# Penyelesaian Lengkap

**Kertas Model SPM**

**Kertas 1**

**1** (a) Bukan fungsi. Objek '2' mempunyai dua imej.
*Not a function. The object '2' has two images.*

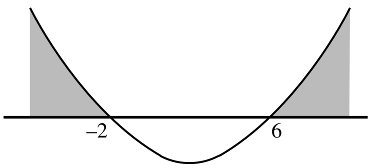
(b) (i) $f^{-1}(p) = q$ atau/*or* $g^{-1}(r) = q$
(ii) $fg^{-1}(r) = p$

**2** (a) $f(x) = k + mx$
Biar/*Let* $y = f^{-1}(x)$
$f(y) = x$
$k + my = x$
$y = \dfrac{x - k}{m}$
$f^{-1}(x) = \dfrac{x - k}{m}$

(b) $f^{-1}(13) = -4$ dan/*and* $f(5) = -5$
$\dfrac{13 - k}{m} = -4$ $k + m(5) = -5$
$13 - k = -4m$ $5m + k = -5 \ldots ②$
$4m - k = -13 \ldots ①$
$① + ②$: $9m = -18$
$m = -2$
Daripada/*From* ②: $5(-2) + k = -5$
$-10 + k = -5$
$k = 5$

**3** (a) $x^2 - 8x + 15 = 0$
$(x - 3)(x - 5) = 0$
$x = 3$ atau/*or* $x = 5$
$k + 1 = 3$ dan/*and* $2m - 3 = 5$
$k = 2$ dan/*and* $m = 4$
atau/*or*
$k + 1 = 5$ dan/*and* $2m - 3 = 3$
$k = 4$ dan/*and* $m = 3$
Penyelesaian/*Solutions*: $k = 2, m = 4; k = 4, m = 3$

(b) $mx - 4 = x^2 - 2x + 2m$
$x^2 - 2x + 2m - mx + 4 = 0$
$x^2 - (2 + m)x + 2m + 4 = 0$
Bersilang pada dua titik berlainan,
*Intersects at two different points,*
$b^2 - 4ac > 0$
$[-(2 + m)]2 - 4(1)(2m + 4) > 0$
$4 + 4m + m^2 - 8m - 16 > 0$
$m^2 - 4m - 12 > 0$
$(m - 6)(m + 2) > 0$




$\therefore m < -2$ atau/*or* $m > 6$

**4** Objek secaman/*Identical objects*: 3S, 2T, 2N

(a) $\dfrac{5!}{2!2!} + \dfrac{5!}{3!2!} + \dfrac{5!}{3!2!} = 50$

(b) $\dfrac{5!}{2!2!} + \dfrac{4!}{2!} = 30 - 12$
$= 18$

**5** $4^{2x} = 5(3^{3x})$
$16^x = 5(27^x)$
$\dfrac{16^x}{27^x} = 5$
$\left(\dfrac{16}{27}\right)^x = 5$

Tambah $\log_a$ pada kedua-dua belah persamaan,
*Add* $\log_a$ *on both sides of equation,*
$\log_a \left(\dfrac{16}{27}\right)^x = \log_a 5$
$x \log_a \dfrac{16}{27} = \log_a 5$ (Terbukti/*Proven*)

**6** (a) $2y = 5x^2 + 2x - 1$
$2y + 1 = 5x^2 + 2x$
$\dfrac{2y + 1}{x^2} = 5 + 2\left(\dfrac{1}{x}\right)$
$Y = 5 + 2X$
$2 - \dfrac{q}{3} = 5 + 2(2p - 3)$
$2 - \dfrac{q}{3} = 5 + 4p - 6$
$= 4p - 1$
$4p = 3 - \dfrac{q}{3}$
$p = \dfrac{9 - q}{12}$

(b) Daripada Rajah/*From Diagram* 6(a), $xy = 4$, $y^2 = 1$
Dalam Rajah/*In Diagram* 6(b),
$X = \dfrac{x}{y}$ $Y = \dfrac{1}{y^2}$
$= \dfrac{xy}{y^2}$ $= 1$
$= 4$
Biar/*Let* $A(4, 1)$, $B(2, 5)$,
$\dfrac{Y - 5}{X - 2} = \dfrac{1 - 5}{4 - 2}$
$Y - 5 = -2(X - 2)$
$= -2X + 4$
$\dfrac{1}{y^2} = -2\left(\dfrac{x}{y}\right) + 9$
$2\left(\dfrac{x}{y}\right) = 9 - \dfrac{1}{y^2}$
$x = \left(\dfrac{9y^2 - 1}{y^2}\right)\dfrac{y}{2}$

$$x = \frac{9y^2 - 1}{2y}$$

**7** (a) $a = \frac{10 - 4}{2}$

$= 3$

$b$ = bilangan kitaran dalam 360°
*number of cycles in* 360°

$\frac{b}{2}$ = bilangan kitaran dalam 180°
*number of cycles in* 180°

$= 4$

$b = 8$

atau/*or*

Kala/*Period* $= \frac{180°}{4} = \frac{360°}{b}$

$b = 8$

$c$ = translasi dari graf asas
*translation from the basic graph*

$= 7$

(b) (i) Kala/*Period* $= \frac{360°}{3}$

$= 120°$

(ii) Amplitud/*Amplitude* = 5

**8** (a) Biar sebutan pertama dan beza sepunya bagi janjang aritmetik masing-masing ialah $a$ dan $d$.
*Let the first term and common difference for the arithmetic progression are a and d respectively.*
Bagi janjang geometri/*For the geometry progression,*

