



KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Pulau Pinang

PULAU PINANG PENERAJU TRANSFORMASI PENDIDIKAN NEGARA

MODUL GMAT + PENANG

FORMAT BAHARU KSSM
MATEMATIK TAMBAHAN 2021

Tingkatan

4

Jawapan &
Langkah Kerja

EDISI GURU

DIGUBAL OLEH GURU-GURU MATEMATIK TAMBAHAN NEGERI PULAU PINANG

BAB 1

FUNGSI FUNCTIONS

$$1(a) \quad h^2 + h - 12 = 0$$

$$(h + 4)(h - 3) = 0$$

$$h = -4$$

$$(b) \quad \text{Apabila } x = 0, g(x) = |3(0) - 6| = 6$$

$$\text{Apabila } g(x) = 0, |3x - 6| = 0$$

$$\text{Apabila } g(x) = 15, |3x - 6| = 15$$

$$a = 6, b = 2, c = 7$$

$$2(a) \quad fg(x) = 4(3x^2 - x + 20)$$

$$= 12x^2 - 4x + 80$$

$$gf(x) = 3(4x)^2 - 4x + 20$$

$$= 48x^2 - 4x + 20$$

$$fg(x) \neq gf(x)$$

$$(b) \quad f^2(x) = 4(4x)$$

$$= 16x$$

$$f^2(x) = g(x)$$

$$16x = 3x^2 - x + 20$$

$$3x^2 - 17x + 20 = 0$$

$$(3x - 5)(x - 4) = 0$$

$$x = \frac{5}{3} \text{ atau } x = 4$$

$$3(a)(i) \quad h(8) = 2(8) - 12 = 4$$

$$(ii) \quad g(p - 1) = \frac{1}{2}h(8) + 1$$

$$3(p - 1) + 15 = \frac{1}{2}(4) + 1$$

$$3p - 3 + 15 = 2 + 1$$

$$p = -3$$

$$(iii) \quad hg(x) = 2(3x + 15) - 12$$

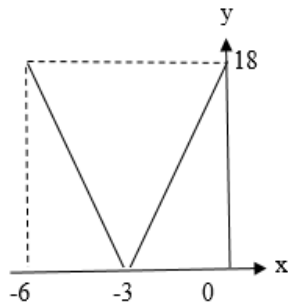
$$= 6x + 18$$

$$3(b)(i) \quad y = |6x + 18|$$

$$\text{Apabila } y = 0, x = -3$$

$$\text{Apabila } x = -6, y = |6(-6) + 18| = 18$$

$$x = 0, y = |6(0) + 18| = 18$$



$$(b)(ii) \quad hg(q) = 2gh(q)$$

$$6q + 18 = 2[3(2q - 12) + 15]$$

$$6q + 18 = 2[6q - 21]$$

$$6q + 18 = 12q - 42$$

$$q = 10$$

$$4. \quad 3m(n) + 5 = 6(n) + n$$

$$7n - 3mn = 5$$

$$n = \frac{5}{7 - 3m}$$

$$n = \frac{5}{7 - 3(1)}$$

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

$$f(3) = 6(3) + 2\left(\frac{5}{4}\right)$$

$$f(3) = 20.5 \text{ or any equivalent.}$$

$$5(a) \quad 2x - 3m \neq 0$$

$$x \neq \frac{3m}{2}$$

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

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

$$(b) \quad (4) = g(m)$$

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

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

$$3m - 4 = -4m$$

6(a) $|2(2) - m| = 0$

$$m = 4$$

$$6 = |2(n) - 4|$$

$$2n - 4 = \pm 6$$

$$n = 5,$$

$$n = -1(\text{rejected})$$

6(b) $|2x - 4| \geq 4$

$$2x - 4 \geq 4, 2x - 4 \leq -4$$

$$x \geq 4, x \leq 0$$

K1 if one of the inequalities seen.

7(a)(i) $x \leq -\frac{1}{2}$

(a)(ii) $f(x) \geq 0$

7(b) $\sqrt{1 - 2m} = 3n + 5$

$$1 - 2m = [3(n - 3) + 5]^2$$

$$1 - 2m = [3n - 4]^2$$

$$2m = 1 - [9n^2 - 24n + 16]$$

$$m = \frac{24n - 9n^2 - 15}{2}$$

7(c) let $y = \sqrt{1 - 2x}$

$$y^2 = 1 - 2x$$

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

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

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

$$= 3 \left[\frac{1 - x^2}{2} \right] + 5$$

$$= \frac{13 - x^2}{2}$$

8(a) 1 dan 2

(b) 3 dan 5

9(a) $\{(1, p), (2, r), (3, s), (4, p)\}$

(b) Banyak kepada satu

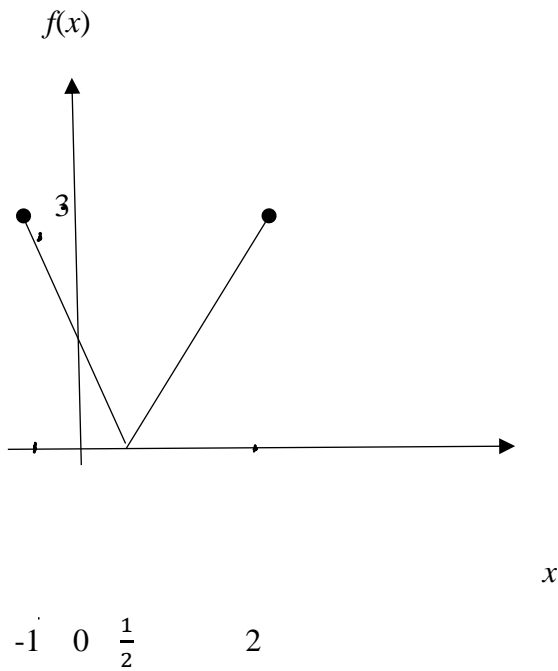
(c) $\{p, r, s\}$

(d) Ya

10.

x	-1	0	$\frac{1}{2}$	1	2
oleh	3	1	0	1	3

$y = f(x) = |2x - 1|$



Julat $0 \leq f(x) \leq 3$

11 (a) let $y = 4x + 2$

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

$$f^{-1}(x) = \frac{x - 2}{4}$$

$$g(x) = \frac{3\left(\frac{x-2}{4}\right) + 1}{\left(\frac{x-2}{4}\right) + 2}$$

$$g(x) = \frac{\left(\frac{3x - 6 + 4}{4}\right)}{\left(\frac{x - 2 + 8}{4}\right)}$$

$$g(x) = \frac{\left(\frac{3x-2}{4}\right)}{\left(\frac{x+6}{4}\right)}$$

$$g(x) = \frac{3x-2}{x+6}$$

(b) . let $y = \frac{3x-2}{x-10}$

$$y(x+6) = 3x-2$$

$$(xy+6y) = 3x-2$$

$$3x-xy = 6y+2$$

$$x(3-y) = 6y+2$$

$$x = \frac{6y+2}{3-y}$$

$$g^{-1}(x) = \frac{6y+2}{3-y}$$

$$\frac{6p+2}{3-p} = p$$

$$3p - p^2 = 6p + 2$$

$$p^2 + 3p + 2 = 0$$

$$(p+2)(p+1) = 0$$

$$p = -2, -1$$

12(a) $|2x-3| = 9$

$$2x-3 = 9$$

$$2x = 9+3$$

$$2x = 12$$

$$x = 6$$

$$|2x-3| = 9$$

$$2x-3 = -9$$

$$2x = -9+3$$

$$2x = -6$$

$$x = -3$$

$$(b)(i) f : x \rightarrow |6 - 2x|,$$

$$x = 0, f(x) = 6$$

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

$$x = 3$$

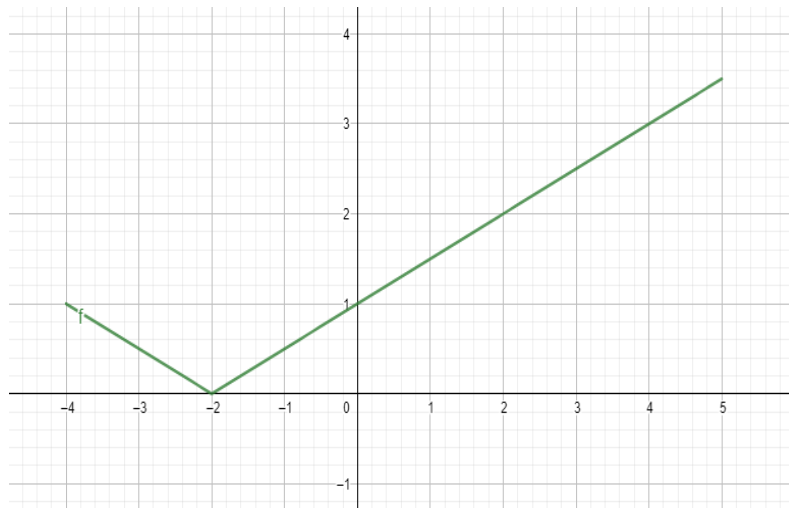
$$\therefore (0, 6) \text{ dan } (3, 0)$$

$$x = -1, f(x) = |6 - 2(-1)| = 8$$

$$x = 5, f(x) = |6 - 2(5)| = 4$$

$$(b)(ii) 0 \leq f(x) \leq 8$$

13(a)



K2 all the points plotted correctly $\{(-4,1), (-2,0), (4,3)\}$

N1 the smoothness of the graph.

Julat bagi $f(x)$ ialah $0 \leq x \leq 3$

$$(b) 3f(x) = 2 - k$$

$$f(x) = \frac{2-k}{3}$$

$$0 < \frac{2-k}{3} \leq 1$$

$$0 < 2 - k \leq 3$$

$$-1 \leq k < 2$$

(c) $\left| \frac{1}{2}m + 1 \right| = n$

$$\frac{1}{2}m + 1 = \pm n$$

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

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

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

K2 if one of the answers seen.

- 14 (a) $k = 5$, $m = 4$, $n = 9$
 (b) $x = 2$, $x = -1$
 (c) Ya/ Yes , $ff^{-1}(x) = x$
 (i) Benar kerana apabila / True because when
 $x = -2$, $ff^{-1}(x) = x$
 (ii) Palsu kerana apabila / False because when
 $x = 3$, $ff^{-1}(3) = 3$

15(a) $y = f(x)$
 Bukan fungsi
 sebab
 graf potong paksi x dua titik / satu kepada banyak hubungan

$y = g(x)$
 Fungsi
 sebab
 graf potong paksi x satu titik sahaja / satu kepada satu hubungan

(b)(i) Fungsi $f(x) = |x|$ dan $f(x) = x^4$ menjadi fungsi satu dengan satu dengan syarat domain f ialah $x \geq 0$.

(ii) $f^{-1}(x) = x$,
 $f^{-1}(x) = x^{\frac{-1}{4}}$

16(a) $Ar(t) = 4\pi\left(\frac{2}{3}t^3\right)^2$
 $Ar(t) = \frac{16}{9}\pi t^6$

(b) $Ar(t) = \frac{16}{9}\pi(2)^6$
 $113\frac{7}{9}\pi m^6$

$$17(a)(i) \quad f(x) = x + b \quad g(x) = 5 - ax$$

$$\begin{aligned} fg(x) &= f(5 - ax) \\ &= (5 - ax) + b \\ &= 5 + b - ax \end{aligned}$$

$$\text{Diberi juga } fg(x) = 15 - 3x.$$

$$\text{Maka, } -a = -3 \quad \text{dan } 5 + b = 15$$

$$a = 3 \quad b = 10$$

$$(a)(ii) \quad f(x) = x + 10 \quad g(x) = 5 - 3x \quad gf(x) = 2$$

$$\begin{aligned} gf(x) &= g(x + 10) \\ &= 5 - 3(x + 10) \\ &= 5 - 3x - 30 \\ &= -3x - 25 \\ gf(x) &= 2 \\ -3x - 25 &= 2 \\ -3x &= 27 \\ x &= -9 \end{aligned}$$

$$17(b)(i) \quad \text{Katakan } y = h(x)$$

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

$$3 = 2y - xy$$

$$xy = 2y - 3$$

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

$$h^{-1} = \frac{2x-3}{x} \quad x \neq 0$$

$$(b)(ii) \quad h(x) = -4$$

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

$$6x = 3$$

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

BAB 2

FUNGSI KUADRATIK *QUADRATIC FUNCTION*

$$\begin{aligned}
 1. \quad & (x+w)^2 = 49 \\
 & (-5+w)^2 = 49 \\
 & w^2 - 10w - 24 = 0 \\
 & (w+2)(w-12) = 0 \\
 & w = -2 \text{ atau } w = 12
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & x^2 + 2kx + 1 - 3h = 0 \\
 & b^2 - 4ac > 0 \\
 & (2k)^2 - 4(1)(1-3h) > 0 \\
 & 4k^2 + 12h - 4 > 0 \\
 & 4k^2 + 12h > 4 \\
 & k^2 + 3h > 1
 \end{aligned}$$

3. Nilai kereta selepas 2 tahun :

$$112000 \left(1 - \frac{x}{100}\right)^2 = 98100$$

$$\frac{56}{5}x^2 - 2240x + 112000 = 98100$$

$$14x^2 - 2800x + 17375 = 0$$

$$x = \frac{-(-2800) \pm \sqrt{(-2800)^2 - 4(14)(17375)}}{2(14)}$$

$$x = 193.59, \quad x = 6.41$$

Peratus penyusutan 193.59% adalah tidak boleh diterima, jadi peratus penyusutan ialah 6.41%. $x = 6,41$

4.

$$3x^2 + 2x - 7 = 0$$

$$\alpha + \beta = -\frac{2}{3}$$

$$\alpha\beta = -\frac{7}{3}$$

(a) HTP baharu :

$$(\alpha + 1) + (\beta + 1) = (\alpha + \beta) + 2$$

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

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

HDP baharu :

$$(\alpha + 1)(\beta + 1) = \alpha\beta + (\alpha + \beta) + 1$$

$$= -\frac{7}{3} + \left(-\frac{2}{3}\right) + 1$$

$$= -2$$

$$x^2 - (\text{HTP})x + (\text{HDP}) = 0$$

$$x^2 - \frac{4}{3}x + (-2) = 0$$

$$3x^2 - 4x - 6 = 0$$

(b) HTP baharu :

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$$

$$= \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$$

$$= \frac{\left(-\frac{2}{3}\right)^2 - 2\left(-\frac{7}{3}\right)}{\left(-\frac{7}{3}\right)}$$

$$= -\frac{46}{21}$$

HDP baharu :

$$\frac{\alpha}{\beta} \left(\frac{\beta}{\alpha} \right) = 1$$

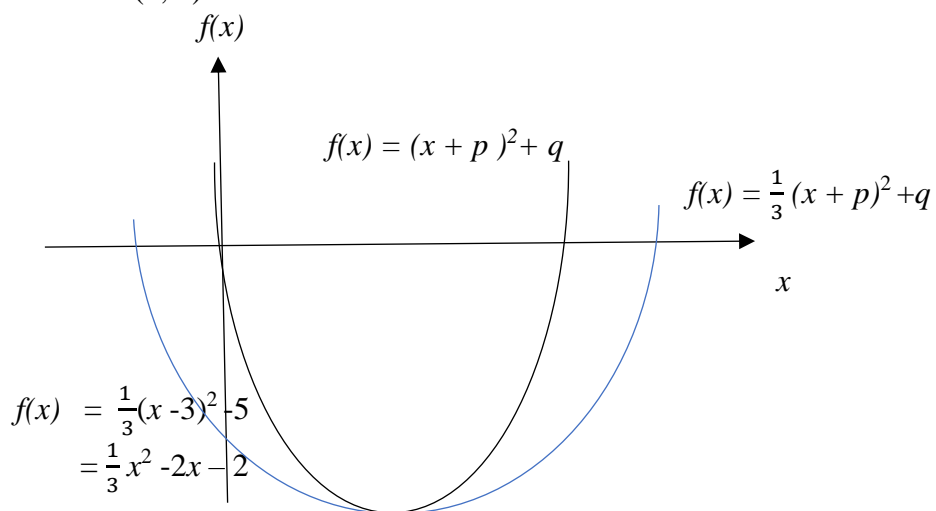
$$x^2 - (HTP)x + (HDP) = 0$$

$$x^2 - \left(-\frac{46}{21} \right) x + 1 = 0$$

$$21x^2 + 46x + 21 = 0$$

5. (a) $x + p = 0$
 $3 + p = 0$
 $p = -3$
 $q = -5$

(b) $x = 0, f(x) = (-3)^2 - 5$
 $= 4$
 $A = (0, 4)$



6. $x = 0 \quad y = 2$
 $x = 3 \quad y = -(3)^2 + 2$
 $y = -7$
 Tinggi = $2 + 7 = 9$ meter

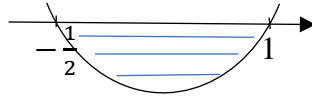
7. (a) $f(x) = x^2 + 2x - 4$
 $= (x + 1)^2 - 1 - 4$
 $= (x + 1)^2 - 5$

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

$m = 1$

$n = 5$

(b) $2x^2 - x - 1 \leq 0$
 $(2x + 1)(x - 1) \leq 0$



Julat $-\frac{1}{2} \leq x \leq 1$

8. (a) $f(x) = (x - 2k)^2 + 5k^2 + 1 - 4k^2$
 $= (x - 2k)^2 + k^2 + 1$

$r^2 + 2k = k^2 + 1$

$r^2 = k^2 - 2k + 1$

$r^2 = (k - 1)^2$

$r = k - 1$

(b) $r^2 - 1 = 2k$

$(k - 1)^2 - 1 = 2k$

$k^2 - 2k + 1 - 1 = 2k$

$k^2 - 4k = 0$

$k(k - 4) = 0$

$k = 0 \quad k = 4$

$r = -1 \quad r = 3$

9. $f(x) = -x^2 + 10x - 21$

$= (-x + 7)(x - 3)$

$f(x) = -[x^2 - 10x + 21]$

$= -[x^2 - 10x + (-\frac{10}{2})^2 - (-\frac{10}{2})^2 + 21]$

$= -[(x - 5)^2 - 25 + 21]$

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

Ketinggian maksimum / *Maksimum Height* = $4 + 1.3 = 5.3$ m

Jarak lembing tersebut dari Amin yang sepadan / *corresponding distance of*

the javelin from Amin = $5 - 3 = 2$ m

$$\begin{aligned}
 10. \quad & \frac{5(x-3)+3(2x+1)}{(2x+1)(x-3)} = 7 \\
 & \frac{5x-15+6x+3}{(2x+1)(x-3)} = 7 \\
 & 11x - 12 = 7(2x^2 - 5x - 3) \\
 & 11x - 12 = 14x^2 - 35x - 21 \\
 & 14x^2 + 46x - 9 = 0 \\
 & 14 \left[x^2 + \frac{23}{7}x - \frac{9}{14} \right] = 0 \\
 & x^2 + \frac{23}{7}x - \frac{9}{14} = 0 \\
 & x^2 + \frac{23}{7}x + \left(\frac{23}{14}\right)^2 - \left(\frac{23}{14}\right)^2 - \frac{9}{14} = 0 \\
 & \left(x + \frac{23}{14}\right)^2 = \frac{9}{14} + \frac{529}{196} \\
 & \left(x + \frac{6}{7}\right)^2 = \frac{655}{196} \\
 & \left(x + \frac{6}{7}\right) = \pm \frac{\sqrt{655}}{14} \\
 & X = \pm \frac{\sqrt{655}}{14} - \frac{6}{7} \\
 & X = \frac{\sqrt{655}-12}{14}, \quad X = \frac{-\sqrt{655}-12}{14}
 \end{aligned}$$

11. For two real and equal roots,

$$\begin{aligned}
 & b^2 - 4ac = 0 \\
 & (-7q^2)^2 - 4(3p)(3p) = 0 \\
 & 49q^2 - 36p^2 = 0 \\
 & 7q - 6p = 0 \quad \text{or} \quad 7q + 6p = 0 \text{ (rejected)} \\
 & \Rightarrow 7q = 6p \\
 & \text{then } q : p = 6 : 7 \\
 & \text{When } p = 7, q = 6 \\
 & 3(7)x^2 - 7(6)x + 3(7) = 0 \\
 & x^2 - 2x + 1 = 0 \\
 & (x - 1)^2 = 0 \\
 & \therefore x = 1
 \end{aligned}$$

$$\begin{aligned}
 12. \quad (a) \quad (i) \quad f(x) &= x^2 + x + 1 \\
 &= x^2 + x + \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 + 1 \\
 &= x^2 + x + \left(\frac{1}{2}\right)^2 + \frac{3}{4} \\
 &= \left(x + \frac{1}{2}\right)^2 + \frac{3}{4}
 \end{aligned}$$

$$(ii) \quad \text{minimum value of } f(x) = \frac{3}{4}$$

$$\begin{aligned}
 (b) \quad (x+1)(x^2+1) &> 1 \\
 (x+1)(x^2+1) - 1 &> 0 \\
 x^3 + x + x^2 + 1 - 1 &> 0 \\
 x(x^2 + x + 1) &> 0 \\
 \text{Thus, } x &> 0
 \end{aligned}$$

$$\begin{aligned}
 13. \quad (a) \quad 3x^2 + 20x &\leq 7 \\
 3x^2 + 20x - 7 &\leq 0 \\
 (x+7)(3x-1) &\leq 0 \\
 -7 \leq x &\leq \frac{1}{3}
 \end{aligned}$$

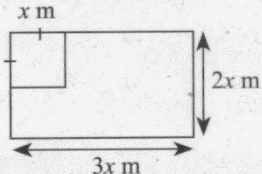
$$\begin{aligned}
 (b) \quad f(x) &= x^2 + 4mx + 4m + 3 \\
 b^2 - 4ac &< 0 \\
 (4m)^2 - 4(1)(4m+3) &< 0 \\
 4m^2 - 4m - 3 &< 0 \\
 (2m-3)(2m+1) &< 0 \\
 \text{Thus, } -\frac{1}{2} &< m < \frac{3}{2} \\
 \therefore r = -\frac{1}{2}, \quad s &= \frac{3}{2}
 \end{aligned}$$

14. (a) $x(x - 5) = 4$
 $x^2 - 5x - 4 = 0$
- (b) $a = 1, b = -5, c = -4$
 Sum of roots $= -\frac{b}{a}$
 $= -\frac{-5}{1} = 5$
- (c) $b^2 - 4ac = (-5)^2 - 4(1)(-4)$
 $= 25 + 16$
 $= 41$
 $b^2 - 4ac > 0$

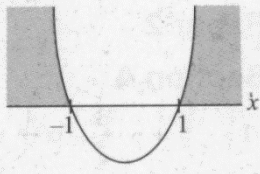
This equation has two different roots

15. $y = (p - 2)x^2 - x + 7 \dots \dots \dots (1)$
 $y = 3x + 5 \dots \dots \dots (2)$
- Substitute (1) into (2):
 $(p - 2)x^2 - x + 7 = 3x + 5$
 $(p - 2)x^2 - x - 3x + 7 - 5 = 0$
 $(p - 2)x^2 - 4x + 2 = 0$
 $a = p - 2, b = -4, c = 2$
 $b^2 - 4ac > 0$
 $(-4)^2 - 4(p - 2)(2) > 0$
 $16 - 8p + 16 > 0$
 $-8p > -32$
 $P < 4$

- 16.



