

**Tingkatan 4 Bab 2**  
**Fungsi Kuadratik**  
**Penyelesaian Lengkap**

**Praktis Formatif 2.1a**

1 (a)  $6x^2 - 7x - 3 = 0$

$$6x^2 - 7x = 3$$

$$x^2 - \frac{7}{6}x = \frac{3}{6}$$

$$x^2 - \frac{7}{6}x = \frac{1}{2}$$

$$x^2 - \frac{7}{6}x + \left(-\frac{7}{6} \times \frac{1}{2}\right)^2 = \frac{1}{2} + \left(-\frac{7}{6} \times \frac{1}{2}\right)^2$$

$$x^2 - \frac{7}{6}x + \frac{49}{144} = \frac{1}{2} + \frac{49}{144}$$

$$\left(x - \frac{7}{12}\right)^2 = \frac{121}{144}$$

$$x - \frac{7}{12} = \pm \frac{11}{12}$$

$$x = \frac{7}{12} + \frac{11}{12} \quad \text{atau} \quad x = \frac{7}{12} - \frac{11}{12}$$

$$x = \frac{3}{2} \quad \quad \quad x = -\frac{1}{3}$$

(b)  $2p^2 - 10p + 3 = 0$

$$2p^2 - 10p = -3$$

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

$$p^2 - 5p + \left(-\frac{5}{2}\right)^2 = -\frac{3}{2} + \left(-\frac{5}{2}\right)^2$$

$$p^2 - 5p + \frac{25}{4} = -\frac{3}{2} + \frac{25}{4}$$

$$\left(p - \frac{5}{2}\right)^2 = \frac{19}{4}$$

$$p - \frac{5}{2} = \pm \sqrt{\frac{19}{4}}$$

$$p = \frac{5}{2} + \sqrt{\frac{19}{4}} \quad \text{atau} \quad p = \frac{5}{2} - \sqrt{\frac{19}{4}}$$

$$p = 4.679 \quad \quad \quad p = 0.321$$

2 (a)  $s^2 + 1 = -\frac{10}{3}s$

$$3s^2 + 3 + 10s = 0$$

$$3s^2 + 10s + 3 = 0$$

$$s = \frac{-10 \pm \sqrt{10^2 - 4(3)(3)}}{2(3)}$$

$$s = \frac{-10 \pm \sqrt{64}}{6}$$

$$s = -\frac{1}{3} \quad \text{atau} \quad -3$$

(b)  $\frac{11v - 2}{v + 3} = 2v$

$$11v - 2 = 2v^2 + 6v$$

$$2v^2 - 5v + 2 = 0$$

$$v = \frac{5 \pm \sqrt{(-5)^2 - (2)(2)}}{2(2)}$$

$$v = \frac{1}{2} \quad \text{atau} \quad 2$$

(c)  $8 + x(2x + 35) = 10x(2x - 1)$

$$8 + 2x^2 + 35x = 20x^2 - 10x$$

$$18x^2 - 45x - 8 = 0$$

$$x = \frac{45 \pm \sqrt{(-45)^2 - 4(18)(-8)}}{2(18)}$$

$$x = \frac{45 \pm 51}{36}$$

$$x = \frac{8}{3} \quad \text{atau} \quad -\frac{1}{6}$$

3 (a)  $(x - 1)(4x - 9) = 10x - 5$

$$4x^2 - 13x + 9 = 10x - 5$$

$$4x^2 - 13x - 10x + 9 + 5 = 0$$

$$4x^2 - 23x + 14 = 0$$

$$x = \frac{23 \pm \sqrt{(-23)^2 - 4(4)(14)}}{2(4)}$$

$$x = \frac{23 \pm \sqrt{305}}{8}$$

$$x = 5.058 \quad \text{atau} \quad 0.692$$

$$(b) \quad \frac{z}{3} + 4 = z^2$$

$$z + 12 = 3z^2$$

$$3z^2 - z - 12 = 0$$

$$z = \frac{1 \pm \sqrt{(-1)^2 - 4(3)(-12)}}{2(3)}$$

$$z = \frac{1 \pm \sqrt{145}}{6}$$

$$z = 2.174 \text{ atau } -1.840$$

$$(c) \quad \frac{y^2 + 3y - 1}{y^2 - y - 1} = 2$$

$$y^2 + 3y - 1 = 2y^2 - 2y - 2$$

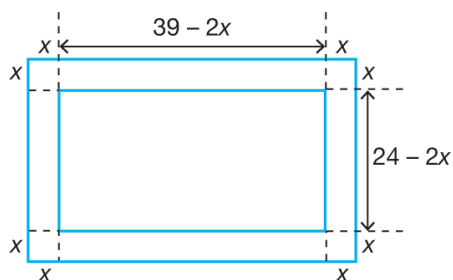
$$y^2 - 5y - 1 = 0$$

$$y = \frac{5 \pm \sqrt{(-5)^2 - 4(-1)}}{2}$$

$$y = \frac{5 \pm \sqrt{29}}{2}$$

$$y = 5.193 \text{ atau } -0.193$$

4



Jumlah luas empat keping kayu

$$= 39 \times 24 - (39 - 2x)(24 - 2x)$$

$$= 936 - (936 - 78x - 48x + 4x^2)$$

$$= 126x - 4x^2$$

Diberi bahawa jumlah luas empat keping kayu

$$= 180 \text{ cm}^2$$

$$-4x^2 + 126x = 180$$

$$4x^2 - 126x + 180 = 0$$

$$x = \frac{126 \pm \sqrt{(-126)^2 - 4(4)(180)}}{2(4)}$$

$$x = \frac{126 \pm \sqrt{12996}}{8}$$

$$x = 1.5 \text{ atau } 30$$

$x = 30$  tidak diterima.  
 $x = 1.5$

### Praktis Formatif 2.1b

1 (a) H.T.P =  $\frac{2}{3} + \frac{1}{4} = \frac{11}{12}$

H.D.P. =  $\frac{2}{3} \times \frac{1}{4} = \frac{1}{6}$

Persamaan kuadratik ialah

$$x^2 - \frac{11}{12}x + \frac{1}{6} = 0$$

$$12x^2 - 11x + 2 = 0$$

(b) H.T.P =  $-5 + 4 = -1$

H.D.P. =  $-5 \times 4 = -20$

Persamaan kuadratik ialah

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

(c) H.T.P =  $-3 - 3 = -6$

H.D.P. =  $(-3)(-3) = 9$

Persamaan kuadratik ialah

$$x^2 + 6x + 9 = 0$$

(d) H.T.P =  $\frac{2}{3} - \frac{2}{5} = \frac{4}{15}$

H.D.P. =  $\frac{2}{3} \times \left(-\frac{2}{5}\right) = -\frac{4}{15}$

Persamaan kuadratik ialah

$$x^2 - \frac{4}{15}x - \frac{4}{15} = 0$$

$$15x^2 - 4x - 4 = 0$$

(e) H.T.P =  $-3 - \frac{1}{2} = -\frac{7}{2}$

H.D.P. =  $-3 \left(-\frac{1}{2}\right) = \frac{3}{2}$

Persamaan kuadratik ialah

$$x^2 + \frac{7}{2}x + \frac{3}{2} = 0$$

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

2 (a)  $2x^2 + 4x - 7 = 0$

H.T.P =  $-\frac{b}{a} = -\frac{4}{2} = -2$

H.D.P. =  $\frac{c}{a} = -\frac{7}{2}$

(b)  $3h^2 - 10h + 5 = 0$

H.T.P =  $\frac{10}{3}$ , H.D.P. =  $\frac{5}{3}$

$$3 \text{ (a) } 2p^2 + 2p - 3 = 0$$

Punca-punca ialah  $\alpha$  dan  $\beta$ .