$T_1 = a$

$T_2 = a + 3d$

$ar = a + 3d \ldots ①$

$T_3 = a + 12d$

$ar^2 = a + 12d \ldots ②$

Daripada/*From* ①: $r = \frac{a + 3d}{a} \ldots ③$

Gantikan ③ ke dalam ②/*Substitute* ③ *into* ②,

$$a\left(\frac{a + 3d}{a}\right)^2 = a + 12d$$

$$a\left(\frac{a^2 + 6ad + 9d^2}{a^2}\right) = a + 12d$$

$$a^2 + 6ad + 9d^2 = a^2 + 12ad$$

$$9d^2 = 6ad$$

$$9d = 6a$$

$$3d = 2a$$

Gantikan ke dalam ③/*Substitute into* ③,

$$r = \frac{a + 2a}{a}$$

$$= 3$$

(b) $a = 6, d = \frac{2}{3}a$

$= 4$

$S_{12} = \frac{12}{2}[2(6) + 11(4)]$

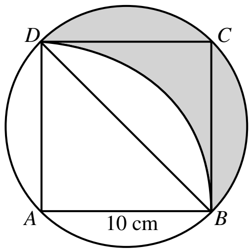
$= 336$

**9** Jejari bulatan/*Radius of circle* $= \frac{1}{2}\sqrt{10^2 + 10^2}$

$= 5\sqrt{2}$

Luas semi bulatan/*Area of semicircle* $= \frac{\pi}{2}(5\sqrt{2})^2$

$= 25\pi$




Luas tembereng $BD$/*Area of segment BD*

$= \frac{1}{2}(10)^2\left(\frac{\pi}{2}\right) - \frac{1}{2}(10)^2$

$= 25\pi - 50$

Luas rantau berlorek/*The area of shaded region*

$= 25\pi - (25\pi - 50)$

$= 50 \text{ cm}^2$

**10** Biar/*Let* $\sqrt{11 - 6\sqrt{2}} = \sqrt{a} - \sqrt{b}$

$$11 - 6\sqrt{2} = (\sqrt{a} - \sqrt{b})^2$$

$$11 - 6\sqrt{2} = a + b - 2\sqrt{ab}$$

$a + b = 11$

$b = 11 - a \ldots ①$

$-2\sqrt{ab} = -6\sqrt{2}$

$\sqrt{ab} = 3\sqrt{2}$

$ab = 18 \ldots ②$

Gantikan ① ke dalam ②/*Substitute* ① *into* ②,

$$a(11 - a) = 18$$

$$11a - a^2 = 18$$

$$a^2 - 11a + 18 = 0$$

$$(a - 9)(a - 2) = 0$$

$$a = 2 \text{ atau/}or\ 9$$

Daripada/*From* ①, $b = (11 - 2)$ atau/*or* $(11 - 9)$

$= 9$ atau/*or* $2$

$\therefore \quad a > b$

$\sqrt{11 - 6\sqrt{2}} = \sqrt{a} - \sqrt{b}$

$= \sqrt{9} - \sqrt{2}$

$= 3 - \sqrt{2}$

**11** (a) $P(Z > k) = 0.5 - 0.3542$

$= 0.1458$

$k = 1.055$

(b) $\frac{X - 65}{\sqrt{12.25}} = 1.055$

$X - 65 = 3.6925$

$X = 68.6925$

**12** (a) $\underset{x \to 3}{\text{had}} \frac{\sqrt{x + 6} - 3}{4 - \sqrt{x + 13}} / \lim_{x \to 3} \frac{\sqrt{x + 6} - 3}{4 - \sqrt{x + 13}}$

$$= \underset{x \to 3}{\text{had}} \frac{(\sqrt{x + 6} - 3)(4 + \sqrt{x + 13})}{16 - (x + 13)}$$

$$\lim_{x \to 3} \frac{(\sqrt{x + 6} - 3)(4 + \sqrt{x + 13})}{16 - (x + 13)}$$

$$= \underset{x \to 3}{\text{had}} \frac{(x + 6 - 9)(4 + \sqrt{x + 13})}{(16 - x - 13)(\sqrt{x + 6} + 3)}$$

$$\lim_{x \to 3} \frac{(x + 6 - 9)(4 + \sqrt{x + 13})}{(16 - x - 13)(\sqrt{x + 6} + 3)}$$

$= \text{had}_{x \to 3} \dfrac{(x-3)(4+\sqrt{x+13})}{(3-x)(\sqrt{x+6}+3)} / \lim_{x \to 3} \dfrac{(x-3)(4+\sqrt{x+13})}{(3-x)(\sqrt{x+6}+3)}$

$= \text{had}_{x \to 3} \dfrac{(x-3)(4+\sqrt{x+13})}{-(x-3)(\sqrt{x+6}+3)} / \lim_{x \to 3} \dfrac{(x-3)(4+\sqrt{x+13})}{-(x-3)(\sqrt{x+6}+3)}$

$= \dfrac{(4+\sqrt{3+13})}{-(\sqrt{3+6}+3)}$

$= \dfrac{4+4}{-(3+3)}$

$= -\dfrac{4}{3}$

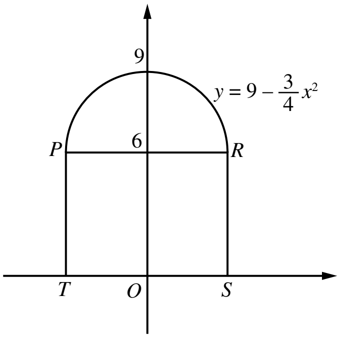
(b) (i) $\dfrac{3}{1-2} = a + 3$

$a = -3 - 3$

$= -6$

(ii) Graf $f(x)$ bersambungan pada $x = 1$.
*The graph $f(x)$ is continuous at $x = 1$.*

**13**




(a) $6 = 9 - \dfrac{3}{4}x^2$

$\dfrac{3}{4}x^2 = 3$

$x^2 = 4$

$x = \pm 2$

$\therefore$ Diameter = 4 m

(b) $V = \pi(2)^2(6) + \pi\int_6^9 x^2 \, dy$

$= 24\pi + \pi\int_6^9 12 - \dfrac{4}{3}y \, dy$

$= 24\pi + \pi\left[12y - \dfrac{2}{3}y^2\right]_6^9$

$= 24\pi + \pi\left\{\left[12(9) - \dfrac{2}{3}(9)^2\right] - \left[12(6) - \dfrac{2}{3}(6)^2\right]\right\}$

