the graph of $y = |\sin x|$ and $y = 1 + \cos 2x$ for $0 \leq x \leq 2\pi$.*

- (ii) Seterusnya, nyatakan
- bilangan penyelesaian**
- untuk
- $0 \leq x \leq 2\pi$
- , bagi persamaan
-
- Hence, state the number of solutions for $0 \leq x \leq 2\pi$. For the equation*

$$\begin{aligned} |\sin x| - 1 &= \cos 2x \\ |\sin x| - 1 &= \cos 2x \end{aligned}$$

[4 ~~markah~~ / marks]

Jawapan / Answer.

Jawapan / Answer:

a) From LHS;

$$\begin{aligned}
 \frac{\sin A - \operatorname{cosec} A}{\cos A - \sec A} &= \frac{\sin A - \frac{1}{\sin A}}{\cos A - \frac{1}{\cos A}} = \frac{\frac{\sin^2 A - 1}{\sin A}}{\frac{\cos^2 A - 1}{\cos A}} = \frac{\frac{\sin^2 A - 1}{\sin A}}{\frac{-(1 - \cos^2 A)}{\cos A}} \\
 &= \frac{\frac{-\cos^2 A}{\sin A}}{\frac{-\sin^2 A}{\cos A}} = \frac{1}{\frac{\sin^3 A}{\cos^3 A}} = \frac{1}{\tan^3 A} = \cot^3 A \quad (\text{Proven!})
 \end{aligned}$$

$$b) 0 \leq x \leq 180^\circ \Rightarrow -30 \leq 2x - 30 \leq 330^\circ$$

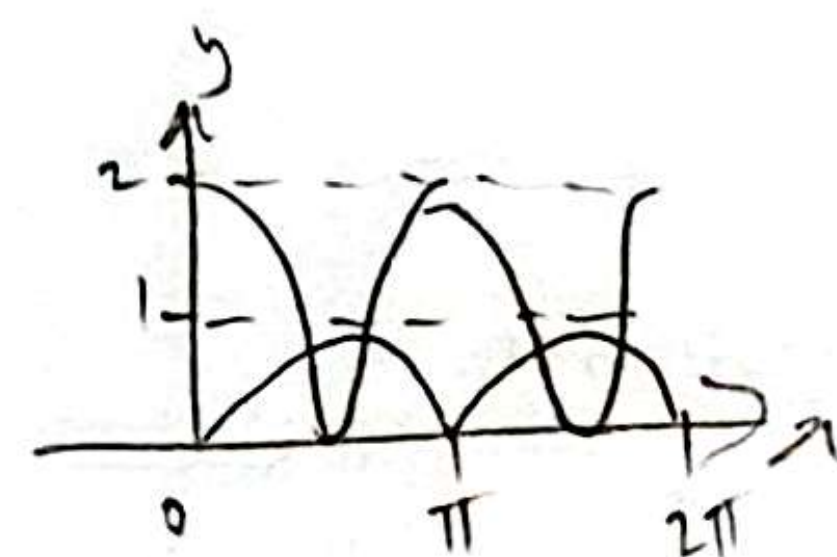
$$\sin(2x - 30^\circ) - \cos 55^\circ = 0$$

$$\sin(2x - 30^\circ) = \cos 55^\circ = \sin 35^\circ \quad (\text{I, II})$$

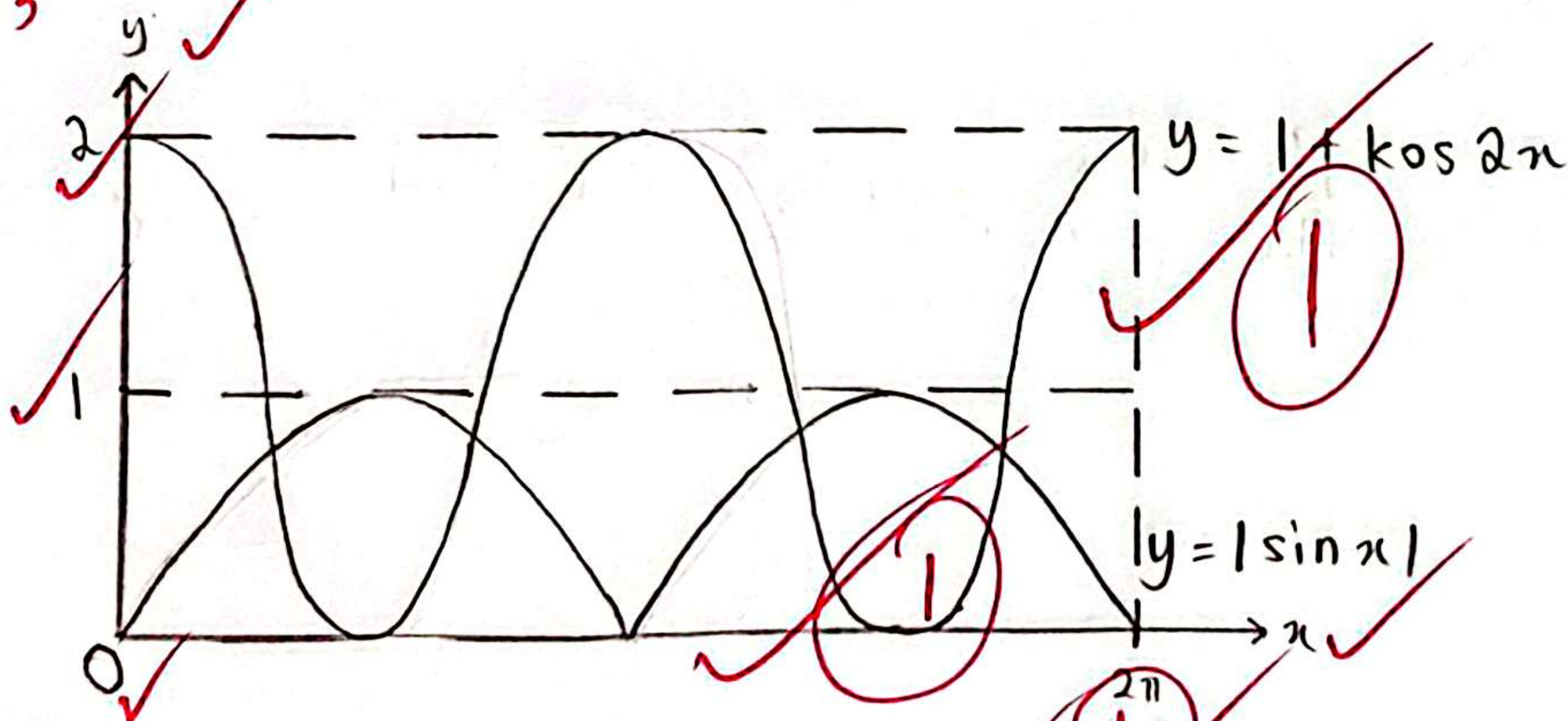
$$x = \sin^{-1}(\sin 35^\circ) = 35^\circ$$