Area of plywood - area of square $\geq (x^2 + 4)$
 $3x(2x) - x^2 \geq x^2 + 4$
 $6x^2 - x^2 - x^2 \geq 4$
 $4x^2 \geq 4$
 $x^2 - 1 \geq 0$
 $(x + 1)(x - 1) \geq 0$
 $x \leq -1$ or $x \geq 1$
 Thus, $x \geq 1$ ($x > 0$, length)



17. (a) Andaikan trek jalan kaki ialah x cm

$$(16 + 2x)(12 + 2x) = 292$$

$$4x^2 + 56x + 192 = 292$$

$$x^2 + 14x - 25 = 0$$

$$x = \frac{-(14) \pm \sqrt{(14)^2 - 4(1)(-25)}}{2(1)}$$

$$x = 1.60, x = -15.60$$

Lebar trek jalan kaki ialah 1.60 m

- (b) Luas trek jalan kaki = $292 - (16 \times 12) = 100 \text{ m}^2$

$$\text{Kos pembinaan trek} = \text{RM } 228 \times 100$$

$$\text{Kos pembinaan trek} = \text{RM } 22\,800$$

18. (a) $f(x) = 2\left(x + \frac{5}{4}\right)^2 - \frac{9}{8}$

$$= 2\left(x^2 + \frac{5}{2}x + \frac{25}{16}\right) - \frac{9}{8}$$

$$= 2x^2 + 5x + 2$$

$$= (2x + 1)(x + 2)$$

$$= 2\left(x + \frac{1}{2}\right)(x + 2)$$

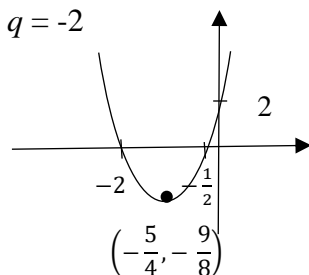
bandingkan dengan $f(x) = a(x - p)(x - q)$

maka $a = 2$

$$p = -\frac{1}{2}$$

$$q = -2$$

- (b)



19. (a) $x = 3$

(b) $(-3, 5)$

(c) $-\frac{25}{4} = a(0-3)^2 + 5$

$$9a = -\frac{25}{4} - 5$$

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

$$f(x) = -\frac{5}{4}(x-3)^2 + 5$$

(d) $g(x) = -\frac{5}{4}(x+3)^2 + 5$

20. (a) $P(n) = -n^2 + 40n - 300$

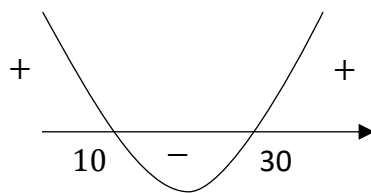
$$P(n) > 0$$

$$-n^2 + 40n - 300 > 0$$

$$-(n^2 - 40n + 300) > 0$$

$$n^2 - 40n + 300 < 0$$

$$(n-10)(n-30) < 0$$



$$10 < n < 30$$

Bilangan maksimum unit robotik = 29

Bilangan minimum unit robotik = 11

(b) (i) $P(n) = -n^2 + 40n - 300$

$$= -(n^2 - 40n + 300)$$

$$= -\left[n^2 - 40n + \left(\frac{-40}{2}\right)^2 - \left(\frac{-40}{2}\right)^2 + 300\right]$$

$$= -(n-20)^2 + 100$$

bilangan unit robotik yang perlu dihasilkan dan dijual = 20

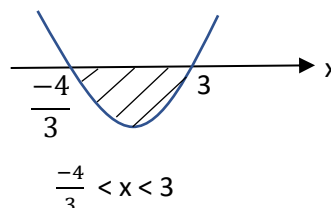
(ii) keuntungan maksimum = $100 \times \text{RM}1000$

$$= \text{RM}100\,000$$

21. (a) (i) $12 + 5x - 3x^2 > 0$

$$3x^2 - 5x - 12 < 0$$

$$(3x+4)(x-3) < 0$$



(a) (ii) $f(x) = 3x^2 - 5x - 12$

(b)
$$y = -\frac{1}{9}x^2 + \frac{2}{3}x + 3$$

$$y = -\frac{1}{9} [x^2 - 6x - 27]$$

$$= -\frac{1}{9} [x^2 - 6x + 3^2 - 3^2 - 27]$$

$$= -\frac{1}{9} [(x - 3)^2 - 9 - 27]$$

$$= -\frac{1}{9} [(x - 3)^2 - 36]$$

$$= -\frac{1}{9}(x - 3)^2 + 4$$

Titik maksimum / Maximum point (3, 4)

Tidak, bola yang ditembak oleh Kumar tidak dapat masuk ke dalam jaring kerana bola ditembak melebihi ketinggian papan jaring.

No, Kumar can not shoot the basket ball into the net. The ball is shooting over the height of the net board.

22. (a) (i) HTP: $\alpha^2 + \beta^2 = 22$

HDP: $\alpha^2 \times \beta^2 = (\alpha\beta)^2 = 7^2 = 49$

$x^2 - 22x + 49 = 0$

(ii) HTP: $(\alpha + \beta)^2 = \alpha^2 + \beta^2 + 2\alpha\beta$
 $= 22 + 2(7) = 36$

$\alpha + \beta = 6$

HDP: $\alpha\beta = 7$

$x^2 - 6x + 7 = 0$

(b) $x^2 - 6x = -7$
 $x^2 - 6x + (-3)^2 = -7 + (-3)^2$
 $(x - 3)^2 = 2$
 $x = 3 \pm \sqrt{2}$
 $k=3, m=2$

23. (a)

$$\alpha : \beta = 4 : 5$$

$$x^2 - 9kx + 80 = 0$$

$$\text{HTP} : 4\alpha + 5\alpha = -\left(\frac{-9k}{1}\right)$$

$$\alpha = k$$

$$\text{HDP} : 4\alpha(5\alpha) = \frac{80}{1}$$

$$\alpha^2 = 4$$

$$\alpha = \pm 2$$

$$k = 2 \text{ atau } k = -2$$

 (b) $k = 2 (k > 0)$

$$x^2 - 9(2)x + 80 = 0$$

$$x^2 - 18x + 80 = 0$$

$$(x-8)(x-10) = 0$$

$$x = 8, x = 10$$

$$\therefore \alpha = 8, \beta = 10$$

$$\begin{aligned} \text{HTP baru: } \alpha^2 + \beta^2 &= 8^2 + 10^2 \\ &= 164 \end{aligned}$$

$$\begin{aligned} \text{HDP baru: } \alpha^2 \beta^2 &= 8^2 (10^2) \\ &= 6400 \end{aligned}$$

Persamaan kuadratik baru ialah

$$x^2 - 164x + 6400 = 0$$

 (c) $k = \frac{1}{3}$

$$x^2 - 9\left(\frac{1}{3}\right)x + 80 = 0$$

$$x^2 - 3x + 80 = 0$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(80)}}{2(1)}$$

$$= \frac{3 \pm \frac{\sqrt{311}}{2}}{2} i$$

$$\therefore x = \frac{3}{2} + \frac{\sqrt{311}}{2} i, \quad x = \frac{3}{2} - \frac{\sqrt{311}}{2} i$$

**BAB
3**
**SISTEM PERSAMAAN
SYSTEM OF EQUATIONS**

1. Let, the price of a packet of cooking chocolate = x
 the price of a packet of dates = y
 the price of a box of candy = z

$$3x + 2y + z = 56 \quad (1)$$

$$4x + 3y + z = 77 \quad (2)$$

$$6x + y + 4z = 83 \quad (3)$$

Eliminate z from (1) and (2),

$$(1): 3x + 2y + z = 56$$

$$(2): 4x + 3y + z = 77 \quad (-)$$

$$-x - y = -21$$

$$x + y = 21 \quad (4)$$

Eliminate z from (2) and (3),

$$4 \times (2): 16x + 12y + 4z = 308$$

$$(3): 6x + y + 4z = 83 \quad (-)$$

$$10x + 11y = 225 \quad (5)$$

Solve (4) and (5) to find the values of x and y ,

$$10 \times (4): 10x + 10y = 210$$

$$(5): 10x + 11y = 225 \quad (-)$$

$$-y = -15$$

$$\text{From (5), } 10x + 11(15) = 225$$

$$10x = 60$$

$$x = 6$$

$$\text{From (1), } 3(6) + 2(15) + z = 56$$

$$z = 8$$

Hence, the price of a packet of cooking chocolate = RM6,

the price of a packet of dates = RM15 and the price of a box of candy = RM8.

2.(a) $x + 6y + 4z = 25100$

$$3x + 7y + z = 29100$$

$$2x + 5y + 3z = 24400$$

(b) $x = 25100 - 6y - 4z$

$$3(25100 - 6y - 4z) + 7y + z = 29100$$

$$y + z = 4200$$

$$7y + 5z = 25800$$

$$x = 3500$$

$$y = 2400$$

$$z = 1800$$

3. x kek pisang, y kek lobak, z kek coklat

$$x + y + z = 245$$

$$20x + 30y + 40z = 7750$$

$$5x + 5y + 10z = 1725$$

$$x + y + 2z = 345$$

$$x = 245 - y - z$$

$$z = 100$$

$$y = 85$$

$$x = 60$$

- 4.(a) Katakan x – bilangan meja

y – bilangan kerusi

z - bilangan rak

$$x + y + z = 28$$

$$x + y - z = -2$$

$$1550x + 750y + 1250z = 33000$$

- (b) $x = 28 - y - z$

$$(28 - y - z) + y - z = -2$$

$$z = 15$$

$$x = 13 - y$$

$$-16y = -112$$

$$y = 7$$

$$x = 6$$

5. Katakan x mewakili bilangan kek kecil, y mewakili bilangan kek sederhana dan z mewakili bilangan kek besar.

$$x = y + z \text{ ----- (1)}$$

$$y = 2z \text{ ----- (2)}$$

$$10x + 15y + 40z = 300 \text{ -----(3)}$$

Ganti (2) ke dalam (1)

$$x = 2z + z \text{ ----- (4)}$$

Ganti (2) dan (4) ke dalam (3)

$$10(3z) + 15(2z) + 40z = 300$$

$$z = 3$$

Ganti $z = 3$ ke dalam (4)

$$x = 3(3) = 9$$

Ganti $z = 3$ dan $x = 9$ ke dalam (1)

$$9 = y + 3$$

$$y = 6$$

6. Ganti $(h, -1)$ dalam $2x - ky = 12x^2 - ky^2 = 7$

$$2(h) - k(-1) = 12(h)^2 - k(-1)^2 = 7$$

$$2h + k = 7 \text{ atau } 12h^2 - k = 7$$

$$k = 7 - 2h$$

Ganti $k = 7 - 2h$ dalam $12h^2 - k = 7$

$$12h^2 - (7 - 2h) = 7$$

$$12h^2 + 2h - 7 - 7 = 0$$

$$12h^2 + 2h - 14 = 0$$

$$6h^2 + h - 7 = 0$$

$$(6h - 7)(h + 1) = 0$$

$$h = 1 \text{ atau } h = -\frac{7}{6}$$

Ganti $h = 1$ atau $h = -\frac{7}{6}$ dalam $k = 7 - 2h$

$$h = 1, k = 5$$

$$h = -\frac{7}{6}, k = \frac{28}{3}$$

7. $x + y + 35 = 84$ atau $x^2 + y^2 = 35^2$

$$y = 49 - x$$

Gantikan $y = 49 - x$ ke dalam:

$$x^2 + (49 - x)^2 = 35^2$$

$$x^2 - 49x + 588 = 0$$

$$(x - 28)(x - 21) = 0$$

$$x = 28, x = 21$$

Gantikan nilai-nilai x ke dalam:

Apabila $x = 28$,

$$y = 49 - 28$$

$$= 21$$

Apabila $x = 21$,

$$y = 49 - 21$$

$$= 28$$

Maka, panjang sisi-sisi segi tiga ialah 21 cm dan 28 cm.

8. $8x + 12y + 16y + 20y = 128$ atau $4x^2 + \frac{1}{2}(12y)(16y) = 448$
 $x = 16 - 6y$

Gantikan $x = 16 - 6y$ ke dalam :

$$4(16 - 6y) + 96y^2 = 448$$

$$4(256 - 192y + 36y^2) + 96y^2 = 448$$

$$1024 - 768y + 144y^2 + 96y^2 = 448$$

$$240y^2 - 768y + 576 = 0$$

$$\begin{aligned}
 5y^2 - 16y + 12 &= 0 \\
 (y - 2)(5y - 6) &= 0 \\
 y = 2 &\quad \text{atau} \quad y = 1.2 \\
 x = 4 &\quad \quad \quad x = 8.8
 \end{aligned}$$

9. Perimeter:

$$\begin{aligned}
 2(40 - y) + 2(x - 15) &= 58 \\
 80 - 2y + 2x - 30 &= 58 \\
 x &= 4 + y
 \end{aligned}$$

Luas:

$$\begin{aligned}
 40(15) + y(x - 15) &= 680 \\
 600 + xy - 15y &= 680 \\
 xy - 15y &= 80
 \end{aligned}$$

Gantikan $x = 4 + y$ ke dalam:

$$y(4 + y) - 15y = 80$$

$$4y + y^2 - 15y = 80$$

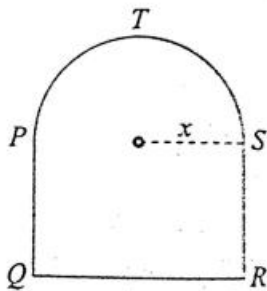
$$y^2 - 11y - 80 = 0$$

$$(y - 16)(y + 5) = 0$$

$$y = 16, \quad y = -5$$

$$\therefore y = 16$$

$$x = 20$$



10.
$$2y + 2x + \frac{2\pi x}{2} = 40$$

$$14y + 36x = 280$$

$$y = \frac{140 - 18x}{7}$$

$$2xy + \frac{22x^2}{14} = 105$$

$$14xy + 11x^2 = 735$$

Gantikan $y = \frac{140 - 18x}{7}$ ke dalam:

$$14x \left(\frac{140 - 18x}{7} \right) + 11 \left(\frac{140 - 18x}{7} \right)^2 = 735$$

$$5x^2 - 56x + 147 = 0$$

$$(x-7)(5x-21)=0$$

$$x=7, \quad x=4.2$$

∴ Jejari semibulatam = 7 cm atau 4.2 cm

11. $4x + y = 9$

$$y = 9 - 4x$$

$$5x^2 + y^2 - 3xy = 15$$

Ganti $(9 - 4x)$ ke dalam :

$$5x^2 + (9 - 4x)^2 - 3x(9 - 4x) = 15$$

$$5x^2 + 81 + 16x^2 - 72x - 27x + 12x^2 = 15$$

$$33x^2 - 99x + 66 = 0$$

$$x^2 - 3x + 2 = 0$$

$$(x-2)(x-1) = 0$$

$$x = 2, \quad x = 1$$

$$y = 1, \quad y = 5$$

Titik pertembungan ialah (2, 1) dan (1, 5)

12. $2xy = 6$

$$4x + 4y + 8 = 24$$

$$x = 4 - y \quad y = 4 - x$$

$$2(4 - y)y = 6$$

$$(y-3)(y-1) = 0$$

$$y = 3 \text{ atau } y = 1$$

$$x = 1 \text{ atau } x = 3$$

13. $32x + 2y = 80$

$$\frac{1}{2}(12x)(8x) + 12xy = 384$$

$$y = 40 - 16x$$

$$x(40 - 16x) + 4x^2 = 32$$

$$3x^2 - 10x + 8 = 0$$

$$(x-2)(3x-4) = 0$$

$$x = 2, \quad y = 8$$

$$x = \frac{4}{3}, \quad y = \frac{56}{3}$$

14. $(2)^2 + (2)(1) + p(1) = q$ atau $2p(2) + 3(1) = q$

$$4p + 3 = 6 + p$$

$$p = 1, \quad q = 7$$

$$x^2 + xy + y = 7 \quad \text{dan} \quad 2x + 3y = 7$$

$$y = \frac{7-2x}{3}$$

$$x^2 + x\left(\frac{7-2x}{3}\right) + \left(\frac{7-2x}{3}\right) = 7$$

$$(x-2)(x+7) = 0$$

$(-7,7)$

15.(a) $\sqrt{(x-4)^2 + (y-2)^2} = \sqrt{5}$
 $x^2 - 8x + 16 + y^2 - 4y + 4 = 5$
 $x^2 + y^2 - 8x - 4y + 15 = 0$

(b) $(y-2) = \frac{1}{2}(x-4)$ (1)
 $x^2 + y^2 - 8x - 4y + 15 = 0$ (2)
 fr(1) $y = \frac{1}{2}x$ (3)
subs (3) into (2)
 $x^2 + \left(\frac{1}{2}x\right)^2 - 8x - 4\left(\frac{1}{2}x\right) + 15 = 0$
 $x^2 - 8x + 12 = 0$
 $x = 2, y = 1$
 $x = 6, y = 3$

16. $(12y)(14x) = 672$
 $2(12y) + 14x + \frac{22}{7}(7x) = 120$
 $y = \frac{4}{x}$
 $2\left(\frac{4}{x}\right) + 3x = 10$
 $(3x-4)(x-2) = 0$
 $x = \frac{4}{3}$
 * $x = 2$ tidak diterima kerana $x \neq y$
 $\frac{1}{2} \times \frac{22}{7} \times \left(7 \times \frac{4}{3}\right)^2 \times t = 61.6$
 $t = 0.45 \text{ m}$

17.(a) $3x + y + z = 5$
 $x + 2y + 2z = 4$
 $5x + y + 3z = 9$

(b) $z = 5 - 3x - y$
 $2x + y = 3$
 $x = \text{RM}1.20$
 $y = \text{RM}0.60$
 $z = \text{RM}0.80$

- 18.(a) Ya kerana ketiga-tiga persamaan mempunyai tiga pembolehubah dan kuasa tertinggi bagi setiap pembolehubah ialah 1.
Yes because the three equations have three variables and the highest power of each variable is 1.

$$\begin{aligned}
 \text{(b)} \quad & 0.2x + 0.4y + 0.3z = 30 \quad (1) \\
 & 0.3x + 0.4y + 0.4z = 40 \quad \dots\dots(2) \\
 & 0.5x + 0.2y + 0.3z = 35 \quad \dots\dots(3) \\
 & (2) - (1) \Rightarrow 0.1x + 0.1z = 10 \\
 & x + z = 100 \quad \dots\dots(4) \\
 & (3) \times 2 \Rightarrow x + 0.4y + 0.6z = 70 \quad \dots\dots(5) \\
 & (5) - (2) \Rightarrow 0.7x + 0.2z = 30 \\
 & 7x + 2z = 300 \quad \dots\dots(6) \\
 & (4) \times 2 \Rightarrow 2x + 2z = 200 \quad \dots\dots(7) \\
 & (6) - (7) \Rightarrow 5x = 100
 \end{aligned}$$

$$x = 20$$

Gantikan $x = 20$ ke dalam (4)

$$20 + z = 100$$

$$z = 80$$

Gantikan $x = 20$ dan $z = 80$ ke dalam (1)

$$0.2(20) + 0.4y + 0.3(80) = 30$$

$$y = 5$$

BAB
4
INDEKS, SURD DAN LOGARITMA
INDICES, SURDS AND LOGARITHMS

1. (a)
$$\frac{(2^2 \times 3)^x \times 3^{x+1}}{2^{2x-3}}$$

$$\frac{2^{2x} \times 3^x \times 3^{x+1}}{2^{2x-3}}$$

$$2^{2x-(2x-3)} \times 3^{x+x+1}$$

$$2^3 \times 3^{2x+1}$$

$$8(3^{2x+1})$$
- (b)
$$(3^2)^{x+1} - 3^{2x+1} + (3^3)^{\frac{2}{3}x}$$

$$3^{2x+2} - 3^{2x+1} + 3^{2x}$$

$$3^{2x} \cdot 9 - 3^{2x} \cdot 3 + 3^{2x}$$

$$3^{2x}(9 - 3 + 1)$$

$$3^{2x}(7)$$
2.
$$\frac{49^{x+1}}{343^{y-2}} = 1$$

$$(7^2)^{x+1} = (7^3)^{y-2}$$

$$7^{2x+2} = 7^{3y-6}$$

$$2x + 2 = 3y - 6$$

$$y = \frac{2x + 8}{3}$$
3.
$$\log_2(3-2x) - 2\log_2 x = \log_2 5.$$

$$\log_2(3-2x) - \log_2 x^2 = \log_2 5$$

$$\log_2 \frac{(3-2x)}{x^2} = \log_2 5$$

$$\frac{3-2x}{x^2} = 5$$

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

$$(5x-3)(x+1) = 0$$

$$x = \frac{3}{5} \text{ or } x = -1 \text{ (Reject)}$$
4. (a)
$$\sqrt{27} - 4\sqrt{5} - \sqrt{20} + 5\sqrt{3} = \sqrt{9 \times 3} - 4\sqrt{5} - \sqrt{4 \times 5} + 5\sqrt{3}$$

$$= 3\sqrt{3} - 4\sqrt{5} - 2\sqrt{5} + 5\sqrt{3}$$

$$= 8\sqrt{3} - 6\sqrt{5}$$
- (b)
$$1 + \frac{1}{\sqrt{3}} = \frac{\sqrt{3}+1}{\sqrt{3}} \text{ and } 1 - \frac{1}{\sqrt{3}} = \frac{\sqrt{3}-1}{\sqrt{3}}$$

$$p = \frac{\sqrt{3}+1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}-1}$$

$$p = \frac{\sqrt{3}+1}{\sqrt{3}-1}$$
 Rationalise the denominator
$$p = \frac{\sqrt{3}+1}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$p = \frac{3+2\sqrt{3}+1}{2}$$

$$p = 2 + \sqrt{3}$$

$$\begin{aligned}
 5. \quad \text{Length of the other side} &= \frac{1+\sqrt{6}}{2\sqrt{3}-\sqrt{2}} \\
 \text{Rationalise the denominator} &= \frac{1+\sqrt{6}}{2\sqrt{3}-\sqrt{2}} \times \frac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}} \\
 &= \frac{2\sqrt{3} + \sqrt{2} + 6\sqrt{2} + 2\sqrt{3}}{10} \\
 &= \frac{4\sqrt{3} + 7\sqrt{2}}{10}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad (a) \quad &\sqrt{64} - \sqrt{27} + 2\sqrt{12} \\
 &8 - 3\sqrt{3} + 4\sqrt{3} \\
 &8 + \sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad &(\sqrt{3} - 2)^2 = 3 - 4\sqrt{3} + 4 \\
 &= 7 - 4\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad (a) \quad &\log_3 \frac{81}{200} = \log_3 \frac{81}{25 \times 8} \\
 &= \log_3 3^4 - \log_3 5^2 - \log_3 2^3 \\
 &= 4 \log_3 3 - 2 \log_3 5 - 3 \log_3 2 \\
 &= 4 - 2y - 3x
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad &\log_x 1372 - \frac{\log_x 2x}{\log_x x^2} = 1 \\
 &\log_x 1372 - 2 \log_x 2x = 1 \\
 &\log_x 1372 - \log_x (2x)^2 = 1 \\
 &\log_x \frac{1372}{4x^2} = 1 \\
 &\frac{1372}{4x^2} = x \\
 &4x^3 = 1372 \\
 &x^3 = 343 \\
 &x = 7
 \end{aligned}$$

$$8. \quad (a) \quad (i) \quad x = 3^u$$

$$\begin{aligned}
 (ii) \quad &\log_3 \frac{9}{x} = \log_3 3^2 - \log_3 x \\
 &= 2 \log_3 3 - u \\
 &= 2 - u
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad &\log_x 27 = \log_x 3^3 \\
 &= 3 \log_x 3 \\
 &= 3 \frac{\log_3 3}{\log_3 x} \\
 &= \frac{3}{u}
 \end{aligned}$$

(b) $(\log_4 y)^2 + 2 \log_4 y - 8 = 0$

Let $\log_4 y = x$

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

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

$x = -4$ or $x = 2$

$\log_4 y = -4$ or $\log_4 y = 2$

$y = 4^{-4}$ or $y = 4^2$

$y = \frac{1}{256}$ or $y = 16$

9. (a) $= 3 \cdot 3^n + 3^n \cdot 2^n + 3^n \cdot 3^3$
 $= 3^n(3 + 2^n + 27)$
 $= 3^n(30 + 2^n)$

Didapati 30 dan 2^n masing-masing ialah gandaan 2. ...