$= 24\pi + 6\pi$

$= 30\pi \text{ m}^3$

(c) $V = 30\pi - \pi(2)^2(1)$

$= 26\pi \text{ m}^3$

**14** (a) $\overrightarrow{OA} = \underset{\sim}{a}$, $\overrightarrow{OB} = \underset{\sim}{b}$

$\overrightarrow{OR} = \dfrac{1}{2}\overrightarrow{OQ}$

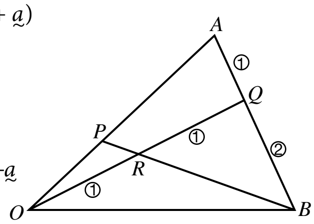
$= \dfrac{1}{2}(\overrightarrow{OB} + \overrightarrow{BQ})$

$= \dfrac{1}{2}(\underset{\sim}{b} + \dfrac{2}{3}\overrightarrow{BA})$

$= \dfrac{1}{2}\underset{\sim}{b} + \dfrac{1}{3}(\overrightarrow{BO} + \overrightarrow{OA})$

$= \dfrac{1}{2}\underset{\sim}{b} + \dfrac{1}{3}(-\underset{\sim}{b} + \underset{\sim}{a})$

$= \dfrac{1}{6}\underset{\sim}{b} + \dfrac{1}{3}\underset{\sim}{a}$




$\overrightarrow{BR} = \overrightarrow{BO} + \overrightarrow{OR}$

$= -\underset{\sim}{b} + \dfrac{1}{6}\underset{\sim}{b} + \dfrac{1}{3}\underset{\sim}{a}$

$= \dfrac{1}{3}\underset{\sim}{a} - \dfrac{5}{6}\underset{\sim}{b}$

(b) (i) $\overrightarrow{BP} = \overrightarrow{BO} + \overrightarrow{OP}$

$= -\underset{\sim}{b} + \lambda\underset{\sim}{a}$

$= \lambda\underset{\sim}{a} - \underset{\sim}{b}$

(ii) $\overrightarrow{BP} = \mu\overrightarrow{BR}$

$= \mu\left(\dfrac{1}{3}\underset{\sim}{a} - \dfrac{5}{6}\underset{\sim}{b}\right)$

$= \dfrac{1}{3}\mu\underset{\sim}{a} - \dfrac{5}{6}\mu\underset{\sim}{b}$

Banding pekali ungkapan di (i) dan (ii),
*Compare coefficients of expressions in* (i) *and* (ii),

$\lambda\underset{\sim}{a} - \underset{\sim}{b} = \dfrac{1}{3}\mu\underset{\sim}{a} - \dfrac{5}{6}\mu\underset{\sim}{b}$

$\underset{\sim}{a}$: $\lambda = \dfrac{1}{3}\mu$

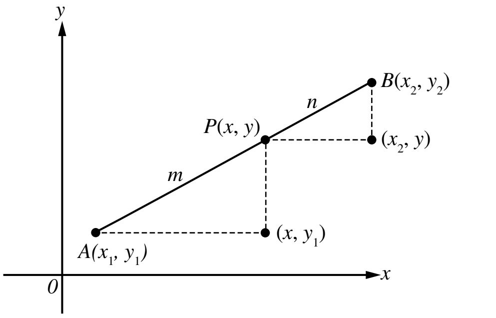
$\underset{\sim}{b}$: $-1 = -\dfrac{5}{6}\mu$

$\mu = \dfrac{6}{5}$

$\lambda = \dfrac{1}{3}\left(\dfrac{6}{5}\right)$

$= \dfrac{2}{5}$

**15** (a)




Aplikasikan konsep keserupaan segi tiga (kadaran)
*Apply the concept of similarity of triangle (proportion)*

$\dfrac{x - x_1}{x_2 - x} = \dfrac{m}{n}$

$n(x - x_1) = m(x_2 - x)$

$nx - nx_1 = mx_2 - mx$

$nx + mx = mx_2 + nx_1$

$x(n + m) = nx_1 + mx_2$

$x = \dfrac{nx_1 + mx_2}{m + n}$

$\dfrac{y - y_1}{y_2 - y} = \dfrac{m}{n}$

$n(y - y_1) = m(y_2 - y)$

$ny - ny_1 = my_2 - my$

$ny + my = my_2 + ny_1$

$y(n + m) = ny_1 + my_2$

$y = \dfrac{ny_1 + my_2}{m + n}$

Maka/*Therefore*,

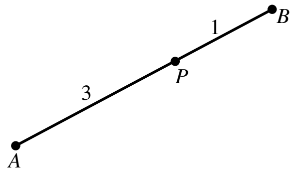
$P(x, y) = \left(\dfrac{nx_1 + mx_2}{m + n}, \dfrac{ny_1 + my_2}{m + n}\right)$

(b) Rumus titik pembahagi tembereng garis:
*Formula for the divisor of line segment:)*

$$(7, 10) = \left(\frac{n(1) + m(9)}{m + n}, \frac{n(1) + m(13)}{m + n}\right)$$

Koordinat-$x$/*x-coordinate*: $7(m + n) = n + 9m$

$$7m + 7n = n + 9m$$
$$7n - n = 9m - 7m$$
$$6n = 2m$$
$$\frac{6}{2} = \frac{m}{n}$$
$$\frac{m}{n} = \frac{3}{1}$$