$$\text{Hasil tambah punca-punca} = -\frac{b}{a}$$

$$\alpha + \beta = -\frac{2}{2} = -1$$

$$\text{Hasil darab punca-punca} = \frac{c}{a}$$

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

Punca-punca baharu ialah  $\alpha+2$  dan  $\beta+2$ .

$$\begin{aligned} \text{H.T.P} &= (\alpha+2) + (\beta+2) \\ &= \alpha + \beta + 4 \\ &= -1 + 4 \\ &= 3 \end{aligned}$$

$$\begin{aligned} \text{H.D.P} &= (\alpha+2)(\beta+2) \\ &= \alpha\beta + 2(\alpha + \beta) + 4 \\ &= -\frac{3}{2} + 2(-1) + 4 \\ &= \frac{1}{2} \end{aligned}$$

Persamaan kuadratik baharu ialah

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

$$2p^2 - 6p + 1 = 0$$

(b) Punca-punca baharu ialah  $\frac{2}{\alpha}$  dan  $\frac{2}{\beta}$ .

$$\begin{aligned} \text{H.T.P} &= \frac{2}{\alpha} + \frac{2}{\beta} \\ &= \frac{2(\alpha + \beta)}{\alpha\beta} \\ &= \frac{2(-1)}{\frac{3}{2}} \\ &= \frac{4}{3} \end{aligned}$$

$$\begin{aligned} \text{H.D.P} &= \frac{2}{\alpha} \times \frac{2}{\beta} \\ &= \frac{4}{\alpha\beta} \\ &= \frac{4}{-\frac{3}{2}} \\ &= -\frac{8}{3} \end{aligned}$$

Persamaan kuadratik baharu ialah

$$p^2 - \frac{4}{3}p - \frac{8}{3} = 0$$

$$3p^2 - 4p - 8 = 0$$

$$4 \text{ (a) } 2t^2 - 5t + 1 = 0$$

Punca-punca ialah  $\alpha$  dan  $\beta$ .

$$\text{Hasil tambah punca-punca} = -\frac{b}{a}$$

$$\alpha + \beta = \frac{5}{2}$$

$$\text{Hasil darab punca-punca} = \frac{c}{a}$$

$$\alpha\beta = \frac{1}{2}$$

Punca-punca baharu ialah  $\frac{\alpha}{3}$  dan  $\frac{\beta}{3}$ .

$$\text{H.T.P} = \frac{\alpha}{3} + \frac{\beta}{3}$$

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

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

$$= \frac{5}{6}$$

$$\text{H.D.P} = \frac{\alpha}{3} \times \frac{\beta}{3}$$

$$= \frac{\alpha\beta}{9}$$

$$= \frac{1}{9}$$

$$= \frac{1}{18}$$

Persamaan kuadratik baharu ialah

$$t^2 - \frac{5}{6}t + \frac{1}{18} = 0$$

$$18t^2 - 15t + 1 = 0$$

(b) Punca-punca baharu ialah  $3-\alpha$  dan  $3-\beta$ .

$$\text{H.T.P} = 3 - \alpha + 3 - \beta$$

$$= 6 - (\alpha + \beta)$$

$$= 6 - \frac{5}{2}$$

$$= \frac{7}{2}$$

$$\text{H.D.P} = (3 - \alpha)(3 - \beta)$$

$$= 9 - (\alpha + \beta) + \alpha\beta$$

$$= 9 - \frac{5}{2} + \frac{1}{2}$$

$$= 7$$

Persamaan kuadrat baharu ialah

$$t^2 - \frac{7}{2}t + 7 = 0$$

$$2t^2 - 7t + 14 = 0$$

5  $x^2 + 9x + q = 0$

Punca-punca ialah  $\alpha$  dan  $2\alpha$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$\alpha + 2\alpha = -9$$

$$3\alpha = -9$$

$$\alpha = -3$$

$$\text{H.D.P.} = \frac{c}{a}$$

$$\alpha \times 2\alpha = q$$

$$q = 2(-3)^2 = 18$$

6  $5x^2 + px + 1 = 0$

Punca-punca ialah  $\alpha$  dan  $5\alpha$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$\alpha + 5\alpha = -\frac{p}{5}$$

$$6\alpha = -\frac{p}{5}$$

$$\alpha = -\frac{p}{30}$$

$$\text{H.D.P.} = \frac{c}{a}$$

$$\alpha \times 5\alpha = \frac{1}{5}$$

$$5\alpha^2 = \frac{1}{5}$$

$$5\left(-\frac{p}{30}\right)^2 = \frac{1}{5}$$

$$\frac{p^2}{900} = \frac{1}{25}$$

$$p^2 = \frac{900}{25}$$

$$p^2 = \frac{900}{25}$$

$$p^2 = 36$$

$$p = \pm 6$$

7  $2x^2 - (d+3)x + d = 0$

Punca-punca ialah  $\alpha$  dan  $4\alpha$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$\alpha + 4\alpha = \frac{d+3}{2}$$

$$2(\alpha + 4\alpha) = d + 3$$

$$10\alpha = d + 3 \dots (1)$$

$$\alpha = \frac{d+3}{10}$$

$$\text{H.D.P.} = \frac{c}{a}$$

$$\alpha \times 4\alpha = \frac{d}{2}$$

$$4\alpha^2 = \frac{d}{2}$$

$$\alpha^2 = \frac{d}{8}$$

$$\left(\frac{d+3}{10}\right)^2 = \frac{d}{8}$$

$$\frac{(d+3)^2}{100} = \frac{d}{8}$$

$$\frac{(d+3)^2}{25} = \frac{d}{2}$$

$$2(d+3)^2 = 25d$$

$$2(d^2 + 6d + 9) = 25d$$

$$2d^2 + 12d + 18 - 25d = 0$$

$$2d^2 - 13d + 18 = 0$$

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

$$d = 2 \text{ atau } \frac{9}{2}$$

8  $2x^2 + hx - 4 = 0$

Punca-punca ialah 4 dan  $k$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$k + 4 = -\frac{h}{2}$$

$$2k + 8 = -h$$

$$h = -2k - 8 \dots (1)$$

$$\text{H.D.P.} = \frac{c}{a}$$

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

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

Daripada (1) :  $h = -2\left(-\frac{1}{2}\right) - 8 = -7$

$$-\frac{3}{2} \leq x \leq \frac{3}{2}.$$

9  $8x^2 + 26x + k = 0$

Punca-punca ialah  $-\frac{5}{2}$  dan  $m$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$-\frac{5}{2} + m = -\frac{26}{8}$$

$$m = -\frac{26}{8} + \frac{5}{2}$$

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

$$\text{H.D.P} = \frac{c}{a}$$

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

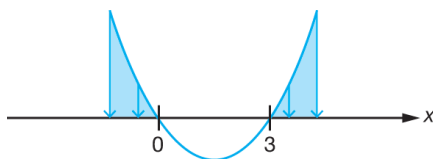
$$-\frac{5}{2}\left(-\frac{3}{4}\right) = \frac{k}{8}$$

$$\frac{15}{8} = \frac{k}{8}$$

$$k = 15$$

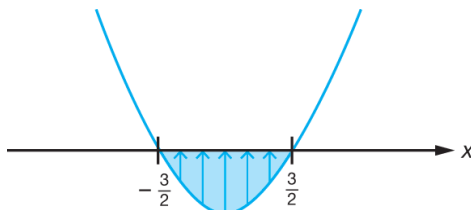
### Praktis Formatif 2.1c

1 (a)  $x^2 - 3x \geq 0$   
 $x(x-3) \geq 0$



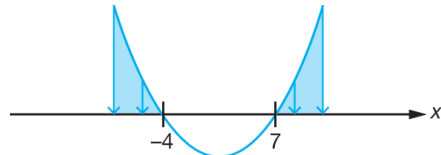
Julat nilai  $x$  yang dikehendaki ialah  
 $x \leq 0$  atau  $x \geq 3$ .

