Penyelesaian Lengkap

SET 1

KERTAS 1

1 $5p - 2q + 10r = 24$ … ①
$p + 7q - 4r = 31$ … ②
$4p - 3q - r = -4$ … ③
①× 2, $10p - 4q + 20r = 48$ … ④
②× 5, $5p + 35q - 20r = 155$ … ⑤
④ + ⑤, $15p + 31q = 203$ … ⑥
③× 4, $16p - 12q - 4r = -16$ … ⑦
⑦ − ②, $15p - 19q = -47$ … ⑧
⑥ − ⑧, $50q = 250$
$q = 5$

Daripada/*From* ⑥,
$15p + 31(5) = 203$
$15p + 155 = 203$
$15p = 48$
$p = 3.2$

Daripada/*From* ③,
$4(3.2) - 3(5) - r = -4$
$12.8 - 15 - r = -4$
$-2.2 - r = -4$
$r = 1.8$
$\therefore p = 3.2, q = 5, r = 1.8$

2 (a) α ialah suatu punca bagi $2x^2 + 3x - 4 = 0$.
α is a root of $2x^2 + 3x - 4 = 0$.
$\therefore 2\alpha^2 + 3\alpha - 4 = 0$
Bahagikan dengan α,
Divide by α,
$2\alpha + 3 - \dfrac{4}{\alpha} = 0$
$2\alpha - \dfrac{4}{\alpha} = -3$
$2\left(\alpha - \dfrac{2}{\alpha}\right) = -3$
$\alpha - \dfrac{2}{\alpha} = -\dfrac{3}{2}$

(b) $2\alpha^2 = 4 - 3\alpha$
$\alpha^2 = \dfrac{4 - 3\alpha}{2}$
$\alpha^4 = \left(\dfrac{4 - 3\alpha}{2}\right)^2$
$= \dfrac{1}{4}(16 - 24\alpha + 9\alpha^2)$
$= \dfrac{1}{4}\left[16 - 24\alpha + 9\left(\dfrac{4 - 3\alpha}{2}\right)\right]$
$= \dfrac{1}{8}(32 - 48\alpha + 36 - 27\alpha)$
$= \dfrac{1}{8}(68 - 75\alpha)$

$\alpha^5 = (\alpha^4)\alpha$
$= \dfrac{1}{8}(68 - 75\alpha)\alpha$
$= \dfrac{1}{8}(68\alpha - 75\alpha^2)$
$= \dfrac{1}{8}\left[68\alpha - 75\left(\dfrac{4 - 3\alpha}{2}\right)\right]$
$= \dfrac{1}{16}(136\alpha - 300 + 225\alpha)$
$= \dfrac{1}{16}(361\alpha - 300)$

Kaedah alternatif
Alternative method
$\alpha^3 = \left(\dfrac{4 - 3\alpha}{2}\right)\alpha$
$= \dfrac{1}{2}(4\alpha - 3\alpha^2)$
$= \dfrac{1}{2}\left[4\alpha - 3\left(\dfrac{4 - 3\alpha}{2}\right)\right]$
$= \dfrac{1}{4}(8\alpha - 12 + 9\alpha)$
$= \dfrac{1}{4}(17\alpha - 12)$

$\alpha^5 = (\alpha^3)(\alpha^2)$
$= \dfrac{1}{4}(17\alpha - 12)\left(\dfrac{4 - 3\alpha}{2}\right)$
$= \dfrac{1}{8}(68\alpha - 51\alpha^2 - 48 + 36\alpha)$
$= \dfrac{1}{8}(104\alpha - 51\alpha^2 - 48)$
$= \dfrac{1}{8}\left[104\alpha - 51\left(\dfrac{4 - 3\alpha}{2}\right) - 48\right]$
$= \dfrac{1}{16}(208\alpha - 204 + 153\alpha - 96)$
$= \dfrac{1}{16}(361\alpha - 300)$

3 (a) (i) $f(x) = kx^{\frac{2}{p-3}} + mx + n$
Kuasa tertinggi bagi x dalam suatu fungsi kuadratik ialah 2.
The highest power of x in a quadratic function is 2.
$\dfrac{2}{p - 3} = 2$
$p - 3 = 1$
$p = 4$

(ii) $f(x) = kx^{\frac{2}{p-3}} + mx + n = 0$
$kx^2 + mx + n = 0$
Daripada graf, $-r$ dan r ialah punca bagi persamaan $f(x) = 0$.
From the graph, $-r$ and r are the roots of the equation $f(x) = 0$.

Hasil tambah punca:
Sum of roots:
$-\dfrac{m}{k} = (-r) + r$
$-\dfrac{m}{k} = 0$
$m = 0$

Hasil darab punca:
Product of roots:

$$\frac{n}{k} = -n$$
$$n \neq 0, \frac{1}{k} = -1$$
$$k = -1$$

Kaedah alternatif
Alternative method

$f(x) = kx^{\frac{2}{p-3}} + mx + n = 0$

$kx^2 + mx + n = 0 \ldots$ ①

Daripada graf, $-r$ dan r ialah punca bagi persamaan $f(x) = 0$.
From the graph, $-r$ and r are the roots of the equation $f(x) = 0$.

$$k(x + r)(x - r) = 0$$
$$kx^2 - kr^2 = 0 \ldots ②$$

Hasil darab punca:
Product of roots:

$$(-r)(r) = -n$$
$$r^2 = n$$

Bandingkan pekali x dalam ① dan ②,
Comparing the coefficients of x in ① and ②,
$m = 0$

Bandingkan pemalar dalam ① dan ②,
Comparing the constants in ① and ②,

$$-kr^2 = n$$
$$-kn = n$$
$$n \neq 0, -k = 1$$
$$k = -1$$

(b) (i) $f(x) = 2[(x + 1)^2 - 3m]$
$= 2(x + 1)^2 - 6m$

Menyamakan nilai minimum bagi $f(x)$,
Equating the minimum value of $f(x)$,

$$-6m = m + 14$$
$$7m = -14$$
$$m = -2$$

(ii) Apabila $m = -2$,
When $m = -2$,

$f(x) = 2[(x + 1)^2 + 6]$

Nilai minimum bagi $y = f(x)$ ialah 12. Oleh kerana 12 adalah lebih besar daripada 0, graf itu terletak di sebelah atas paksi-x.
$\therefore f(x) = 0$ mempunyai punca-punca khayalan.
The minimum value of $y = f(x)$ is 12. Since 12 is greater than 0, the graph lies above the x-axis.
$\therefore f(x) = 0$ has imaginary roots.

4 $3^{p+2} - 3^{p+1} - 2(3^{p-1})$
$= 3^{p-1}(3^3 - 3^2 - 2)$
$= 3^{p-1}(27 - 9 - 2)$
$= 16(3^{p-1})$

$$27[3^{p+2} - 3^{p+1} - 2(3^{p-1})] = 16(3^{p^2+2p})$$
$$27[16(3^{p-1})] = 16(3^{p^2+2p})$$
$$3^3(3^{p-1}) = 3^{p^2+2p}$$
$$3^{3+(p-1)} = 3^{p^2+2p}$$
$$3^{p+2} = 3^{p^2+2p}$$
$$p + 2 = p^2 + 2p$$
$$p^2 + p - 2 = 0$$
$$(p - 1)(p + 2) = 0$$