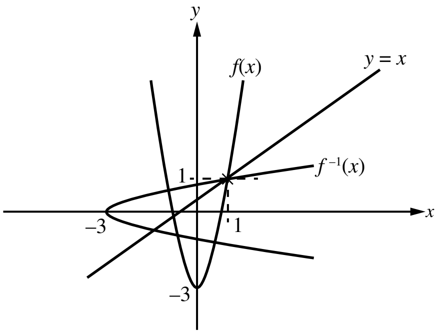



$\therefore AP : AB = 3 : 4$

**Kertas 2**

**1** $x + y + z = 26 \ldots$ ①
$x - 4y + 5z = 30 \ldots$ ②
$5x + 2y + 2z = 46 \ldots$ ③
① – ②: $5y - 4z = -4 \ldots$ ④
① × 5: $5x + 5y + 5z = 130 \ldots$ ⑤
⑤ – ③: $3y + 3z = 84 \ldots$ ⑥
④ × 3: $15y - 12z = -12 \ldots$ ⑦
⑥× 4: $12y + 12z = 336 \ldots$ ⑧
⑦ + ⑧ $27y = 324$
$y = 12$
Daripada/*From* ④: $z = 16$
Daripada/*From* ②: $x = -2$

**2** (a)




(b) Ujian garis mengufuk menunjukkan bahawa fungsi $f$ mempunyai 2 objek bagi setiap imej, maka $f$ ialah hubungan banyak kepada satu. Songsangan hubungan $f$ ialah hubungan satu kepada banyak. Maka, fungsi $f^{-1}$ tidak wujud.
*The horizontal line test shows that the function f has 2 objects for every image, so f is a many-to-one relation. The inverse of f is a one-to-many relation. Thus, function $f^{-1}$ does not exist.*

(c) $gf(x) = 12x^2 - 4$
$g(4x^2 - 3) = 12x^2 - 4$
Biar/*Let* $y = 4x^2 - 3$

$$x^2 = \frac{y + 3}{4}$$
$$g(y) = 12\left(\frac{y + 3}{4}\right) - 4$$
$$= 3y + 9 - 4$$
$$= 3y + 5$$
$$\therefore \quad g(x) = 3x + 5$$

**3** (a) $b^2 - 4ac = (5h)^2 - 4(1)(4h^2)$
$= 25h^2 - 16h^2$
$= 9h^2$
$= (3h)^2$
$b^2 - 4ac \geqslant 0$, tertunjuk fungsi $f$ mempunyai punca nyata bagi semua nilai $h$.
*$b^2 - 4ac \geqslant 0$, proven that the function f has real roots for all the values of h.*

(b) $f(x) = (x^2 + 5hx) + 4h^2$

$$= \left[\left(x + \frac{5h}{2}\right)^2 - \frac{25h^2}{4}\right] + 4h^2$$
$$= \left(x + \frac{5h}{2}\right)^2 - \frac{25h^2}{4} + \frac{16h^2}{4}$$
$$= \left(x + \frac{5h}{2}\right)^2 - \frac{9h^2}{4}$$

$a$ positif/*positive*, $\therefore$ titik minimum/*minimum point*

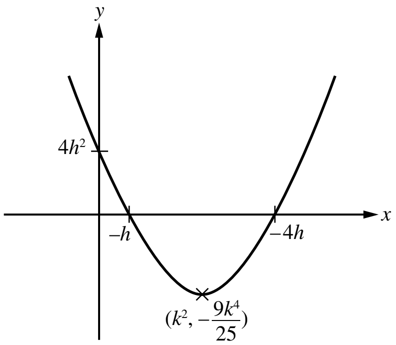
$$= \left(-\frac{5h}{2}, -\frac{9h^2}{4}\right)$$
$$-\frac{5h}{2} = k^2$$
$$h = -\frac{2}{5}k^2$$
$$\therefore f(x) \text{ minimum} = -\frac{9h^2}{4}$$
$$= -\frac{9}{4}\left(-\frac{2k^2}{5}\right)^2$$
$$= -\frac{9}{4}\left(\frac{4k^4}{25}\right) = -\frac{9k^4}{25}$$

(c) Titik minimum/*Minimum point*

$$= \left(-\frac{5h}{2}, -\frac{9h^2}{4}\right)$$
$$= \left(k^2, -\frac{9k^4}{25}\right)$$

Pintasan-$y$/*y-intercept* $= 4h^2$
Punca/*Roots*, $f(x) = 0$

$$\left(x + \frac{5h}{2}\right)^2 - \frac{9h^2}{4} = 0$$
$$\left(x + \frac{5h}{2}\right)^2 = \frac{9h^2}{4}$$
$$x = \pm\sqrt{\frac{9h^2}{4}} - \frac{5h}{2}$$
$$= \pm\frac{3h}{2} - \frac{5h}{2}$$
$$= -h \text{ atau/}or\ -4h$$




**4** (a) $(1 - \sin x + \text{kos } x)^2$
$= (1 - \sin x + \text{kos } x)(1 - \sin x + \text{kos } x)$
$= 1 - \sin x + \text{kos } x - \sin x + \sin^2 x - \sin x \text{ kos } x$
$\quad + \text{kos } x - \sin x \text{ kos } x + \text{kos}^2 x$
$= 1 - 2 \sin x + 2 \text{ kos } x + \sin^2 x + \text{kos}^2 x$
$\quad - 2 \sin x \text{ kos } x$
$= 2 - 2 \sin x + 2 \text{ kos } x - 2 \sin x \text{ kos } x$
$= 2(1 - \sin x) + 2 \text{ kos } x (1 - \sin x)$
$= (2 + 2 \text{ kos } x)(1 - \sin x)$
$= 2(1 - \sin x)(1 + \text{kos } x)$ [Tertunjuk]

*$(1 - \sin x + \cos x)^2$*
*$= (1 - \sin x + \cos x)(1 - \sin x + \cos x)$*
*$= 1 - \sin x + \cos x - \sin x + \sin^2 x - \sin x \cos x$*
*$\quad + \cos x - \sin x \cos x + \cos^2 x$*
*$= 1 - 2 \sin x + 2 \cos x + \sin^2 x + \cos^2 x - 2 \sin x \cos x$*
*$= 2 - 2 \sin x + 2 \cos x - 2 \sin x \cos x$*
*$= 2(1 - \sin x) + 2 \cos x (1 - \sin x)$*
*$= (2 + 2 \cos x)(1 - \sin x)$*
*$= 2(1 - \sin x)(1 + \cos x)$ [Shown]*