$$2x - 30^\circ = 35^\circ, 145^\circ$$

$$x = 32.50^\circ, 87.50^\circ$$



$$c) y = 1 + \cos 2x, y = |\sin x|$$



$$ii) |\sin x| - 1 = \cos 2x$$

$$|\sin x| = 1 + \cos 2x$$

Bilangan penyelesaian = 4

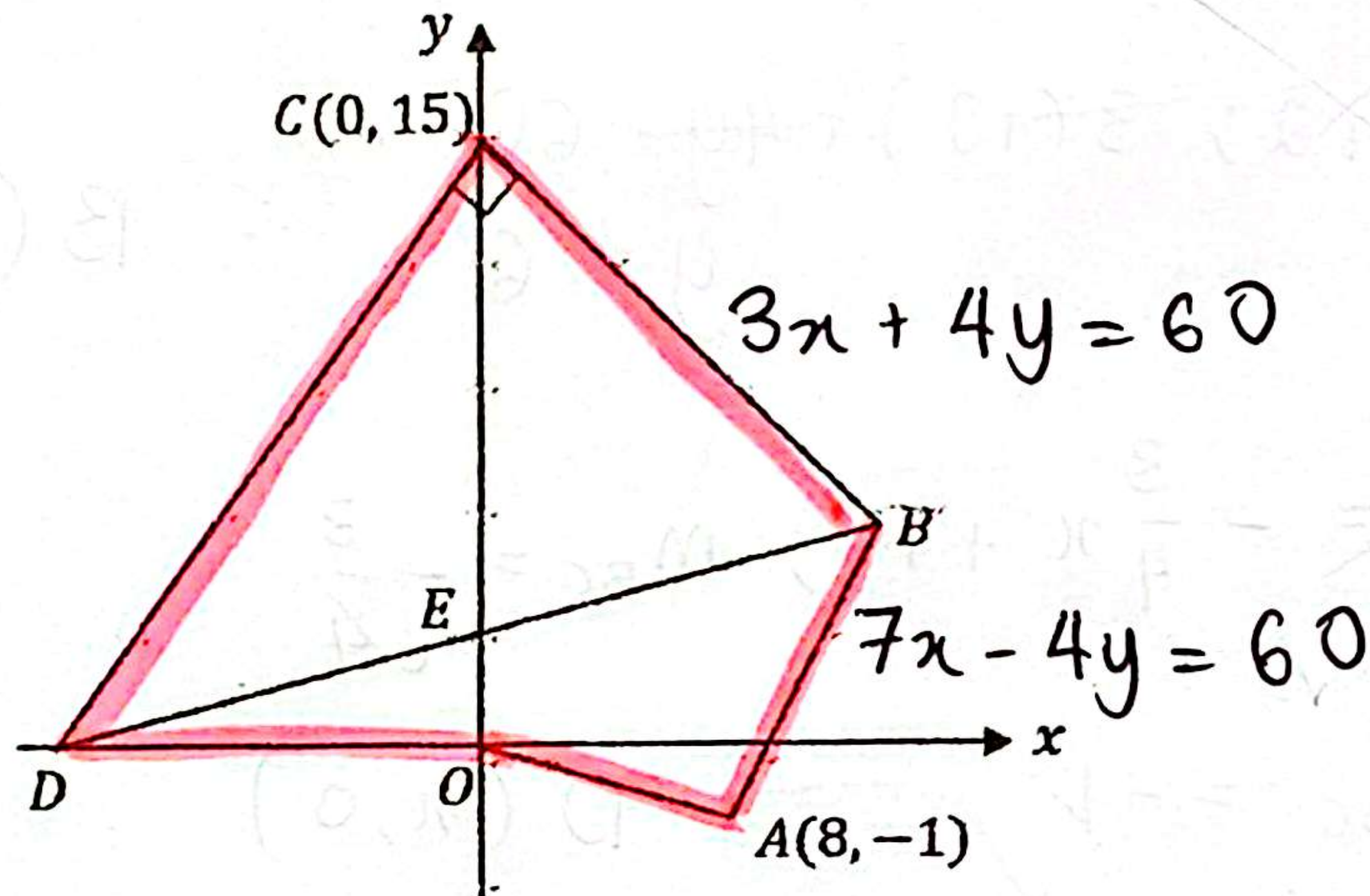
10

Penyelesaian secara lukisan berskala tidak diterima.

Solution by scale drawing is not accepted.

Rajah 9 menunjukkan sebuah pentagon $OABCD$. Persamaan bagi sisi AB ialah $7x - 4y = 60$ dan persamaan bagi sisi BC ialah $3x + 4y = 60$. Koordinat titik A ialah $(8, -1)$ dan koordinat titik C ialah $(0, 15)$. Sisi CD berserenjang dengan sisi BC .

Diagram 9 shows a pentagon $OABCD$. The equation of side AB is $7x - 4y = 60$ and the equation of side BC is $3x + 4y = 60$. The coordinates of point A are $(8, -1)$ and the coordinates of point C are $(0, 15)$. The side CD is perpendicular to side BC .



Rajah 9
Diagram 9

- (a) Cari
Find
- koordinat titik B ,
the coordinates of point B ,
 - koordinat titik D ,
the coordinates of point D .
- [4 markah / marks]
- (b) Seterusnya, cari luas pentagon $OABCD$.
Hence, find the area of pentagon $OABCD$.
- [2 markah / marks]
- (c) Garis lurus BD memotong paksi- y di titik E . Cari nisbah $BE:ED$.
The straight line BD cuts the y -axis at point E . Find the ratio $BE:ED$.
- [2 markah / marks]
- (d) Titik P bergerak dengan keadaan jarak P dari asalan adalah dua kali jarak A dari asalan.
Cari persamaan bagi lokus P .
Point P moves such that the distance of P from the origin is twice the distance of A from the origin.
Find the equation for the locus of P .
- [2 markah / marks]

Jawapan / Answer :