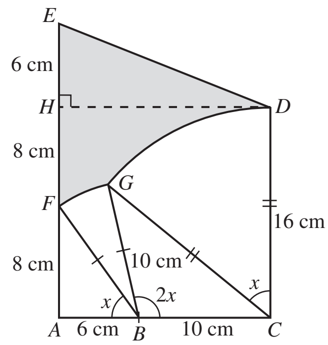
$p = 1$ atau/*or* $p = -2$

5 (a) $$\frac{12\sqrt{5}}{3 + \sqrt{5} + \sqrt{14}} = \frac{12\sqrt{5}[(3 + \sqrt{5}) - \sqrt{14}]}{[(3 + \sqrt{5}) + \sqrt{14}][(3 + \sqrt{5}) - \sqrt{14}]}$$
$$= \frac{12\sqrt{5}(3 + \sqrt{5} - \sqrt{14})}{(3 + \sqrt{5})^2 - (\sqrt{14})^2}$$
$$= \frac{12\sqrt{5}(3 + \sqrt{5} - \sqrt{14})}{9 + 6\sqrt{5} + 5 - 14}$$
$$= \frac{12\sqrt{5}(3 + \sqrt{5} - \sqrt{14})}{6\sqrt{5}}$$
$$= 2(3 + \sqrt{5} - \sqrt{14})$$

(b) (i) $\log_r \frac{1}{p^2} = \log_r p^{-2}$
$= -2\log_r p$
$= -2a$

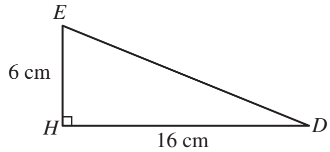
(ii) $$\log_{r^5} p\sqrt{r} = \frac{\log_r p\sqrt{r}}{\log_r r^5}$$
$$= \frac{\log_r p + \log_r \sqrt{r}}{5 \log_r r}$$
$$= \frac{\log_r p + \frac{1}{2}\log_r r}{5(1)}$$
$$= \frac{a + \frac{1}{2}(1)}{5}$$
$$= \frac{2a + 1}{10}$$

6 (a)



$$\tan x = \frac{8}{6}$$
$$x = 0.9273 \text{ radian}$$
$$\angle ABF = 0.9273 \text{ radian}$$

(b) $\angle FBG = \pi - x - 2x$
$= \pi - 3 \times 0.9273$
$= 0.3601$ radian



$DE = \sqrt{16^2 + 6^2}$
$= \sqrt{292}$ cm

Perimeter bagi rantau yang berlorek
Perimeter of the shaded region
$= 10(0.3601) + 16(0.9273) + 14 + \sqrt{292}$
$= 3.601 + 14.8368 + 14 + 17.088$
$= 49.526$ cm

7 (a) (i) $g(x) = \frac{3 - x}{x}, x \neq 0$

a ialah imej bagi 1 di bawah fungsi g.
a is the image of 1 under function g.

$a = g(1)$
$= \frac{3 - 1}{1}$
$= 2$

(ii) $f(x) = \frac{1}{2}x - 2$

$g[f(x)] = g\left(\frac{1}{2}x - 2\right)$

$= \dfrac{3 - \left(\frac{1}{2}x - 2\right)}{\frac{1}{2}x - 2}$

$= \dfrac{5 - \frac{1}{2}x}{\frac{1}{2}x - 2}$

$= \dfrac{10 - x}{x - 4}$

$y = \dfrac{10 - x}{x - 4}$

$y(x - 4) = 10 - x$

$xy - 4y = 10 - x$

$x(y + 1) = 4y + 10$

$x = \dfrac{4y + 10}{y + 1}$

$h(x) = (gf)^{-1}(x)$

$= \dfrac{4x + 10}{x + 1}, x \neq -1$

Kaedah alternatif
Alternative method

$h[gf(x)] = x$

$h\left(\dfrac{10 - x}{x - 4}\right) = x$

Katakan $\dfrac{10 - x}{x - 4} = u$

Let $\dfrac{10 - x}{x - 4} = u$

$10 - x = ux - 4u$

$x(u + 1) = 4u + 10$

$x = \dfrac{4u + 10}{u + 1}$

$h(u) = \dfrac{4u + 10}{u + 1}$

$h(x) = \dfrac{4x + 10}{x + 1}, x \neq -1$

(b) $f(x) = 3x + 5$

$g(x) = m(x - 5)$

$fg(x) = x$

$f[m(x - 5)] = x$

$3[m(x - 5)] + 5 = x$

$3mx - 15m + 5 = x$

Kaedah 1/*Method* 1
Menyamakan pekali bagi x,
Equating the coefficients of x,

$3m = 1$

$m = \dfrac{1}{3}$

Kaedah 2/*Method* 2
Menyamakan pemalar,
Equating the constants,

$-15m + 5 = 0$

$15m = 5$

$m = \dfrac{1}{3}$

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

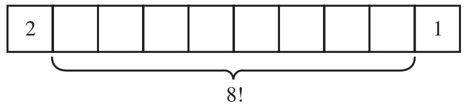
$= \dfrac{1}{3}(x - 5)$

8 (a) Bilangan cara yang berlainan untuk memilih
Number of different ways to choose
$= {}^{12}C_5$
$= 792$

(b) (i) Bilangan cara yang berlainan untuk menyusun dua lencana magnetik dengan reka bentuk tertentu diletak bersebelahan
Number of different ways to arrange two magnetic badges of the particular design that are placed side by side
$= 9! \times 2!$
$= 362\,880 \times 2$
$= 725\,760$

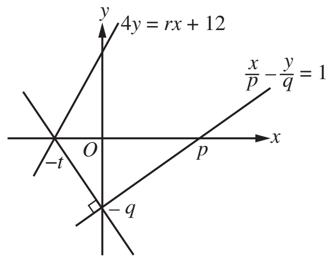
Bilangan cara yang berlainan untuk menyusun dua lencana magnetik dengan reka bentuk tertentu tidak diletak bersebelahan
Number of different ways to arrange two magnetic badges of the particular design that are not placed side by side
$= 10! - 725\,760$
$= 2\,903\,040$

(ii)



Bilangan cara yang berlainan untuk menyusun dua lencana magnetik dengan reka bentuk tertentu pada kedua-dua hujung rak itu
Number of different ways to arrange two magnetic badges of the particular design at both ends of the shelf
$= 2 \times 8! \times 1$
$= 80\,640$

9 (a)



(i) $4y = rx + 12$

Apabila $y = 0$
When $y = 0$,
$x = -t$

Gantikan $x = -t$, $y = 0$ ke dalam $4y = rx + 12$,
Substitute $x = -t$, $y = 0$ *into* $4y = rx + 12$,

$4(0) = r(-t) + 12$

$0 = -rt + 12$

$rt = 12$

(ii) $m_1 = -\dfrac{-q}{p} = \dfrac{q}{p}$

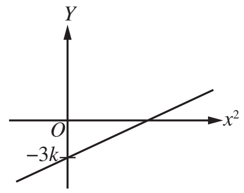
$m_2 = -\dfrac{-q}{-t} = -\dfrac{q}{t}$

Apabila dua garis lurus adalah berserenjang, $m_1m_2 = -1$.
When two straight lines are perpendicular, $m_1m_2 = -1$.

$\left(\dfrac{q}{p}\right)\left(-\dfrac{q}{t}\right) = -1$

$q^2 = pt$

(b)



$\dfrac{y}{x} = mx^2 - n$

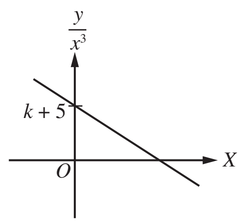
$Y = \dfrac{y}{x}, X = x^2$

$Y = mX - n$

Pintasan-Y bagi garis lurus itu ialah $-3k$.
The Y-intercept of the straight line is $-3k$.

$-n = -3k$

$n = 3k$ … ①



$\frac{y}{x} = mx^2 - n$

$\frac{y}{x^3} = m - \frac{n}{x^2}$

$Y = \frac{y}{x^3}, X = \frac{1}{x^2}$

$Y = m - nX$

Pintasan-Y bagi garis lurus itu ialah $k + 5$.
The Y-intercept of the straight line is $k + 5$.