(b)  $4x^2 - 9 \leq 0$   
 $(2x+3)(2x-3) \leq 0$



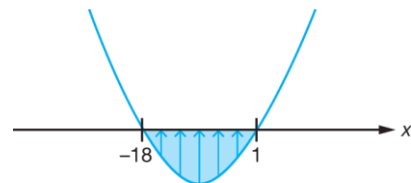
Julat nilai  $x$  yang dikehendaki ialah

(c)  $x^2 - 3x - 28 > 0$   
 $(x+4)(x-7) > 0$



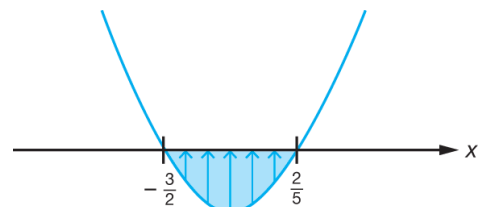
Julat nilai  $x$  yang dikehendaki ialah  
 $x < -4$  atau  $x > 7$ .

(d)  $x^2 + 17x - 18 < 0$   
 $(x+18)(x-1) < 0$



Julat nilai  $x$  yang dikehendaki ialah  
 $-18 < x < 1$ .

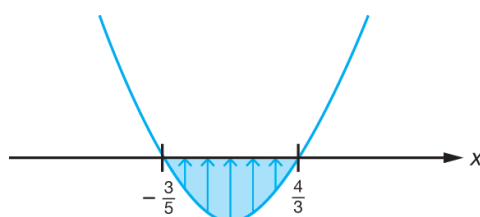
(e)  $6 - 11x - 10x^2 \geq 0$   
 $10x^2 + 11x - 6 \leq 0$   
 $(2x+3)(5x-2) \leq 0$



Julat nilai  $x$  yang dikehendaki ialah

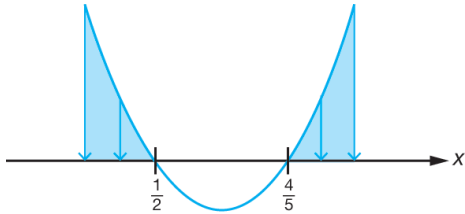
$$-\frac{3}{2} \leq x \leq \frac{2}{5}.$$

(f)  $12 + 11x - 15x^2 \geq 0$   
 $15x^2 - 11x - 12 \leq 0$   
 $(5x+3)(3x-4) \leq 0$



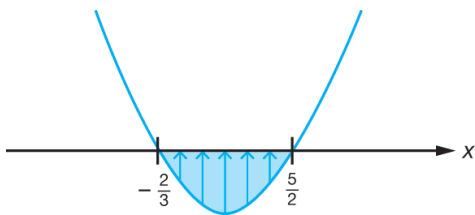
Julat nilai  $x$  yang dikehendaki ialah  
ialah  $-\frac{3}{5} \leq x \leq \frac{4}{3}$ .

(g)  $10x^2 > 13x - 4$   
 $10x^2 - 13x + 4 > 0$   
 $(2x - 1)(5x - 4) > 0$



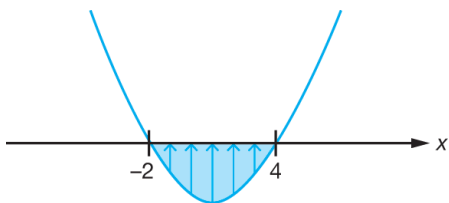
Julat nilai  $x$  yang dikehendaki ialah  
 $x < \frac{1}{2}$  atau  $x > \frac{4}{5}$ .

(h)  $11x + 10 \geq 6x^2$   
 $6x^2 - 11x - 10 \leq 0$   
 $(3x + 2)(2x - 5) \leq 0$



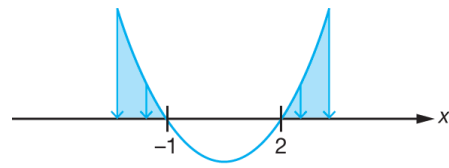
Julat nilai  $x$  yang dikehendaki ialah  
 $-\frac{2}{3} \leq x \leq \frac{5}{2}$

(i)  $x(x - 2) \leq 8$   
 $x^2 - 2x - 8 \leq 0$   
 $(x + 2)(x - 4) \leq 0$



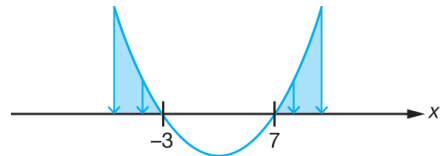
Julat nilai  $x$  yang dikehendaki ialah  
ialah  $-2 \leq x \leq 4$ .

(j)  $(2x - 1)^2 > 9$   
 $4x^2 - 4x + 1 - 9 > 0$   
 $4x^2 - 4x - 8 > 0$   
 $x^2 - x - 2 > 0$   
 $(x + 1)(x - 2) > 0$



Julat nilai  $x$  yang dikehendaki ialah  
 $x < -1$  atau  $x > 2$ .

(k)  $(x + 1)(x - 5) \geq 16$   
 $x^2 - 4x - 5 - 16 \geq 0$   
 $x^2 - 4x - 21 \geq 0$   
 $(x + 3)(x - 7) \geq 0$



Julat nilai  $x$  yang dikehendaki ialah  
 $x \leq -3$  atau  $x \geq 7$ .

2  $-1 < x^2 + 3x + 1 \leq 1$ .

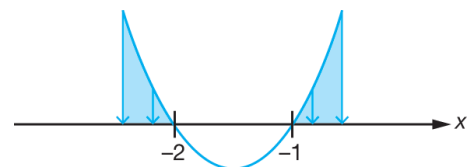
Ketaksamaan pertama ialah

$$-1 < x^2 + 3x + 1$$

$$x^2 + 3x + 1 + 1 > 0$$

$$x^2 + 3x + 2 > 0$$

$$(x + 1)(x + 2) > 0$$



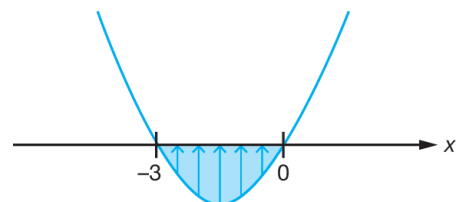
Julat nilai  $x$  yang dikehendaki ialah  
 $x < -2$  atau  $x > -1$  ... (1)

Ketaksamaan kedua ialah

$$x^2 + 3x + 1 \leq 1$$

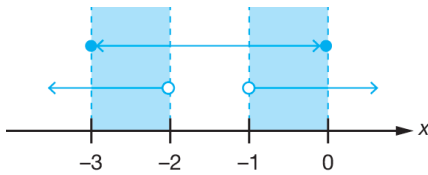
$$x^2 + 3x \leq 0$$

$$x(x + 3) \leq 0$$



Julat nilai  $x$  yang dikehendaki ialah  
 $-3 \leq x \leq 0 \dots (2)$

Menggabungkan (1) dan (2) :



Julat nilai  $x$  yang dikehendaki ialah  
 $-3 \leq x < -2$  atau  $-1 < x \leq 0$ .