↓

↑
A B

$$3x + 4y = 60$$

$$(+) \quad 7x - 4y = 60$$

$$10x = 120$$

$$n = 12$$

$$y = 6$$

$$\therefore B(12, 6)$$

$$-\frac{3}{4}$$



$$\frac{4}{3}$$

$$m_{DC} = \frac{4}{3}$$

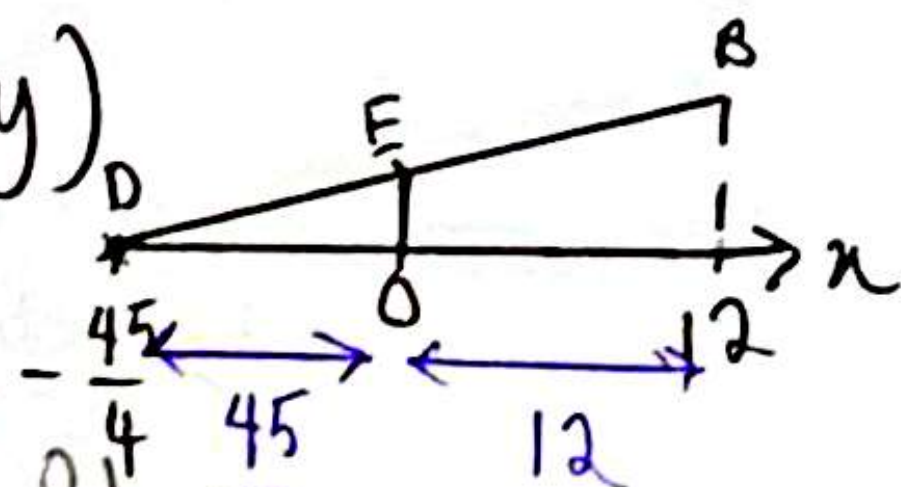
$$D(x, 0)$$

$$\frac{4}{3} = -\frac{15}{\pi}$$

$$x = -\frac{45}{4}$$

$$\therefore D\left(-\frac{45}{4}, 0\right)$$

6) $E(0, y)$



$$\frac{BE}{ED} = \frac{12}{\frac{45}{4}} = \frac{16}{15}$$

$$\therefore BE:ED = 16:15$$

b) 

$$= \frac{1}{2} \left[0(-1) + 8(6) + 12(15) + 0(0) + \left(-\frac{45}{4}\right)(0) \right] \left[0(8) + (-1)(12) + 6(0) + 15\left(-\frac{45}{4}\right) + 0(0) \right]$$
$$= \frac{1635}{8}$$

d) $P(n, y) \Rightarrow OP = 20A$ ✓

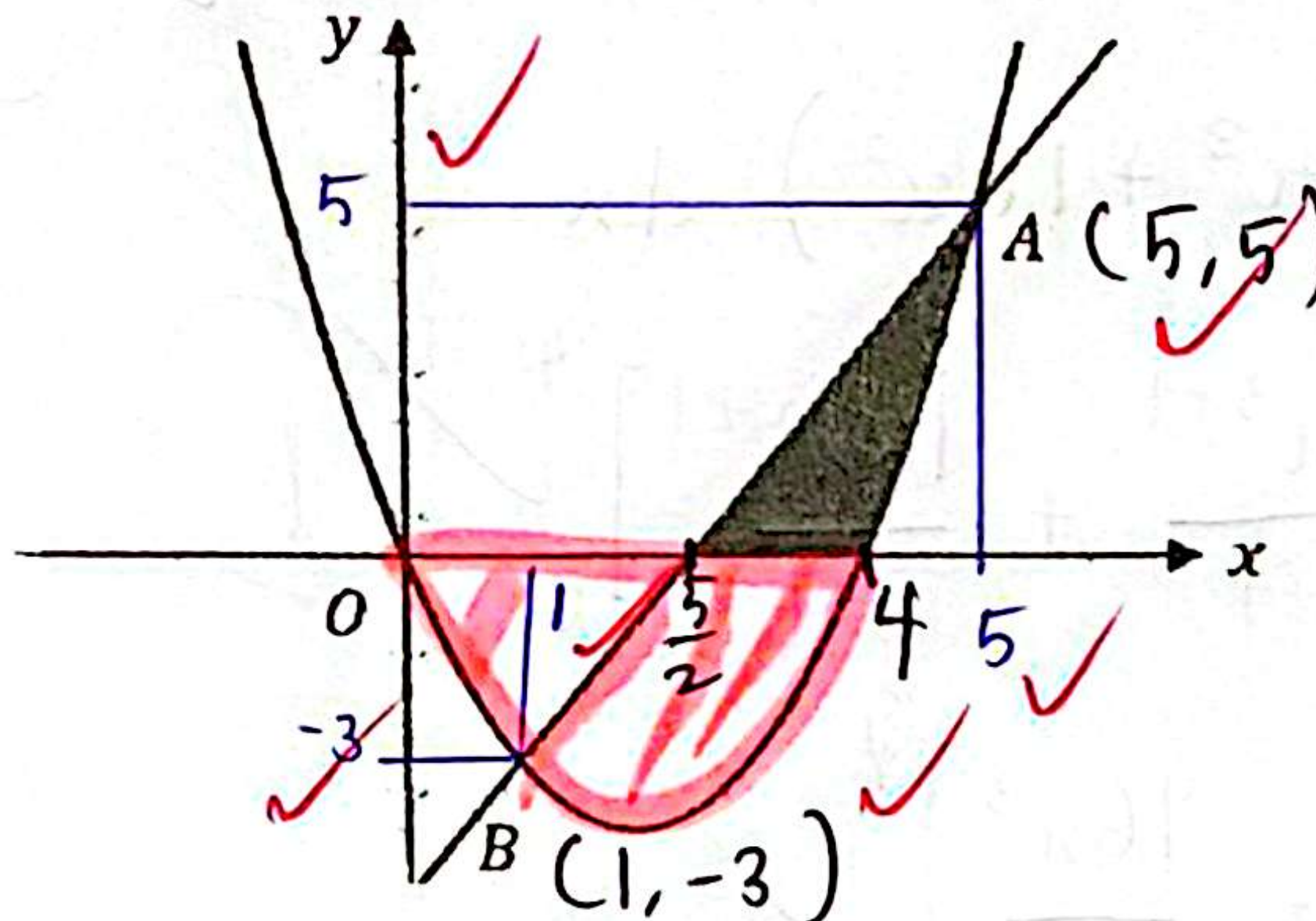
$$\sqrt{(x-0)^2 + (y-0)^2} = 2\sqrt{(8-0)^2 + (-1-0)^2}$$

$$x^2 + y^2 = 4(65) = 260$$

$$\therefore x^2 + y^2 - 260 = 0$$

- 10 Dalam Rajah 10, graf garis lurus $y = 2x - 5$ memotong graf lengkung $y = x^2 - 4x$ pada dua titik A dan B.

In Diagram 10, the graph of the straight line $y = 2x - 5$ intersects the graph of the curve $y = x^2 - 4x$ at two points A and B.



Rajah 10
Diagram 10

- (a) Cari luas rantau berlorek.
Find the area of the shaded region.

[6 markah / marks]

- (b) Rantau yang dibatasi oleh lengkung dan paksi-x diputar melalui 360° pada paksi-x.
Cari isi padu bongkah kisaran yang terbentuk. Berikan jawapan anda dalam sebutan π .
The region bounded by the curve and the x-axis is rotated through 360° about the x-axis.
Find the volume of the resulting solid of revolution. Give your answer in terms of π .