$m = k + 5 \ldots$ ②

Daripada ①, $k = \frac{n}{3}$

From ①, $k = \frac{n}{3}$

$\therefore m = \frac{n}{3} + 5$

10 (a) $S_n = 8(1 - 2^{-2n})$

$T_n = S_n - S_{n-1}$
$= 8(1 - 2^{-2n}) - 8[1 - 2^{-2(n-1)}]$
$= 8 - 8(2^{-2n}) - 8 + 8[2^{-2(n-1)}]$
$= -8(2^{-2n}) + 8[2^{-2n}(2^2)]$
$= -8(2^{-2n}) + 32(2^{-2n})$
$= 24(2^{-2n})$

$\therefore p = 24$

(b) $r = \frac{T_n}{T_{n-1}}$
$= \frac{24(2^{-2n})}{24[2^{-2(n-1)}]}$
$= \frac{2^{-2n}}{2^{-2(n-1)}}$
$= 2^{-2n+2(n-1)}$
$= 2^{-2}$
$= \frac{1}{4}$

Oleh kerana $r = \frac{1}{4}$ ialah pemalar, maka janjang itu ialah suatu janjang geometri.

Since $r = \frac{1}{4}$ *is a constant, the progression is a geometric progression.*

(c) $a = T_1$
$= 24(2^{-2})$
$= 6$

$S_\infty = \frac{a}{1 - r}$
$= \frac{6}{1 - \frac{1}{4}}$
$= 8$

> **Kaedah alternatif**
> ***Alternative method***
> Apabila $n \to \infty, 2^{-2n} \to 0$
> *When* $n \to \infty, 2^{-2n} \to 0$
> $S_n \to 8$
> $\therefore S_\infty = 8$

11 (a) $\int_5^7 f(x)\,dx = \left[k(x+2)^{\frac{3}{2}}\right]_5^7$

$f(x) = \frac{d}{dx}\left[k(x+2)^{\frac{3}{2}}\right]$
$= \frac{3}{2}k(x+2)^{\frac{1}{2}}$
$= \frac{3}{2}k\sqrt{x+2}$

Apabila $x = 7, f(x) = 3$,
When $x = 7, f(x) = 3$,

$3 = \frac{3}{2}k\sqrt{7+2}$

$3 = \frac{3}{2}k\sqrt{9}$

$3 = \frac{3}{2}k(3)$

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

$\therefore f(x) = \sqrt{x+2}$

(b) Isi padu bagi bongkah
Volume of solid

$= \pi\int_5^7 (x+2)\,dx + \frac{1}{3}\pi(3)^2(8)$
$= \pi\left[\frac{x^2}{2} + 2x\right]_5^7 + 24\pi$
$= \pi\left[\left(\frac{49}{2} + 14\right) - \left(\frac{25}{2} + 10\right)\right] + 24\pi$
$= 16\pi + 24\pi$
$= 40\pi$ unit^3/*units*^{3}

12 (a) (i) $\overrightarrow{OP} = 5\underset{\sim}{i} + 4\underset{\sim}{j}$

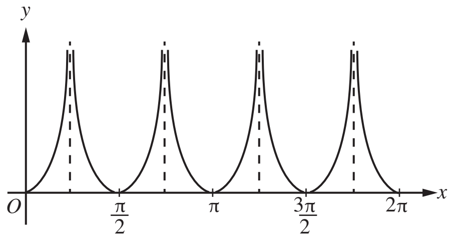
(ii) $\overrightarrow{OP} + \overrightarrow{PQ} = \overrightarrow{OQ}$
$\overrightarrow{PQ} = \overrightarrow{OQ} - \overrightarrow{OP}$
$= \begin{pmatrix} -3 \\ 0 \end{pmatrix} - \begin{pmatrix} 5 \\ 4 \end{pmatrix}$
$= \begin{pmatrix} -3-5 \\ 0-4 \end{pmatrix}$
$= \begin{pmatrix} -8 \\ -4 \end{pmatrix}$

(b) $\underset{\sim}{c} = 5\underset{\sim}{a} - 2\underset{\sim}{b}$
$p\underset{\sim}{x} + (2p - q)\underset{\sim}{y} = 5(3\underset{\sim}{x} + 4\underset{\sim}{y}) - 2(7\underset{\sim}{x} - 2\underset{\sim}{y})$
$= 15\underset{\sim}{x} + 20\underset{\sim}{y} - 14\underset{\sim}{x} + 4\underset{\sim}{y}$
$= \underset{\sim}{x} + 24\underset{\sim}{y}$

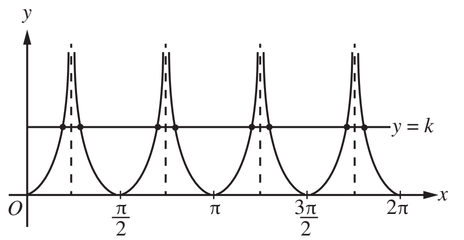
Bandingkan pekali bagi $\underset{\sim}{x}$,
Comparing the coefficients of $\underset{\sim}{x}$,
$p = 1$

Bandingkan pekali bagi $\underset{\sim}{y}$,
Comparing the coefficients of $\underset{\sim}{y}$,
$2p - q = 24$
$2 - q = 24$
$q = -22$

13 (a) (i)



(ii)

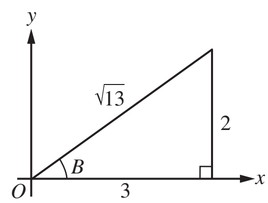


Garis $y = k$ memotong lengkung $y = |\tan 2x|$ pada lapan titik.
The line $y = k$ *cuts the curve* $y = |\tan 2x|$ *at eight points.*
$\therefore k > 0$

(b) $\tan A = \frac{1}{5}$

$\cos B = \frac{3}{\sqrt{13}}$

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



$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$
$$= \frac{\frac{1}{5} + \frac{2}{3}}{1 - \left(\frac{1}{5}\right)\left(\frac{2}{3}\right)}$$
$$= \frac{3+10}{15-2}$$
$$= \frac{13}{13}$$
$$= 1$$

$0 < A < \frac{\pi}{2}$ dan/*and* $0 < B < \frac{\pi}{2}$

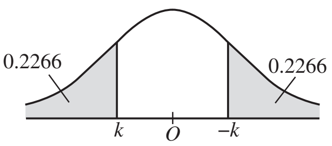
$\therefore 0 < A + B < \pi$

Oleh sebab $0 < A + B < \pi$ dan $\tan(A + B) = 1$, $A + B$ terletak pada sukuan pertama.

Since $0 < A + B < \pi$ *and* $\tan(A + B) = 1$, $A + B$ *lies in the first quadrant.*

$\therefore A + B = \frac{\pi}{4}$

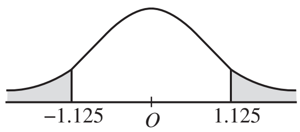
14 (a) (i)
$$P(k < Z < 0) = 0.2734$$
$$0.5 - P(Z < k) = 0.2734$$
$$P(Z < k) = 0.2266$$
$$P(Z > -k) = 0.2266$$



$-k = 0.75$

$k = -0.75$

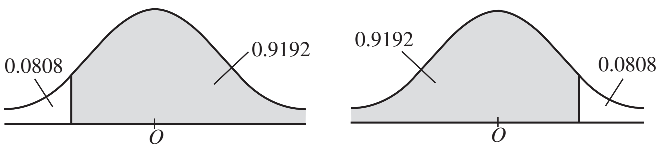
(ii) $P\left(|Z| > \frac{3-2k}{4}\right)$
$$= P\left(|Z| > \frac{3-2(-0.75)}{4}\right)$$
$$= P(|Z| > 1.125)$$
$$= P(Z > 1.125 \text{ atau/}or\ Z < -1.125)$$



$$= 2 \times P(Z > 1.125)$$
$$= 2 \times 0.1304$$
$$= 0.2608$$

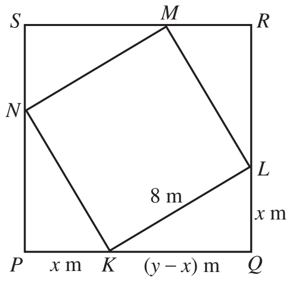
(b) (i) $X \sim N(\mu, 25)$
$$Z = \frac{X-\mu}{5}$$
$$-0.75 = \frac{68.25-\mu}{5}$$
$$68.25 - \mu = -3.75$$
$$\mu = 72$$