### Praktis Formatif 2.2a

- 1 (a)  $2x^2 - 8x + 3 = 0$   
 $b^2 - 4ac = (-8)^2 - 4(2)(3) = 40$   
 Oleh sebab  $b^2 - 4ac > 0$ , punca-punca persamaan kuadratik adalah nyata dan berbeza.
- (b)  $3x^2 - 2x + 9 = 0$   
 $b^2 - 4ac = (-2)^2 - 4(3)(9) = -104$   
 Oleh sebab  $b^2 - 4ac < 0$ , persamaan kuadratik tidak mempunyai punca-punca nyata.
- (c)  $x^2 + 10x + 25 = 0$   
 $b^2 - 4ac = 10^2 - 4(1)(25) = 0$   
 Oleh sebab  $b^2 - 4ac = 0$ , persamaan kuadratik mempunyai punca-punca nyata yang sama.
- (d)  $-2x^2 + 6x + 3 = 0$   
 $b^2 - 4ac = 6^2 - 4(-2)(3) = 60$   
 Oleh sebab  $b^2 - 4ac > 0$ , persamaan kuadratik mempunyai punca-punca nyata yang berbeza.
- (e)  $3x^2 - 6x + 4 = 0$   
 $b^2 - 4ac = (-6)^2 - 4(3)(4) = -12$   
 Oleh sebab  $b^2 - 4ac < 0$ , persamaan kuadratik tidak mempunyai punca-punca nyata.
- (f)  $4x^2 - 12x + 9 = 0$   
 $b^2 - 4ac = (-12)^2 - 4(4)(9) = 0$

Oleh sebab  $b^2 - 4ac = 0$ , persamaan kuadratik mempunyai punca-punca nyata yang sama.

### Praktis Formatif 2.2b

- 1 (a)  $x^2 - 2hx + 3h + 4 = 0$   
 $a = 1, b = -2h, c = 3h + 4$   
 $b^2 - 4ac = 0$   
 $(-2h)^2 - 4(1)(3h + 4) = 0$   
 $4h^2 - 12h - 16 = 0$   
 $h^2 - 3h - 4 = 0$   
 $(h + 1)(h - 4) = 0$   
 $h = -1$  atau  $4$
- (b)  $x^2 - 2(3 + h)x - h - 1 = 0$   
 $a = 1, b = -2(3 + h), c = -h - 1$   
 $b^2 - 4ac = 0$   
 $[-2(3 + h)]^2 - 4(1)(-h - 1) = 0$   
 $4(3 + h)^2 + 4h + 4 = 0$   
 $(3 + h)^2 + h + 1 = 0$   
 $h^2 + 6h + 9 + h + 1 = 0$   
 $h^2 + 7h + 10 = 0$   
 $(h + 2)(h + 5) = 0$   
 $h = -2$  atau  $-5$
- (c)  $hx^2 + 8x = 8hx - 36$   
 $hx^2 + 8x - 8hx + 36 = 0$   
 $a = h, b = 8 - 8h, c = 36$   
 $b^2 - 4ac = 0$   
 $(8 - 8h)^2 - 4h(36) = 0$   
 $64 - 128h + 64h^2 - 144h = 0$   
 $64h^2 - 128h - 80 = 0$   
 $4h^2 - 8h - 5 = 0$   
 $(2h + 1)(2h - 5) = 0$   
 $h = -\frac{1}{2}$  atau  $\frac{5}{2}$
- (d)  $(3 - h)x^2 + h + 1 = 2(h + 1)x$   
 $(3 - h)x^2 - 2(h + 1)x + h + 1 = 0$   
 $a = 3 - h, b = -2(h + 1), c = h + 1$   
 $b^2 - 4ac = 0$   
 $[-2(h + 1)]^2 - 4(3 - h)(h + 1) = 0$   
 $4(h + 1)^2 - 4(3h + 3 - h^2 - h) = 0$   
 $(h + 1)^2 - (-h^2 + 2h + 3) = 0$   
 $h^2 + 2h + 1 + h^2 - 2h - 3 = 0$

$$2h^2 - 2 = 0$$

$$h^2 - 1 = 0$$

$$h = \pm 1$$

2  $x^2 + 2kx = 5p - 1$

$$x^2 + 2kx + 1 - 5p = 0$$

$$a = 1, b = -2k, c = -5p + 1$$

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

$$(-2k)^2 - 4(1)(-5p + 1) = 0$$

$$4k^2 + 20p - 4 = 0$$

$$k^2 + 5p - 1 = 0$$

$$5p = 1 - k^2$$

$$p = \frac{1 - k^2}{5}$$

3  $3mx + q = 2 - 2x^2$

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

$$a = 2, b = 3m, c = q - 2$$

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

$$(3m)^2 - 4(2)(q - 2) = 0$$

$$9m^2 - 8q + 16 = 0$$

$$8q = 9m^2 + 16$$

$$q = \frac{9m^2 + 16}{8}$$

4 (a)  $x^2 + k = kx - 3$

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

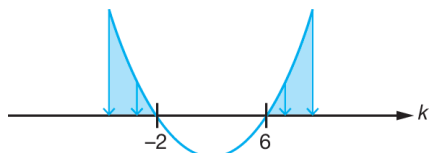
$$a = 1, b = -k, c = k + 3$$

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

$$(-k)^2 - 4(1)(k + 3) > 0$$

$$k^2 - 4k - 12 > 0$$

$$(k + 2)(k - 6) > 0$$



Julat nilai  $k$  yang dikehendaki ialah  
 $k < -2$  atau  $k > 6$ .

(b)  $kx^2 + k = 6 - 8x$

$$kx^2 + 8x + k - 6 = 0$$

$$a = k, b = 8, c = k - 6$$

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

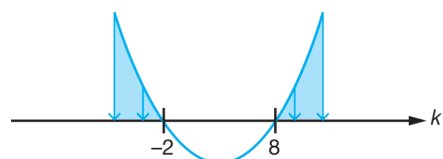
$$8^2 - 4k(k - 6) > 0$$

$$16 - k(k - 6) > 0$$

$$16 - k^2 + 6k > 0$$

$$k^2 - 6k - 16 < 0$$

$$(k + 2)(k - 8) < 0$$



Julat nilai  $k$  yang dikehendaki ialah  
 $-2 < k < 8$ .

(c)  $x^2 + 2k = (2k - 3)x$

$$x^2 - (2k - 3)x + 2k = 0$$

$$a = 1, b = -(2k - 3), c = 2k$$

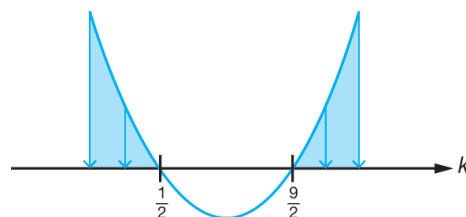
$$b^2 - 4ac > 0$$

$$[-(2k - 3)]^2 - 4(1)(2k) > 0$$

$$4k^2 - 12k + 9 - 8k > 0$$

$$4k^2 - 20k + 9 > 0$$

$$(2k - 9)(2k - 1) > 0$$



Julat nilai  $k$  yang dikehendaki ialah  
 $k < \frac{1}{2}$  atau  $k > \frac{9}{2}$ .