Jawapan / Answer:

$$a) x^2 - 4x = 0 = x(x - 4); x = 0, x = 4$$

$$x^2 - 4x = 2x - 5$$

$$x^2 - 6x + 5 = 0$$

$$(x - 5)(x - 1) = 0$$

$$x = 1, x = 5$$

when;

$$x = 5; y = 2(5) - 5 = 5, (5, 5)$$

$$x = 1; y = 2(1) - 5 = -3, (1, -3)$$

$$2x - 5 = 0$$

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

$$\frac{1}{2} \times 5 = \frac{1}{2} (5) \left(5 - \frac{5}{2}\right) = \frac{25}{4}$$

$$A = \int_4^5 x^2 - 4x \, dx = \left[\frac{x^{2+1}}{2+1} - \frac{4x^{1+1}}{1+1} \right]_4^5$$

$$= \left[\frac{x^3}{3} - 2x^2 \right]_4^5$$

$$= \left[\frac{(5)^3}{3} - 2(5)^2 \right] - \left[\frac{(4)^3}{3} - 2(4)^2 \right] = \frac{7}{3}$$

$$\text{Volume} = \frac{25}{4} - \frac{7}{3} = \frac{47}{12}$$

Jawapan / Answer:

$$10\ b) \quad y = x^2 - 4x \quad \checkmark$$

$$y^2 = (x^2 - 4x)^2 = x^4 - 8x^3 + 16x^2 \quad \checkmark$$

$$V = \int_0^4 \pi (x^4 - 8x^3 + 16x^2) \, dx$$

$$= \pi \left[\frac{x^{4+1}}{4+1} - \frac{8x^{3+1}}{3+1} + \frac{16x^{2+1}}{2+1} \right]_0^4 \quad \checkmark$$

$$= \pi \left[\frac{x^5}{5} - 2x^4 + \frac{16x^3}{3} \right]_0^4 \quad \checkmark$$

$$= \pi \left[\left(\frac{(4)^5}{5} - 2(4)^4 + \frac{16(4)^3}{3} \right) - \left(\frac{(0)^5}{5} - 2(0)^4 + \frac{16(0)^3}{3} \right) \right] \quad \checkmark$$

$$= \frac{512}{15} \pi \quad \checkmark$$

Gunakan kertas graf untuk menyelesaikan soalan berikut.

Use the graph paper to solve this question.

Sekumpulan pelajar membuat satu ujikaji untuk membuktikan dua kuantiti x dan y dihubungkan oleh persamaan $y = \frac{4}{a^2}(x+b)^2$, dengan keadaan a dan b ialah pemalar.

Jadual 11 menunjukkan nilai-nilai bagi enam pasangan kuantiti x dan y yang diperoleh daripada ujikaji tersebut.

A group of students made an experiment to prove that two quantities x and y are related by the equation $y = \frac{4}{a^2}(x+b)^2$, such that a and b are constants.

Table 11 shows the values for six pairs of quantities x and y obtained from the experiment.

x	0.2	0.4	0.6	1.0	1.2	1.4
y	1.4	2.6	4.0	7.8	10.2	13.0

Jadual 11

Table 11

- (a) Berdasarkan Jadual 11, bina satu jadual bagi nilai-nilai $\sqrt{y}$.

Based on Table 11, construct a table for the values of $\sqrt{y}$.

[1 markah / mark]

- (b) Plot $\sqrt{y}$ melawan x dengan menggunakan skala 2 cm kepada 0.2 unit pada x dan 2 cm kepada 0.5 unit pada paksi $\sqrt{y}$. Seterusnya, lukis garis lurus penyuaian terbaik.

Plot $\sqrt{y}$ against x using a scale of 2 cm to 0.2 units on the x -axis and 2 cm to 0.5 units on the $\sqrt{y}$ -axis. Hence, draw the line of best fit.

[3 markah / marks]

- (c) Gunakayn graf di 11 (b) untuk mencari nilai
Using the graph in 11(b), find the value of

(i) a ,

(ii) b ,

(iii) nilai y apabila $x = 0.7$.
the value of y when $x = 0.7$.

[6 markah / marks]

Jawapan / Answer:

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

$$\sqrt{y} = \frac{2}{a}(x+b) = \frac{2x}{a} + \frac{2b}{a} = \frac{2}{a}(x) + \frac{2b}{a}$$

ma: a)

$$y = \left(\frac{2}{a}\right)^2 (n+b)^2$$

$$y = \left(\frac{2}{a}(n+b)\right)^2$$

$$\sqrt{y} = \frac{2}{a}(n+b) = \frac{2}{a}(n) + \frac{2b}{a}$$

n	0.2	0.4	0.6	1.0	1.2	1.4
$\sqrt{y}$	1.183	1.612	2	2.793	3.194	3.606

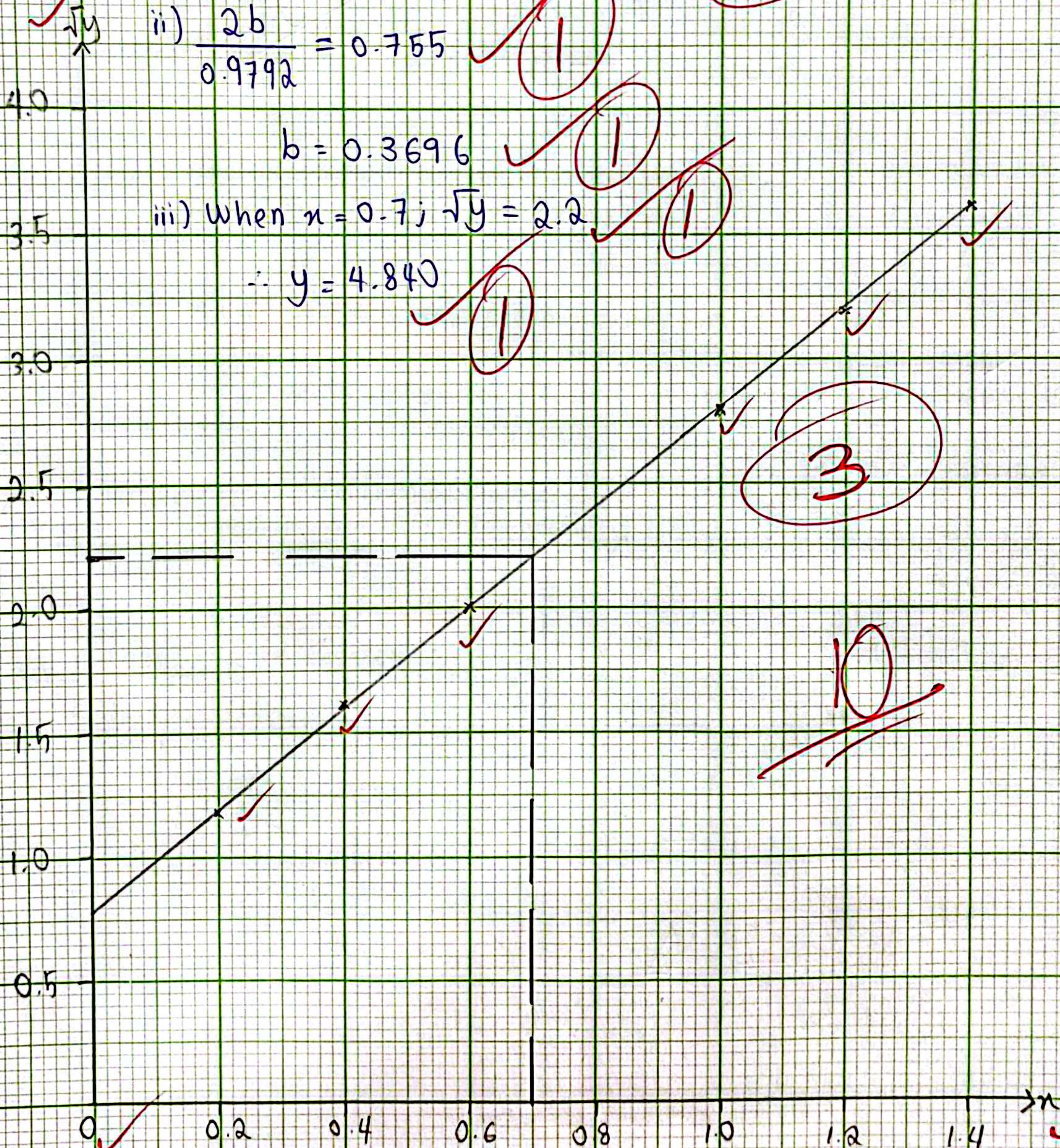
$$\text{bi) } \frac{2}{a} = \frac{2 - 1.183}{0.6 - 0.2}, \quad a = 0.9792$$