(ii)
$$P(X > m + 60) = 0.9192$$
$$P\left(Z > \frac{(m+60)-72}{5}\right) = 0.9192$$
$$P\left(Z > \frac{m-12}{5}\right) = 0.9192$$



$$P(Z > 1.4) = 0.0808$$
$$\frac{m-12}{5} = -1.4$$
$$m - 12 = -7$$
$$m = 5$$

15 (a)



$$(y-x)^2 + x^2 = 8^2$$
$$(y-x)^2 = 64 - x^2$$
$$y - x = \sqrt{64-x^2}$$
$$y = x + \sqrt{64-x^2}$$

(b) Katakan A = luas segi empat sama $PQRS$

Let A = area of square PQRS

$$A = y^2$$
$$= \left(x + \sqrt{64-x^2}\right)^2$$
$$\frac{dA}{dx} = 2\left(x + \sqrt{64-x^2}\right)\left[1 + \frac{1}{2}(64-x^2)^{-\frac{1}{2}}(-2x)\right]$$
$$= 2\left(x + \sqrt{64-x^2}\right)\left(1 - \frac{x}{\sqrt{64-x^2}}\right)$$
$$= 2\left(\sqrt{64-x^2} + x\right)\left(\frac{\sqrt{64-x^2} - x}{\sqrt{64-x^2}}\right)$$
$$= \frac{2(64 - x^2 - x^2)}{\sqrt{64-x^2}}$$
$$= \frac{2(64-2x^2)}{\sqrt{64-x^2}}$$
$$= \frac{4(32-x^2)}{\sqrt{64-x^2}}$$

> **Kaedah alternatif**
> ***Alternative method***
> $$A = \left(x + \sqrt{64-x^2}\right)^2$$
> $$= x^2 + (64 - x^2) + 2x\sqrt{64-x^2}$$
> $$= 64 + 2x\sqrt{64-x^2}$$
> $$\frac{dA}{dx} = 2x\left[\frac{1}{2}(64-x^2)^{-\frac{1}{2}}(-2x)\right] + \sqrt{64-x^2}\ (2)$$
> $$= \frac{-2x^2}{\sqrt{64-x^2}} + 2\sqrt{64-x^2}$$
> $$= \frac{-2x^2 + 2(64-x^2)}{\sqrt{64-x^2}}$$
> $$= \frac{-2x^2 + 128 - 2x^2}{\sqrt{64-x^2}}$$
> $$= \frac{128-4x^2}{\sqrt{64-x^2}}$$
> $$= \frac{4(32-x^2)}{\sqrt{64-x^2}}$$

Apabila $\frac{dA}{dx} = 0$,

When $\frac{dA}{dx} = 0$,
$$\frac{4(32-x^2)}{\sqrt{64-x^2}} = 0$$
$$32 - x^2 = 0$$
$$x^2 = 32$$

$x > 0 \therefore x = 4\sqrt{2}$

x	$< 4\sqrt{2}$	$4\sqrt{2}$	$> 4\sqrt{2}$
Tanda untuk $\frac{dA}{dx}$ *Sign for $\frac{dA}{dx}$*	+	0	–
Lakaran tangen ***Sketch of the tangent***	/	—	\

$\therefore$ A adalah maksimum apabila $x = 4\sqrt{2}$.
$\therefore$ *A is maximum when $x = 4\sqrt{2}$.*

Apabila $x = 4\sqrt{2}$,
When $x = 4\sqrt{2}$,

$$\begin{aligned} y &= 4\sqrt{2} + \sqrt{64 - 32} \\ &= 4\sqrt{2} + \sqrt{32} \\ &= 4\sqrt{2} + 4\sqrt{2} \\ &= 8\sqrt{2} \end{aligned}$$

$\therefore$ Panjang sisi tanah segi empat sama $PQRS$ ialah $8\sqrt{2}$ m.
$\therefore$ *The length of sides of the square land $PQRS$ is $8\sqrt{2}$ m.*

KERTAS 2

1 (a)

$$\begin{aligned} f(x) &= \frac{4}{3x} \\ \frac{f(x)}{g(x)} &= \frac{x+3}{2x^2+x} \\ \frac{\frac{4}{3x}}{g(x)} &= \frac{x+3}{2x^2+x} \\ (x+3)\,g(x) &= \frac{4}{3x}(2x^2+x) \\ (x+3)\,g(x) &= \frac{4}{3}(2x+1) \\ g(x) &= \frac{4(2x+1)}{3(x+3)} \end{aligned}$$

(b)

$$\begin{aligned} g(-1) &= \frac{4(-2+1)}{3(-1+3)} \\ &= \frac{4(-1)}{3(2)} \\ &= -\frac{2}{3} \end{aligned}$$

$$\begin{aligned} g^2(-1) &= g[g(-1)] \\ &= g\left(-\frac{2}{3}\right) \\ &= \frac{4\left(-\frac{4}{3}+1\right)}{3\left(-\frac{2}{3}+3\right)} \\ &= \frac{4\left(-\frac{1}{3}\right)}{3\left(\frac{7}{3}\right)} \\ &= -\frac{4}{21} \end{aligned}$$

(c)

$$\begin{aligned} g^{-1}f(x) &= x \\ f(x) &= g(x) \\ \frac{4}{3x} &= \frac{4(2x+1)}{3(x+3)} \\ x + 3 &= 2x^2 + x \\ 2x^2 &= 3 \\ x^2 &= \frac{3}{2} \\ x &= \pm\sqrt{\frac{3}{2}} \\ &= \pm\frac{\sqrt{3}}{\sqrt{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right) \\ &= \pm\frac{\sqrt{6}}{2} \end{aligned}$$

2 (a) A_n = Luas bagi segi empat sama ke-n
A_n = Area of the n^{th} square

$$\begin{aligned} A_1 &= p^2 \text{ cm}^2 \\ A_2 &= \left(\frac{1}{2}p\right)^2 \\ &= \frac{1}{4}p^2 \text{ cm}^2 \\ A_3 &= \left(\frac{1}{4}p\right)^2 \\ &= \frac{1}{16}p^2 \text{ cm}^2 \\ \frac{A_2}{A_1} &= \frac{\frac{1}{4}p^2}{p^2} = \frac{1}{4} \\ \frac{A_3}{A_2} &= \frac{\frac{1}{16}p^2}{\frac{1}{4}p^2} = \frac{1}{4} \end{aligned}$$

$\frac{A_2}{A_1}$ atau $\frac{A_3}{A_2}$ ialah suatu pemalar $\frac{1}{4}$.

$\therefore$ Luas bagi segi empat sama membentuk suatu janjang geometri.
Nisbah sepunya bagi janjang itu ialah $\frac{1}{4}$.

$\frac{A_2}{A_1}$ or $\frac{A_3}{A_2}$ is a constant $\frac{1}{4}$.

$\therefore$ *The area of the squares forms a geometric progression.*
Common ratio of the progression is $\frac{1}{4}$.