5 (a)  $x^2 - dx + d + 3 = 0$

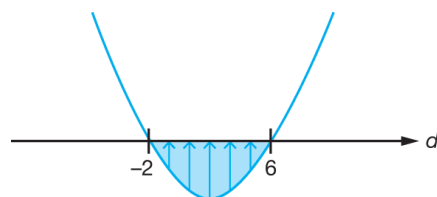
$$a = 1, b = -d, c = d + 3$$

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

$$(-d)^2 - 4(1)(d + 3) < 0$$

$$d^2 - 4d - 12 < 0$$

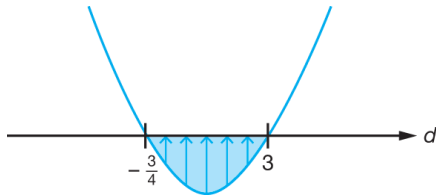
$$(d + 2)(d - 6) < 0$$



Julat nilai  $d$  yang dikehendaki ialah  
 $-2 < d < 6$ .



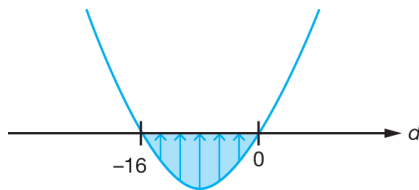
(b)  $dx^2 + 4dx = -9 - x^2$   
 $(d+1)x^2 - 4dx + 9 = 0$   
 $a = d+1, b = -4d, c = 9$   
 $b^2 - 4ac < 0$   
 $(-4d)^2 - 4(d+1)(9) < 0$   
 $16d^2 - 36(d+1) < 0$   
 $4d^2 - 9(d+1) < 0$   
 $4d^2 - 9d - 9 < 0$   
 $(d-3)(4d+3) < 0$



Julat nilai  $d$  yang dikehendaki ialah

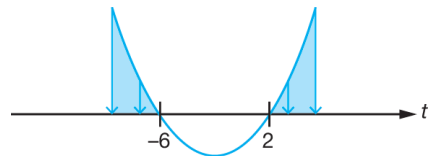
$$-\frac{3}{4} < d < 3.$$

(c)  $(2-3d)x^2 + 2 = (d-4)x$   
 $a = (2-3d), b = -(d-4), c = 2$   
 $b^2 - 4ac < 0$   
 $[-(d-4)]^2 - 4(2-3d)(2) < 0$   
 $d^2 - 8d + 16 - 16 + 24d < 0$   
 $d^2 + 16d < 0$   
 $d(d+16) < 0$



Julat nilai  $d$  yang dikehendaki ialah  
 $-16 < d < 0.$

6  $2x^2 - tx + 1 = 2x - 1$   
 $2x^2 - tx - 2x + 2 = 0$   
 $a = 2, b = -t-2, c = 2$   
 $b^2 - 4ac \geq 0$   
 $(-t-2)^2 - 4(2)(2) \geq 0$   
 $t^2 + 4t + 4 - 16 \geq 0$   
 $t^2 + 4t - 12 \geq 0$   
 $(t+6)(t-2) \geq 0$



Julat nilai  $t$  yang dikehendaki ialah  
 $t \leq -6$  atau  $t \geq 2.$

### Praktis Formatif 2.3a

- 1 (a)  $f(x) = 9x^2 - 12x + 8$   
 Oleh sebab  $a > 0$ , maka bentuk graf ialah  $\cup$ .  
 (b)  $g(x) = -2x^2 - 5x + 3$   
 Oleh sebab  $a < 0$ , maka bentuk graf ialah  $\cap$ .  
 (c)  $h(x) = (x+1)^2 - 4$   
 Oleh sebab  $a > 0$ , maka bentuk graf ialah  $\cup$ .  
 (d)  $m(x) = 1 - (2-x)^2$   
 Oleh sebab  $a < 0$ , maka bentuk graf ialah  $\cap$ .

### Praktis Formatif 2.3b

- 1 (a) Bentuk graf ialah  $\cup$  dan ia menyentuh paksi- $x$  pada satu titik sahaja.  
 Fungsinya ialah  $d(x) = 4x^2 - 20x + 25$   
 kerana  $(-20)^2 - 4(4)(25) = 0$ .  
 (b) Bentuk graf ialah  $\cup$  dan ia bersilang dengan paksi- $x$  pada dua titik yang berlainan.  
 Fungsinya ialah  $p(x) = x^2 - 6x + 8$   
 kerana  $(-6)^2 - 4(1)(8) = 4 (> 0)$ .  
 (c) Bentuk graf ialah  $\cap$  dan ia tidak bersilang dengan paksi- $x$ .  
 Fungsinya ialah  $q(x) = -2x^2 - 3x - 4$   
 kerana  $(-3)^2 - 4(-2)(-4) = -23 (< 0)$ .  
 (d) Bentuk graf ialah  $\cap$  dan ia bersilang dengan paksi- $x$  pada dua titik yang berlainan.  
 Fungsinya ialah  $h(x) = 5x - 6 - x^2 = -x^2 + 5x - 6$  kerana  $5^2 - 4(-1)(-6) = 1 (> 0)$ .  
 (e) Bentuk graf ialah  $\cup$  dan ia tidak bersilang dengan paksi- $x$ . Fungsinya

ialah  $k(x) = x^2 - 2x + 4$  kerana

$$(-2)^2 - 4(1)(4) = -12.$$

(f) Bentuk graf ialah  $\cap$  dan ia menyentuh paksi-x pada satu titik sahaja.

Fungsinya ialah

$$m(x) = 8x - 16 - x^2 = -x^2 + 8x - 16$$

kerana  $(8)^2 - 4(-1)(-16) = 0$ .

2 (a) Tidak mempunyai punca-punca yang nyata

(b) Punca-punca nyata yang berbeza

(c) Punca-punca nyata yang sama

(d) Tidak mempunyai punca-punca yang nyata

(e) Punca-punca nyata yang sama

(f) Punca-punca nyata yang berbeza

3 (a)  $f(x) = -2x^2 + 3x - 4$

$$b^2 - 4ac = 3^2 - 4(-2)(-4) = -23 (< 0)$$

Graf bagi  $f(x)$  tidak bersilang dengan paksi-x.

(b)  $g(x) = 4x^2 - 3x - 5$

$$b^2 - 4ac = (-3)^2 - 4(4)(-5) = 89 (> 0)$$

Graf bagi  $g(x)$  bersilang dengan paksi-x pada dua titik yang berlainan.

(c)  $m(x) = (x-2)^2 + 3$

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

$$= x^2 - 4x + 7$$

$$b^2 - 4ac = (-4)^2 - 4(1)(7) = -12 (< 0)$$

Graf bagi  $m(x)$  tidak bersilang dengan paksi-x.

(d)  $n(x) = 5 - (2x+1)^2$

$$= 5 - (4x^2 + 4x + 1)$$

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

$$b^2 - 4ac = (-4)^2 - 4(-4)(4) = 80 (> 0)$$

Graf bagi  $n(x)$  bersilang dengan paksi-x pada dua titik yang berlainan.