$$\text{ii) } \frac{2b}{0.9792} = 0.755$$

$$b = 0.3696$$

$$\text{iii) When } n = 0.7; \sqrt{y} = 2.2$$

$$\therefore y = 4.840$$



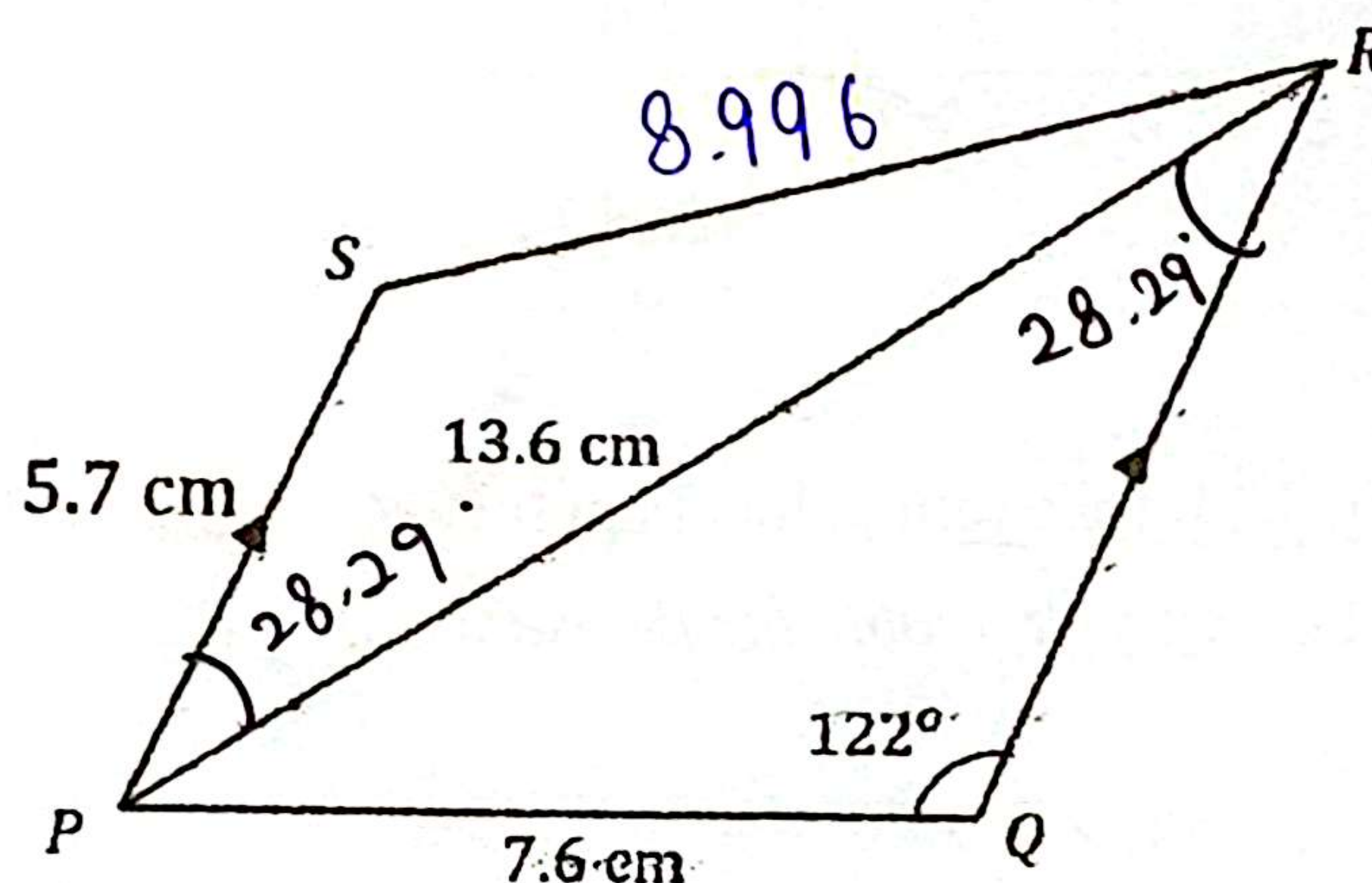
Bahagian C

[20 markah]

Bahagian ini mengandungi empat soalan. Jawab dua soalan.

- 12 Penyelesaian secara lukisan berskala tidak diterima.
Solution by scale drawing is not accepted.

Rajah 12 menunjukkan sebuah trapezium $PQRS$ dengan keadaan PS selari dengan QR .
Diagram 12 shows a trapezium $PQRS$ with PS parallel to QR .



Rajah 12
 Diagram 12

- (a) Cari
Find
- $\angle PRQ$, ✓
 - panjang, dalam cm, bagi SR ,
the length, in cm, of SR ,
 - luas, dalam cm^2 , seluruh rajah.
the area, in cm^2 , of the whole diagram.