(b) (i) $p + 2q^2 = \text{kos } 48° + 2(\sin 24°)^2$
$= \text{kos } 2(24°) + 2 \sin^2 24°$
$= 2 \text{ kos}^2 24° - 1 + 2(1 - \text{kos}^2 24°)$
$= 2 \text{ kos}^2 24° - 1 + 2 - 2 \text{ kos}^2 24°$
$= 1$ [Terbukti]

$p + 2q^2 = \cos 48° + 2(\sin 24°)^2$
$= \cos 2(24°) + 2 \sin^2 24°$
$= 2 \cos^2 24° - 1 + 2(1 - \cos^2 24°)$
$= 2 \cos^2 24° - 1 + 2 - 2 \cos^2 24°$
$= 1$ [*Proven*]

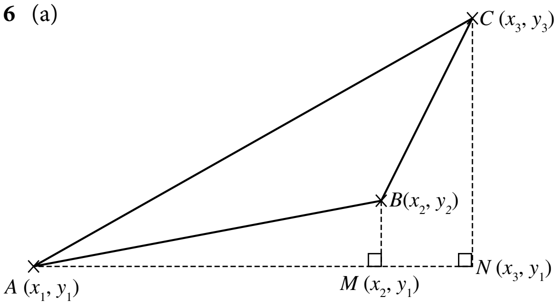
(ii) $\sin 72° = \sin(48° + 24°)$
$= \sin 48° \text{ kos } 24° + \text{kos } 48° \sin 24°$
$= \sin 2(24)° \text{ kos } 24° + pq$
$= (2 \sin 24° \text{ kos } 24°) \text{ kos } 24° + pq$
$= 2q(1 - \sin^2 24) + pq$
$= 2q - 2q^3 + pq$

$\sin 72° = \sin(48° + 24°)$
$= \sin 48° \cos 24° + \cos 48° \sin 24°$
$= \sin 2(24)° \cos 24° + pq$
$= (2 \sin 24° \cos 24°) \cos 24° + pq$
$= 2q(1 - \sin^2 24°) + pq$
$= 2q - 2q^3 + pq$

**5** (a) $5\ 000\left(\frac{51}{50}\right)^{2n} \geqslant 2 \times 5\ 000$
$\left(\frac{51}{50}\right)^{2n} \geqslant 2$
$2n \log\left(\frac{51}{50}\right) \geqslant \log 2$
$2n \geqslant \frac{\log 2}{\log \frac{51}{50}}$
$n \geqslant 17.5$
$n$ minimum = 18

(b) $8^{\log_2 x} = 64$
$2^{3 \log_2 x} = 2^6$
$3 \log_2 x = 6$
$\log_2 x = 2$
$x = 4$

**6** (a)




Luas $\Delta ABC$/*Area of* $\Delta ABC$
= Luas $\Delta ANC$ – Luas $\Delta AMB$ – Luas trapezium $BMNC$
*Area of $\Delta ANC$ – Area of $\Delta AMB$ – Area of trapezium $BMNC$*
$= \frac{1}{2}(x_3 - x_1)(y_3 - y_1) - \frac{1}{2}(x_2 - x_1)(y_2 - y_1) - \frac{1}{2}[(y_2 - y_1) + (y_3 - y_1)](x_3 - x_2)$
$= \frac{1}{2}[(x_3y_3 - x_3y_1 - x_1y_3 + x_1y_1) - (x_2y_2 - x_2y_1 - x_1y_2 + x_1y_1) - (y_2 + y_3 - 2y_1)(x_3 - x_2)]$
$= \frac{1}{2}[x_3y_3 - x_3y_1 - x_1y_3 + x_1y_1 - x_2y_2 + x_2y_1 + x_1y_2 - x_1y_1 - (x_3y_2 + x_3y_3 - 2x_3y_1 - x_2y_2 - x_2y_3 + 2x_2y_1)]$
$= \frac{1}{2}[x_3y_3 - x_3y_1 - x_1y_3 + x_1y_1 - x_2y_2 + x_2y_1 + x_1y_2 - x_1y_1 - x_3y_2 - x_3y_3 + 2x_3y_1 + x_2y_2 + x_2y_3 - 2x_2y_1]$
$= \frac{1}{2}[x_3y_1 - x_1y_3 - x_2y_1 + x_1y_2 - x_3y_2 + 2x3y_1 + x_2y_3 - 2x_2y_1]$
$= \frac{1}{2}(x_1y_2 + x_2y_3 + x_3y_1 - x_1y_3 - x_2y_1 - x_3y_2]$
atau ditulis sebagai/*or is written as*
$= \frac{1}{2}\begin{vmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{vmatrix}$

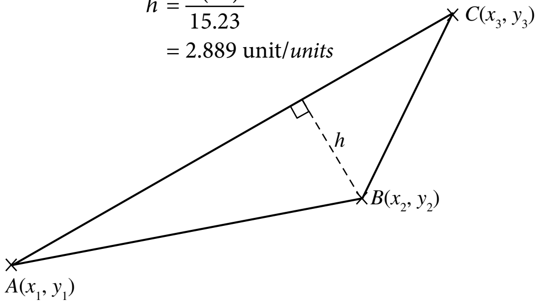
(b) (i) $A\Delta ABC = \begin{vmatrix} -4 & 8 & 10 & -4 \\ 0 & 2 & 6 & 0 \end{vmatrix}$
$= \frac{1}{2}|(-8 + 48 + 0) - (-24 + 20 + 0)|$
$= \frac{1}{2}|40 + 4|$
$= 22$ unit²/*units*²