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

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

$$[-(w+4)]^2 - 4(1)(1) = 0$$

$$w^2 + 8w + 16 - 4 = 0$$

$$w^2 + 8w + 12 = 0$$

$$(w+2)(w+6) = 0$$

$$w = -2 \text{ atau } -6$$

(b)  $g(x) = x^2 - wx + w + 3$

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

$$(-w)^2 - 4(1)(w+3) = 0$$

$$w^2 - 4w - 12 = 0$$

$$(w+2)(w-6) = 0$$

$$w = -2 \text{ atau } 6$$

(c)  $h(x) = (4-2w)x^2 + 3wx - 2w - 1$

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

$$(3w)^2 - 4(4-2w)(-2w-1) = 0$$

$$9w^2 - 4(-6w + 4w^2 - 4) = 0$$

$$9w^2 + 24w - 16w^2 + 16 = 0$$

$$-7w^2 + 24w + 16 = 0$$

$$7w^2 - 24w - 16 = 0$$

$$(w-4)(7w+4) = 0$$

$$w = 4 \text{ atau } -\frac{4}{7}$$

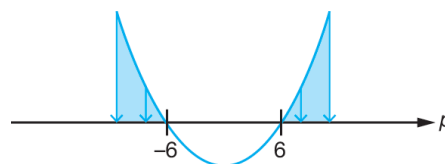
5 (a)  $f(x) = 3x^2 + px + 3$

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

$$p^2 - 4(3)(3) > 0$$

$$p^2 - 36 > 0$$

$$(p+6)(p-6) > 0$$



Julat nilai  $p$  yang dikehendaki ialah  $p < -6$  atau  $p > 6$ .

(b)  $g(x) = px^2 + (p+1)x + p + 1$

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

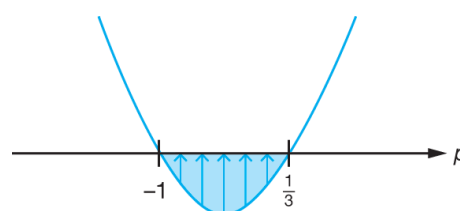
$$(p+1)^2 - 4p(p+1) > 0$$

$$p^2 + 2p + 1 - 4p^2 - 4p > 0$$

$$-3p^2 - 2p + 1 > 0$$

$$3p^2 + 2p - 1 < 0$$

$$(p+1)(3p-1) < 0$$



Julat nilai  $p$  yang dikehendaki ialah

$$-1 < p < \frac{1}{3}.$$

(c)  $m(x) = x^2 + (2-2p)x + 2p+1$

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

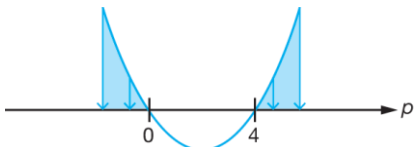
$$(2-2p)^2 - 4(1)(2p+1) > 0$$

$$4-8p+4p^2-8p-4 > 0$$

$$4p^2-16p > 0$$

$$p^2-4p > 0$$

$$p(p-4) > 0$$



Julat nilai  $p$  yang dikehendaki ialah  
 $p < 0$  atau  $p > 4$ .

6 (a)  $f(x) = qx^2 + 6x + q - 8$

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

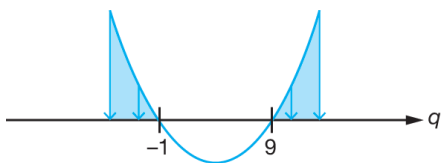
$$6^2 - 4q(q-8) < 0$$

$$36 - 4q^2 + 32q < 0$$

$$-4q^2 + 32q + 36 < 0$$

$$q^2 - 8q - 9 > 0$$

$$(q-9)(q+1) > 0$$



Julat nilai  $q$  yang dikehendaki ialah  
 $q < -1$  atau  $q > 9$ .

(b)  $g(x) = 4x^2 + 4(3-q)x + 1$

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

$$[4(3-q)]^2 - 4(4)(1) < 0$$

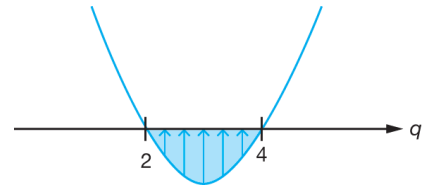
$$16(3-q)^2 - 16 < 0$$

$$(3-q)^2 - 1 < 0$$

$$9 - 6q + q^2 - 1 < 0$$

$$q^2 - 6q + 8 < 0$$

$$(q-2)(q-4) < 0$$



Julat nilai  $q$  yang dikehendaki ialah  
 $2 < q < 4$ .

(c)  $m(x) = x^2 + (q-1)x + q+2$

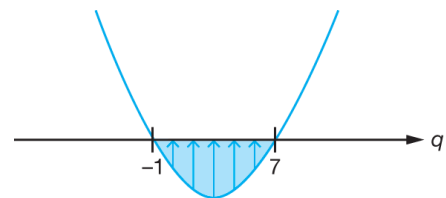
$$b^2 - 4ac < 0$$

$$(q-1)^2 - 4(1)(q+2) < 0$$

$$q^2 - 2q + 1 - 4q - 8 < 0$$

$$q^2 - 6q - 7 < 0$$

$$(q+1)(q-7) < 0$$



Julat nilai  $q$  yang dikehendaki ialah  
 $-1 < q < 7$ .

### Praktis Formatif 2.3c

1 (a)  $f(x) = x^2 - 2x + 3$

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

$$= x^2 - 2x + 1 - 1 + 3$$

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

Nilai minimum = 2 apabila  $x = 1$ .

(b)  $g(x) = 2 + 6x - x^2$

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

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

$$= -(x^2 - 6x + 9 - 9 - 2)$$

$$= -[(x-3)^2 - 11]$$

$$= -(x-3)^2 + 11$$

Nilai maksimum = 11 apabila  $x = 3$ .

(c)  $q(x) = 2x^2 + 8x - 1$

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

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

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

$$= 2 \left[ (x+2)^2 - \frac{9}{2} \right]$$

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

Nilai minimum = -9 apabila  $x = -2$

(d)  $m(x) = 5 - 4x - 2x^2$

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

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

$$= -2 \left( x^2 + 2x + 1 - 1 - \frac{5}{2} \right)$$

$$= -2 \left[ (x+1)^2 - \frac{7}{2} \right]$$

$$= -2(x+1)^2 + 7$$

Nilai maksimum = 7 apabila

$$x = -1$$

(e)  $n(x) = 5x^2 + 8x - 10$

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

$$= 5 \left[ x^2 + \frac{8}{5}x + \left(\frac{1}{2} \times \frac{8}{5}\right)^2 - \left(\frac{1}{2} \times \frac{8}{5}\right)^2 - 2 \right]$$

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

$$= 5 \left[ \left(x + \frac{4}{5}\right)^2 - \frac{66}{25} \right]$$

$$= 5 \left[ \left(x + \frac{4}{5}\right)^2 - \frac{66}{25} \right]$$

$$= 5 \left( x + \frac{4}{5} \right)^2 - \frac{66}{5}$$

Nilai minimum =  $-\frac{66}{5}$  apabila

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

(f)  $p(x) = 6x - 9 - 4x^2$

$$= -4 \left( x^2 - \frac{6}{4}x + \frac{9}{4} \right)$$

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

$$= -4 \left[ x^2 - \frac{3}{2}x + \left(-\frac{3}{4}\right)^2 - \left(-\frac{3}{4}\right)^2 + \frac{9}{4} \right]$$

$$= -4 \left( x^2 - \frac{3}{2}x + \frac{9}{16} - \frac{9}{16} + \frac{9}{4} \right)$$

$$= -4 \left[ \left(x - \frac{3}{4}\right)^2 + \frac{27}{16} \right]$$

$$= -4 \left( x - \frac{3}{4} \right)^2 - \frac{27}{4}$$

Nilai maksimum =  $-\frac{27}{4}$  apabila

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

2  $f(x) = x^2 + 6x + k$

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

$$= x^2 + 6x + 9 - 9 + k$$

$$= (x+3)^2 - 9 + k$$

Nilai minimum = -2

$$-9 + k = -2$$

$$k = 7$$

3  $m(x) = 3x(2-x) + q$

$$= 6x - 3x^2 + q$$

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

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

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

$$= -3 \left[ (x-1)^2 - 1 - \frac{q}{3} \right]$$

$$= -3(x-1)^2 + 3 + q$$

Nilai maksimum = 5

$$3 + q = 5$$

$$q = 2$$

4  $g(x) = 4 - 3x - dx^2$

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

$$\begin{aligned}
&= -d \left[ x^2 + \frac{3}{d} + \left( \frac{3}{2d} \right)^2 - \left( \frac{3}{2d} \right)^2 - \frac{4}{d} \right] \\
&= -d \left[ x^2 + \frac{3}{d} + \left( \frac{9}{4d^2} \right) - \left( \frac{9}{4d^2} \right) - \frac{4}{d} \right] \\
&= -d \left( x + \frac{3}{2d} \right)^2 + \left( \frac{9}{4d} \right) + 4
\end{aligned}$$