[9 markah / marks]

- (b) Garis lurus RS dipanjangkan ke titik T dengan keadaan $TP = SP$. Lakarkan sisi empat $PQRT$.
The straight line RS is extended to point T such that $TP = SP$. Sketch the quadrilateral $PQRT$.

[1 markah / mark]

Jawapan / Answer:

Jawapan / Answer:

$$a) \quad \frac{\sin \angle PRQ}{7.6} = \frac{\sin 122}{13.6}$$

$$\angle PRQ = 28.29'$$

$$ii) \quad \angle PRQ = \angle RPS$$

$$SR^2 = 5.7^2 + 13.6^2 - 2(5.7)(13.6) \cos 28.29'$$

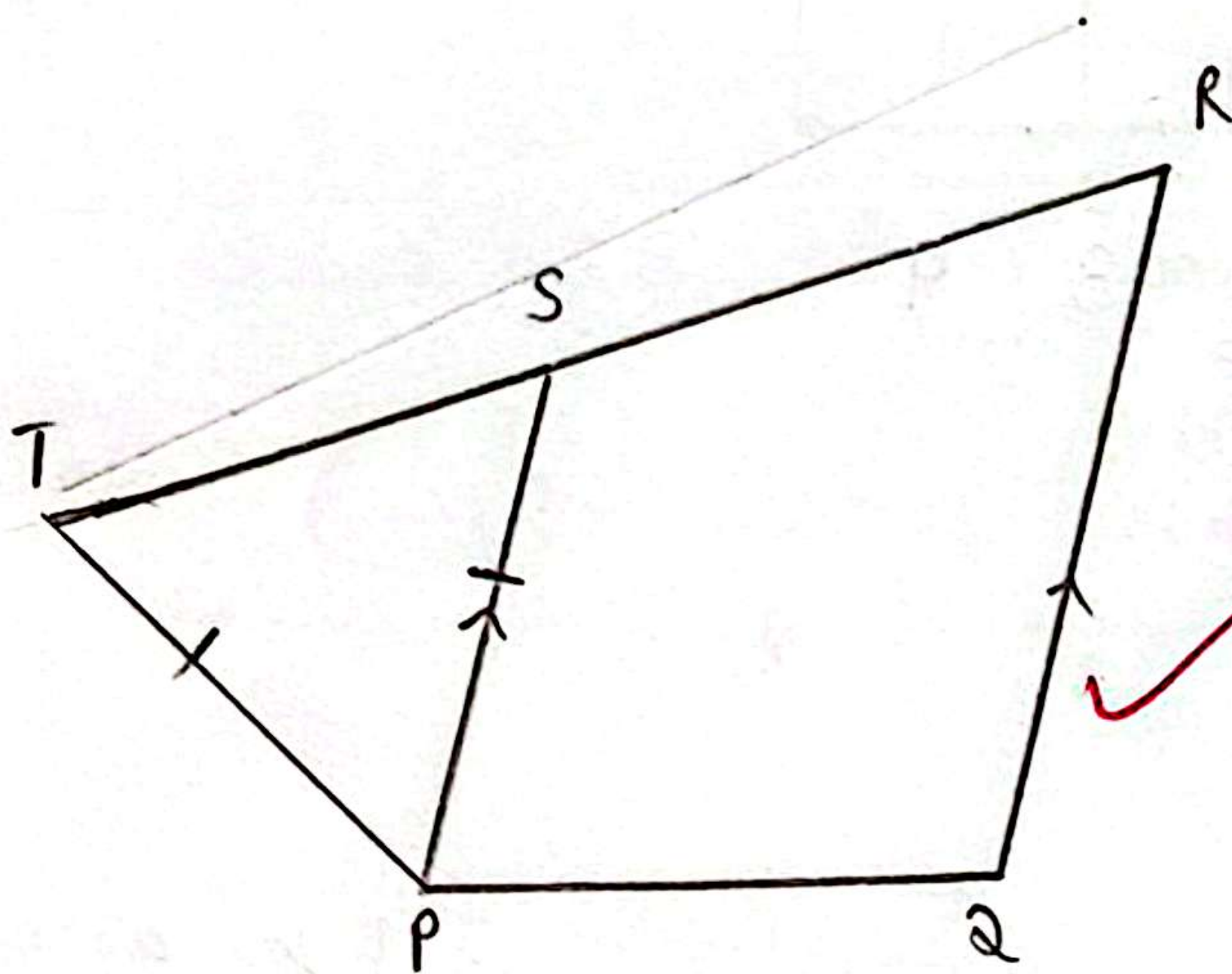
$$SR = 8.996$$

$$iii) \quad \text{Area of } \triangle PQR = \text{Area of } \triangle PQR + \text{Area of } \triangle PQR$$

$$= \frac{1}{2}(5.7)(13.6) \sin 28.29' + \frac{1}{2}(13.6)(7.6) \sin 29.71'$$

$$= 43.98$$

b)