(b) (i) Apabila $p = 60$,
When $p = 60$,

$$\begin{aligned} A_1 &= 60^2 \\ &= 3\,600 \text{ cm}^2 \end{aligned}$$

Sebutan pertama, $a = 3\,600$
First term, $a = 3\,600$

$$\begin{aligned} T_n &= ar^{n-1} \\ 3\,600\left(\frac{1}{4}\right)^{n-1} &= 14\frac{1}{16} \\ 3\,600\left(\frac{1}{4}\right)^{n-1} &= \frac{225}{16} \\ \left(\frac{1}{4}\right)^{n-1} &= \frac{1}{226} \\ \left(\frac{1}{4}\right)^{n-1} &= \left(\frac{1}{4}\right)^4 \\ n - 1 &= 4 \\ n &= 5 \end{aligned}$$

$\therefore$ Segi empat sama yang kelima mempunyai luas $14\frac{1}{16}$ cm^2.
$\therefore$ *The fifth square has an area of $14\frac{1}{16}$ cm^2.*

(ii)

$$\begin{aligned} S_\infty &= \frac{a}{1-r} \\ &= \frac{3\,600}{1-\frac{1}{4}} \\ &= 4\,800 \end{aligned}$$

$\therefore$ Hasil tambah ketakterhinggaan bagi luas segi empat sama itu ialah 4 800 cm^2.
$\therefore$ *The sum to infinity for the area of the squares is 4 800 cm^2.*

3 (a) $\underset{\sim}{a} = 5\underset{\sim}{i} + \underset{\sim}{j}$
$\underset{\sim}{b} = 9\underset{\sim}{i} + 3\underset{\sim}{j}$

$\underset{\sim}{w} = \underset{\sim}{i} + 2\underset{\sim}{j}$

Halaju paduan bagi kayak *A*
Resultant velocity of kayak A

$= \underset{\sim}{a} + \underset{\sim}{w}$
$= (5\underset{\sim}{i} + \underset{\sim}{j}) + (\underset{\sim}{i} + 2\underset{\sim}{j})$
$= 6\underset{\sim}{i} + 3\underset{\sim}{j}$
$= 3(2\underset{\sim}{i} + \underset{\sim}{j})$ m s^{-1}

Halaju paduan bagi kayak *B*
Resultant velocity of kayak B

$= \underset{\sim}{b} + \underset{\sim}{w}$
$= (9\underset{\sim}{i} + 3\underset{\sim}{j}) + (\underset{\sim}{i} + 2\underset{\sim}{j})$
$= 10\underset{\sim}{i} + 5\underset{\sim}{j}$
$= 5(2\underset{\sim}{i} + \underset{\sim}{j})$

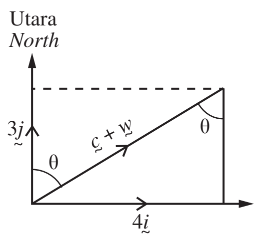
$\underset{\sim}{b} + \underset{\sim}{w} = \frac{5}{3}(\underset{\sim}{a} + \underset{\sim}{w})$

Halaju paduan bagi kayak *B* adalah $\frac{5}{3}$ kali halaju paduan bagi kayak *A*.
The resultant velocity of kayak B is $\frac{5}{3}$ *times the resultant velocity of kayak A.*

$\therefore n = \frac{5}{3}$

(b) (i) Halaju paduan bagi kayak *C*
Resultant velocity of kayak C

$= \underset{\sim}{c} + \underset{\sim}{w}$
$= (3\underset{\sim}{i} + \underset{\sim}{j}) + (\underset{\sim}{i} + 2\underset{\sim}{j})$
$= (4\underset{\sim}{i} + 3\underset{\sim}{j})$ m s^{-1}

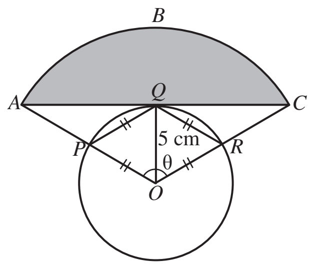


(ii) $|\underset{\sim}{c} + \underset{\sim}{w}| = \sqrt{4^2 + 3^2}$
$= 5$

$\tan\theta = \frac{4}{3}$
$\theta = 53° 8'$

$\therefore$ Halaju paduan bagi kayak *C* ialah 5 m s^{-1} pada arah U 53° 8′ T.
$\therefore$ *The resultant velocity of kayak C is* 5 m s^{-1} *in the direction of* N 53° 8′ E.

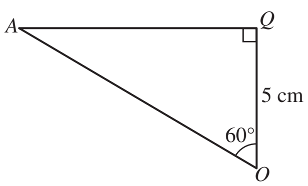
4 (a)



$OP = PQ = OR = QR = OQ$
$\angle POQ = \angle QOR = 60°$

$\theta = 2 \times 60°$
$= 120°$
$= 120° \times \frac{\pi}{180°}$
$= \frac{2\pi}{3}$ rad

(b)



$\frac{AQ}{5} = \tan 60°$

$AQ = 5 \tan 60°$
$= 8.66$ cm
$AC = 2 \times 8.66$
$= 17.32$ cm

$\frac{5}{OA} = \cos 60°$

$\frac{5}{OA} = \frac{1}{2}$

$OA = 10$ cm

Panjang lengkok *AC*
Arc length AC

$= 10 \times \frac{2\pi}{3}$
$= 20.95$ cm

Perimeter bagi rantau yang berlorek
Perimeter of the shaded region

$= 20.95 + 17.32$
$= 38.27$ cm

(c) Luas bagi rantau yang berlorek
Area of the shaded region

$= \frac{1}{2} \times 10^2 \times \frac{2\pi}{3} - \frac{1}{2} \times 17.32 \times 5$
$= 104.73 - 43.3$
$= 61.43$ cm^2

5 (a) Koordinat bagi titik *P* ialah $(k, k^2 + 2k - 3)$.
The coordinates of point P are $(k, k^2 + 2k - 3)$.

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

$\frac{dy}{dx} = 2x + 2$

Pada titik *P*,
At point P,

$\frac{dy}{dx} = 2k + 2$

Kecerunan bagi $PQ = 2k + 2$
Gradient of $PQ = 2k + 2$

$\frac{k^2 + 2k - 3 - (-13)}{k - 3} = 2k + 2$

$\frac{k^2 + 2k + 10}{k - 3} = 2k + 2$

$k^2 + 2k + 10 = (2k + 2)(k - 3)$
$k^2 + 2k + 10 = 2k^2 - 4k - 6$
$k^2 - 6k - 16 = 0$
$(k + 2)(k - 8) = 0$

$k = -2$ atau/*or* $k = 8$
$k < 0$, $\therefore k = -2$

(b) Apabila $k = -2$,
When $k = -2$,
$P(-2, -3)$

$\frac{dy}{dx} = 2(-2) + 2$
$= -2$

Persamaan tangen *PQ*:
Equation of tangent PQ:

$y - (-3) = -2[x - (-2)]$
$y + 3 = -2x - 4$
$y = -2x - 7$

Luas bagi rantau yang berlorek
Area of the shaded region

$= \int_{-2}^{3} [(x^2 + 2x - 3) - (-2x - 7)]\, dx$

$= \int_{-2}^{3} (x^2 + 2x - 3 + 2x + 7)\, dx$

$= \int_{-2}^{3} (x^2 + 4x + 4)\, dx$

$= \left[\frac{x^3}{3} + 2x^2 + 4x\right]_{-2}^{3}$

$= \left[\frac{3^3}{3} + 2(3^2) + 4(3)\right] - \left[\frac{(-2)^3}{3} + 2(-2^2) + 4(-2)\right]$
$= [9 + 18 + 12] - \left[-\frac{8}{3} + 8 - 8\right]$
$= 39 + \frac{8}{3}$
$= \frac{125}{3}$ unit²/*units*²

6 (a) Bilangan kod berlainan yang boleh dibentuk
Number of different codes that can be formed
$= {}^6P_4$
$= 360$

(b) Bilangan cara untuk menyusun 1 konsonan daripada 4 konsonan
Number of ways to arrange 1 *consonant from* 4 *consonants*
$= {}^4P_1$
$= 4$

Bilangan cara untuk menyusun 3 huruf daripada 5 huruf yang lain
Number of ways to arrange 3 *letters from* 5 *other letters*
$= {}^5P_3$
$= 60$

Bilangan kod berlainan yang bermula dengan suatu konsonan
Number of different codes that begin with a consonant
$= 4 \times 60$
$= 240$

(c) Bilangan cara untuk menyusun 3 huruf konsonan dan 1 huruf vokal
Number of ways to arrange 3 *consonants and* 1 *vowel*
$= {}^4P_3 \times {}^2P_1$
$= 24 \times 2$
$= 48$