Maka, $3^{1+n} + 6^n + 3^{n+3}$ boleh dibahagi tepat dengan 2 bagi semua integer positif n .

10. (a) $(3^x)^2 - 10(3^x) + 9 = 0$

Let $3^x = y$

$y^2 - 10y + 9 = 0$

$(y - 9)(y - 1) = 0$

$y = 9$ or $y = 1$

$3^x = 9$ or $3^x = 1$

$x = 2$ or $x = 0$

(b) $4^x + 4^x \cdot 4 + 4^x \cdot 16 = 84$

$4^x(21) = 84$

$4^x = 4$

$x = 1$

11. Area triangle $= \frac{1}{2} \times 2^{x-1} \times 2^{(x-2)^2}$

$= 2^{-1+x-1+x^2-4x+4}$

$= 2^{x^2-3x+2}$

Area rectangle $= (2^{x-2})^2$

$= 2^{2x-4}$

$2^{x^2-3x+2} = 2^{2x-4}$

$x^2 - 3x + 2 = 2x - 4$

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

$(x - 3)(x - 2) = 0$

$x = 3$ or $x = 2$

$$\begin{aligned}
 12. \quad 2 \log_2 \frac{y}{x} &= 2 + 2 \log_2 x & 2(4x^4) - 6(2x^2) &= 20x^2 \\
 \log_2 \left(\frac{y}{x}\right)^2 - \log_2 x^2 &= 2 & 8x^4 - 12x^2 &= 20x^2 \\
 \log_2 \frac{y^2}{x^4} &= 2 & 8x^4 - 32x^2 &= 0 \\
 y^2 &= 2^2 \times x^4 = 4x^4 & 8x^2(x^2 - 4) &= 0 \\
 y &= 2x^2 & 8x^2(x-2)(x+2) &= 0 \\
 & & x = 0 \text{ (Reject) or } x = 2 \text{ or } x = -2 \text{ (Reject)} & \\
 & & \text{Hence, } y = 8 &
 \end{aligned}$$

$$\begin{aligned}
 13. \quad (a) \quad & \frac{6}{\sqrt{12}} + \frac{1}{\sqrt{3+2}} - 3 \sqrt{\frac{1}{3}} \\
 &= \frac{6}{2\sqrt{3}} + \frac{1}{\sqrt{3+2}} - \frac{3}{\sqrt{3}} \\
 &= \frac{3}{\sqrt{3}} + \frac{1}{\sqrt{3+2}} - \frac{3}{\sqrt{3}} \\
 &= \frac{1}{\sqrt{3+2}} \times \frac{\sqrt{3}-2}{\sqrt{3}-2} \\
 &= \frac{\sqrt{3}-2}{-1} \\
 &= 2 - \sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad & \frac{1}{\sqrt{2}-1} + \frac{2}{\sqrt{5}+\sqrt{3}} - \frac{3}{\sqrt{5}-\sqrt{2}} \\
 &= \frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} + \frac{2}{\sqrt{5}+\sqrt{3}} \times \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}-\sqrt{3}} - \frac{3}{\sqrt{5}-\sqrt{2}} \times \frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}+\sqrt{2}} \\
 &= \frac{\sqrt{2}+1}{2-1} + \frac{2(\sqrt{5}-\sqrt{3})}{5-3} - \frac{3(\sqrt{5}+\sqrt{2})}{5-2} \\
 &= \frac{\sqrt{2}+1}{1} + \frac{2(\sqrt{5}-\sqrt{3})}{2} - \frac{3(\sqrt{5}+\sqrt{2})}{3} \\
 &= \sqrt{2} + 1 + (\sqrt{5} - \sqrt{3}) - (\sqrt{5} + \sqrt{2}) \\
 &= 1 - \sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 14. \quad (a) \quad \log_{10} 25 &= \log_{10} \frac{100}{4} \\
 &= \log_{10} 10^2 - \log_{10} 2^2 \\
 &= 2 \log_{10} 10 - 2 \log_{10} 2 \\
 &= 2 - 2a
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad \log_{10} 50 &= \log_{10} \sqrt{25} \times 10 \\
 &= \log_{10} 25^{\frac{1}{2}} + \log_{10} 10 \\
 &= \frac{1}{2} \log_{10} 25 + 1 \\
 &= \frac{1}{2} p + 1
 \end{aligned}$$

15. (a) $16^{x-1} = 1$
 $\frac{16^x}{16^1} = 1$
 $16^x = 16^1$
 $x = 1$
- (b) $2\log_3 p = \log_3 48 - 1$
 $\log_3 p^2 = \log_3(3 \times 16) - 1$
 $= \log_3 3 + \log_3 16 - 1$
 $= 1 + \log_3 16 - 1$
 $= \log_3 16$
 $p^2 = 16$
 $p = 4$
- c) $\log_2 2x = 2 + \log_2(x - 4)$
 $\log_2 2x = \log_2 2^2 + \log_2(x - 4)$
 $\log_2 2x = \log_2 2^2(x - 4)$
 $\log_2 2x = \log_2 4(x - 4)$
 $2x = 4(x - 4)$
 $x = 2(x - 4)$
 $x = 8$
16. (a) $2^x \cdot 9^x = 2^{1-x} \cdot 3^{x-1}$
 $2^x \cdot 9^x = \frac{2^1 \cdot 3^x}{2^x \cdot 3^1}$
 $2^x \cdot 3^{2x} = \frac{2^1 \cdot 3^x}{3^1 \cdot 2^x}$
 $2^x \cdot 3^{2x} \cdot \frac{2^x}{3^x} = \frac{2}{3}$
 $2^{x+x} \cdot 3^{2x-x} = \frac{2}{3}$
 $2^{2x} \cdot 3^x = \frac{2}{3}$
 $(2^2 \cdot 3)^x = \frac{2}{3}$
 $12^x = \frac{2}{3}$
- (b) $4^x - 1 = \frac{4}{3}(2^x)$
 $2^{2x} - 1 = \frac{4}{3}(2^x)$
 $a^2 - 1 = \frac{4}{3}(a)$
 $3a^2 - 3 = 4a$
 $3a^2 - 4a - 3 = 0$
 $a = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-3)}}{2(3)}$
 $a = 1.869 \text{ atau } -0.5352$
 $2^x = 1.869, 2^x \neq 1.869 \text{ (diabaikan)}$
 $x = 0.90$
17. $5^{2k}(5^h) = 10 + 5^{2k}$
 $pq = 10 + p$
 $p(q - 1) = 10$
 $p = \frac{10}{q - 1}$

18. (a) $P(6) = 50 \times 3^{0.5(6)}$
 $= 1350$

(b) $P(n) > 12\,000$
 $50 \times 3^{0.5(n)} > 12\,000$
 $3^{0.5n} > 240$
 $\log_{10}(3^{0.5n}) > \log_{10} 240$
 $0.5n > \frac{\log_{10} 240}{\log_{10} 3}$
 $n > 9.977$

Maka, $n=10$ / Tahun ke-10.

(c) $P_0 \times 3^{0.5(8)} = 6075$
 $P_0 = \frac{6075}{3^4}$
 $= 75$

19. $\frac{p(\sqrt{5}-1)+4(\sqrt{5}+1)}{(\sqrt{5}+1)(\sqrt{5}-1)} = q + 4\sqrt{5}$
 $p\sqrt{5} - p + 4\sqrt{5} + 4 = 4(q + 4\sqrt{5})$
 $(p + 4)\sqrt{5} + 4 - p = 4q + 16\sqrt{5}$
 $p + 4 = 16 \quad 4 - p = 4q$
 $p = 12 \quad 4 - 12 = 4q$
 $q = -2$

20. (a) $I(t) = 22 \times 3^{-0}$
 $I(t) = 22 \times 1$
 $= 22 \text{ ampere}$

(b) i) $I(1) = 22 \times 3^{-1}$
 $I(t) = 22 \times \frac{1}{3}$
 $= \frac{22}{3}$ atau 7.333 ampere

ii) $I(5) = 22 \times 3^{-5}$
 $I(t) = 22 \times \frac{1}{3^5}$
 $= 0.091 \text{ ampere}$

(c) $22 \times 3^{-t} > \frac{1}{4}$
 $3^{-t} > \frac{1}{88}$
 $3^t < 88$
 $\log_{10} 3^t < \log_{10} 88$
 $t < 4.075$

Maka, masa yang diambil ialah 4 saat

$$\begin{aligned}
 21. \quad X &= q^n \\
 q &= X^{\frac{1}{n}} \\
 \log_{pq} \sqrt{X} &= \log_{pq} X^{\frac{1}{2}} \\
 &= \frac{1}{2} \log_{pq} X \\
 &= \frac{1}{2} \left(\frac{\log_p X}{\log_p pq} \right) \\
 &= \frac{1}{2} \left(\frac{m}{\log_p p + \log_p q} \right) \\
 &= \frac{1}{2} \left(\frac{m}{1 + \log_p X^{\frac{1}{n}}} \right) \\
 &= \frac{1}{2} \left(\frac{m}{1 + \frac{1}{n} \log_p X} \right) = \frac{1}{2} \left(\frac{m}{1 + \frac{1}{n}(m)} \right) = \frac{1}{2} \left(\frac{mn}{m+n} \right)
 \end{aligned}$$

$$\begin{aligned}
 22. \quad (a) \quad (i) \quad &12000(1.03)^{15} \\
 &= 18\,695.61 \\
 &= \text{RM } 18\,696
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad &12\,000(1.03)^t > 21\,000 \\
 &(1.03)^t > 1.75 \\
 &\log_{10} (1.03)^t > \log_{10} 1.75 \\
 &t > \frac{\log_{10} 1.75}{\log_{10} 1.03} \\
 &t > 18.93
 \end{aligned}$$

Maka, $t = 19$ / tahun ke-19.

$$\begin{aligned}
 (b) \quad &\log_x 9 + \log_3 x = 3 \\
 &\frac{\log_3 9}{\log_3 x} + \log_3 x = 3 \\
 &\frac{2 \log_3 3}{\log_3 x} + \log_3 x = 3 \\
 &\frac{2}{\log_3 x} + \log_3 x = 3 \\
 &2 + (\log_3 x)^2 = 3 \log_3 x \\
 &(\log_3 x)^2 - 3 \log_3 x + 2 = 0 \\
 &(\log_3 x - 1)(\log_3 x - 2) = 0 \\
 &(\log_3 x - 1) = 0 \quad \text{atau} \quad (\log_3 x - 2) = 0 \\
 &\log_3 x = 1 \qquad \qquad \log_3 x = 2 \\
 &x = 3^1 \qquad \qquad \qquad x = 3^2 \\
 &x = 3 \qquad \qquad \qquad x = 9
 \end{aligned}$$

23. (a) $\frac{3^{3(x+y)}}{3^{2x}}$
 $= 3^{3x+3y-2x}$
 $= 3^{x+3y}$
 $= 3^x(3^y)^3$
 $= pq^3$
- (b) $\log_9 9p^2 - \log_9 q$
 $= \log_9 9 + \log_9 p^2 - \log_9 q$
 $= 1 + \frac{\log_3 p^2}{\log_3 9} - \frac{\log_3 q}{\log_3 9}$
 $= 1 + \frac{2x}{2} - \frac{y}{2}$
 $= 1 + x - \frac{1}{2}y$
24. (a) $\log_3(3x-1) - 4\left(\frac{\log_3 x^2}{\log_3 9}\right) + \log_3 x^3$
 $= \log_3(3x-1) - 2\log_3 x^2 + \log_3 x^3$
 $= \log_3 \frac{(3x-1)x^3}{x^4}$
 $= \log_3 \left(\frac{3x-1}{x}\right)$
 $\frac{3x-1}{x} = 3^{-1} = \frac{1}{3}$
 $9x - 3 = x$
 $x = \frac{3}{8}$
25. (a) $3\log_2 m + 2\log_2 p = 21$
 $3\log_2 m + 2(4\log_2 m - 17) = 21$
 $11\log_2 m = 55$
 $\log_2 m = 5$
 $m = 2^5$
 $m = 32$
- $4\log_2 m - \log_2 p = 17$
 $\log_2 p = 4\log_2 m - 17$
 $\log_2 p = 4(5) - 17$
 $\log_2 p = 3$
 $p = 2^3$
 $p = 8$
- (b) $3^{2x} 3^y = 1$
 $3^{2x+y} = 3^0$
 $2x + y = 0$
 $y = -2x$
 $y = -2\left(\frac{2}{7}\right)$
 $y = -\frac{4}{7}$
- $2^{3x} = 2^2 2^{2y}$
 $2^{3x} = 2^{2+2y}$
 $3x = 2 + 2y$
 $3x = 2 + 2(-2x)$
 $7x = 2$
 $x = \frac{2}{7}$
26. (a) (i) $S = 25000(1.051)^x$
 $\frac{S}{25000} = 1.051^x$
 $\log_{1.023} \frac{S}{25000} = x$
 OR
 $S = 25000(1.051)^x$
 $\log_{10} S = \log_{10} 25000(1.051)^x$
 $\log_{10} S = \log_{10} 25000 + x \log_{10} 1.051$
- (ii) $25000(1.023)^x > 45000$
 $x > \log_{1.051} \frac{45000}{25000}$

$$\begin{aligned}
 x &> \frac{\log_{10} 1.8}{\log_{10} 1.051} \\
 x &> 11.82 \\
 x &= 12 \text{ years}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } MV &= P\left(1 + \frac{r}{n}\right)^{nt} \\
 17000 &= 10500\left(1 + \frac{0.05}{1}\right)^{1t} \\
 \frac{17000}{10500} &= 1.05^t \\
 \ln \frac{17000}{10500} &= \ln 1.05^t \\
 \ln 17000 - \ln 10500 &= t \ln 1.05 \\
 t &= \frac{\ln 17000 - \ln 10500}{\ln 1.05} \\
 t &= 9.88 \quad t = 10 \text{ years}
 \end{aligned}$$

$$\begin{aligned}
 27. \quad \text{(a) } \log_5(5^{p+1} - 16) &= p \\
 5^p \cdot 5 - 16 &= 5^p \\
 5^p \cdot 5 - 5^p &= 16 \\
 5^p(5 - 1) &= 16 \\
 5^p &= 4 \\
 \log_{10} 5^p &= \log_{10} 4 \\
 p \log_{10} 5 &= \log_{10} 4 \\
 p &= \frac{\log_{10} 4}{\log_{10} 5} \\
 p &= 0.8614
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } 4^a &= 6^b = 24^c \\
 \text{Let } 4^a &= k, \quad 6^b = k \text{ and } 24^c = k \\
 4 &= k^{\frac{1}{a}}, \quad 6 = k^{\frac{1}{b}} \text{ and } 24 = k^{\frac{1}{c}} \\
 24 &= 4 \times 6 \\
 k^{\frac{1}{c}} &= k^{\frac{1}{a}} \times k^{\frac{1}{b}} \\
 k^{\frac{1}{c}} &= k^{\frac{1}{a} + \frac{1}{b}} \\
 \frac{1}{c} &= \frac{1}{a} + \frac{1}{b} \\
 \frac{1}{c} &= \frac{a+b}{ab} \\
 c &= \frac{ab}{a+b}
 \end{aligned}$$

$$28. \quad \text{(a) } m > 1$$

$$\begin{aligned}
 \text{(b) } \frac{27^{p+2q}}{9^p} &= \frac{(3^3)^{p+2q}}{(3^2)^p} \\
 &= \frac{3^{3p} \times 3^{6q}}{3^{2p}} \\
 &= \frac{(3^p)^3 \times (3^q)^6}{(3^p)^2} \\
 &= 3^p \times (3^q)^6 \\
 &= xy^6
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & \frac{1}{x+\sqrt{3}} + \frac{1}{x-\sqrt{3}} = 4 \\
 & \frac{x-\sqrt{3}+x+\sqrt{3}}{x^2-3} = 4 \\
 & 2x = 4(x^2 - 3) \\
 & 2x = 4x^2 - 12 \\
 & 4x^2 - 2x - 12 = 0 \\
 & 2x^2 - x - 6 = 0 \\
 & (2x + 3)(x - 2) = 0 \\
 & x = -\frac{3}{2} \text{ or } x = 2
 \end{aligned}$$

$$\begin{aligned}
 29. \quad \text{(a)} \quad & 5^{3m} = 9(3^{2m}) \\
 & \frac{5^{3m}}{3^{2m}} = 9 \\
 & \left(\frac{125}{9}\right)^m = 9 \\
 & \log_x \left(\frac{125}{9}\right)^m = \log_x 9 \\
 & m \log_x \frac{125}{9} = \log_x 9 \quad (\text{Shown})
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & \log_x 1372 - \log_{\sqrt{x}} 2x = 1 \\
 & \log_x 1372 - \frac{\log_x 2x}{\log_x x^{\frac{1}{2}}} = 1 \\
 & \log_x 1372 - 2 \log_x 2x = 1 \\
 & \log_x 1372 - \log_x (2x)^2 = 1 \\
 & \log_x \frac{1372}{4x^2} = 1 \\
 & \frac{1372}{4x^2} = x \\
 & 1372 = 4x^3 \\
 & x^3 = 343 \\
 & x = 7
 \end{aligned}$$

BAB 5

JANJANG PROGRESSION

1. (a) $3k + 2 - (k + 4) = 10 - (3k + 2)$

$$3k + 2 - k - 4 = 10 - 3k - 2$$

$$2k - 2 = 8 - 3k$$

$$2k + 3k = 8 + 2$$

$$5k = 10$$

$$k = 2$$

(b) $S_{20} = \frac{n}{2} [2a + (n - 1) d]$

$$S_{20} = \frac{20}{2} [2(6) + 19(2)]$$

$$= 10 [12 + 38]$$

$$= 10 [50]$$

$$= 500$$

2. (a) Jujukan jumlah ketebalan buku : 3, 5, 7,...

$$a = 3, d = 2$$

Jumlah ketebalan buku pada kedudukan ke-11

$$= 3 + (11 - 1)(2)$$

$$= 23$$

(b) $T_n = 31$

$$31 = 3 + (n - 1)(2)$$

$$n - 1 = 14$$

$$n = 15$$

Maka, bilangan buku yang telah disusun ialah 15 buah.

3. (a) $a = 12 \times 400$

$$= 4800$$

$$d = 12 \times 100$$

$$= 1200$$

$$S_6 = \frac{6}{2} [2(4800) + (6 - 1)(1200)]$$

$$= 3(9600 + 6000)$$

$$= 46800$$

$$\text{Jumlah simpanan} = \text{RM } 46800$$

4. Jujukan perimeter segiempat sama : 12, 28, 44,

Panjang tali, $S_n = 1404 \text{ cm}$

$$S_n = \frac{n}{2}[2(12) + (n-1)(16)] = 1404$$

$$n(24 + 16n - 16) = 2808$$

$$2n^2 + n - 351 = 0$$

$$(n-13)(2n+27) = 0$$

$$n = 13 \text{ atau } n = -13.5$$

Sharvin boleh membentuk 13 buah segiempat sama

5. $S_1 = \frac{1}{4}\left[5 + \frac{3}{2}(1)\right] = \frac{13}{8}$

$$S_2 = \frac{2}{4}\left[5 + \frac{3}{2}(2)\right] = 4$$

$$T_2 = 4 - \frac{13}{8} = \frac{19}{8}$$

$$a = \frac{13}{8}$$

$$d = \frac{19}{8} - \frac{13}{8} = \frac{3}{4}$$

$$S_{18} = \frac{18}{4}\left[5 + \frac{3}{2}(18)\right] = 144$$

$$S_4 = \frac{4}{4}\left[5 + \frac{3}{2}(4)\right] = 11$$

$$S_{18} - S_4 = 144 - 11 = 133$$

6. $77 + (n-1)(11) < 250$

$$n = 16$$

$$\frac{179}{2}[2(71) + 178(1)] - \frac{16}{2}[2(77) + 15(11)]$$

$$26088$$

7. (a) P : 180, 165, 150, d = -15

Q : x, x-4, x-8,.....

$$T_n = 0$$

$$a + (n - 1) d = 0$$

$$180 - (n - 1)(-15) = 0$$

$$n - 1 = \frac{-180}{-15}$$

$$n - 1 = 12$$

$$n = 13$$

(b) $T_{13} = a + (n - 1)d = 0$

$$x + 12(-4) = 0$$

$$x = 48$$

(c) $P: S_{13} = \frac{13}{2} [2(180) + 12(-15)]$

$$= 1170 \text{ cm}$$

$$Q: S_{13} = \frac{13}{2} [2(48) + 12(-4)]$$

$$= 312 \text{ cm}$$

Beza / Difference

$$1170 \text{ cm} - 312 \text{ cm} = 858 \text{ cm}$$

8. a) $S_6 = 105$

$$\frac{6}{2}(2a + 5d) = 105$$

$$(2a + 5d) = 35 \text{ --- (1)}$$

$$S_6 - T_4 = 89$$

$$105 - T_4 = 89$$

$$T_4 = 16$$

$$a + 3d = 16 \text{ --- (2)}$$

$$a = 16 - 3d \text{ ----- (3)}$$

Gantikan (3) dalam (1)

$$2(16- 3d) + 5d = 35$$

$$32 - 6d + 5d = 35$$

$$-d = 3$$

$$d = -3$$

$$a = 16 - 3(-3)$$

$$a = 25$$

9. (a) 18, 22, 26, k, ...