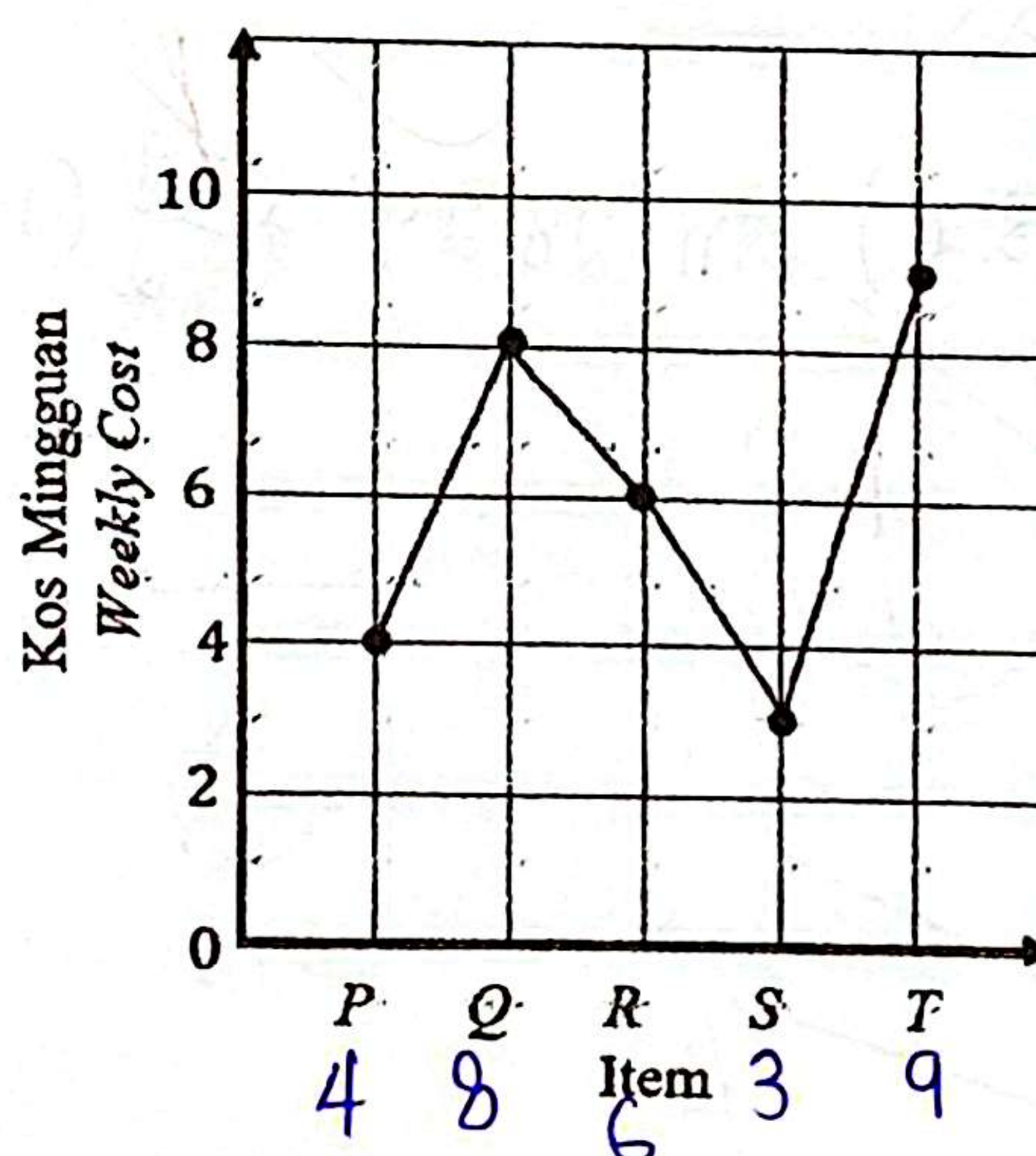
10

13

Jadual 13 menunjukkan harga dan indeks harga bagi lima item P, Q, R, S dan T . Rajah 13 pula menunjukkan graf garis yang mewakili kos mingguan lima item tersebut untuk tahun 2020. Table 13 shows the price and the price indices of five items P, Q, R, S and T . Diagram 13 shows a line graph indicating the weekly cost of the five items for the year 2020.

Item	Harga (RM) Price (RM)		Indeks Harga Pada Tahun Price Index In The Year 2023 (2020 = 100)
	2020	2023	
P	0.80	1.00	125
Q	1.50	x	120
R	2.50	2.80	112
S	y	4.20	105
T	5.00	7.00	z

Jadual 13
Table 13



Rajah 13
Diagram 13

- (a) Cari nilai x , nilai y dan nilai z .
Find the value of x , of y and of z . [3 markah / marks]
- (b) Hitung nombor indeks gubahan bagi harga item-item itu untuk tahun 2023 berdasarkan tahun 2020.
Calculate the composite index number for the prices of the items for the year 2023 based on the year 2020. [2 markah / marks]
- (c) Jumlah kos bulanan item pada tahun 2020 ialah RM450. Hitung jumlah kos bulanan yang sepadan untuk tahun 2023.
The total monthly cost of the item in the year 2020 is RM450. Calculate the corresponding total monthly cost for the year 2023. [2 markah / marks]

- (d) Kos item tersebut meningkat sebanyak 12% dari tahun 2023 hingga tahun 2025. Cari indeks gubahan bagi tahun 2025 berdasarkan tahun 2020.

The cost of the items increases by 12% from the year 2023 to the year 2025. Find the composite index for the year 2025 based on the year 2020.

[3 markah / marks]

Jawapan / Answer:

$$a) \quad 120 = \frac{x}{1.50} \times 100, \quad x = \text{RM } 1.80$$

$$105 = \frac{4.20}{y} \times 100, \quad y = \text{RM } 4$$

$$z = \frac{7}{5} \times 100 = 140$$

$$b) \quad \bar{I}_{2023/2020} = \frac{4(125) + 8(120) + 6(112) + 3(105) + 9(140)}{4 + 8 + 6 + 3 + 9} = 123.57$$

$$c) \quad 123.57 = \frac{Q_{2023}}{450} \times 100$$

$$Q_{2023} = \text{RM } 556.07$$

$$d) \quad \begin{array}{ccccc} 2020 & \xrightarrow{123.57} & 2023 & \xrightarrow{112} & 2025 \\ & & \downarrow c & & \downarrow \end{array}$$

$$100c = 123.57(112)$$

$$c = 138.40$$

$$\bar{I}_{2025/2020} = 138.40$$

10

- 14 $s = t^3 - 2t - 4$
 Suatu zarah bergerak pada satu garis lurus dan melalui satu titik tetap O . Sesarannya, s m, diberi oleh $s = pt^3 + qt - 4$, dengan keadaan t ialah masa, dalam saat, selepas melalui O . Diberi bahawa zarah mencapai halaju 1 ms^{-1} selepas 1 saat dan pecutannya ialah 12 ms^{-2} apabila $t = 2$ saat.

[Anggapkan gerakan ke arah kanan sebagai positif.]

A particle moves in a straight line and passes through a fixed point O . Its displacement, s m, is given by $s = pt^3 + qt - 4$, such that t is the time, in seconds, after leaving O . Given that the particle reaches velocity of 1 ms^{-1} after 1 second and its acceleration is 12 ms^{-2} when $t = 2$ seconds.

[Assume motion to the right is positive.]

Cari

Find

- (a) nilai p dan nilai q ,
 nilai p dan nilai q ,

$$t = 1, v = 1$$

$$t = 2, \frac{dv}{dt} = 12$$

- (b) sesarannya dari O apabila zarah mencapai halaju 25 ms^{-1} ,
 its displacement from O when the particle reaches a velocity of 25 ms^{-1} ,

$$v = 25$$

[4 markah / marks]

- (c) julat masa apabila zarah itu mengalami halaju negatif,
 the time range when the particle experiences negative velocity,

$$v < 0$$

[2 markah / marks]

- (d) jarak yang di lalui oleh zarah dalam saat ketiga.
 the distance traveled by the particle in the third second.

$$(s_3 - s_2)$$

[2 markah / marks]

[2 markah / marks]