Nilai maksimum =  $\frac{41}{8}$

$$\frac{9}{4d} + 4 = \frac{41}{8}$$

$$\frac{9}{4d} = \frac{9}{8}$$

$$d = 2$$

5  $f(x) = -3x^2 + px + 18$

$$\begin{aligned}
&= -3 \left( x^2 - \frac{p}{3}x - 6 \right) \\
&= -3 \left[ x^2 - \frac{p}{3}x + \left( -\frac{p}{6} \right)^2 - \left( -\frac{p}{6} \right)^2 - 6 \right] \\
&= -3 \left[ x^2 - \frac{p}{3}x + \left( \frac{p^2}{36} \right) - \left( \frac{p^2}{36} \right) - 6 \right] \\
&= -3 \left[ \left( x - \frac{p}{6} \right)^2 - \left( \frac{p^2}{36} \right) - 6 \right] \\
&= -3 \left( x - \frac{p}{6} \right)^2 + \left( \frac{p^2}{12} \right) + 18
\end{aligned}$$

Nilai maksimum =  $q$  apabila  $x = -2$

Nilai maksimum =  $\left( \frac{p^2}{12} \right) + 18$  apabila

$$x = \frac{p}{6}$$

Dengan perbandingan,  $\frac{p}{6} = -2$

$$p = -12$$

$$q = \left( \frac{p^2}{12} \right) + 18$$

$$q = \left( \frac{144}{12} \right) + 18 = 12 + 18 = 30$$

6  $f(x) = tx^2 - 12x + 20$

$$\begin{aligned}
&= t \left( x^2 - \frac{12}{t}x + \frac{20}{t} \right) \\
&= t \left[ x^2 - \frac{12}{t}x + \left( -\frac{12}{2t} \right)^2 - \left( -\frac{12}{2t} \right)^2 + \frac{20}{t} \right]
\end{aligned}$$

$$\begin{aligned}
&= t \left[ x^2 - \frac{12}{t}x + \left( \frac{36}{t^2} \right) - \left( \frac{36}{t^2} \right) + \frac{20}{t} \right] \\
&= t \left[ \left( x - \frac{6}{t} \right)^2 - \left( \frac{36}{t^2} \right) + \frac{20}{t} \right] \\
&= t \left( x - \frac{6}{t} \right)^2 - \frac{36}{t} + 20
\end{aligned}$$

$f(x)$  mempunyai nilai maksimum apabila

$$x = \frac{6}{t}$$

Tetapi di beri bahawa  $f(x)$  mempunyai nilai maksimum apabila  $x = -2$ .

Dengan perbandingan,  $\frac{6}{t} = -2$   
 $t = -3$

$$\begin{aligned}
\text{Nilai maksimum} &= -\frac{36}{t} + 20 \\
&= -\frac{36}{-3} + 20 \\
&= 12 + 20 \\
&= 32
\end{aligned}$$

### Praktis Formatif 2.3d

1 (a)  $g(x) = a(x-h)^2 + k$

Daripada graf,

$$g(x) = a(x-3)^2 - 2$$

Dengan perbandingan,  $h = 3$  dan

$$k = -2$$

(b)  $g(x) = a(x-3)^2 - 2$

Apabila  $x = 0$ ,  $y = -6$

$$g(0) = a(0-3)^2 - 2 = -6$$

$$9a = -4$$

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

(c) Persamaan paksi simetri ialah  $x = 3$ .

2 (a) Persamaan paksi simetri ialah

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

$$x = 1$$

(b)  $f(x) = a(x-h)^2 + k$

Tetapi diberi bahawa

$$f(x) = a(x-1)^2 - 5$$

Maka,  $h = 1$  dan  $k = -5$

(c) Apabila  $x = 3$ ,  $y = 0$ .

$$f(3) = a(3-1)^2 - 5$$

$$0 = 4a - 5$$

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

3 (a) Persamaan paksi simetri ialah  $x = \frac{1+3}{2}$   
 $x = 2$

(b)  $f(x) = a(x-k)^2 - 4$   
 $x = k$   
 Tetapi telah ditentukan di (a) bahawa  $x = 2$ .  
 Dengan perbandingan,  $k = 2$ .

(c)  $f(x) = a(x-2)^2 - 4$   
 Koordinat titik minimum ialah  $(2, -4)$ .

(d) Apabila  $x = 1, y = 0$   
 $f(x) = a(x-k)^2 - 4$   
 $0 = a(1-2)^2 - 4$   
 $a = 4$

(e) Apabila lengkung itu dipantulkan pada paksi-x, tanda setiap sebutan akan berubah, iaitu  
 $f(x) = -4(x-2)^2 + 4$

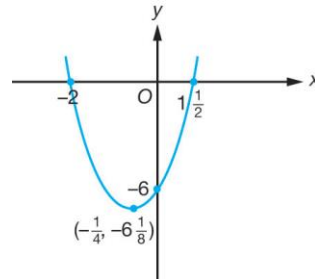
(f) Apabila lengkung itu dipantulkan pada paksi-y, tanda bagi  $b$  akan berubah, iaitu  
 $f(x) = 4(x+2)^2 - 4$

### Praktis Formatif 2.3e

1 (a)  $f(x) = (2x-3)(x+2)$   
 $= 2x^2 + x - 6$   
 $= 2\left(x^2 + \frac{x}{2} - 3\right)$   
 $= 2\left[x^2 + \frac{x}{2} + \left(\frac{1}{2(2)}\right)^2 - \left(\frac{1}{2(2)}\right)^2 - 3\right]$   
 $= 2\left[x^2 + \frac{x}{2} + \left(\frac{1}{16}\right) - \left(\frac{1}{16}\right) - 3\right]$   
 $= 2\left[\left(x + \frac{1}{4}\right)^2 - \frac{49}{16}\right]$   
 $= 2\left(x + \frac{1}{4}\right)^2 - \frac{49}{8}$

Titik minimum ialah  $\left(-\frac{1}{4}, -6\frac{1}{8}\right)$ .  
 Pintaasan-y ialah  $-6$ .

Pintasan-x ialah  $1\frac{1}{2}$  dan  $-2$ .



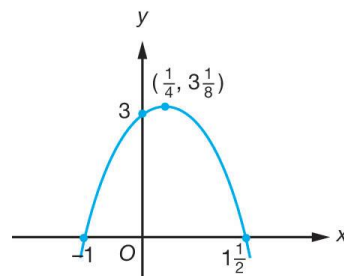
Persamaan paksi simetri ialah  $x = -\frac{1}{4}$ .