Janjang itu ialah janjang aritmetik dengan

The progression is an arithmetic progression with

$$a = 18, d = 22-18 = 4$$

(b) $T_4 = a + 3d$

$$k = 18 + 3(4)$$

$$k = 30$$

(c) $S_{10} = \frac{10}{2} [2(18) + 9(4)] = 360$ atau

$$S_{10} = 360 \text{ (Sudut bagi putaran lengkap suatu bulatan ialah } 360^\circ \text{.)}$$

(The angle of the complete cycle of a circle is } 360^\circ \text{.)}

10. $ar^2 = 30$ -----(1)

$$ar^2 + ar^3 = 45$$

$$ar^2(1+r) = 45$$
------(2)

$$\frac{(2)}{(1)} \quad 1+r = \frac{45}{30} = \frac{3}{2}$$

$$r = \frac{1}{2}$$

$$a\left(\frac{1}{4}\right) = 30$$

$$a = 120$$

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

$$= \frac{120}{\frac{1}{2}}$$

$$= 240$$

11. $a+1 = 92, d = -2, S_n = 598$

$$S_n = \frac{n}{2}(a+1)$$

$$598 = \frac{n}{2}(92)$$

$$n = 13$$

$$598 = \frac{13}{2}[2a + (13-1)(-2)]$$

$$a = 58$$

$$T_n = 44$$

$$58 + (n-1)(-2) = 44$$

$$n = 8$$

12. (a) En. Ali : $x, x+y, x+2y, \dots$

$$T_8 = x + 7y = 240 \text{ -----(1)}$$

$$T_{15} = x + 14y = 380 \text{ -----(2)}$$

$$(2) - (1) \quad 7y = 140$$

$$y = 20$$

$$x + 7(20) = 240$$

$$x = 100$$

(b) En. Tan : 200, 210, 220, ... $T_n = 200 + (n-1)(10) \text{ -----(1)}$

En Ali : 100, 120, 140, ... $T_n = 100 + (n-1)(20) \text{ -----(2)}$

$$(1) = (2) \quad 200 + (n-1)(10) = 100 + (n-1)(20)$$

$$10(n-1) = 100$$

$$n = 11$$

13. (a) $S_\infty = \frac{a}{1-r}$

$$= \frac{10,000}{1-0.9}$$

$$= 100\,000 \text{ kg}$$

b) (i) $T_n \geq 1000$

$$10000(0.9)^{n-1} \geq 1000$$

$$(n-1) \log 0.9 \geq \log 0.1$$

$$n \leq 22.85$$

$$n=22$$

$$\begin{aligned} \text{b) (ii) } S_{22} &= \frac{a(1-r^n)}{1-r} \\ &= \frac{10000(1-0.9^{22})}{1-0.9} \\ &= 90152 \text{ kg} \end{aligned}$$

14. (a) 180000 , 214020 , 254469.78 , ...

$$r = \frac{214020}{180000} = 1.189$$

$$\begin{aligned} \text{Thn 2017} &= T_6 \\ &= 180000 (1.189)^5 \\ &= 427741 \end{aligned}$$

(b) $T_n > 720000$

$$\begin{aligned} 180000 (1.189)^n &> 720000 \\ (1.189)^n &> 4 \\ n &> \frac{\log_{10} 4}{\log_{10} 1.189} \\ n &> 8 \\ n &= 9 \end{aligned}$$

(c) $S_7 = \frac{180000 ((1.189)^7 - 1)}{1.189 - 1}$
 $= 2247131$

15. (a) $a = 96 \text{ cm}^3$
 $T_3 = 69.36 \text{ cm}^3$
 $ar^2 = 69.36$
 $96r^2 = 69.36$
 $r^2 = 0.7225$
 $r = 0.85$

(b) $T_8 = ar^7$
 $= 96(0.85)^7$
 $= 30.78 \text{ cm}^3$

$$\begin{aligned}
 \text{(c) } S_n &> 530 \\
 \frac{96(1-0.85^n)}{1-0.85} &> 530 \\
 n \log_{10} 0.85 &> \log_{10} 0.1719 \\
 n &> 10.83 \\
 n &= 11
 \end{aligned}$$

$$16. \quad \text{(a) } K=4, r = \frac{1}{5} \left(4 - \frac{6}{4}\right) = \frac{1}{2}$$

$$\begin{aligned}
 S_n &= \frac{a(1-r^n)}{1-r} = 31 \\
 16 \left[1 - \left(\frac{1}{2}\right)^n\right] &= \frac{31}{2} \\
 1 - \left(\frac{1}{2}\right)^n &= \frac{31}{32} \\
 \frac{1}{32} &= \left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^5 \dots \\
 \therefore n &= 5
 \end{aligned}$$

$$\text{(b) } k=2, r = \frac{1}{5}(2-3) = -\frac{1}{5}$$

$$\begin{aligned}
 S_\infty &= \frac{16}{1 - \left(-\frac{1}{5}\right)} \\
 &= \frac{40}{3}
 \end{aligned}$$

$$17. \quad \text{(a) } v=0.0048, w = 0.000048$$

$$\text{(b) } r = \frac{0.0048}{0.48} = 0.01$$

$$18. \quad \text{(a) } T_5 = 3T_2$$

$$\begin{aligned}
 a+4d &= 3(a+d) \\
 a+4d &= 3+3d \\
 d &= 2a
 \end{aligned}$$

$$\begin{aligned}
 S_4 &= \frac{4}{2}(2a+3d) \\
 &= 2(2a+6a) \\
 &= 16a
 \end{aligned}$$

$$\begin{aligned}
 S_8 &= \frac{8}{2}(2a+7d) \\
 &= 4(2a+14a) \\
 &= 4S_4
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) (i)} \quad T_n &< 300 \\
 68 + (n - 1)(5) &< 300 \\
 (n - 1)(5) &< 232 \\
 (n - 1) &< 46.4 \\
 n &< 47.4
 \end{aligned}$$

Bilangan kerusi maksimum yang dapat disimpan di dalam stor ialah 47 buah.

$$\begin{aligned}
 \text{(ii)} \quad &47, 45, 43, \dots \\
 a = 47, \quad d &= -2 \\
 S_n = \frac{15}{2} [2(47) + 14(-2)] \\
 &= 495
 \end{aligned}$$

Tidak setuju kerana jumlah bilangan kerusi yang ada di stor ialah 495 buah.

$$\begin{aligned}
 19. \quad \text{(a) beza sepunya, } d &= y - 3 - y \\
 &= -3
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad T_8 &= y \\
 a + 7(-3) &= y \\
 a - 21 &= y \\
 a &= y + 21
 \end{aligned}$$

$$\begin{aligned}
 S_{10} &= \frac{10}{2} [2(y + 21) + 9(-3)] \\
 &= 5(2y + 15)
 \end{aligned}$$

$$\begin{aligned}
 20. \quad &2.5, 4, 5.5, \dots \\
 a &= 2.5, d = 1.5
 \end{aligned}$$

$$\begin{aligned}
 \text{(a)} \quad T_{15} &= 2.5 + 14(1.5) \\
 &= 23.5 \text{ cm}
 \end{aligned}$$

$$(b) \quad S_n > 300$$

$$\frac{n}{2} [2(2.5) + (n-1)(1.5)] > 300$$

$$n(3.5 + 1.5n) > 600$$

$$1.5n^2 + 3.5n - 600 > 0$$

$$n = \frac{-3.5 \pm \sqrt{[3.5^2 - 4(1.5)(-600)]}}{2(1.5)}$$

$$n = 18.87 \quad , \quad n = -21.20 \text{ (abaikan)}$$

Bilangan lilitan bulatan minimum yang dapat dibentuk ialah 18

21. (a) $x, x + 0.1x, \dots$

$$r = \frac{x + 0.1x}{x}$$

$$= 1.1$$

$$T_n = x(1.1)^{n-1}$$

(b) $2x, 2x + 0.1x, \dots$

$$r = \frac{2.1x}{2x} = 1.05$$

$$T_n = 2x(1.05)^{n-1}$$

(c) $T_{\text{apple}} > T_{\text{mitox}}$

$$x(1.1)^{n-1} > 2x(1.05)^{n-1}$$

$$\log_{10} x + (n-1) \log_{10} 1.1 > \log_{10} 2x + (n-1) \log_{10} 1.05$$

$$n > 15.9$$

$$n = 16$$

BAB 6

HUKUM LINEAR LINEAR LAW

1.

$$(a) \quad ax^2 = x^2y - by$$

$$\frac{ax^2}{x^2y} = \frac{x^2y}{x^2y} - \frac{by}{x^2y}$$

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

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

$$\frac{1}{a} = 2$$

$$a = \frac{1}{2}$$

$$(b) \quad -\frac{b}{a} = \frac{6-2}{5-0}$$

$$-\frac{b}{1} = \frac{4}{5}$$

$$b = -\frac{2}{5}$$

2.

$$(a) \quad y = 1000a^x$$

$$\log_{10} y = \log_{10} 1000a^x$$

$$\log_{10} y = \log_{10} 1000 + \log_{10} a^x$$

$$\log_{10} y = 3 + x \log_{10} a$$

$$\log_{10} y = \log_{10} a(x) + 3$$

$$(b) \quad b = 3$$

$$\log_{10} a = \frac{1-3}{1-0}$$

$$\log_{10} a = -2$$

$$a = 10^{-2} @ \frac{1}{100} @ 0.01$$

$$3. \log_e P = \log_e 6.4 + 0.0187 t$$

$$\log_e P = \log_e 6.4 + 0.0187 (25)$$

$$\log_e \left(\frac{P}{6.4} \right) = 0.4675$$

$$\frac{P}{6.4} = 2.718^{0.4675}$$

$$P = 10.214 \text{ bilion}$$

$$4. (2, 9) \text{ atau } (6, 1)$$

$$\text{Kecerunan} = \frac{9-1}{2-6}$$

$$\frac{p-1}{4-6} = \frac{9-1}{2-6}$$

$$p = 5$$

5.

$$(a) y = px^2 + qx$$

pada (1, 5)

$$5 = p(1)^2 + q(1)$$

$$p + q = 5 \dots\dots(1)$$

Pada (3,33)

$$33 = p(3)^2 + q(3)$$

$$9p + 3q = 33 \dots\dots(2)$$

Menggunakan penyelesaian persamaan linear serentak;

$$p = 3$$

$$q = 2$$

(b) $y = 3x^2 + 2x$

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

$$a = 2, \quad \frac{14-2}{b-0} = 3$$

$$b = 4$$

atau

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

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

$$a = 3, \quad \frac{14-3}{b} = 2$$

$$b = \frac{11}{2}$$

6.

$$y^2 = m(xy) + c \dots \dots \dots (1)$$

gantikan titik (2,12) → (1)

$$12 = m(2) + c \dots \dots \dots (2)$$

bahagikan (1) dengan y^2

$$1 = m\left(\frac{x}{y}\right) + c\left(\frac{1}{y^2}\right) \dots \dots \dots (3)$$

gantikan titik (4,-7) → (3)

$$1 = m(4) + c(-7) \dots \dots \dots (4)$$

Selesaikan persamaan serentak bagi (2) dan (4)

$$m = \frac{85}{18}, \quad c = \frac{23}{9}$$

$$y^2 = \frac{85}{18}(xy) + \frac{23}{9}$$

7.

$$y = mx^2 + 3x + 5n$$

$$y - 3x = mx^2 + 5n$$

$$m = \frac{3 - (-5)}{4 - 0}$$

$$m = 2$$

$$5n = -5$$

$$n = -1$$

8.

$$(a) \sqrt{(12-0)^2 + (11-y)^2} = 15$$

$$y = 2$$

$$K(0, 2)$$

$$(b) m = \frac{11-2}{12-0}$$

$$m = \frac{3}{4}$$

$$c = 2$$

$$\log_{10} y = \frac{3}{4} \log_{10} x + 2$$

$$y = 100x^{\frac{3}{4}}$$

$$(c) y = 100(16)^{\frac{3}{4}}$$

$$y = 800$$

$$(d) 2700 = 100x^{\frac{3}{4}}$$

$$x = 81$$

9.

$$(a) \quad (i) \quad m = \frac{7-3}{2-6}$$

$$m = -1$$

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

$$7 = -2 + c$$

$$c = 9$$

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

$$(ii) \quad y = -x^3 + 9x$$

$$(b) \quad -7 = -x^2 + 9$$

$$x^2 = 16$$

$$x = 4, x = -4$$

10.

$$(a) \quad p\sqrt{q} = hp + k$$

$$Y = p\sqrt{q}, \quad X = q, \quad m = h, \quad c = k$$

$$(b) \quad cx + dy = xy$$

$$\frac{x}{y} = \frac{x}{c} - \frac{d}{c}$$

$$m = \frac{1}{c}, \quad \text{pintasan } y = -\frac{d}{c}$$

$$\frac{1}{c} = \frac{3 - \frac{1}{3}}{4 - 0}$$

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

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

11.

$$(a) \quad m = \frac{12-4}{12-4}$$

$$m = 1$$

$$12 = 1(12) + c$$

$$c = 0$$

$$\frac{y}{x} = x^2$$

$$y = x^3$$

$$(b) \quad 8 = \frac{p(1)}{q(1)+2}$$

$$8q + 16 = p$$

$$y = \frac{px}{qx+2}$$

$$\frac{1}{y} = \frac{2}{px} + \frac{q}{p}$$

$$\frac{2}{p} = \frac{1}{6}$$

$$p = 12$$

$$8q + 16 = 12$$

$$q = -\frac{1}{2}$$

12.

$$y^2 = \frac{(x-1)^2}{p} + \frac{2q}{p}$$

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

$$\frac{1}{p} = \frac{7-3}{2-0}$$

$$p = \frac{1}{2}$$

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

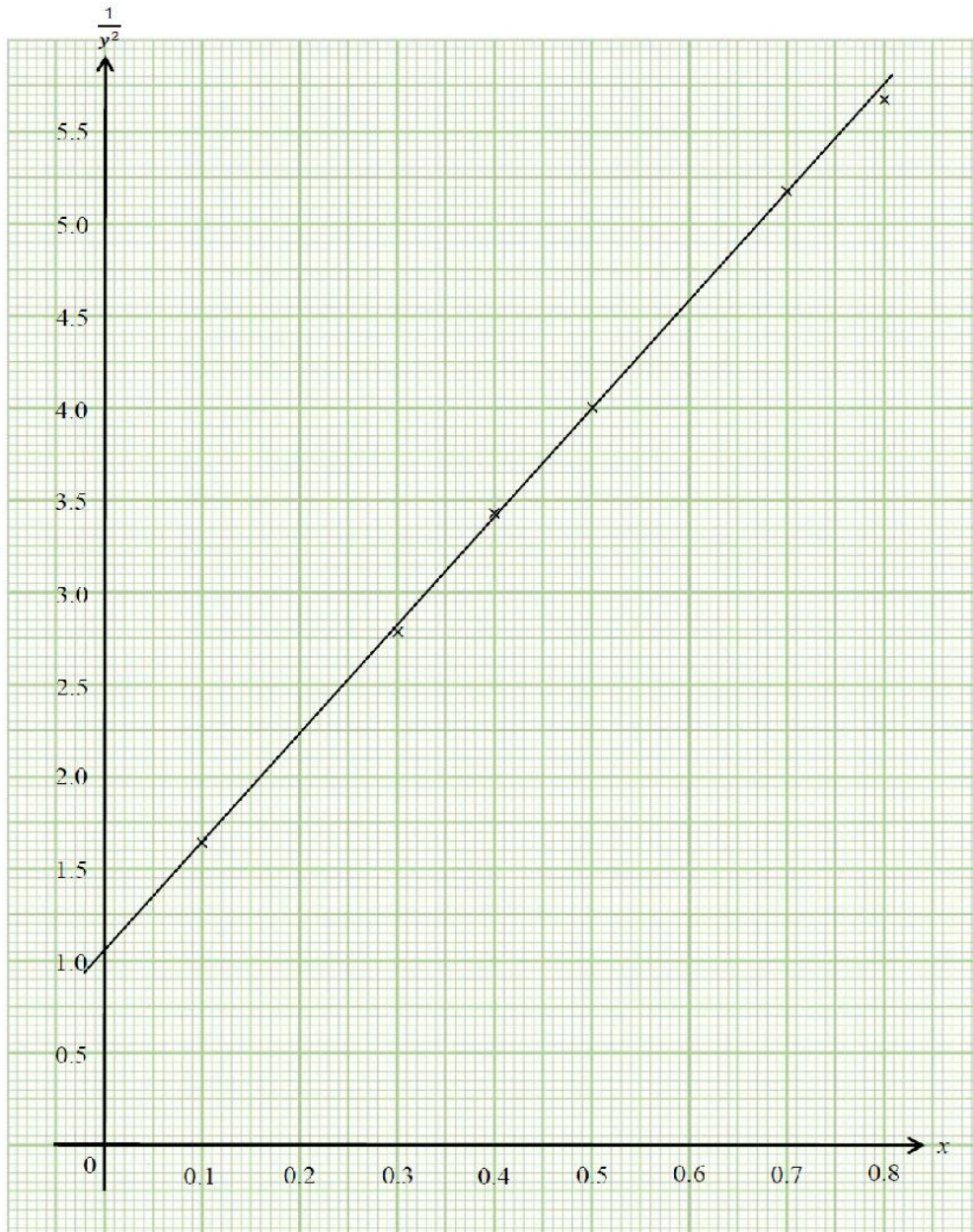
$$3 = \frac{2q}{\frac{1}{2}}$$

$$q = \frac{3}{4}$$

13.

(a)

x	0.1	0.3	0.4	0.5	0.7	0.8
$\frac{1}{y^2}$	1.64	2.78	3.43	4.00	5.17	5.67



(b) $\frac{1}{y^2} = \frac{1}{r}(x) + \frac{s}{r}$

(i) $0.17 \leq r \leq 0.18$

(ii) $0.18 \leq s \leq 0.19$

14. (a)

$\frac{1}{x^2}$	1.56	1.00	0.69	0.51	0.39	0.25
$\frac{y}{x}$	5.00	18.00	25.00	29.25	32.50	35.25