(ii) $AC = \sqrt{(6-0)^2 + [10-(-4)]^2}$
$= 15.23$

$A_{\Delta ABC} = \frac{1}{2}(AC)(h)$

$22 = \frac{1}{2}(15.23)(h)$

$h = \frac{2(22)}{15.23}$
$= 2.889$ unit/*units*




**7** $\overrightarrow{OA} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$; $\overrightarrow{OB} = \begin{pmatrix} 3 \\ 15 \end{pmatrix}$

(a) $\overrightarrow{AB} = h\underset{\sim}{u} + k\underset{\sim}{v}$

$\overrightarrow{AO} + \overrightarrow{OB} = h\begin{pmatrix} 2 \\ 1 \end{pmatrix} + k\begin{pmatrix} -9 \\ 5 \end{pmatrix}$

$\begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} 3 \\ 15 \end{pmatrix} = \begin{pmatrix} 2h - 9k \\ h + 5k \end{pmatrix}$

$\begin{pmatrix} 2h - 9k \\ h + 5k \end{pmatrix} = \begin{pmatrix} 5 \\ 12 \end{pmatrix}$

$2h - 9k = 5$ … ①
$h + 5k = 12$ … ②
② × 2: $2h + 10k = 24$ … ③
③ – ①: $19k = 19$
$k = 1$

Daripada/*From* ②: $h + 5(1) = 12$
$h = 7$

(b) $\overrightarrow{AB} = \begin{pmatrix} 5 \\ 12 \end{pmatrix}$

Magnitud/*Magnitude* $\overrightarrow{AB}$, $|\overrightarrow{AB}| = \sqrt{5^2 + 12^2}$
$= 13$ unit/*units*

Vektor unit pada arah $\overrightarrow{AB}$
*The unit vector in the direction of* $\overrightarrow{AB}$

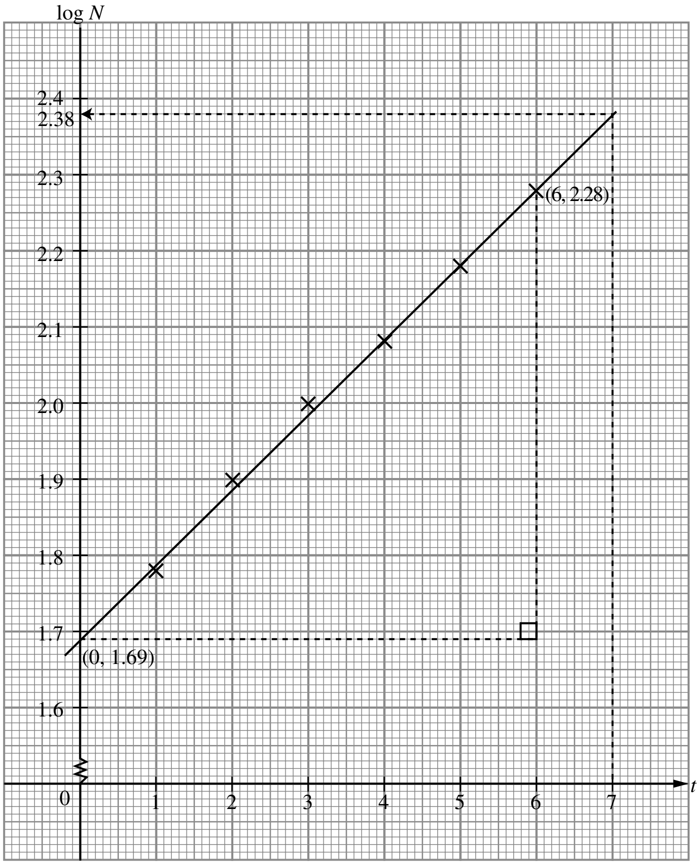
$= \frac{\overrightarrow{AB}}{|\overrightarrow{AB}|}$

$= \frac{5\underset{\sim}{i} + 12\underset{\sim}{j}}{12} = \frac{5}{13}\underset{\sim}{i} + \frac{12}{13}\underset{\sim}{j}$

**8** $N = Ar^t$
$\log N = \log A + t \log r$

| $t$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **log $N$** | 1.78 | 1.90 | 2.00 | 2.08 | 2.18 | 2.28 |

(a)



(b) (i) $c = 1.69$

$\log A = 1.69$

$A = 48.98$

(ii) $m = \dfrac{2.28 - 1.69}{6 - 0}$

$= 0.0983$

$\log r = 0.0983$

$r = 1.253$

(c) $t = 7$

$\log N = 2.38$

$N = 239.9$

$\approx 240$

**9** (a) $y_1 = 1^2 - 9$

$= -8$

$y_2 = 3^2 - 9$

$= 0$

(b) $A_R = \int_0^1 x^2 - 9\, dx + \frac{1}{2}(8)(2)$

$= \left[\frac{x^3}{3} - 9x\right]_0^1 + 8$

$= \left|\left[\frac{1^3}{3} - 9(1)\right] - 0\right| + 8$

$= 16\frac{2}{3}$ unit²/*units*²

$A_S = \int_1^3 x^2 - 9\, dx - \frac{1}{2}(8)(2)$

$= \left[\frac{x^3}{3} - 9x\right]_1^3 - 8$

$= \left|\left[\frac{3^3}{3} - 9(3)\right] - \left[\frac{1^3}{3} - 9(1)\right]\right| - 8$

$= 1\frac{1}{3}$ unit²/*units*²

$\dfrac{A_R}{A_S} = \dfrac{16\frac{2}{3}}{1\frac{1}{3}}$

$= 12.5$

$A_R = 12.5A_S$ (Tertunjuk/*Shown*)

(c) $V = \pi\int_1^3 (x^2 - 9)^2\, dx - \frac{1}{3}\pi(8)^2(2)$

$= \pi\int_1^3 (x^4 - 18x^2 + 81)\, dx - 42\frac{2}{3}\pi$

$= \pi\left[\frac{x^5}{5} - 6x^3 + 81x\right]_1^3 - 42\frac{2}{3}\pi$

$= \pi\left\{\left[\frac{3^5}{5} - 6(3)^3 + 81(3)\right] - \left[\frac{1^5}{5} - 6\,(1)^3 + 81(1)\right]\right\}$