Bilangan cara untuk menyusun 4 huruf konsonan
Number of ways to arrange 4 *consonants*
$= {}^4P_4$
$= 24$

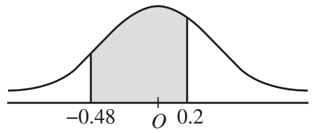
Bilangan kod berlainan yang mengandungi sekurang-kurangnya tiga huruf konsonan
Number of different codes that contain at least three consonants
$= 48 + 24$
$= 72$

7 (a) X = Bilangan murid yang memiliki telefon pintar
X = *Number of students who possessed smartphone*
$X \sim B\left(10, \frac{1}{4}\right)$

P(lebih daripada 3 orang murid memiliki telefon pintar)
P(*more than* 3 *students possessed smartphone*)
$= P(X > 3)$
$= 1 - P(X \leqslant 3)$
$= 1 - P(X = 0) - P(X = 1) - P(X = 2)$
$= 1 - {}^{10}C_0\left(\frac{1}{4}\right)^0\left(1 - \frac{1}{4}\right)^{10} - {}^{10}C_1\left(\frac{1}{4}\right)^1\left(1 - \frac{1}{4}\right)^9$
$\quad - {}^{10}C_2\left(\frac{1}{4}\right)^2\left(1 - \frac{1}{4}\right)^8$
$= 1 - 0.05631 - 0.1877 - 0.2816$
$= 0.4744$

(b) X = Tekanan darah pekerja
X = *Blood pressure of workers*
$X \sim N(140, 25^2)$

(i) P(tekanan darah antara 128 mm Hg dengan 145 mm Hg)
P(*blood pressure between* 128 mm Hg *and* 145 mm Hg)
$= P(128 < X < 145)$
$= P\left(\frac{128 - 140}{25} < Z < \frac{145 - 140}{25}\right)$
$= P(-0.48 < Z < 0.2)$



$= 1 - P(Z > 0.48) - P(Z > 0.2)$
$= 1 - 0.3156 - 0.4207$
$= 0.2637$

(ii) P(tekanan darah lebih daripada 150 mm Hg)
P(*blood pressure more than* 150 mm Hg)
$= P(X > 150)$
$= P\left(Z > \frac{150 - 140}{25}\right)$
$= P(Z > 0.4)$
$= 0.3446$
$\frac{40}{N} = 0.3446$
$N = \frac{40}{0.3446}$
$= 116.1$

∴ Bilangan pekerja dalam kumpulan itu ialah 116 orang.
∴ *Number of workers in the group is* 116.

8 (a)
$$2PS = PT$$
$$4PS^2 = PT^2$$
$$4[(x + 2)^2 + (y + 1)^2] = (x + 8)^2$$
$$4(x^2 + 4x + 4 + y^2 + 2y + 1) = x^2 + 16x + 64$$
$$4(x^2 + 4x + y^2 + 2y + 5) = x^2 + 16x + 64$$
$$4x^2 + 16x + 4y^2 + 8y + 20 = x^2 + 16x + 64$$
$$3x^2 + 4y^2 + 8y - 44 = 0 \ldots ①$$

∴ Persamaan lintasan bagi titik P itu ialah
$3x^2 + 4y^2 + 8y - 44 = 0$
∴ *The equation of the path of point P is*
$3x^2 + 4y^2 + 8y - 44 = 0$

(b) $m_{OM} = -\frac{1}{4}$

Persamaan bagi LM:
Equation of LM:
$y = -\frac{1}{4}x \ldots ②$

Gantikan $y = -\frac{1}{4}x$ ke dalam ①,
Substitute $y = -\frac{1}{4}x$ *into* ①,

$$3x^2 + 4\left(-\frac{1}{4}x\right)^2 + 8\left(-\frac{1}{4}x\right) - 44 = 0$$
$$3x^2 + \frac{1}{4}x^2 - 2x - 44 = 0$$
$$\frac{13}{4}x^2 - 2x - 44 = 0$$
$$13x^2 - 8x - 176 = 0$$
$$(13x + 44)(x - 4) = 0$$
$$x = -\frac{44}{13} \text{ atau/}or\ x = 4$$

Apabila $x = -\frac{44}{13}$,
When $x = -\frac{44}{13}$,
$y = -\frac{1}{4}\left(-\frac{44}{13}\right)$
$= \frac{11}{13}$

$\therefore$ Koordinat bagi titik L ialah $\left(-\frac{44}{13}, \frac{11}{13}\right)$.

$\therefore$ *The coordinates of point L are* $\left(-\frac{44}{13}, \frac{11}{13}\right)$.

(c) Luas bagi ΔLMN
Area of ΔLMN

$$= \frac{1}{2}\left|\begin{matrix} -\frac{44}{13} & 0 & 4 & -\frac{44}{13} \\ \frac{11}{13} & -1-2\sqrt{3} & -1 & \frac{11}{13} \end{matrix}\right|$$

$$= \frac{1}{2}\left|\left[\left(-\frac{44}{13}\right)(-1-2\sqrt{3}) + 0(-1) + 4\left(\frac{11}{13}\right)\right] - \left[\left(\frac{11}{13}\right)(0) + (-1-2\sqrt{3})(4) + (-1)\left(-\frac{44}{13}\right)\right]\right|$$

$$= \frac{1}{2}\left|\left[\frac{44}{13}(1+2\sqrt{3}) + \frac{44}{13}\right] - \left[-4(1+2\sqrt{3}) + \frac{44}{13}\right]\right|$$

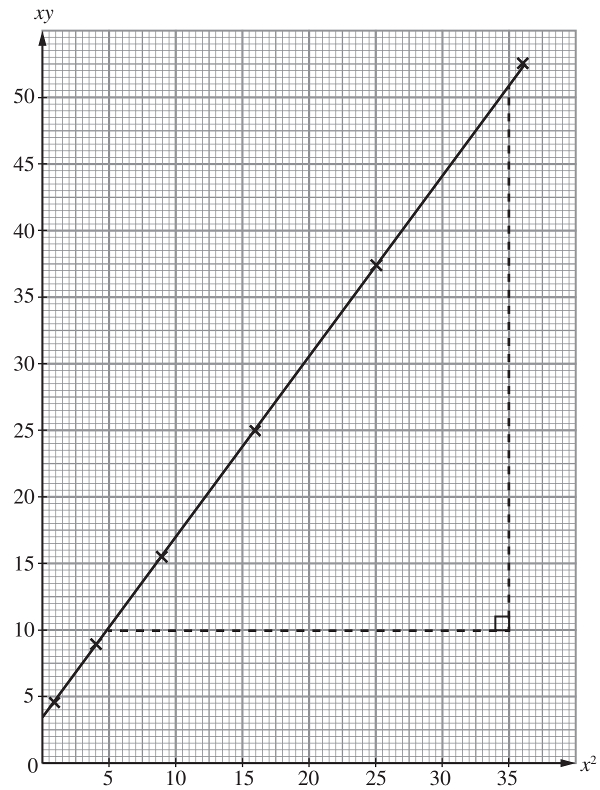
$$= \frac{1}{2}\left|\frac{96}{13}(1+2\sqrt{3})\right|$$

$$= \frac{48}{13}(1+2\sqrt{3}) \text{ unit}^2/\textit{units}^2$$

9 (a)

x^2	1	4	9	16	25	36
xy	4.53	8.62	15.42	24.96	37.25	52.32

(b)



(c) $y = \frac{k}{p}x + \frac{p}{x}$

$xy = \frac{k}{p}x^2 + p$

$Y = xy, X = x^2$

$Y = \frac{k}{p}X + p$

Pintasan-Y:
Y-intercept:
$p = 3.5$

Kecerunan:
Gradient:

$\frac{k}{p} = \frac{51-10}{35-5}$

$\frac{k}{3.5} = \frac{41}{30}$

$k = \frac{41}{30} \times 3.5$

$= 4.78$

10 (a) $\frac{1}{2(1+\cos A)} + \frac{1}{2(1-\cos A)}$

$= \frac{(1-\cos A) + (1+\cos A)}{2(1+\cos A)(1-\cos A)}$

$= \frac{2}{2(1-\cos^2 A)}$

$= \frac{1}{\sin^2 A}$

$= \text{cosec}^2 A$

Apabila $A = \frac{\pi}{4}$,
When $A = \frac{\pi}{4}$,

$\frac{3}{4\left(1+\cos\frac{\pi}{4}\right)} + \frac{3}{4\left(1-\cos\frac{\pi}{4}\right)}$

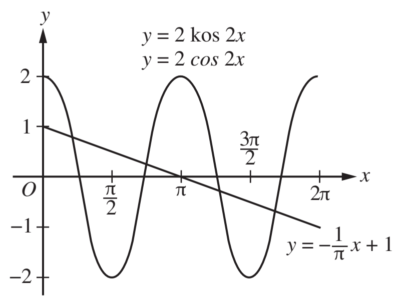
$= \frac{3}{2}\left[\frac{1}{2\left(1+\cos\frac{\pi}{4}\right)} + \frac{1}{2\left(1-\cos\frac{\pi}{4}\right)}\right]$

$= \frac{3}{2}\text{cosec}^2\frac{\pi}{4}$

$= \frac{3}{2}(\sqrt{2})^2$

$= 3$

(b) (i)



(ii) $2\sin^2 x - \frac{1}{2} = \frac{1}{2\pi}x$

$1 - \cos 2x - \frac{1}{2} = \frac{1}{2\pi}x$

$\frac{1}{2} - \cos 2x = \frac{1}{2\pi}x$

$1 - 2\cos 2x = \frac{1}{\pi}x$

$2\cos 2x = -\frac{1}{\pi}x + 1$

Garis lurus itu ialah $y = -\frac{1}{\pi}x + 1$.

Daripada graf, garis lurus itu memotong lengkung $y = 2$ kos $2x$ pada 4 titik.

$\therefore$ Bilangan penyelesaian bagi persamaan $2\sin^2 x - \frac{1}{2} = \frac{1}{2\pi}x$ untuk $0 \leqslant x \leqslant 2\pi$ ialah 4.

The straight line is $y = -\frac{1}{\pi}x + 1$.

From the graph, the straight line cuts the curve $y = 2\cos 2x$ *at* 4 *points.*

$\therefore$ *The number of solutions for the equation* $2\sin^2 x - \frac{1}{2} = \frac{1}{2\pi}x$ *for* $0 \leqslant x \leqslant 2\pi$ *is* 4.

11 (a) $y = x^4 + ax^3 + bx^2$

$\frac{dy}{dx} = 4x^3 + 3ax^2 + 2bx$

Gantikan $x = 2$, $y = 16$ ke dalam $y = x^4 + ax^3 + bx^2$,
Substitute $x = 2$, $y = 16$ *into* $y = x^4 + ax^3 + bx^2$,

$$\begin{aligned} 2^4 + a(2)^3 + b(2)^2 &= 16 \\ 16 + 8a + 4b &= 16 \\ 8a + 4b &= 0 \\ 2a + b &= 0 \ldots ① \end{aligned}$$

Apabila $x = 2$, $\frac{dy}{dx} = 0$,
When $x = 2$, $\frac{dy}{dx} = 0$,

$$\begin{aligned} 4(2)^3 + 3a(2)^2 + 2b(2) &= 0 \\ 32 + 12a + 4b &= 0 \\ 12a + 4b &= -32 \\ 3a + b &= -8 \ldots ② \end{aligned}$$

② – ①, $a = -8$

Daripada ①,
From ①,

$$\begin{aligned} 2(-8) + b &= 0 \\ b &= 16 \end{aligned}$$

(b) $\frac{dy}{dx} = 4x^3 - 24x^2 + 32x$

$\frac{d^2y}{dx^2} = 12x^2 - 48x + 32$

Apabila $x = 2$,
When $x = 2$,

$$\begin{aligned} \frac{d^2y}{dx^2} &= 12(2)^2 - 48(2) + 32 \\ &= -16 < 0 \end{aligned}$$

$\therefore$ (2, 16) ialah titik maksimum.
$\therefore$ (2, 16) *is a maximum point.*

Apabila $\frac{dy}{dx} = 0$,
When $\frac{dy}{dx} = 0$,

$$\begin{aligned} 4x^3 - 24x^2 + 32x &= 0 \\ 4x(x^2 - 6x + 8) &= 0 \\ x(x - 2)(x - 4) &= 0 \end{aligned}$$

$x = 0$, $x = 2$ atau/*or* $x = 4$
$y = x^4 - 8x^3 + 16x^2$

Apabila $x = 0$, $y = 0$,
When $x = 0$, $y = 0$,

$\frac{d^2y}{dx^2} = 32 > 0$

$\therefore$ (0, 0) ialah titik minimum.
$\therefore$ (0, 0) *is a minimum point.*

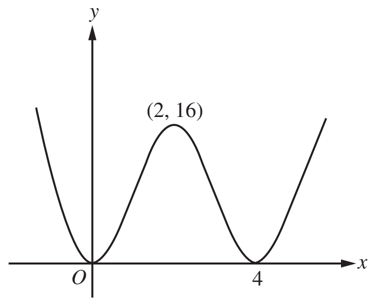
Apabila $x = 4$,
When $x = 4$,

$$\begin{aligned} y &= 4^4 - 8(4)^3 + 16(4)^2 \\ &= 256 - 512 + 256 \\ &= 0 \end{aligned}$$

$$\begin{aligned} \frac{d^2y}{dx^2} &= 12(4)^2 - 48(4) + 32 \\ &= 192 - 192 + 32 \\ &= 32 > 0 \end{aligned}$$

$\therefore$ (4, 0) ialah titik minimum.
$\therefore$ (4, 0) *is a minimum point.*

(c)



12 (a) (i) $\frac{\sin \angle ACD}{13.5} = \frac{\sin 38°}{11.3}$

$$\begin{aligned} \sin \angle ACD &= \frac{13.5 \sin 38°}{11.3} \\ &= 0.7355 \\ \angle ACD &= 47° 21' \end{aligned}$$

(ii) $\cos \angle ABC = \frac{4.1^2 + 9.5^2 - 11.3^2}{2(4.1)(9.5)}$

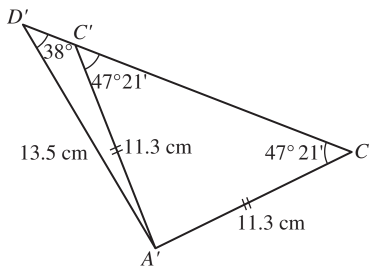
$$\begin{aligned} &= -\frac{20.63}{77.9} \\ &= -0.2648 \\ \angle ABC &= 180° - 74° 39' \\ &= 105° 21' \end{aligned}$$

(iii) $\angle CAD = 180° - 38° - 47° 21'$
$= 94° 39'$

Luas bagi sisi empat *ABCD*
Area of quadrilateral ABCD

$$\begin{aligned} &= \frac{1}{2}(4.1)(9.5) \sin 105° 21' + \frac{1}{2}(13.5)(11.3) \sin 94° 39' \\ &= 18.78 + 76.02 \\ &= 94.8 \text{ cm}^2 \end{aligned}$$

(b) (i)



(ii) $\angle A'C'D' = 180° - 47° 21'$
$= 132° 39'$

13 (a) (i) $I_{2022/2018} = \frac{P_{2022}}{P_{2018}} \times 100$

$$\begin{aligned} &= \frac{P_{2022}}{P_{2020}} \times \frac{P_{2020}}{P_{2018}} \times 100 \\ x &= \frac{110}{100} \times 140 \\ &= 154 \\ y &= \frac{80}{100} \times 130 \\ &= 104 \end{aligned}$$

(ii) $I_{2022/2018} = \frac{P_{2022}}{P_{2018}} \times 100$

$$\begin{aligned} 104 &= \frac{6.50}{P_{2018}} \times 100 \\ P_{2018} &= \frac{6.50}{104} \times 100 \\ &= 6.25 \end{aligned}$$

Harga bagi bahan *E* pada tahun 2018 ialah RM6.25.
The price for ingredient E in the year 2018 *was* RM6.25.