(b) rujuk graf

$$(c) \quad (i) \quad ay = \frac{b}{x} + x$$

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

$$\frac{1}{a} = 41$$

$$a = 0.024$$

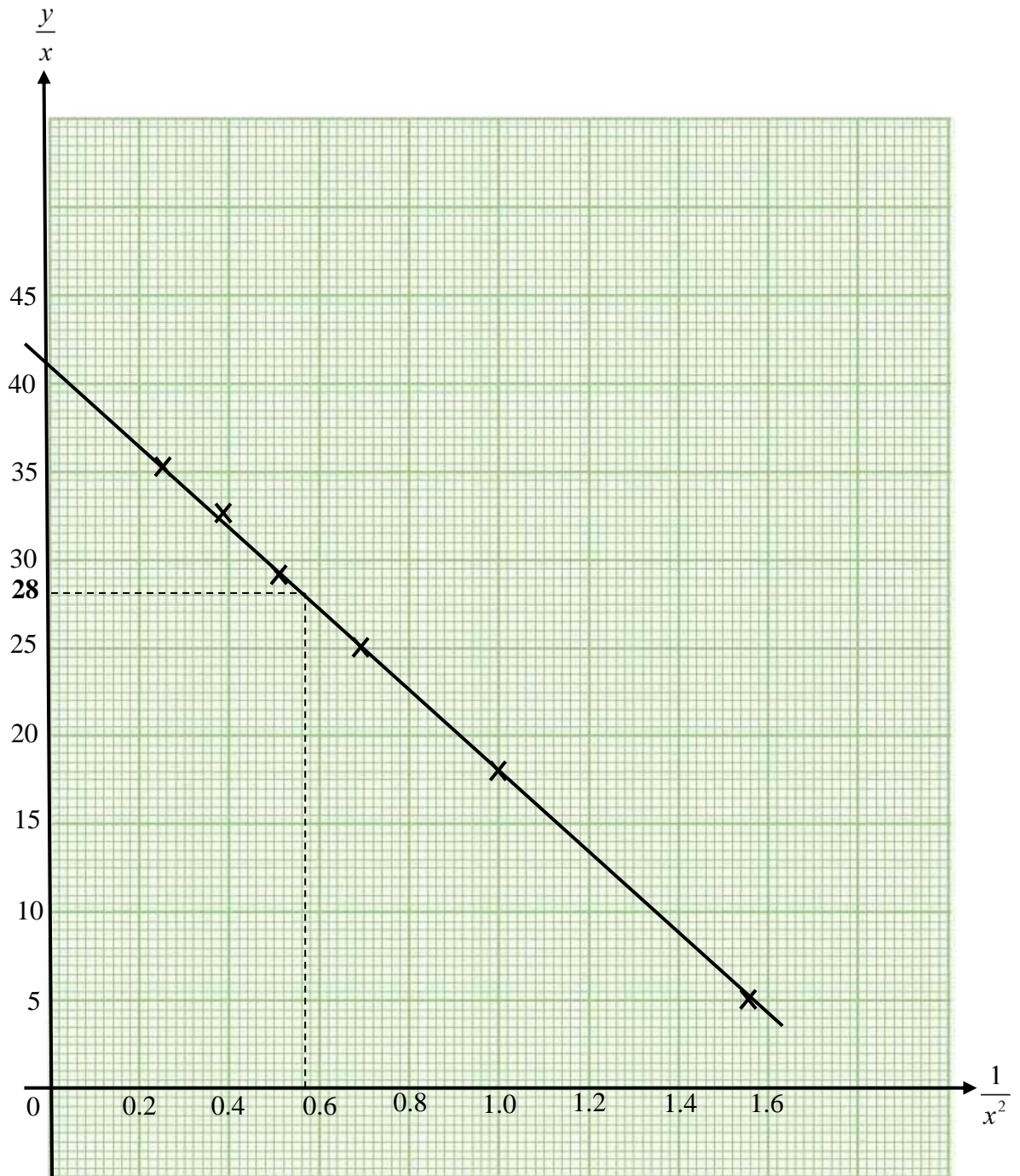
$$(ii) \quad \frac{b}{0.024} = \frac{35.25 - 29.25}{0.25 - 0.51}$$

$$b = -0.55$$

$$(iii) \quad \frac{y}{1.32} = 28$$

$$y = 36.96$$

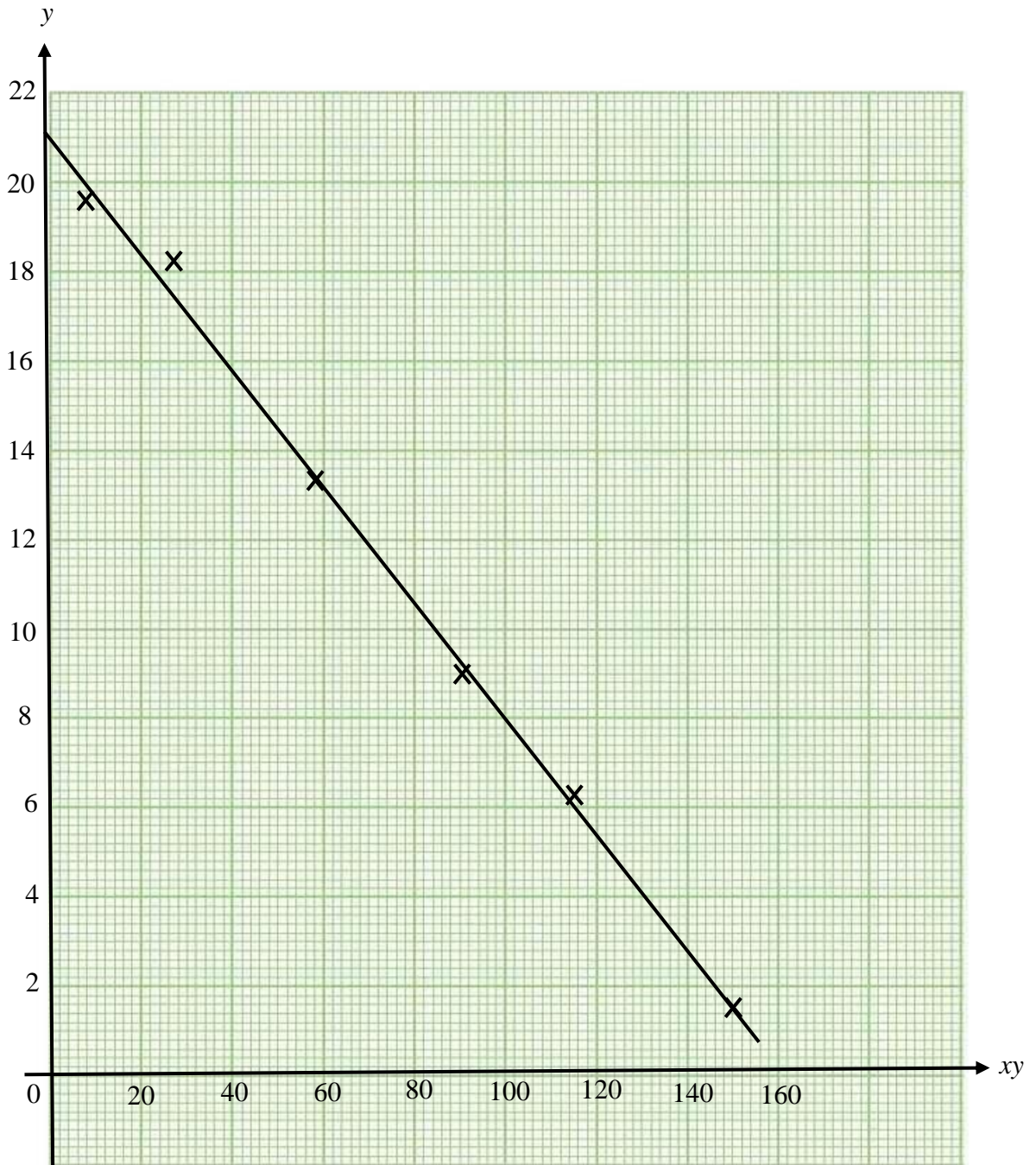
Graf soalan 14



15. (a)

xy	7.64	26.57	58.92	90.16	114.85	150.18
y	19.6	18.2	13.3	8.9	6.3	1.5

(b) rujuk kepada graf



$$(c) \quad (i) \quad xy - yb = a$$

$$y = \frac{xy}{b} - \frac{a}{b}$$

$$\frac{1}{b} = \frac{13.3 - 21}{58.92 - 0}$$

$$b = -7.69$$

$$(ii) \quad -\frac{a}{b} = 21$$

$$a = 21(-7.69)$$

$$a = 161.49$$

16. (a)

V	10	20	30	40	50	60
$\frac{1}{P}$	0.64	0.78	0.92	1.06	1.20	1.33

(b) rujuk graf

$$(c) \quad (i) \quad \frac{1}{P} = 1.1$$

$$P = 0.909 \text{ atm}$$

$$(ii) \quad \frac{1}{P} = \left(\frac{1}{a}\right)V + \frac{b}{a}$$

$$\frac{1}{a} = \frac{0.64 - 0.5}{10 - 0}$$

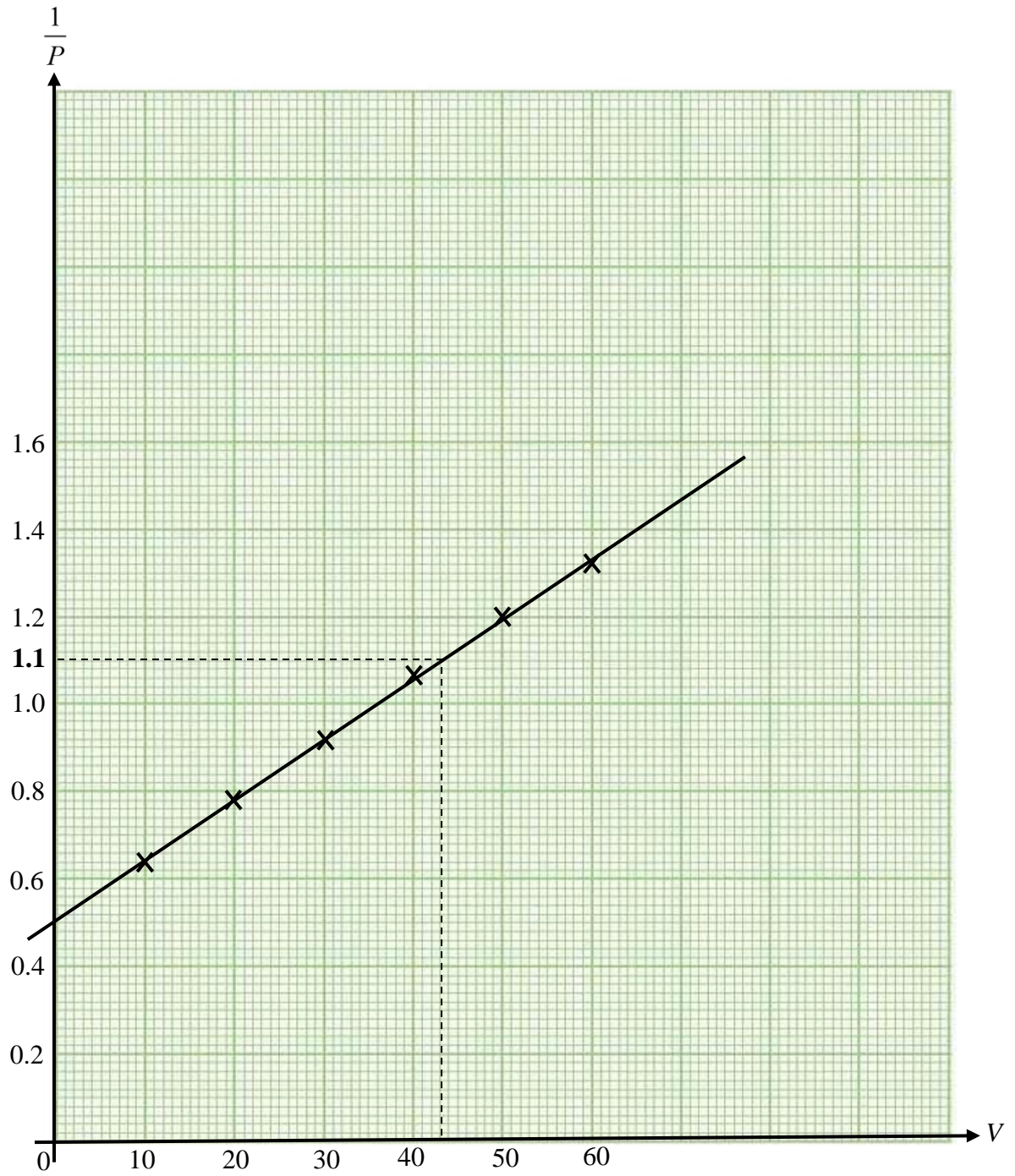
$$a = 71.43$$

$$(iii) \quad \frac{b}{a} = 0.5$$

$$\frac{b}{71.43} = 0.5$$

$$b = 35.72$$

Graf soalan 16



17. (a) $y\sqrt{x} = px + q$

(b)

x	1	2	3	4	5
$y\sqrt{x}$	4.00	11.03	18.01	25.00	31.98

(c) (i) $y\sqrt{x} = px + q$

$$p = \frac{4 - (-3.2)}{1 - 0}$$

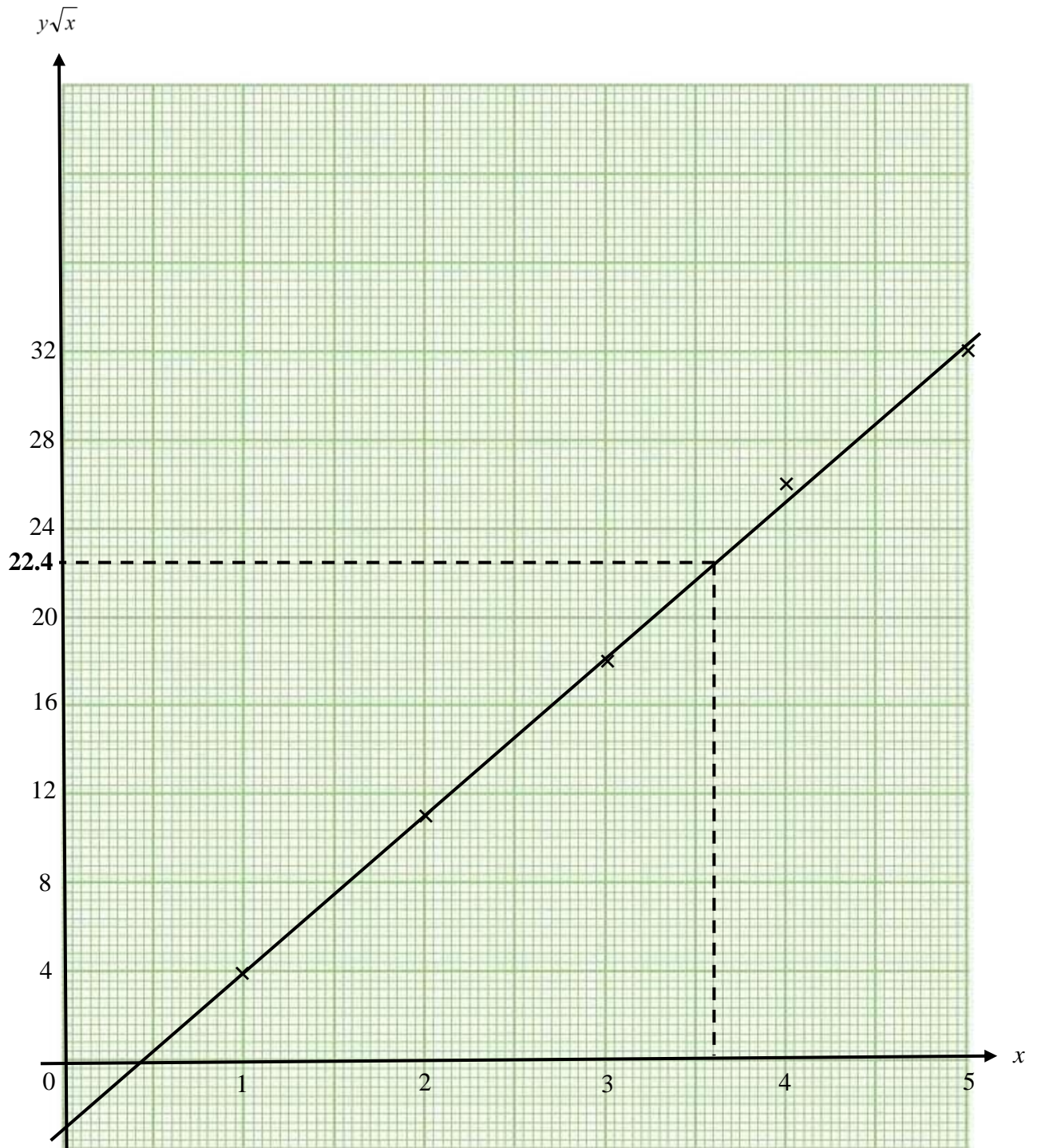
$$p = 7.2$$

(ii) $q = -3.2$

(iii) $x = 3.6, \quad y\sqrt{x} = 22.4$

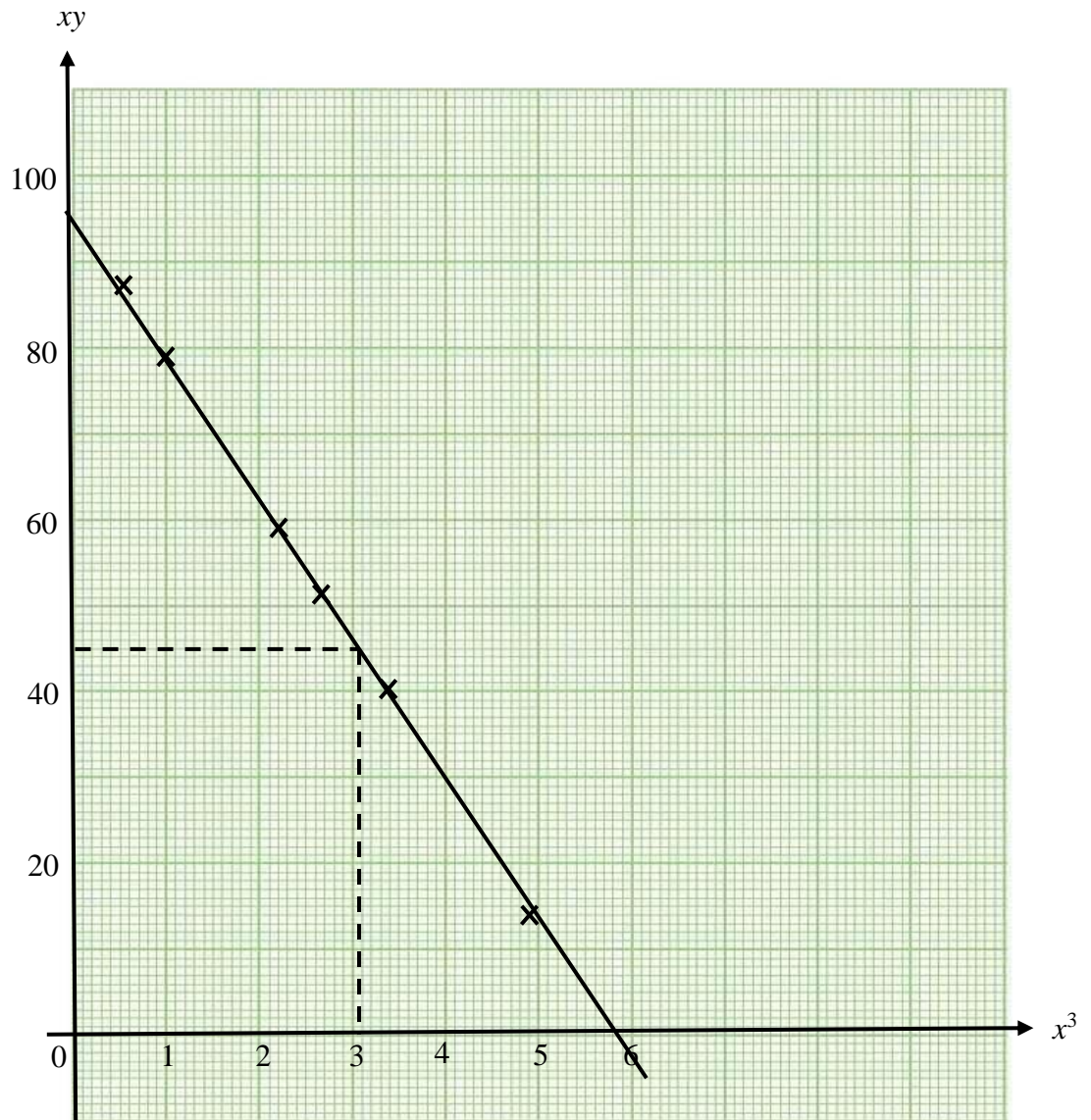
$$y = \frac{22.4}{\sqrt{3.6}}$$

$$= 11.8$$



18. (a)

x^3	0.51	1.0	2.2	2.7	3.4	4.9
xy	87	79	59	51.1	40	13.9



$$(b) \quad xy = px^3 + q$$

Menggunakan kecerunan = p atau pintasan- $xy = q$

$$(i) \quad p = \frac{59 - 95}{2.2 - 0} \quad q = 95$$

$$p = -16.36$$

$$(ii) \quad \text{bila } xy = 45, \text{ maka } x^3 = 3.1$$

$$x = 1.458$$

19. (a)

x	2	3	4	5	6	7
$\frac{y}{x}$	3.8	4.4	5.1	5.8	6.4	7.1

(b) Rujuk graf

$$(c) (i) \quad \frac{y}{k} = 2x^2 + \frac{p}{k}x$$

$$\frac{y}{x} = 2kx^2 + p$$

$$p = 2.5$$

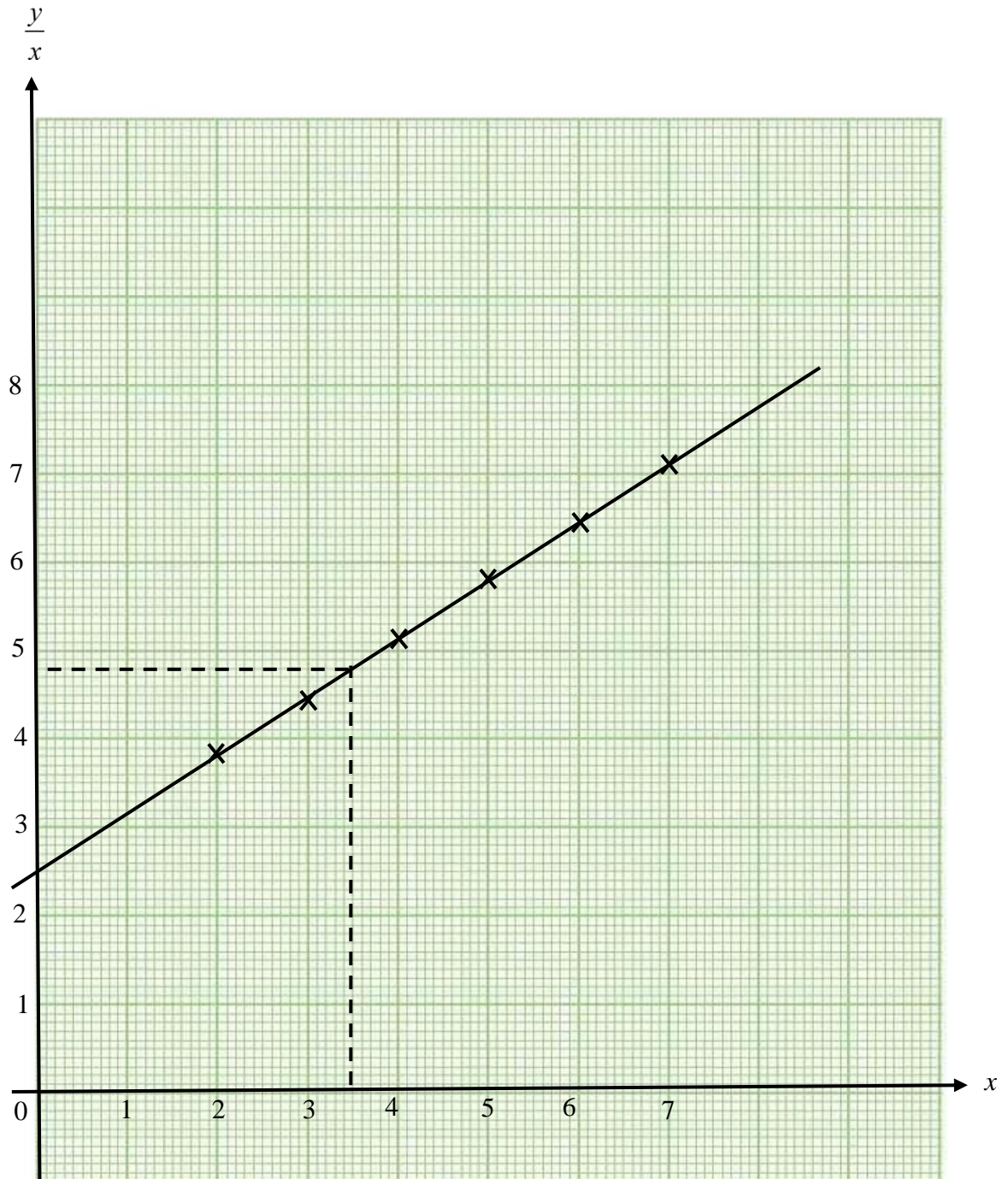
$$(ii) \quad 2k = \frac{6.4 - 2.5}{6 - 0}$$