Jawapan / Answer:

$$a) v = \frac{ds}{dt} = 3pt^{3-1} + qt^{1-1} = 3pt^2 + q$$

$$t = 1, v = 1; \quad 1 = 3p(1)^2 + q$$

$$3p + q = 1 \quad \text{--- (1)}$$

$$\frac{dv}{dt} = 6pt^{2-1} = 6pt$$

$$t = 2, \frac{dv}{dt} = 12; \quad 12 = 6p(2)$$

$$p = 1$$

$$\therefore p = 1$$

$$q = -2$$

$$3(1) + q = 1$$

$$q = -2$$

Jawapan / Answer:

$$b) v = 25 = 3t^2 - 2 \checkmark$$

$$0 = 3t^2 - 27 = 3(t^2 - 9)$$

$$t^2 - 9 = 0 = (t + 3)(t - 3)$$

$$t = 3, t = -3 \text{ (ignore)}$$

$$\therefore t = 3 \checkmark$$

$$s = (3)^3 - 2(3) - 4 = 17 \text{ (17m dari kanon 0)}$$

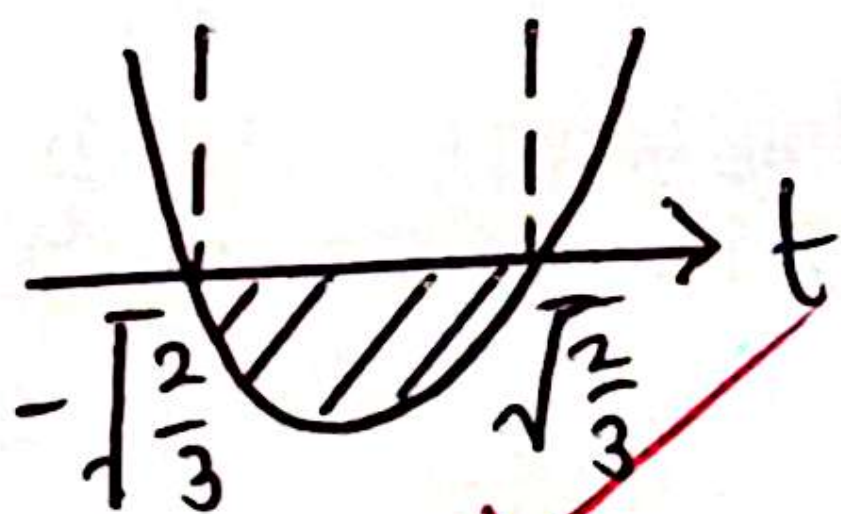
$$c) v = 0 = 3t^2 - 2$$

$$t = \pm \sqrt{\frac{2}{3}}$$

$$v < 0$$

$$3t^2 - 2 < 0$$

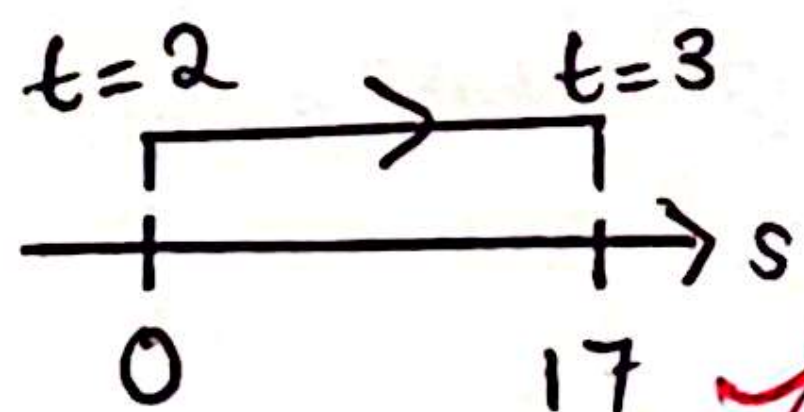
$$\therefore t \geq 0 \checkmark$$



$$\therefore 0 \leq t < \sqrt{\frac{2}{3}}$$

$$d) t = 3; s = 17 \checkmark$$

$$t = 2; s = (2)^3 - 2(2) - 4 = 0$$



Jarak yang dilalui
dalam saat ke-3

$$= 17 - 0 = 17 \checkmark$$

10

15

Gunakan kertas graf untuk menjawab soalan ini.

Use graph paper to answer this question.

Jadual 15 menunjukkan perbelanjaan dan komisen seunit bagi dua jenis komoditi, A dan B.

Seorang pelabur ingin melabur dalam kedua-dua jenis komoditi. Dia bercadang untuk membeli x unit komoditi A dan y unit komoditi B.

Table 15 shows the expenditures and commissions per unit on two types of commodities, A and B.

An investor want to invest in both types of commodities. He intends to buy x unit of commodity A and y units of commodity B.

Komoditi Commodity	Perbelanjaan Expenditure (RM)	Komisyen Commission (RM)
A	60	55
B	40	10

Jadual 15

Table 15

Perbelanjaan bagi pelaburan tersebut adalah berdasarkan kekangan berikut.

The expenditure of the investment is based on the following constraints.

I: Peruntukan (maksimum) bagi pelaburan itu ialah RM2 400. $60x + 40y \leq 2400$
The maximum allocation for the investment is RM2 400.

II: Sasaran komisyen adalah sekurang-kurangnya RM600. $55x + 10y \geq 600$
The commission target is at least RM600.

III: Nisbah bilangan unit komoditi A kepada bilangan unit komoditi B adalah paling banyak 2 : 1. $\frac{x}{y} \leq \frac{2}{1}$
The ratio of the number of units of commodity A to the number of commodity B is at most 2 : 1.

(a) Tulis tiga ketaksamaan, selain $x \geq 0$ dan $y \geq 0$, yang memenuhi semua kekangan di atas.
Write down three inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all the above constraint.
[3 markah / marks]

(b) Menggunakan skala 2 cm kepada 10 unit pada kedua-dua paksi, bina dan lorek rantau R yang memenuhi semua kekangan di atas.
Using a scale of 2 cm to 10 units on both axes, construct and shade the region R that satisfies all the above constraints.
[3 markah / marks]

(c) Gunakan graf anda di 15(b), cari
Use your graph from 15(b), find

- (i) Jumlah maksimum komisen yang pelabur itu boleh dapat jika dia membelanjakan RM1 200 untuk komoditi A.
The maximum total commission the investor can get if he spend RM1 200 on commodity A.
- (ii) Jumlah maksimum komisen yang diterima jika bilangan pelaburan dalam komoditi A sama dengan dalam komoditi B.
The maximum amount of commission received if the number of investments in commodity A is the same as in commodity B.

[4 markah / marks]

i) I: $60x + 40y \leq 2400 \Rightarrow 3x + 2y \leq 120$ (40, 0), (0, 60)

II: $55x + 10y \geq 600 \Rightarrow 11x + 2y \geq 120$, (0, 60), (10, 5)

III: $\frac{x}{y} \leq \frac{2}{1} \Rightarrow 2y \geq x$

ci) Bilangan unit $x = \frac{1200}{60} = 20$

Apabila $x = 20$; $y_{\text{maks}} = 30$

Jumlah komisen = ~~$1200 + 30(10) = \text{RM } 1500$~~

$\hookrightarrow = 20(55) + 30(10) = \text{RM } 1400$

ii) Apabila $y = x$;

$x = y = 24$ (maksimum)

Jumlah komisen = $24(55) + 24(10)$

= RM 1560