$- 42\frac{2}{3}\pi$

$= 54\frac{2}{5}\pi - 42\frac{2}{3}\pi$

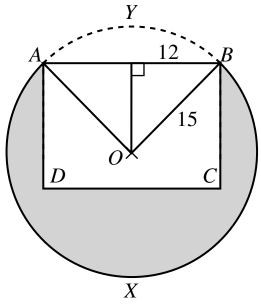
$= 11\frac{11}{15}\pi$ unit³/*units*³

**10** (a) $\angle AOB = 2\sin^{-1}\frac{12}{15}$

$= 106.26° \times \frac{\pi \text{ rad}}{180°}$

$= 1.8546$ rad

$\approx 1.855$ rad (Tertunjuk/*Shown*)




(b) Luas tembereng $ABY$/*The area of segment ABY*

$= \frac{1}{2}(15)^2(1.855) - \frac{1}{2}(15)^2(\sin 106.26°)$

$= 100.69 \text{ cm}^2$

(c) $A_{AXBCDA} = \pi(15)^2 - (24)(13) - 100.69$

$= 294.17 \text{ cm}^2$

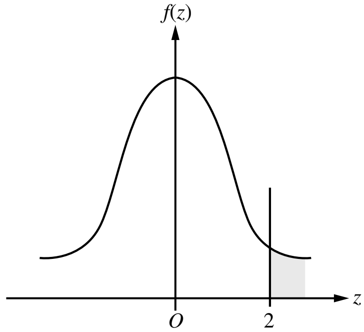
(d) Peratusan isi padu kayu yang tertinggal

*The percentage of wood remaining*

$= \dfrac{294.17\, h}{\pi(15)^2\, h} \times 100\%$

$= 41.62\%$

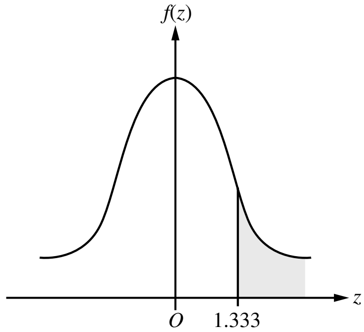
**11** (a) $X \sim N(90, 15^2)$




(i) $P(X > 120) = P\left(Z > \frac{120 - 90}{15}\right)$

$= P(Z > 2)$

$= 0.0228$




(ii) $P(X > 110) = P\left(Z > \frac{110 - 90}{15}\right)$

$= P\,(Z > 1.333)$

$\dfrac{n(X > 110)}{n(S)} = 0.0913$

$n(X > 110) = 82\ 170$

(b) (i) $n = 2$

$p = 0.5$

(ii) $P(X = 1) = {}^2C_1(0.5)^1(0.5)^1$

$= 0.5$

**12** (a) $s_K = \int 2t - 8\ dt$

$= t^2 - 8t + c$

$t = 0$, $s_K$ (dari/*from* $P$) = 60 (terima juga $s_K$ dari $Q$
*accept* $s_K$ *from* $Q$)

$\therefore s_K = t^2 - 8t + 60$ atau/*or* $s_{K(Q)} = t^2 - 8t$

Ketika mereka bertemu/*The moment they meet*

$s_S = s_K$ atau/*or* $s_S - 60 = s_{K(Q)}$

$t^2 + 4t = t^2 - 8t + 60$

$12t = 60$

$t = 5$

$s_S = 5^2 + 4(5)$

$= 45$ m

Mereka berada pada 45 m ke kanan dari titik $P$.
*They are at* 45 m *to the right from point P.*

(b) $v_K = 0$

$2t - 8 = 0$

$t = 4$

$s_K = (4)^2 - 8(4) + 60$ atau/*or* $s_{K(Q)} = (4)^2 - 8(4)$

$= 44$ m $= -16$ m

Khalid berada pada 44 m ke kanan dari titik $P$ (16 m ke kiri dari titik $Q$).
*Khalid is at* 44 m *to the right from point P* (*at* 16 m *to the left from point Q*).

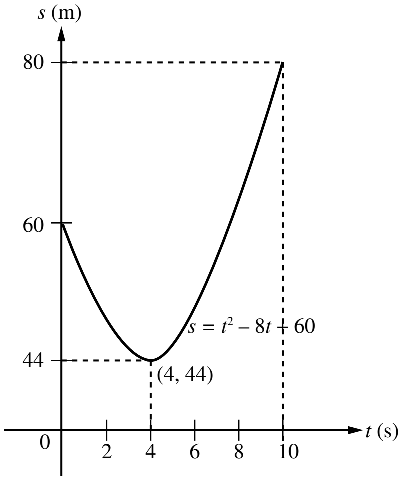
(c) $v_S = \dfrac{ds_s}{dt}$

$= 2t + 4$

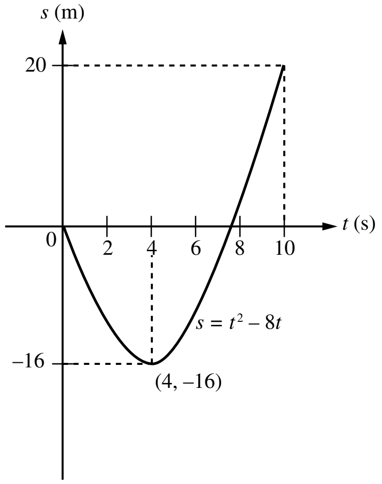
$t = 4$, $v_S = 2(4) + 4$

$= 12$ m s$^{-1}$

(d)