$$k = 0.325$$

$$(iii) \quad x = 3.5, \quad \frac{y}{x} = 4.8$$

$$y = 16.8$$

Graf soalan 19



BAB 7

GEOMETRI KOORDINAT COORDINATE GEOMETRY

$$1. \left[\frac{3(2t)+2(-16)}{3+2}, \frac{3(0)+2(10)}{3+2} \right] = (8, s)$$

$$6t - 32 = 40 \text{ or } 5s = 20 \text{ or equivalent}$$

$$t = 12, s = 2$$

$$2. (p, t) = \left[\frac{3(3h)+1(3p)}{4}, \frac{3(-h)+1(2p)}{4} \right]$$

$$p = \frac{3(3h)+1(3p)}{4}$$

$$4p = 9h + 3p$$

$$p = 9h$$

$$t = \frac{3(-h)+1(2p)}{4}$$

$$4t = -3h + 2p$$

$$2t = -3h$$

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

$$p = 9\left(-\frac{2}{3}t\right)$$

$$p = -6t$$

3(a)

$$6w = 18 \quad \text{dan} \quad 9z = -18$$

$$w = 3 \quad z = -2$$

(b)

$$m = \frac{\text{-pintasan-y}}{\text{pintasan-x}}$$

$$= -\frac{-18}{18}$$

$$= 1$$

atau yang setara

$$4. \quad 18 = \frac{1}{2} |(1 \times a) + (-2b \times b) + (-2a \times 5) - (-2b \times 5) - (-2a \times a) - (1 \times b)|$$

$$36 = |-9a + 2a^2 - 2b^2 + 9b|$$

$$36 = -9a + 2a^2 - 2b^2 + 9b \quad \text{or} \quad -36 = -9a + 2a^2 - 2b^2 + 9b$$

$$b - a = 4 \quad \text{or} \quad b - a = -4$$

$$b - (-b) = 4 \quad \text{or} \quad b - (-b) = -4$$

$$b = 2 \quad \text{or} \quad b = -2$$

$$a = -2 \quad \text{or} \quad a = 2$$

Hence, $a = 2, b = -2; a = -2, b = 2$

$$5. \quad m = \frac{220-70}{100-(-200)} = \frac{1}{2}$$

$$y-145 = -2(x-(-50))$$

Equation of perpendicular bisector library and canteen, $y = -2x + 45$

$$-95 = -2(70)+45$$

Flagpole need to be moved because it is located in the walkway

$$6(a) \quad m_{QR} = 1$$

$$\frac{s-0}{9-3} = 1$$

$$s = 6$$

$$m_{PQ} = \frac{3-0}{0-3} = -1 \quad m_{PQ} \times m_{QR} = -1 \times 1$$

(b) *Persamaan garis lurus PS*

$$y - 3 = 1(x - 0)$$

$$y = x + 3 \dots (1)$$

Persamaan garis lurus RS

$$y - 6 = \frac{1}{7}(x - 9)$$

$$7y = x + 33 \dots (2)$$

Gantikan(1)kedalam(2)

$$7(x + 3) = x + 33$$

$$x = 2$$

$$\begin{aligned} \text{Dari(1): } y &= 2 + 3 \\ y &= 5 \end{aligned}$$

$$\therefore h = 2 \text{ dan } k = 5$$

$$7(a) \quad m_{AC} = \frac{4-2}{7-(-3)} = \frac{2}{10} = \frac{1}{5}$$

$$\text{serenjang:} \quad m_1 m = -1$$

$$\frac{1}{5} \times m_2 = -1$$

$$m_2 = -5$$

$$\begin{aligned} \text{Titik tengah} &= \left(\frac{7 + (-3)}{2}, \frac{2 + 4}{2} \right) \\ &= (2, 3) \end{aligned}$$

$$y - y_1 = m(x - x_1)$$

$$y - 3 = -5(x - 2)$$

$$y = -5 + 13$$

(b) Luas ΔABC

$$= \frac{1}{2} \begin{vmatrix} 7 & 2 & -3 & 7 \\ 4 & 8 & 2 & 4 \end{vmatrix}$$

$$= \frac{1}{2} |(56 + 4 - 12 - (8 - 24 + 14))|$$

$$= \frac{1}{2} |50|$$

$$= 25 \text{ unit}^2$$

(c) $PA = \frac{1}{2} PB$

$$\sqrt{(x-7)^2 + (y-4)^2} = \frac{1}{2} \sqrt{(x-2)^2 + (y-8)^2}$$

$$(x-7)^2 + (y-4)^2 = \frac{1}{4} [(x-2)^2 + (y-8)^2]$$

$$x^2 - 14x + 49 + y^2 - 8y + 16 = \frac{1}{4} (x^2 - 4x + 4 + y^2 - 16y + 64)$$

$$x^2 - 14x + y^2 - 8 + 65 = \frac{1}{4} x^2 - x + 4y^2 - 4y + 17$$

$$\frac{3}{4} x^2 + \frac{3}{4} y^2 - 13x - 4y + 48 = 0$$

$$3x^2 + 3y^2 - 52x - 16y + 192 = 0$$

$$8(a) \sqrt{(x-2)^2 + (y-3)^2} = 5$$

$$x^2 + y^2 - 4x - 6y - 12 = 0$$

$$(b) \sqrt{(x+4)^2 + y^2} \text{ atau } \sqrt{x^2 + (y-2)^2}$$

$$\sqrt{(x+4)^2 + y^2} = \sqrt{x^2 + (y-2)^2}$$

$$8x + 4y = -12 \quad \text{atau} \quad 2x + y = -3$$

$$(c) y = -2x - 3$$

$$x^2 + (-2x - 3)^2 - 4x - 6(-2x - 3) - 12 = 0$$

$$(x+3)(x+1) = 0$$

$$x = -3, -1$$

$$y = 3, -1$$

$$(-3, 3)$$

$$(-1, -1)$$

$$9(a) \frac{1}{2} |(0(-4) + p(-12) + 4(0)) - (0(-12) + 4(-4) + p(0))| = 20$$

$$-12p + 16 = 40 \quad \text{atau} \quad -12p + 16 = -40$$

$$p = -2$$

$$(b) \text{KT} = x, \text{TL} = y$$

$$\frac{4(x) + (-2)(y)}{x + y} = \frac{4}{5}$$

atau

$$\frac{-12(x) + (-4)(y)}{x + y} = \frac{-28}{5}$$

$$\frac{x}{y} = \frac{8}{32}$$

$$\text{KT} : \text{TL} = 1 : 4$$

$$(c) 2\sqrt{(x+2)^2 + (y+4)^2} \text{ atau } \sqrt{(x-4)^2 + (y+12)^2}$$

$$2\sqrt{(x+2)^2 + (y+4)^2} = \sqrt{(x-4)^2 + (y+12)^2}$$

$$4(x^2 + 4x + 4 + y^2 + 8y + 16) = x^2 - 8x + 16 + y^2 + 24y + 144$$

$$3x^2 + 3y^2 + 24x + 8y - 80 = 0$$

$$10(a) \quad m_{EF} = \frac{4-6}{7-3} = \frac{-2}{4} = -\frac{1}{2}$$

EF dan GH adalah selari

$$m_{EF} = m_{GH} = -\frac{1}{2}$$

Persamaan garis lurus GH

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

$$y + 3 = -\frac{1}{2}x + 1$$

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

(b)

apabila $x = 12, y = k$

$$k = -\frac{1}{2}(12) - 2$$

$$k = -8$$

11(a) $A(0,8)$ dan $C(2,0)$

$$\left(\frac{0(3)+2(1)}{1+3}, \frac{8(3)+0(1)}{1+3}\right)$$

$$\left(\frac{1}{2}, 6\right)$$

(b) $m = \frac{1}{4}$

$$y - 6 = \frac{1}{4}\left(x - \frac{1}{2}\right)$$

$$y = \frac{1}{4}x + \frac{47}{8} \quad \text{atau} \quad 8y = 2x + 47$$

12. Luas = $\frac{1}{2}|(15 + (-18) + (-10) - 9 - 25 - 12)|$
 $\frac{59}{2}$ atau 29.5

$$\text{Jarak } PQ = \sqrt{(-5 - 6)^2 + (-3 + 5)^2}$$

11.18

$$\frac{1}{2} \times 11.18 \times \text{tinggi} = 29.5$$

Jarak terdekat = 5.2773

$$\begin{aligned}
 13(a) \quad Luas &= \frac{1}{2} |(0 \times -2) + (5 \times 5) + (-1 \times 0) - (0 \times 5) - (-2 \times -1) - (5 \times 0)| \\
 &= \frac{1}{2} |23| \\
 &= 11.5
 \end{aligned}$$

(b) (i) $PA = 2PB$

$$\sqrt{(x+2)^2 + (y-5)^2} = 2\sqrt{(x-5)^2 + (y+1)^2}$$

$$3x^2 + 3y^2 - 44x + 18y + 75 = 0$$

(b) (ii) $x = 0$

$$3(0)^2 + 3y^2 - 44(0) + 18y + 75 = 0$$

$$3y^2 + 18y + 75 = 0$$

$$\begin{aligned}
 b^2 - 4ac &= (18^2) - 4(3)(75) \\
 &= -576 < 0
 \end{aligned}$$

Tiada persilangan

14.(a) Apabila $x = 0$

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

$$a = 1, b = -3, c = -8$$

$$\begin{aligned}
 b^2 - 4ac &= (-3)^2 - 4(1)(-8) \\
 &= 41 (> 0)
 \end{aligned}$$

$y^2 - 3y - 8 = 0$ mempunyai 2 punca nyata berbeza
 \therefore lokus L bersilang dengan paksi $-x$ pada dua titik

(b) apabila $y = x - 2$

$$x^2 + (x-2)^2 + 3x - 3(x-2) - 8 = 0$$

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

$$\begin{aligned}
 b^2 - 4ac &= (-4)^2 - 4(2)(2) \\
 &= 0 \text{ (dua punya nyata yang sama)}
 \end{aligned}$$

maka $x^2 + y^2 + 3x - 3y - 8 = 0$ bersilang pada satu titik sahaja

$\therefore 2x^2 - 4x + 2 = 0$ ialah tangen kepada lokus L

15. Nisbah Maria-Ivone : Ivone - Frank = 1 : 1
 Nisbah Maria-Raj : Raj - Ivone = 3 : 1
 \therefore Nisbah Raj-Ivone : Ivone-Frank = 1 : 4

Biar (x, y) = kedudukan Ivone

$$(x, y) = \left[\frac{40(0) + 1(20)}{1+4}, \frac{40(0) + 1(15)}{1+4} \right]$$

$$= (4, 3)$$

16.(a)

$$\sqrt{(h-5)^2 + (2h-6)^2} = \sqrt{32}$$

$$5h^2 - 34h + 29 = 0$$

$$(5h-29)(h-1) = 0$$

$$h = \frac{29}{5}, h = 1$$

$$\frac{2-0}{1-3} = \frac{k-0}{-2-3} \text{ atau } \frac{2-0}{1-3} = \frac{k-2}{-2-1}$$

$$k = 5$$

(b) (i) $(m_{AM} \times m_{DM})$ atau $(m_{AM} \times m_{BD})$ atau $(m_{AM} \times m_{MD})$

$$1 \times -1 = -1$$

$$(ii) = \frac{1}{2} |5(0) + 3(-4) + (-5)(*5) + (-2)(6)$$

$$-6(3) - 0(-5) - (-4)(-2) - *5(5)|$$

$$= \frac{1}{2} |-49 - 51|$$

$$= \frac{1}{2} |-100|$$

$$= 50$$

17.(a) 1:1

$$b) \text{ midpoint } QS = \left(\frac{4+1}{2}, \frac{4+3}{2} \right)$$

$$= \left(\frac{5}{2}, \frac{7}{2} \right)$$

$$\frac{m+n}{2} = \frac{5}{2}$$

$$m + n = 5$$

18.(a) $y = x + 6$

$$m_{RS} = -1$$

$$-1 = \frac{-6}{h}$$

$$h = 6$$

b) $T = \left(\frac{18-2}{4}, \frac{0+4}{4}\right)$
 $T = (4, 1)$

19.(a) $m_{BC} = \frac{2}{5}$

(b) Let the coordinates of D be $(h, 14)$
 Katakan koordinat D ialah $(h, 14)$

$$m_{AD} = m_{BC}$$

$$\frac{14 - 10}{h - (-2)} = \frac{2}{5}$$

$$B(-6, 0) \quad D(8, 14)$$

(c) $m_{BD} = \frac{14-0}{8-(-6)}$

$$m_{BD} = 1$$

$$BD \perp AC, \Rightarrow m_{AC} = -1$$

OR

(d) Katakan koordinat C ialah (x, y)
 Let the coordinates of C be (x, y)

Titik tengah AC = titik tengah BD
 Midpoint of AC = Midpoint of BD

$$\frac{x + (-2)}{2} = 1, \quad \frac{y + 10}{2} = 7$$

$$C(4, 4)$$

Luas sisi empat BCDF
 Area of the quadrilateral $BCDF$

$$= \frac{1}{2} \begin{vmatrix} -6 & 4 & 8 & -6 & -6 \\ 0 & 4 & 14 & 14 & 0 \end{vmatrix}$$

$$= 140 \text{ units}^2$$

BAB 8

VEKTOR VECTOR

$$1.(a) \quad (i) \quad \overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$$

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

$$= \begin{pmatrix} -k+1 \\ -1 \end{pmatrix}$$

$$\overrightarrow{BC} = \overrightarrow{BO} + \overrightarrow{OC}$$

$$= \begin{pmatrix} -1 \\ -2 \end{pmatrix} + \begin{pmatrix} h \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} h-1 \\ -4 \end{pmatrix}$$

$$\overrightarrow{AB} = \lambda \overrightarrow{BC}$$

$$\begin{pmatrix} -k+1 \\ -1 \end{pmatrix} = \lambda \begin{pmatrix} h-1 \\ -4 \end{pmatrix}$$

$$-k+1 = \lambda(h-1) \quad \text{and} \quad -1 = \lambda(-4)$$

$$-k+1 = \frac{1}{4}(h-1) \quad \lambda = \frac{1}{4}$$

$$h = -4k + 5$$

$$(ii) \quad \text{Given } k = 2h - 1,$$

$$h = -4(2h - 1) + 5$$

$$h = 1$$

$$2. \quad \underline{OC} = 16\underline{i} + 12\underline{j} - 4\underline{i} - 3\underline{j} = 12\underline{i} + 9\underline{j}$$

$$|OC| = 15$$

$$\text{Unit Vector } \underline{OC} = \frac{12\underline{i} + 9\underline{j}}{15} = \frac{4\underline{i} + 3\underline{j}}{5}$$

$$b) \quad -\underline{i} - 9\underline{j} + 5\underline{i} - 3\underline{j} \quad \text{atau} \quad \underline{i} + 9\underline{j} - 5\underline{i} + 3\underline{j}$$

$$4\underline{i} - 12\underline{j} \quad \text{or} \quad -4\underline{i} + 12\underline{j}$$

$$\sqrt{4^2 + 12^2}$$

$$12.65$$

$$\begin{aligned}
 3. \text{ a). } P &= (4, -1), \overrightarrow{OP} = \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\
 Q &= (-5, 8), \overrightarrow{OQ} = \begin{pmatrix} -5 \\ 8 \end{pmatrix} \\
 \overrightarrow{PQ} &= \overrightarrow{PO} + \overrightarrow{OQ} \\
 &= -\begin{pmatrix} 4 \\ -1 \end{pmatrix} + \begin{pmatrix} -5 \\ 8 \end{pmatrix} \\
 &= \begin{pmatrix} -4-5 \\ 1+8 \end{pmatrix} \\
 &= \begin{pmatrix} -9 \\ 9 \end{pmatrix}
 \end{aligned}$$

$$\begin{aligned}
 \text{Vektor unit / Unit vector, } \hat{x} &= \frac{1}{\sqrt{(-9)^2 + 9^2}} \begin{pmatrix} -9 \\ 9 \end{pmatrix} \\
 &= \frac{1}{9\sqrt{2}} \begin{pmatrix} -9 \\ 9 \end{pmatrix} \\
 &= \frac{1}{\sqrt{2}} \begin{pmatrix} -1 \\ 1 \end{pmatrix}
 \end{aligned}$$

$$\begin{aligned}
 \text{b i). } \overrightarrow{PQ} &= m \overrightarrow{QR} \\
 -9\hat{i} + 9\hat{j} &= m(\overrightarrow{OR} - \overrightarrow{OQ}) \\
 &= m[(k\hat{i} + 2\hat{j}) - (-5\hat{i} + 8\hat{j})] \\
 &= m(k+5)\hat{i} - 6m\hat{j}
 \end{aligned}$$

$$9 = -6m$$

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

$$-9 = -\frac{3}{2}(k+5)$$

$$k = 1$$

$$\begin{aligned}
 \text{bii). } \overrightarrow{PQ} &= -9\hat{i} + 9\hat{j} \\
 |\overrightarrow{PQ}| &= \sqrt{(-9)^2 + 9^2} \\
 &= \sqrt{162}
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{PR} &= \overrightarrow{PO} + \overrightarrow{OR} \\
 &= \overrightarrow{OR} - \overrightarrow{OP} \\
 &= k\hat{i} + 2\hat{j} - (4\hat{i} - \hat{j}) \\
 &= (k-4)\hat{i} + 3\hat{j}
 \end{aligned}$$

$$\begin{aligned}
 |\overrightarrow{PR}| &= \sqrt{(k-4)^2 + 3^2} \\
 &= \sqrt{k^2 - 8k + 25}
 \end{aligned}$$

$$\begin{aligned}
 |\overrightarrow{PQ}| &= |\overrightarrow{PR}| \\
 \sqrt{162} &= \sqrt{k^2 - 8k + 25} \\
 k^2 - 8k - 137 &= 0 \\
 k &= \frac{8 \pm \sqrt{(-8)^2 - 4(-137)}}{2} \\
 k &= 4 \pm 3\sqrt{17}
 \end{aligned}$$

$$4. (a) \quad \begin{aligned} &(-15\underline{x} + 10\underline{y}) + 2\underline{y} \\ &-15\underline{x} + 12\underline{y} \end{aligned}$$

$$(b) \quad (i) \quad \begin{aligned} \overrightarrow{PQ} &= \frac{2}{5} \overrightarrow{BA} + n\overrightarrow{AC} \\ &= \frac{2}{5}(-15\underline{x} + 12\underline{y}) + n(2\underline{y}) \\ &= -6\underline{x} + (2n + 4)\underline{y} \end{aligned}$$

$$(ii) \quad \begin{aligned} -6 &= 12\lambda \text{ or } 2n + 4 = -11\lambda \\ 2n + 4 &= -11\left(-\frac{1}{2}\right) \\ n &= \frac{3}{4} \end{aligned}$$

$$5. (a) \quad \begin{aligned} \overrightarrow{BC} &= 7\underline{i} + 4\underline{j} \\ \overrightarrow{DC} &= \frac{21}{4}\underline{i} + 3\underline{j} \\ \overrightarrow{AD} &= (4\underline{i} + 9\underline{j}) - \left(\frac{21}{4}\underline{i} + 3\underline{j}\right) \\ &= -\frac{5}{4}\underline{i} + 6\underline{j} \end{aligned}$$

$$(b) \quad \begin{aligned} \left(\begin{pmatrix} p \\ 2 \end{pmatrix} - \begin{pmatrix} p \\ 2 \end{pmatrix}\right) - \left(\begin{pmatrix} q \\ 8 \end{pmatrix} - \begin{pmatrix} p \\ 2 \end{pmatrix}\right) &= \begin{pmatrix} 6 \\ q \end{pmatrix} \\ q = 2p - 10 \text{ or } p + q &= -4 \\ \text{Selesaikan persamaan serentak} & \end{aligned}$$

$$\begin{aligned} p &= 2 \\ q &= -6 \end{aligned}$$

$$6. (a) \quad \begin{aligned} \underline{a} &= 2\underline{b} - \frac{1}{3}\underline{c} \\ (k+1)\underline{i} + 4\underline{j} &= 2(3\underline{i} - 2\underline{j}) - \frac{1}{3}(-5\underline{i} + m\underline{j}), \\ &= 6\underline{i} - 4\underline{j} + \frac{5}{3}\underline{i} - \frac{m}{3}\underline{j}, \\ &= \frac{23}{3}\underline{i} + \left(-4 - \frac{m}{3}\right)\underline{j} \end{aligned}$$

$$\begin{aligned} k+1 &= \frac{23}{3} & \text{ dan } & 4 = -4 - \frac{m}{3} \\ k &= \frac{20}{3} & \text{ dan } & m = -24 \end{aligned}$$

$$(b) \quad \begin{aligned} \sqrt{(k+1)^2 + 4^2} &= \sqrt{20} \\ (k+1)^2 + 16 &= 20 \\ (k+1)^2 &= 4 \\ k &= 1, -3 \end{aligned}$$

$$\begin{aligned}
 7. (a) \text{ (i)} \quad \overrightarrow{AQ} &= \overrightarrow{AB} + \overrightarrow{BQ} \\
 &= -\overrightarrow{BA} + \frac{1}{2}\overrightarrow{BC} \\
 &= -\underline{r} + \frac{1}{2}\underline{s}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad \overrightarrow{BP} &= \overrightarrow{BA} + \overrightarrow{AP} \\
 &= -\underline{r} + \frac{1}{2}(\overrightarrow{AB} + \overrightarrow{BC}) \\
 &= \underline{r} + \frac{1}{2}(-\underline{r} + \underline{s}) \\
 &= \frac{1}{2}\underline{r} + \frac{1}{2}\underline{s}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad \overrightarrow{CD} &= \overrightarrow{CP} + \overrightarrow{PD} \\
 &= \frac{1}{2}\overrightarrow{CA} + \frac{1}{3}\overrightarrow{PB} \\
 &= \frac{1}{2}(-\underline{s} + \underline{r}) + \frac{1}{3}\left(-\frac{1}{2}\underline{r} - \frac{1}{2}\underline{s}\right) \\
 &= \frac{1}{3}\underline{r} - \frac{2}{3}\underline{s}
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{CR} &= \overrightarrow{CB} + \overrightarrow{BR} \\
 &= -\underline{s} + \frac{1}{2}\underline{r}
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{CD} &= \frac{1}{3}\underline{r} - \frac{2}{3}\underline{s} \\
 &= \frac{1}{3}(\underline{r} - 2\underline{s})
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{CR} &= -\underline{s} + \frac{1}{2}\underline{r} \\
 &= \frac{1}{2}(-2\underline{s} + \underline{r}) \\
 &= \frac{1}{2}(\underline{r} - 2\underline{s})
 \end{aligned}$$

$$\begin{aligned}
 2\overrightarrow{CR} &= \underline{r} - 2\underline{s} \\
 \overrightarrow{CD} &= \frac{1}{3}(2\overrightarrow{CR}) \\
 \overrightarrow{CD} &= \frac{2}{3}\overrightarrow{CR}
 \end{aligned}$$

$\therefore C, D$ dan R adalah segaris // *are collinear*.

$$\begin{aligned}
 8. (a) \text{ (i)} \quad \overrightarrow{BC} &= \overrightarrow{BA} + \overrightarrow{AC} \\
 &= \overrightarrow{AC} - \overrightarrow{AB} \\
 &= (-7\underline{i} + 5\underline{j}) - (3\underline{i} + 2\underline{j}) \\
 &= -4\underline{i} + 3\underline{j}.
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad |\overrightarrow{BC}| &= \sqrt{(-4)^2 + 3^2} \\
 &= 5 \text{ unit}
 \end{aligned}$$

Vektor unit dalam arah \overrightarrow{BC} ialah $\frac{1}{5}(-4\underline{i} + 3\underline{j})$.