(b) $$\bar{I} = \frac{\Sigma I_i w_i}{\Sigma w_i}$$

$$129.6 = \frac{120(2) + 154(3) + 145(6) + 125(p) + 104(5)}{2 + 3 + 6 + p + 5}$$

$$129.6 = \frac{125p + 2\,092}{16 + p}$$

$$2\,073.6 + 129.6p = 125p + 2\,092$$
$$4.6p = 18.4$$
$$p = 4$$

(c) $$\bar{I}_{2022/2018} = \frac{P_{2022}}{P_{2018}} \times 100$$

$$129.6 = \frac{P_{2022}}{20} \times 100$$

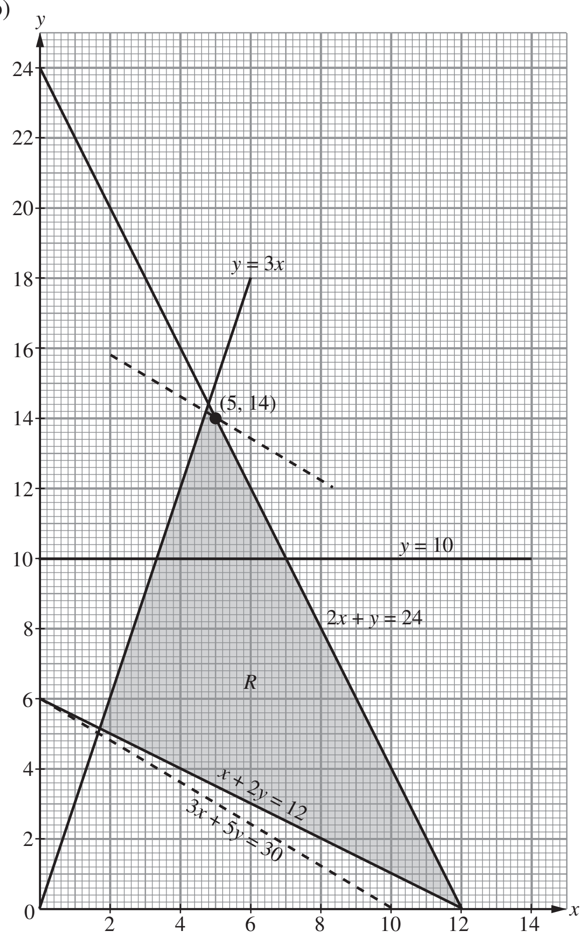
$$P_{2022} = \frac{20}{100} \times 129.6$$
$$= \text{RM}25.92$$

Keuntungan
Profit
$= \frac{75}{100} \times \text{RM}25.92$
$= \text{RM}19.44$

Harga jualan
Selling price
$= \text{RM}20 + \text{RM}19.44$
$= \text{RM}39.44$

14 (a) x = Bilangan pintu pagar automatik P yang dihasilkan
x = Number of automatic gates P produced
y = Bilangan pintu pagar automatik Q yang dihasilkan
y = Number of automatic gates Q produced
$2x + y \leqslant 24$
$x + 2y \geqslant 12$
$\frac{x}{y} \geqslant \frac{1}{3}$
$y \leqslant 3x$

(b)



(c) (i) Apabila $y = 10$, nilai minimum bagi x ialah 4.
$\therefore$ Bilangan minimum pintu pagar P yang dihasilkan ialah 4 unit.
When $y = 10$, the minimum value of x is 4.
$\therefore$ The minimum number of automatic gates P produced is 4 units.

(ii) Jumlah keuntungan
Total profit
$= 150x + 250y$

$150x + 250y = 1\,500$
$3x + 5y = 30$

Jumlah keuntungan maksimum
Total maximum profit
$= 150(5) + 250(14)$
$= \text{RM}4\,250$

15 (a) $v = 2t^3 - 11t^2 + 12t$

Apabila zarah itu berhenti seketika, $v = 0$,
When the particle stops momentarily, $v = 0$,

$$2t^3 - 11t^2 + 12t = 0$$
$$t(2t^2 - 11t + 12) = 0$$
$$t(2t - 3)(t - 4) = 0$$
$$t = 0,\ t = \frac{3}{2} \text{ atau/}or\ t = 4$$

$\therefore$ Masa apabila zarah itu berhenti seketika ialah $t = 0$ s, $t = \frac{3}{2}$ s atau $t = 4$ s.
$\therefore$ The time when the particle stops momentarily is $t = 0$ s, $t = \frac{3}{2}$ s or $t = 4$ s.

(b) $$a = \frac{dv}{dt}$$
$$= 6t^2 - 22t + 12$$
$$= 6\left(t^2 - \frac{11}{3}t + 2\right)$$
$$= 6\left[\left(t - \frac{11}{6}\right)^2 - \frac{121}{36} + 2\right]$$
$$= 6\left[\left(t - \frac{11}{6}\right)^2 - \frac{49}{36}\right]$$

Pecutan minimum
Minimum acceleration
$= 6\left(-\frac{49}{36}\right)$
$= -\frac{49}{6} \text{ m s}^{-2}$

(c) $$s = \int (2t^3 - 11t^2 + 12t)\, dt$$
$$= \frac{t^4}{2} - \frac{11t^3}{3} + 6t^2 + c$$

Apabila $t = 0$, $s = 0$, $c = 0$,
When $t = 0$, $s = 0$, $c = 0$,

$$s = \frac{t^4}{2} - \frac{11t^3}{3} + 6t^2$$

Apabila $s = 0$,
When $s = 0$,

$$\frac{t^4}{2} - \frac{11t^3}{3} + 6t^2 = 0$$
$$3t^4 - 22t^3 + 36t^2 = 0$$
$$t^2(3t^2 - 22t + 36) = 0$$
$$t \neq 0,\ 3t^2 - 22t + 36 = 0$$

Katakan t_1 dan t_2 ialah punca-punca bagi $3t^2 - 22t + 36 = 0$.
Let t_1 and t_2 are roots of $3t^2 - 22t + 36 = 0$.

$$(t_1 - t_2)^2 = (t_1 + t_2)^2 - 4t_1t_2$$
$$= \left(\frac{22}{3}\right)^2 - 4(12)$$
$$= \frac{52}{9}$$

$t_1 - t_2 = \frac{2\sqrt{13}}{3}$

$\therefore$ Beza antara masa yang diambil oleh zarah itu untuk kembali ke titik tetap O buat kali pertama dengan kali kedua ialah $\frac{2\sqrt{13}}{3}$ s.

$\therefore$ *The difference between the times taken by the particle to return to the fixed point O for the first time and second time is* $\frac{2\sqrt{13}}{3}$ s.

(d) Apabila $t = \frac{3}{2}$,

When $t = \frac{3}{2}$,

$$s = \frac{1}{2}\left(\frac{3}{2}\right)^4 - \frac{11}{3}\left(\frac{3}{2}\right)^3 + 6\left(\frac{3}{2}\right)^2$$

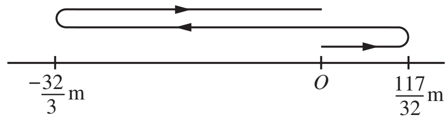
$$= \frac{117}{32} \text{ m}$$

Apabila $t = 4$,

When $t = 4$,

$$s = \frac{4^4}{2} - \frac{11(4)^3}{3} + 6(4)^2$$

$$= -\frac{32}{3} \text{ m}$$



Jumlah jarak yang dilalui

Total distance travelled

$$= 2\left(\frac{117}{32}\right) + 2\left(\frac{32}{3}\right)$$

$$= 28\frac{31}{48} \text{ m}$$