atau/*or*

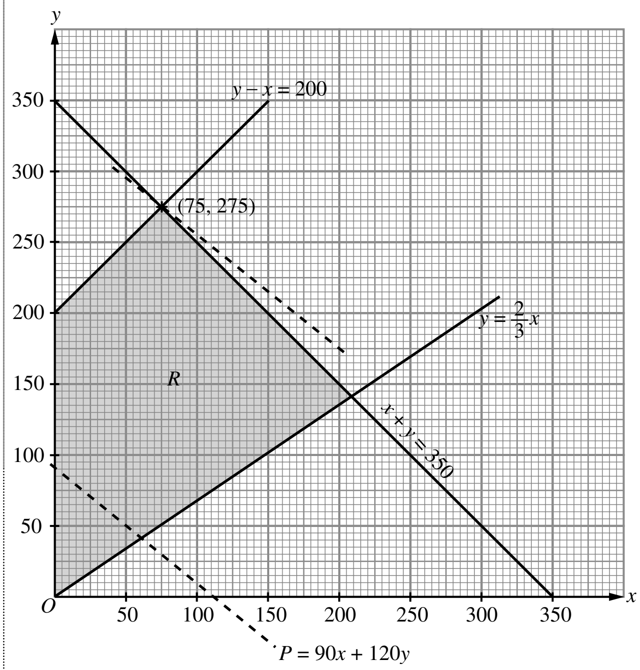



**13** (a) I $y - x \leqslant 200$

II $y \geqslant \dfrac{2}{3}x$

III $x + y \leqslant 350$

(b)




(c) (i) $P = 90x + 120y$

$y = \dfrac{P}{120} - \dfrac{90}{120}x$

$\left(\text{Lukis garis lurus dengan kecerunan } -\dfrac{90}{120}\right)$

$P$ maksimum pada titik (75, 275)
*P is maximum at the point* (75, 275)

$P = 90x + 120y$

$= 90(75) + 120(275)$

$= 39\ 750$

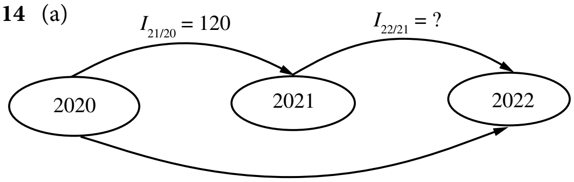
Keuntungan maksimum/*Maximum profit*
= RM39 750

(ii) $y = 225, 25 \leqslant x \leqslant 125$

$90(25) + 120(225) \leqslant P \leqslant 90(125) + 120(225)$

$\text{RM}29\,250 \leqslant P \leqslant \text{RM}38\,250$

**14** (a)




$$I_{22/20} = \frac{I_{21/20} \times I_{22/21}}{100}$$

$$140 = \frac{120 \times I_{22/21}}{100}$$

$$I_{22/21} = \frac{140 \times 100}{120} = 116.67$$

(b) $P_{20} = \text{RM}8$, $P_{22} = \text{RM}10$

(i) $x = \frac{\text{RM}10}{\text{RM}8} \times 100 = 125$

(ii) $140 = \frac{P_{21}}{\text{RM}8} \times 100$

$$P_{21} = \frac{140}{100} \times \text{RM}8 = \text{RM}11.20$$

(c) $\bar{I}_{21/20} = \frac{\Sigma Iw}{\Sigma w}$

$$110 = \frac{120(2) + 140(1) + y(3)}{2 + 1 + 3}$$

$$y = \frac{110(6) - 380}{3} = 93.33$$

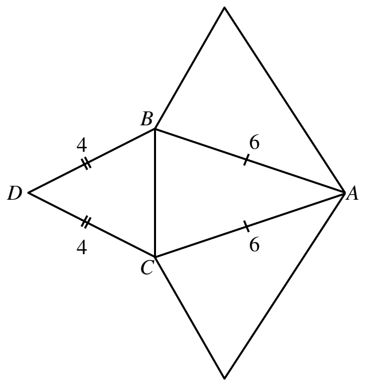
(d) $P_{21} = \text{RM}500, P_{20} = ?$

$$\bar{I}_{21/20} = \frac{P_{21}}{P_{20}} \times 100$$

$$110 = \frac{\text{RM}500}{P_{20}} \times 100$$

$$P_{20} = \frac{\text{RM}500}{110} \times 100 = \text{RM}454.55$$

**15**




(a) $A_{\Delta ABC} = 14.7$

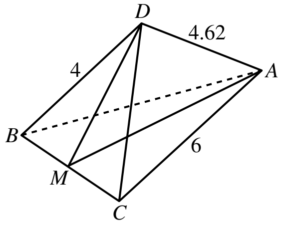
$$\frac{1}{2}(6)(6) \sin \angle BAC = 14.7$$

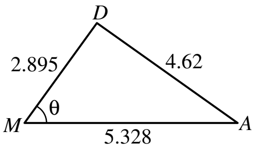
$$\sin \angle BAC = 0.8167$$

$$\angle BAC = 54.76°$$

$$BC = \sqrt{6^2 + 6^2 - 2(6)(6) \text{ kos}/\cos 54.76°} = 5.52 \text{ cm}$$

(b)




$$BM = \frac{1}{2}(5.52) = 2.76$$

$$AM = \sqrt{6^2 - 2.76^2} = \sqrt{28.3824} = 5.328$$

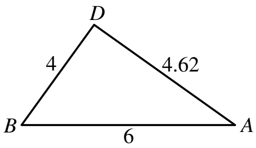
$$DM = \sqrt{4^2 - 2.76^2} = \sqrt{8.3824} = 2.895$$

$$4.62^2 = 8.3824 + 28.3824 - 2(2.895)(5.328) \text{ kos}/\cos\theta$$

$$\text{kos}/\cos\theta = 0.4999$$

$$\theta = 60°$$

(c)




$$s = \frac{1}{2}(4 + 6 + 4.62) = 7.31$$

$$A_{\Delta ABD} = \sqrt{7.31(7.31 - 4)(7.31 - 4.62)(7.31 - 6)} = 9.234 \text{ cm}^2$$