(b) Diberi \overrightarrow{AD} adalah selari dengan \overrightarrow{BC} ,
 Maka $\overrightarrow{AD} = k \overrightarrow{BC}$, k -pemalar
 $p\mathbf{i} - 15\mathbf{j} = k(-4\mathbf{i} + 3\mathbf{j})$.

$$\begin{aligned} -15 &= 3k \\ k &= -5 \end{aligned}$$

$$\begin{aligned} p &= -4k \\ p &= 20 \end{aligned}$$

$$\begin{aligned} 9.(a) \quad (i) \quad \overrightarrow{OC} &= \overrightarrow{OA} + \overrightarrow{AC} \\ &= \mathbf{a} + \frac{3}{5} \overrightarrow{AB} \\ &= \mathbf{a} + \frac{3}{5} (-\mathbf{a} + \mathbf{b}) \\ &= \frac{2}{5} \mathbf{a} + \frac{3}{5} \mathbf{b} \end{aligned}$$

$$\begin{aligned} (ii) \quad \overrightarrow{DA} &= \overrightarrow{DO} + \overrightarrow{OA} \\ &= \mathbf{a} - \frac{1}{2} \mathbf{b} \end{aligned}$$

$$\begin{aligned} (b) \quad (i) \quad \overrightarrow{OE} &= k \overrightarrow{OC} \\ &= k \left(\frac{2}{5} \mathbf{a} + \frac{3}{5} \mathbf{b} \right) \\ &= \frac{2}{5} k \mathbf{a} + \frac{3}{5} k \mathbf{b} \end{aligned}$$

$$\begin{aligned} (ii) \quad \overrightarrow{OE} &= \overrightarrow{OB} + \overrightarrow{BE} \\ &= \mathbf{b} + h \overrightarrow{DA} \\ &= \mathbf{b} + h \left(\mathbf{a} - \frac{1}{2} \mathbf{b} \right) \\ &= h \mathbf{a} + \left(1 - \frac{1}{2} h \right) \mathbf{b} \end{aligned}$$

Bandungkan, pada arah \mathbf{b}

$$\frac{3}{5} k = 1 - \frac{1}{2} h$$

$$\frac{3}{5} k = 1 - \frac{1}{2} \left(\frac{2}{5} k \right)$$

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

Bandungkan, pada arah \mathbf{a}

$$\frac{2}{5} k = h$$

$$\frac{2}{5} \left(\frac{5}{4} \right) = h$$

$$h = \frac{1}{2}$$

$$OC : CE = 4 : 1$$

$$10.(a) \quad i) \quad \overrightarrow{PR} = 9\underline{x} - 7\underline{y}$$

$$ii) \quad \overrightarrow{OQ} = 3\underline{x} + 7\underline{y}$$

$$\begin{aligned} (b) \quad \overrightarrow{OS} &= h \overrightarrow{OQ} \\ &= h(3\underline{x} + 7\underline{y}) \\ &= 3h\underline{x} + 7h\underline{y} \end{aligned}$$

$$\begin{aligned} \overrightarrow{PS} &= k \overrightarrow{PR} \\ &= k(9\underline{x} - 7\underline{y}) \\ &= 9k\underline{x} - 7k\underline{y} \end{aligned}$$

$$\begin{aligned} \overrightarrow{OS} &= \overrightarrow{OP} + \overrightarrow{PS} \\ &= 7\underline{y} + 9k\underline{x} - 7k\underline{y} \\ &= 7\underline{y} - 7k\underline{y} + 9k\underline{x} \\ &= (7 - 7k) \underline{y} + 9k\underline{x} \end{aligned}$$

$$3h = 9k$$

$$h = 3k$$

$$7(3k) = 7 - 7k$$

$$k = \frac{7}{28} = \frac{1}{4}$$

$$h = 3 \left(\frac{1}{4} \right) .$$

$$h = \frac{3}{4}$$

$$\begin{aligned}
 11.(a) \text{ (i) } \overrightarrow{BC} &= \overrightarrow{OC} - \overrightarrow{OB} \\
 &= \frac{2}{3}\overrightarrow{OA} - \overrightarrow{OB} \\
 &= \frac{2}{3}\underline{x} - \underline{y}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) } \overrightarrow{OD} &= \overrightarrow{OA} + \overrightarrow{AD} \\
 &= \underline{x} + \frac{1}{2}\overrightarrow{AB} && \text{(Diberi } \overrightarrow{AB} = 2\overrightarrow{AD}\text{)} \\
 &= \underline{x} + \frac{1}{2}(\overrightarrow{OB} - \overrightarrow{OA}) \\
 &= \underline{x} + \frac{1}{2}(\underline{y} - \underline{x}) \\
 &= \frac{1}{2}\underline{x} + \frac{1}{2}\underline{y}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) (i) } \overrightarrow{OE} &= h\overrightarrow{OD} \\
 &= h\left(\frac{1}{2}\underline{x} + \frac{1}{2}\underline{y}\right) \\
 &= \frac{1}{2}h\underline{x} + \frac{1}{2}h\underline{y}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) } \overrightarrow{OE} &= \overrightarrow{OB} + \overrightarrow{BE} \\
 &= \underline{y} + k\overrightarrow{BC} \\
 &= \underline{y} + k\left(\frac{2}{3}\underline{x} - \underline{y}\right) \\
 &= \frac{2}{3}k\underline{x} + (1 - k)\underline{y}
 \end{aligned}$$

(c) Dari \overrightarrow{OE} yang didapati daripada b(i) dan (ii) dan dengan menyamakan pekali bagi x :

$$\frac{1}{2}h = \frac{2}{3}k$$

Samakan pekali bagi y :

$$\frac{1}{2}h = 1 - k$$

Gantikan (1) ke dalam (2)

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

$$k = \frac{3}{5}$$

$$\frac{1}{2}h = \frac{2}{3}\left(\frac{3}{5}\right)$$

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

$$\begin{aligned}
 12. (a) (i) \quad \overrightarrow{AQ} &= \overrightarrow{AD} + \overrightarrow{DQ} \\
 &= \overrightarrow{AD} + \overrightarrow{AP} \\
 &= \underline{v} + 6\underline{u} \\
 &= 6\underline{u} + \underline{v}
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad \overrightarrow{PC} &= \overrightarrow{PB} + \overrightarrow{BC} \\
 &= \frac{1}{3}\overrightarrow{AP} + \overrightarrow{AD} \\
 &= \frac{1}{3}(6\underline{u}) + \underline{v} \\
 &= 2\underline{u} + \underline{v}
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{PR} &= \overrightarrow{PA} + \overrightarrow{AR} \\
 &= \overrightarrow{PA} + \frac{3}{2}\overrightarrow{AQ} & AQ = 2QR \\
 &= -6\underline{u} + \frac{3}{2}(6\underline{u} + \underline{v}) \\
 &= \frac{3}{2}(2\underline{u} + \underline{v}) \\
 &= \frac{3}{2}\overrightarrow{PC}
 \end{aligned}$$

PR ialah selari dengan PC oleh itu P , C dan R adalah segaris.

$$\begin{aligned}
 (b) (i) \text{ Dari (a) (ii) : } \overrightarrow{PC} &= 2\underline{u} + \underline{v} \\
 &= 2(3\underline{i}) + (2\underline{i} + 5\underline{j}) \\
 &= 8\underline{i} + 5\underline{j}.
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad |\overrightarrow{PC}| &= \sqrt{8^2 + 5^2} \\
 &= \sqrt{89} \text{ unit}
 \end{aligned}$$

$$\begin{aligned}
 \text{Vektor unit dalam arah } \overrightarrow{PC} &= \frac{\overrightarrow{PC}}{|\overrightarrow{PC}|} \\
 &= \frac{8}{\sqrt{89}}\underline{i} + \frac{5}{\sqrt{89}}\underline{j}
 \end{aligned}$$

$$\begin{aligned}
 13.(a) (i) \quad \overrightarrow{BP} &= \overrightarrow{OP} - \overrightarrow{OB} \\
 &= \frac{1}{4}\overrightarrow{OA} - \overrightarrow{OB} \\
 &= \frac{1}{4}(8\underline{x}) - 6\underline{y} \\
 &= 2\underline{x} - 6\underline{y}
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad \overrightarrow{OQ} &= \overrightarrow{OB} + \overrightarrow{BQ} \\
 &= \overrightarrow{OB} + \frac{1}{2}\overrightarrow{BA} \\
 &= \overrightarrow{OB} + \frac{1}{2}(\overrightarrow{OA} - \overrightarrow{OB}) \\
 &= 6\underline{y} + \frac{1}{2}(8\underline{x} - 6\underline{y}) \\
 &= 4\underline{x} + 3\underline{y}
 \end{aligned}$$

$$(b) \quad \overrightarrow{OS} = h\overrightarrow{OQ}, \quad \overrightarrow{BS} = k\overrightarrow{BP}$$

$$\begin{aligned}\overrightarrow{BS} &= \overrightarrow{OS} - \overrightarrow{OB} \\ k\overrightarrow{BP} &= h\overrightarrow{OQ} - \overrightarrow{OB} \\ k(2\underline{x} - 6\underline{y}) &= h(4\underline{x} + 3\underline{y}) - 6\underline{y} \\ 2k\underline{x} - 6k\underline{y} &= 4h\underline{x} + (3h - 6)\underline{y}\end{aligned}$$

$$\begin{aligned}2k &= 4h \\ k &= 2h\end{aligned}$$

$$\begin{aligned}-6k &= 3h - 6 \\ -6(2h) &= 3h - 6 \\ h &= \frac{2}{5}\end{aligned}$$

$$k = 2\left(\frac{2}{5}\right) = \frac{4}{5}$$

$$\begin{aligned}\text{(c) } |\overrightarrow{AB}|^2 &= |\overrightarrow{OA}|^2 + |\overrightarrow{OB}|^2 \\ &= (8|\underline{x}|)^2 + (6|\underline{y}|)^2 \\ &= 16^2 + 18^2 \\ &= 580 \\ |\overrightarrow{AB}| &= 24.08 \text{ unit}\end{aligned}$$

$$\begin{aligned}14. \text{ (a) (i) } \overrightarrow{AP} &= \overrightarrow{AO} + \overrightarrow{OP} \\ &= -2\underline{y} + 6\underline{x}\end{aligned}$$

$$\begin{aligned}\text{(ii) } \overrightarrow{OQ} &= \overrightarrow{OA} + \overrightarrow{AQ} \\ &= 2\underline{y} + \frac{1}{4}\overrightarrow{AB} \\ &= 2\underline{y} + \frac{1}{4}(\overrightarrow{AO} + \overrightarrow{OB}) \\ &= 2\underline{y} + \frac{1}{4}(-2\underline{y} + 18\underline{x}) \\ &= \frac{3}{2}\underline{y} + \frac{9}{2}\underline{x}\end{aligned}$$

$$\begin{aligned}\text{(b) (i) } \overrightarrow{AR} &= h \overrightarrow{AP} \\ &= h(-2\underline{y} + 6\underline{x}) \\ &= -2h\underline{y} + 6h\underline{x}\end{aligned}$$

$$\begin{aligned}\text{(ii) } \overrightarrow{RQ} &= k \overrightarrow{OQ} \\ &= k\left(\frac{3}{2}\underline{y} + \frac{9}{2}\underline{x}\right) \\ &= \frac{9}{2}k\underline{x} + \frac{3}{2}k\underline{y}\end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad \overrightarrow{AR} + \overrightarrow{RQ} &= \overrightarrow{AQ} \\
 -2h\hat{y} + 6h\hat{x} + k\hat{x} + \frac{3}{2}k\hat{y} &= \frac{1}{4}\overrightarrow{AB} \\
 6h\hat{x} + k\hat{x} + \frac{3}{2}k\hat{y} - 2h\hat{y} &= \frac{1}{4}(\overrightarrow{AO} + \overrightarrow{OB}) \\
 (6h + k)\hat{x} + \left(\frac{3}{2}k - 2h\right)\hat{y} &= \frac{1}{4}(-2\hat{y} + 18\hat{x}) \\
 (6h + k)\hat{x} + \left(\frac{3}{2}k - 2h\right)\hat{y} &= \frac{9}{2}\hat{x} - \frac{1}{2}\hat{y}
 \end{aligned}$$

$$\begin{aligned}
 6h + k &= \frac{9}{2} \\
 h &= \frac{3-3k}{4}
 \end{aligned}$$

$$\begin{aligned}
 \frac{3}{2}k - 2h &= -\frac{1}{2} \\
 3k - 4h &= -1 \\
 3k - 4\left(\frac{3-3k}{4}\right) &= -1 \\
 k &= \frac{1}{3} \\
 h &= \frac{1}{2}
 \end{aligned}$$

$$\therefore h = \frac{1}{2}, k = \frac{1}{3}$$

$$\begin{aligned}
 15.\text{(a)} \quad \overrightarrow{CD} &= \overrightarrow{CO} + \overrightarrow{OD} \\
 &= -3\hat{a} + \frac{1}{3}\hat{b} \\
 \overrightarrow{AB} &= \overrightarrow{AO} + \overrightarrow{OB} \\
 &= -\hat{a} + \hat{b}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad \text{(i)} \quad \overrightarrow{OP} &= \overrightarrow{OC} + \overrightarrow{CP} \\
 &= 3\hat{a} + m\left(-3\hat{a} + \frac{1}{3}\hat{b}\right) \\
 &= (3-3m)\hat{a} + \frac{1}{3}m\hat{b}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad \overrightarrow{OP} &= \overrightarrow{OA} + \overrightarrow{AP} \\
 &= \hat{a} + m(-\hat{a} + \hat{b}) \\
 &= (1-n)\hat{a} + n\hat{b}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad 3 - 3m &= 1 - n \quad @ \quad \frac{1}{3}m = n \\
 \text{Selesaikan persamaan serentak} \\
 m &= \frac{3}{4} \\
 n &= \frac{1}{4}
 \end{aligned}$$

16.

$$(a) \quad \overrightarrow{AE} = \overrightarrow{AD} + \overrightarrow{DE} \text{ or } 18\underline{y} + \frac{3}{5}(25\underline{x}) \\ = 15\underline{x} + 18\underline{y}$$

$$(b) \quad \sqrt{6^2 + 5.4^2} \\ = 8.072$$

$$(c) \quad (i) \quad 15h\underline{x} + 18h\underline{y}$$

$$(ii) \quad k \left[-25\underline{x} + \frac{2}{3}(18\underline{y}) \right] \\ = -25k\underline{x} + 12k\underline{y}$$

$$(iii) \quad 15h\underline{x} + 18h\underline{y} = 25\underline{x} + (-25k\underline{x} + 12k\underline{y}) \\ h = \frac{10}{21} \text{ dan } k = \frac{5}{7}.$$

BAB 9

PENYELESAIAN SEGITIGA SOLUTION OF TRIANGLES

$$1. (a) 2(2x + 2) = 5x$$

$$x = 4$$

$$AB = 2(4) + 2$$

$$= 10$$

$$BC = 5(4)$$

$$= 20$$

$$AC = 4(4) + 2$$

$$= 18$$

$$s = \frac{10+20+18}{2}$$

$$= 24$$

Luas/Area

$$= \sqrt{24(24 - 10)(24 - 20)(24 - 18)}$$

$$= 89.80 \text{ cm}^2$$

$$(b)(i) \quad \frac{\sin \angle QLK}{6} = \frac{\sin 50^\circ}{7}$$

$$\angle QLK = 41.04^\circ$$

$$\angle KQL = 180^\circ - 41.04^\circ - 50^\circ$$

$$= 88.96^\circ$$

$$(b)(ii) \quad LR^2 = 10^2 + 8^2 - 2(10)(8) \cos 110^\circ$$

$$LR = 14.79 \text{ cm}$$

$$2. (a) \quad \frac{1}{2} \times 6 \times 6 \times \sin A = 15$$

$$\sin A = \frac{15}{18} = 0.8333$$

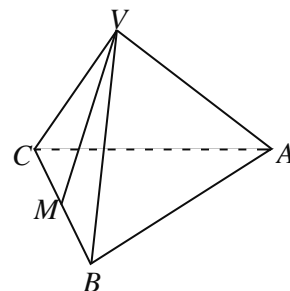
$$\frac{BC}{0.8333} = \frac{6}{\sin 61.78^\circ}$$

$$BC = 5.674 \text{ cm}$$

$$(b) \quad VM = \sqrt{4^2 + 2.837^2} = 2.820$$

$$\frac{2.820}{\sin 25^\circ} = \frac{AV}{\sin 55^\circ}$$

$$AV = 5.466 \text{ cm}$$



$$(c) \cos A = \frac{5.466^2 + 6^2 - 4^2}{2 \times 5.466 \times 6}$$

$$\angle A = 40.5^\circ$$

$$\text{Area of triangle } VAB = \frac{1}{2} \times 6 \times 5.466 \times \sin 40.5^\circ$$

$$= 10.65 \text{ cm}^2$$

3. (i) In $\triangle OAB$,

$$\frac{\sin \angle AOB}{4} = \frac{\sin 120^\circ}{12}$$

$$\sin \angle AOB = 0.2887$$

$$\angle AOB = 16.78^\circ$$

$$\angle OBA = 180^\circ - 120^\circ - 16.78^\circ$$

$$= 43.22^\circ$$

(ii) In $\triangle OAB$,

$$\frac{OA}{\sin 43.22^\circ} = \frac{12}{\sin 120^\circ}$$

$$OA = 9.489 \text{ cm}$$

(iii) In $\triangle VOA$,

$$VA = \sqrt{5^2 + 9.489^2}$$

$$= 10.73 \text{ cm}$$

In $\triangle VOB$,

$$VB = \sqrt{5^2 + 12^2}$$

$$= 13 \text{ cm}$$

In $\triangle VAB$,

$$VA^2 = VB^2 + AB^2 - 2(VB)(AB) \cos \angle VBA$$

$$\cos \angle VBA = \frac{VB^2 + AB^2 - VA^2}{2(VB)(AB)}$$

$$= \frac{13^2 + 4^2 - 10.73^2}{2(13)(4)}$$

$$= 0.6718$$

$$\angle VBA = 47.79^\circ$$

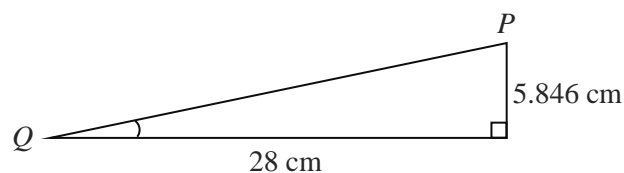
(iv) Area of $\triangle VAB = \frac{1}{2} (VB)(AB) \sin \angle VBA$

$$= \frac{1}{2} (13)(4) \sin 47.79^\circ$$

$$= 19.26 \text{ cm}^2$$

4. (a) $\frac{1}{2} \times 4 \times 7 \times \sin C = 12$
 $\angle C = 59^\circ$
- (b) $BD^2 = 4^2 + 7^2 - 2 \times 4 \times 7 \times \cos 59^\circ$
 $BD = 5.601 \text{ cm}$
- (c) $\frac{\sin A}{5.601} = \frac{\sin 40^\circ}{8}$
 $\angle A = 27^\circ$
 $\angle ABD = 113^\circ$
- (d) $\frac{1}{2} \times 5.601 \times 8 \times \sin 113^\circ$
 $12 + \frac{1}{2} \times 5.601 \times 8 \times \sin 113^\circ$
 33.94

5. (i) Luas/Area $\Delta JKL = 38 \text{ cm}^2$
 $\frac{1}{2} \times 6 \times 13 \times \sin \angle JKL = 38$
 $\sin \angle JKL = \frac{38}{39}$
 $\angle JKL = 77^\circ$
- (ii) $\frac{JQ}{6} = \sin 77^\circ$
 $JQ = 6 \times \sin 77^\circ = 5.846 \text{ cm}$
- (iii) $JL^2 = 6^2 + 13^2 - 2(6)(13) \cos 77^\circ$
 $JL = 13.03 \text{ cm}$
 $\frac{\sin \angle KJL}{13} = \frac{\sin 77^\circ}{13.03}$
 $\sin \angle KJL = \frac{13 \times \sin 77^\circ}{13.03}$
 $\angle KJL = 76^\circ 26'$
- (iv) $\tan x = \frac{5.846}{28}$
 $x = 11^\circ 48'$



$$6. (a) (i) \cos Q = \frac{12.2^2 - 8.2^2 - 9.6^2}{2 \times 8.2 \times 9.6}$$

$$\angle PQR = 104.27^\circ$$

$$(ii) \frac{\sin \angle PSR}{12.2} = \frac{\sin 40.5^\circ}{8.5}$$

$$\angle PSR = 68.77^\circ$$

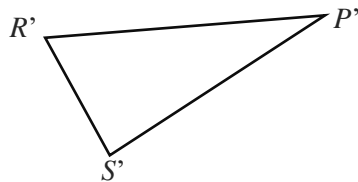
$$(iii) \frac{1}{2} \times 8.2 \times 9.6 \times \sin 104.27^\circ$$

$$\frac{1}{2} \times 8.5 \times 12.2 \times \sin 70.73^\circ$$

$$38.15 + 48.95$$

$$87.10 \text{ cm}^2$$

(b) (i)



(ii) 111.23°

$$7. (a) (i) \frac{\sin \angle ABC}{12.4} = \frac{\sin 43.2^\circ}{9.5}$$

$$\angle ABC = 63.32^\circ$$

$$(ii) 12.4^2 = 9.9^2 + 5.4^2 - 2(9.9)(5.4) \cos \angle ADC$$

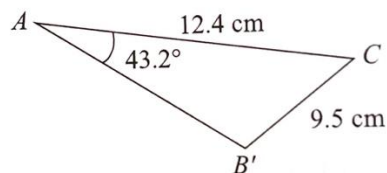
$$\angle ADC = 104.4^\circ$$

$$(iii) \text{Luas sisi empat } ABCD = \text{luas } \triangle ABC + \text{luas } \triangle ADC$$

$$= \frac{1}{2} (12.4)(9.5) \sin 73.48^\circ + \frac{1}{2} (9.9)(5.4) \sin 104.4^\circ$$

$$= 82.36$$

(b) (i)



$$(ii) \angle AB'C = 180^\circ - 63.32^\circ$$

$$= 116.68^\circ$$

$$8. (a) \sin \angle CDB = \frac{4}{5}$$

$$\angle CDB = 53.13^\circ$$

$$\angle BDC = 180^\circ - 53.13^\circ$$

$$\angle BDC = 126.87^\circ$$

$$BD^2 = (8.52)^2 + (9.32)^2 - 2(8.52)(9.32) \cos 126.87^\circ$$

$$BD = 15.9606 \text{ cm}$$

$$(b) \frac{AD}{\sin 68.87^\circ} = \frac{9.32}{\sin 58^\circ}$$

$$AD = 10.2510$$

$$(c) \text{Luas } ABC + \text{Luas } ABD = \frac{1}{2}(10.2510)(9.32) \sin 53.13^\circ + \frac{1}{2}(9.32)(8.52) \sin 126.87^\circ$$

$$= 69.9782$$

$$(d) \frac{1}{2}(10.2510 + 8.52) h = 69.9782$$

$$h = 7.4560$$

$$9. (a) \frac{\sin \angle ABE}{6} = \frac{\sin 30^\circ}{6}$$

$$\angle ABE = 41.81^\circ$$

$$\angle EBC = 180^\circ - 41.81^\circ = 138.19^\circ$$

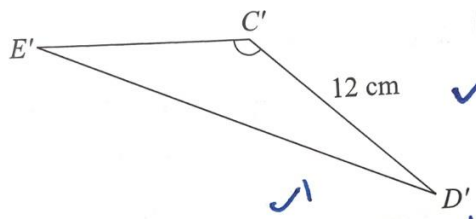
$$(b) CE^2 = 6^2 + 10^2 - 2(6)(10) \cos 138.19^\circ$$

$$CE = 15.01$$

$$(c) \frac{1}{2}(12)(15.01) \sin \angle DCE = 50$$

$$\angle DCE = 33.72^\circ$$

(d)



$$\angle D'C'E' = 180^\circ - 33.72^\circ$$

$$= 146.28^\circ$$

$$10. (a) \frac{\sin \angle ABD}{10} = \frac{\sin 30^\circ}{8}$$

$$\angle ABD = 38.68^\circ$$

$$\frac{\sin \angle BCD}{8} = \frac{\sin 141.32^\circ}{16}$$

$$\angle BCD = 18.21^\circ$$

$$\angle ADC = 20.47^\circ + 111.32^\circ$$

$$= 131.79^\circ$$

$$ABC^2 = 10^2 + 16^2 - 2(10)(16) \cos 131.79^\circ$$

$$ABC = 23.86$$

$$(b)(i) \angle TWU = 180 - 75^\circ 30' - 45^\circ 30'$$

$$= 59^\circ$$

$$\frac{\sin 45^\circ 30'}{TW} = \frac{\sin 59^\circ}{300}$$

$$TW = 249.63 \text{ m}$$

$$(ii) TV^2 = 250^2 + 300^2 - 2(250)(300) \cos 65^\circ$$

$$TV = 298.51 \text{ m}$$

$$\text{Panjang VTW} = 298.51 + 249.63$$

$$= 548.14 \text{ m}$$

$$11. (a) (i) \cos \angle DEC = (5^2 + 4^2 - 8^2) / [2(5)(4)]$$

$$\angle DEC = 125.10^\circ$$

$$(ii) \frac{12}{\sin 125.10^\circ} = \frac{BE}{\sin 70^\circ}$$

$$BE = 13.78 \text{ cm}$$

$$(b)(i) \frac{AB}{\sin 120^\circ} = \frac{8}{\sin 30^\circ}$$

$$AB = 13.86 \text{ cm}$$

$$(ii) \frac{\sin \angle CAB}{7} = \frac{\sin 60^\circ}{13.86}$$

$$\angle CAB = 25.94^\circ$$

$$\angle ADC = 180^\circ - 25.94^\circ - 30^\circ$$

$$= 124.06^\circ$$

$$\frac{AD}{\sin 30^\circ} = \frac{13.86}{\sin 124.06^\circ}$$

$$AD = 8.37 \text{ cm}$$

$$\begin{aligned}\text{Luas } ADB &= \frac{1}{2} (8.37)(13.86) \sin 25.94^\circ \\ &= 52.16 \text{ cm}^2\end{aligned}$$

$$12. (a)(i) 180^\circ - 84^\circ = 96^\circ$$

$$\frac{96^\circ}{2} = 48^\circ$$

$$\frac{QR}{\sin 84^\circ} = \frac{10}{\sin 48^\circ}$$

$$QR = 13.38 \text{ cm}$$

$$(ii) \frac{\sin \angle RQP}{5} = \frac{\sin 42^\circ}{13.38}$$

$$\angle RQP = 14.48^\circ$$

$$\begin{aligned}\angle PRQ &= 180^\circ - 14.48^\circ - 42^\circ \\ &= 123.52^\circ\end{aligned}$$

$$\begin{aligned}PQ^2 &= 13.38^2 + 5^2 - (13.38)(5)\cos 123.52^\circ \\ PQ &= 15.55\end{aligned}$$

$$\begin{aligned}QS &= \sqrt{(20^2 - 15.52^2)} \\ &= 12.61 \text{ cm}\end{aligned}$$

$$(b) \cos \angle PRS = (10^2 + (\sqrt{113})^2 - (\sqrt{85})^2) / [2(10)(\sqrt{113})]$$

$$\angle PRS = 52.98^\circ$$

$$\begin{aligned}\text{Luas } PRS &= \frac{1}{2} (10)(\sqrt{113}) \sin 52.98^\circ \\ &= 42.44 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Luas } PSQ &= \frac{1}{2} (7)(6) \\ &= 21 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Luas } SQR &= \frac{1}{2} (6)(8) \\ &= 24 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Luas } PQR &= \frac{1}{2} (7)(8) \\ &= 28 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Jumlah luas permukaan pyramid} &= 42.44 + 21 + 24 + 28 \\ &= 115.44 \text{ cm}^2\end{aligned}$$

$$13. (a) (i) \frac{1}{2}(BC)(15)\sin 30^\circ = 45$$

$$BC = \frac{45 \times 2}{15 \sin 30^\circ} = 12 \text{ cm}$$

$$(ii) AC^2 = 15^2 + 12^2 - 2(15)(12)\cos 30^\circ = 57.2309$$

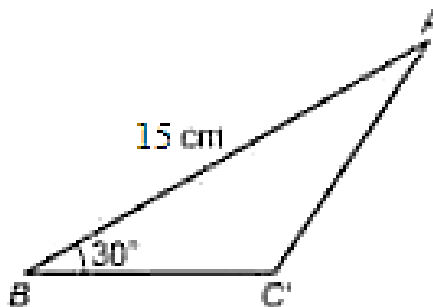
$$AC = 7.57 \text{ cm}$$

$$(iii) \frac{\sin \angle ACB}{15} = \frac{\sin 30^\circ}{7.57}$$

$$\sin \angle ACB = 0.9908$$

$$\angle ACB = 82.22^\circ$$

(b) (i)



$$(ii) \angle AC'B = 180^\circ - 82.22^\circ = 97.78^\circ$$

$$\angle BAC' = 180^\circ - 97.78^\circ - 30^\circ = 52.22^\circ$$

$$\text{Luas segi tiga } ABC' = \frac{1}{2}(15)(7.57)\sin 52.22^\circ = 44.87 \text{ cm}^2$$

$$14. (a) (i) PR^2 = 8^2 + 10^2 - 2(8)(10)\cos 75^\circ = 122.589$$

$$PR = 11.07 \text{ cm}$$

$$(ii) \angle PSR = 180^\circ - 75^\circ = 105^\circ$$

$$\frac{\sin \angle SPR}{5} = \frac{\sin 105^\circ}{11.07}$$

$$\sin \angle SPR = 0.4363$$

$$\angle SPR = 25.87^\circ$$

(b) (i) Luas segi tiga PQR

$$= \frac{1}{2}(10)(8)\sin 75^\circ$$

$$= 38.64 \text{ cm}^2$$

(ii) Jarak terdekat ialah jarak berserenjang dari Q ke PR.

Katakan jarak tersebut ialah x cm

$$\frac{\sin \angle QPR}{10} = \frac{\sin 75^\circ}{11.07}$$

$$\sin \angle QPR = 0.8726$$

$$\angle QPR = 60.76^\circ$$

$$\frac{\sin 60.76^\circ}{x} = \frac{\sin 90^\circ}{8}$$

$$x = 6.98 \text{ cm}$$

BAB 10

NOMBOR INDEKS INDEX NUMBERS

1(a)

$$x + y = 110$$

$$112.1 = \frac{339 + 125y + 3x + 208}{8 + y}$$

$$3(110 - y) + 12.9y = 349.8$$

$$y = 2$$

$$x = 108$$

1(b)

$$\frac{110 \times 4 + (x+10)^2(6) + 150 \times 7 + 170 \times 3}{4+6+7+3} = 143.2$$

$$x^2 + 20x - 44 = 0$$

$$(x - 2)(x + 22) = 0$$

$$x = 2, x = -22 \text{ (bukan jawapan)}$$

$$x = 2$$

$$\begin{aligned} \text{Indeks harga susu} &= (2+10)^2 \\ &= 144 \end{aligned}$$

Harga susu bertambah sebanyak 44% dari tahun 2019 ke tahun 2021.

There is an increase of 44% in the price of milk from the year 2019 to the year 2021.

$$2(a) \frac{4.5}{m} \times 100 = 125$$

$$m = 3.60$$

$$\frac{3.85}{3.50} \times 100 = n$$

$$n = 110$$

$$(a) \frac{(120 \times 2) + (110 \times 6) + (150 \times 5) + (125 \times 7)}{2 + 6 + 5 + 7} = 126.5$$

$$(c) \frac{60}{100} = \frac{x}{126.25}$$

$$x = 75.75$$

$$(d) 125 \times \frac{115}{100} = 143.75$$

3.

$$(a) \frac{p}{2} \times 100 = 125$$

$$p = 2.50$$

$$(b) \frac{q+0.15}{q} \times 100 = 140$$

$$q = 0.38$$

$$r = 0.15 + 0.38$$

$$= 0.53$$

$$(c) (i) \frac{40}{x} \times 100 = 126$$

$$x = 31.75$$

$$(ii) \frac{(125 \times 6) + (120 \times 3) + 140r + (110 \times 2)}{6 + 3 + r + 2} = 126$$

$$r = 4$$

$$4 (a) \frac{x}{30} \times 100 = 120$$

$$x = 36$$

$$y = \frac{35}{28} \times 100 = 125$$

$$z = \frac{24}{160} \times 100 = 15$$

$$(b) (i) \frac{120 \times 54 + 120 \times 72 + 125 \times 90 + 160 \times 144}{54 + 72 + 90 + 144} = 137.25$$

$$(ii) \frac{411.75}{P_{2020}} \times 100 = 137.25$$

$$P_{2020} = 300$$

$$(c) \frac{90}{100} \times 137.25 = 123.525$$

$$5.(a) p = \frac{8.96}{5.60} \times 100$$

$$= 160$$

$$\frac{q}{5.20} \times 100 = 95$$

$$q = 4.94$$

$$\frac{10.98}{r} \times 100 = 180$$

$$r = 6.10$$

$$(b) \frac{160 \times 18 + 95 \times 18 + 125 \times 12 + 180 \times 2}{18 + 18 + 12 + 2} = 129$$

$$(c) \frac{P_{2018}}{2590} \times 100 = 129$$

$$P_{2018} = 3341.10$$

$$(d) \frac{105}{100} \times 129 = 135.45$$

6.

$$(a) x = \frac{126}{105} \times 100$$

$$x = 120$$

$$\frac{y}{108} \times 100 = 125$$

$$y = 135$$

$$\frac{117}{z} \times 100 = 130$$

$$z = 90$$

$$(b) \bar{I}_{18/16} = \frac{120(31) + 110(5) + 125(18) + 130(6)}{31 + 5 + 18 + 6} = 121.67$$

$$(c) P_{18} = \frac{126}{100} \times 600 = 756$$

$$(d) \bar{I}_{20/16} = \frac{121.67}{100} \times 121.67 = 148.04$$

7.

$$(a) I_{15/12} = 90$$

$$\frac{P_{15}}{40} \times 100 = 90$$

$$P_{15} = 36$$

$$(b) \bar{I}_{15/12} = \frac{90(2) + 118(3) + 105(4) + 125(1)}{2 + 3 + 4 + 1} = 107.9$$

$$\frac{50500}{P_{12}} \times 100 = 107.9$$

$$P_{12} = 46803$$

$$(c) \bar{I}_{20/12} = \frac{160 \times 107.9}{100} = 172.6$$

Peratus perubahan ialah meningkat 72.6%

8.

- (a) Katakan $x = P_{12}$ =perbelanjaan untuk bil bil pada tahun 2012.
 Let $x = P_{12}$ =expenses for bills in the year 2012.

Katakan x = harga pada tahun 2008

Let x =price in the year 2008.

Maka $x + 15$ =harga pada tahun 2010

Then $x + 15$ =price in the year 2010

$$\frac{P_{12}}{P_{10}} = \frac{105}{100}$$

$$\frac{x}{105} = \frac{105}{100}$$

$$\frac{P_{10}}{100} = \frac{105}{100}$$

$$\frac{P_{14}}{P_{10}} \times 100 = 108 \Rightarrow \frac{x+114}{P_{10}} = \frac{108}{100}$$

$$x + 114 = \frac{108}{100} \left(\frac{100x}{105} \right)$$

$$x = 3990$$

$$\therefore P_{14} = 3990 + 114 = 4104$$

(b) $\frac{3422}{P_{10}} \times 100 = 118$

$$P_{10} = 2900$$

$$\frac{P_{14}}{2900} \times 100 = 121$$

$$P_{14} = 3509$$

(c) $h = \frac{110}{100} \times 110 = 121$

(d)

(i) $\frac{106(2)+108(3)+121(6)+121(w)}{2+3+6+w} = 116.4$
 $w = 4$

(ii) $\frac{P_{17}}{P_{10}} = \frac{130}{100} \times 116.4 = 151.32$

9.

(a) $M : 180 \times 110\% = 198$

$N : 145$

$O : 125 \times 95\% = 118.75$

(b) $\frac{250}{N(2014)} \times 100 = 145$

$$N(2014) = \frac{250 \times 100}{145}$$

$$= \text{RM}172.41$$

$$\begin{aligned} \text{(c)} \quad \frac{N(2022)}{500} \times 100 &= 118.75 \\ N(2022) &= \frac{118.75 \times 500}{100} \\ &= \text{RM}593.75 \end{aligned}$$

$$\begin{aligned} \text{(d) Indeks gubahan} \\ &= \frac{198 \times 150 + 145 \times 120 + 118.75 \times 90}{360} \\ &= \frac{57\,787.5}{360} \\ &= 160.52 \end{aligned}$$

10.

$$\begin{aligned} \text{(a)} \quad \frac{\text{RM}50}{Q(2019)} \times 100 &= 125 \\ Q(2019) &= \frac{\text{RM}50 \times 100}{125} \\ &= \text{RM}40 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{125(4) + 120y + 80(5) + 150(y+3)}{4 + y + 5 + (y+3)} &= 120 \\ \frac{500 + 120y + 400 + 150y + 450}{12 + 2y} &= 120 \\ 1350 + 270y &= 1440 + 240y \\ 30y &= 90 \\ y &= 3 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad \frac{P(2020)}{\text{RM}15} \times 100 &= 120 \\ P(2020) &= \frac{120 \times \text{RM}15}{100} \\ &= \text{RM}18 \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad I &= 80 \times \frac{120}{100} = 96 \\ \bar{I} &= \frac{125(4) + 120(3) + 96(5) + 150(6)}{12 + 6} \\ &= \frac{2240}{18} \\ &= 124.44 \end{aligned}$$

11.

$$\text{(a) (i)} \quad x = 120$$

$$\begin{aligned} \text{(ii)} \quad \frac{3.00}{y} \times 100 &= 120 \\ y &= \frac{3.00 \times 100}{120} \\ y &= \text{RM } 2.50 \end{aligned}$$

$$\text{(b)} \quad \frac{(132.8 \times 50) + (120 \times 20) + (190 \times 1)}{50 + 20 + 1} = \frac{6640 + 2400 + 190}{71}$$

$$\frac{9230}{71} = 130$$

$$\begin{aligned} \text{(c) (i)} \quad \frac{P_{2015}}{P_{2013}} &= \frac{P_{2017}}{P_{2013}} \times \frac{P_{2015}}{J_{2017}} \times 100 \\ &= \frac{140}{100} \times \frac{100}{130} \times 100 \\ &= 107.69 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad \frac{P_{2017}}{1.60} \times 100 &= 140 \\ P_{2017} &= \frac{1.60 \times 140}{100} \\ P_{2017} &= RM2.24 \end{aligned}$$

$$\begin{aligned} \text{Jumlah maksimum} &= \frac{80}{2.24} \\ &= 35.71 \approx 35 \end{aligned}$$

12. (a)(i) **Bahan B**

$$\begin{aligned} P_{2017} &= 30 \\ P_{2020} &= 30.90 \\ I_{\frac{2020}{2017}} &= a = \frac{30.90}{30} \times 100 = 103 \end{aligned}$$

(ii)

$$I_{\frac{2020}{2017}} = 107.8 = \frac{113(6) + 103(n+2) + (103+9)(n) + 101(3)}{6+n+2+n+3}$$

$$n = 2$$

(b)

$$\begin{aligned} I_{\frac{2016}{2018}} &= 120 \\ I_{\frac{2016}{2020}} &= 80 \\ P_{2020} &= 240 \\ P_{2018} &=? \end{aligned}$$

	2016	2018	2020
2016			
2018	120	100	
2020	80	x	

$$\frac{x}{100} = \frac{80}{120}$$

$$x = 66.67$$

$$\therefore I_{\frac{2018}{2020}} = 66.67$$

$$I_{\frac{2018}{2020}} = \frac{P_{2018}}{P_{2020}} \times 100 = 66.67$$

$$\frac{P_{2018}}{240} \times 100 = 66.67$$

$$P_{2018} = 160$$

13 (a) $P: I_{\frac{2020}{2015}} = \frac{20}{10} \times 100 = 200$

$$Q: I_{\frac{2020}{2015}} = \frac{30}{20} \times 100 = 150$$

$$R: I_{\frac{2020}{2015}} = \frac{10}{10} \times 100 = 100$$

(b) (i) $\bar{I}_{\frac{2020}{2015}} = \frac{200(1)+150(2)+100(3)}{1+2+3} = 133.33$

(ii)

$$Q: I_{\frac{2020}{2015}} = 150$$

$$\frac{P_{2020}}{P_{2015}} \times 100 = 150$$

$$\frac{30}{P_{2015}} \times 100 = 150$$

$$P_{2015} = \frac{30 \times 100}{150} = 20$$

14. (a)

$$\bar{I}_{\frac{2019}{2014}} = \frac{A \text{ and } B}{100(x)+120(y)} = \frac{340}{3}$$

$$3(100x+120y) = 340(x+y)$$

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

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

A and C

$$\bar{I}_{\frac{2019}{2014}} = \frac{100(x)+80(z)}{x+z} = \frac{165}{2}$$

$$2(100x+80z) = 165(x+z)$$

$$x = \frac{1}{7}z$$

$$\frac{x}{z} = \frac{1}{7}$$

$$\therefore \therefore x:y:z = 1:2:7$$

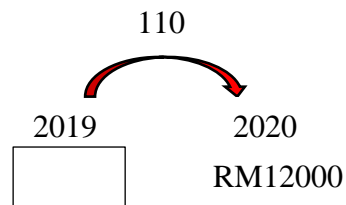
(b) $\bar{I}_{\frac{2019}{2014}} = \frac{100(1)+120(2)+80(7)}{1+2+7} = 90$

(c)

$$I_{\frac{2019}{2014}} = \frac{P_{2019}}{P_{2014}} \times 100 = \frac{450}{P_{2014}} \times 100 = 120$$

$$P_{2014} = \frac{450 \times 100}{120} = 375$$

(d)



$$I_{\frac{2020}{2019}} = \frac{P_{2020}}{P_{2019}} \times 100 = \frac{12000}{P_{2019}} \times 100 = 110$$

$$P_{2019} = \frac{12000 \times 100}{110} = 10909.09$$

15. (a)

B

$$I_{\frac{2020}{2014}} = 140$$

$$I_{\frac{2019}{2018}} = 125$$

$$I_{\frac{2020}{2018}} = k$$

$$\frac{k}{140} = \frac{125}{100}$$

	2018	2019	2020
2018		125	<i>k</i>
2019		100	140
2020			

$$k = \frac{125 \times 140}{100} = 175$$

(b)

$$m + m + 20 + 50 = 100$$

$$m = 30$$

$$m = 15$$

A

	2018	2019	2020
2018		120	138
2019		100	<i>p</i>
2020			

$$\frac{p}{138} = \frac{100}{120}$$

$$p = 115$$

$$I_A = \frac{100 \times 138}{120} = 115$$

$$I_C = \frac{100 \times 130}{130} = 100$$

$$I_B = \frac{100 \times 175}{125} = 140$$

$$I_D = \frac{100 \times 165}{110} = 150$$

$$\bar{I}_{2019}^{2020} = \frac{115(15) + 140(15) + 100(20) + 150(50)}{100} = 133.25$$

$$x = 33.25$$

(c)

$$\bar{I}_{2019}^{2020} = 133.25$$

$$\frac{P_{2020}}{P_{2019}} \times 100 = 133.25$$

$$\frac{18}{P_{2019}} \times 100 = 133.25$$

$$P_{2019} = \frac{18 \times 100}{133.25} = 13.51$$