(b)  $g(x) = (1+x)(3-2x)$   
 $= -2x^2 + x + 3$   
 $= -2\left(x^2 - \frac{1}{2}x - \frac{3}{2}\right)$   
 $= -2\left[x^2 - \frac{1}{2}x + \left(\frac{-1}{2 \times 2}\right)^2 - \left(\frac{-1}{2 \times 2}\right)^2 - \frac{3}{2}\right]$   
 $= -2\left[x^2 - \frac{1}{2}x + \left(\frac{1}{16}\right) - \left(\frac{1}{16}\right) - \frac{3}{2}\right]$   
 $= -2\left[\left(x - \frac{1}{4}\right)^2 - \left(\frac{25}{16}\right)\right]$   
 $= -2\left(x - \frac{1}{4}\right)^2 + \frac{25}{8}$

Titik maksimum ialah  $\left(\frac{1}{4}, 3\frac{1}{8}\right)$ .

Pintasan-y ialah  $3$ .

Pintasan-x ialah  $-1$  dan  $1\frac{1}{2}$ .



Persamaan paksi simetri ialah  $x = \frac{1}{4}$

(c)  $h(x) = 3x^2 + 12x - 4$

$$\begin{aligned}
&= 3\left(x^2 + 4x - \frac{4}{3}\right) \\
&= 3\left(x^2 + 4x - \frac{4}{3}\right) \\
&= 3\left[x^2 + 4x + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 - \frac{4}{3}\right] \\
&= 3\left(x^2 + 4x + 4 - 4 - \frac{4}{3}\right) \\
&= 3\left[(x+2)^2 - 16\right] \\
&= 3(x+2)^2 - 16
\end{aligned}$$

Titik minimum ialah  $(-2, -16)$ .

Pintasan- $y = -4$

Pada paksi- $x$  ( $y = 0$ ),

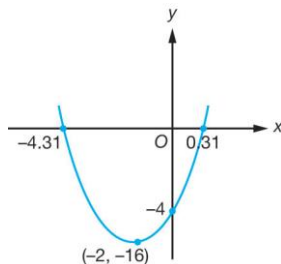
$$3x^2 + 12x - 4 = 0$$

$$x = \frac{-12 \pm \sqrt{12^2 - 4(3)(-4)}}{2(3)}$$

$$x = \frac{-12 \pm \sqrt{192}}{6}$$

$$x = -4.31 \text{ atau } 0.72$$

Lengkung bersilang dengan paksi- $x$  pada  $(-4.31, 0)$  dan  $(0.72, 0)$ .



Persamaan paksi simetri ialah

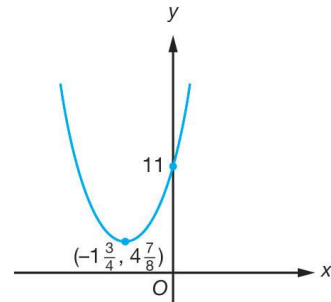
$$x = -2.$$

$$\begin{aligned}
\text{(d) } m(x) &= 2x^2 + 7x + 11 \\
&= 2\left(x^2 + \frac{7}{2}x + \frac{11}{2}\right) \\
&= 2\left[x^2 + \frac{7}{2}x + \left(\frac{1}{2} \times \frac{7}{2}\right)^2 - \left(\frac{1}{2} \times \frac{7}{2}\right)^2 + \frac{11}{2}\right] \\
&= 2\left[x^2 + \frac{7}{2}x + \frac{49}{16} - \left(\frac{49}{16}\right) + \frac{11}{2}\right] \\
&= 2\left[\left(x + \frac{7}{4}\right)^2 + \frac{39}{16}\right] \\
&= 2\left(x + \frac{7}{4}\right)^2 + \frac{39}{8}
\end{aligned}$$

Titik minimum ialah

$$\left(-1\frac{3}{4}, 4\frac{7}{8}\right)$$

Pintasan- $y = 11$



Persamaan paksi simetri ialah

$$x = -\frac{7}{4}.$$

$$\begin{aligned}
\text{(e) } n(x) &= 1 - 2x - x^2 \\
&= -x^2 - 2x + 1 \\
&= -(x^2 + 2x - 1) \\
&= -\left[x^2 + 2x + \left(\frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 - 1\right] \\
&= -(x^2 + 2x + 1 - 1 - 1) \\
&= -(x+1)^2 - 2
\end{aligned}$$

Titik maksimum ialah  $(-1, 2)$ .

Pintasan- $y = 1$

Pada paksi- $x$ ,  $y = 0$

$$-x^2 - 2x + 1 = 0$$

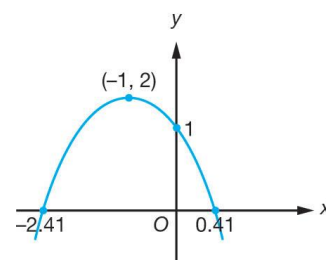
$$x^2 + 2x - 1 = 0$$

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

$$x = \frac{-2 \pm \sqrt{8}}{2(1)}$$

$$x = 0.21 \text{ atau } 0.41$$

Lengkung bersilang dengan paksi- $x$  pada  $(-2.41, 0)$  dan  $(0.41, 0)$ .

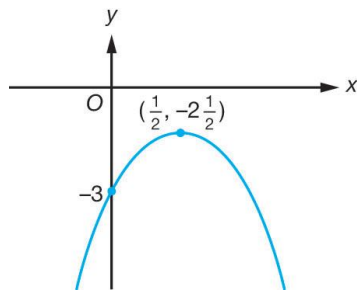


Persamaan paksi simetri ialah  
 $x = -1$ .

$$\begin{aligned}
 \text{(f) } p(x) &= 2x - 3 - 2x^2 \\
 &= -2x^2 + 2x - 3 \\
 &= -2\left(x^2 - x + \frac{3}{2}\right) \\
 &= -2\left[x^2 - x + \left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right)^2 + \frac{3}{2}\right] \\
 &= -2\left(x^2 - x + \frac{1}{4} - \frac{1}{4} + \frac{3}{2}\right) \\
 &= -2\left[\left(x - \frac{1}{2}\right)^2 + \frac{5}{4}\right] \\
 &= -2\left(x - \frac{1}{2}\right)^2 - \frac{5}{2}
 \end{aligned}$$

Titik maksimum ialah  $\left(\frac{1}{2}, -\frac{5}{2}\right)$ .

Pintasan-y = -3



Persamaan paksi simetri ialah

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

$$\begin{aligned}
 \text{2 (a) } f(x) &= (x-2)^2 - (2x-3)^2 \\
 &= x^2 - 4x + 4 - (4x^2 - 12x + 9) \\
 &= x^2 - 4x + 4 - 4x^2 + 12x - 9 \\
 &= -3x^2 + 8x - 5 \\
 &= -3\left(x^2 - \frac{8}{3}x + \frac{5}{3}\right) \\
 &= -3\left(x^2 - \frac{8}{3}x + 16 - 16 - 5\right) \\
 &= -3\left[x^2 - \frac{8}{3}x + \left(-\frac{8}{(2)(3)}\right)^2 - \left(-\frac{8}{(2)(3)}\right)^2 + \frac{5}{3}\right] \\
 &= -3\left[x^2 - \frac{8}{3}x + \frac{16}{9} - \frac{16}{9} + \frac{5}{3}\right]
 \end{aligned}$$

$$= -3\left[\left(x - \frac{4}{3}\right)^2 - \frac{1}{9}\right]$$

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

Titik maksimum ialah  $\left(\frac{4}{3}, \frac{1}{3}\right)$ .

Pintasan-y ialah = -5

Pada paksi-x, ( $y = 0$ )

$$-3x^2 + 8x - 5 = 0$$

$$3x^2 - 8x + 5 = 0$$

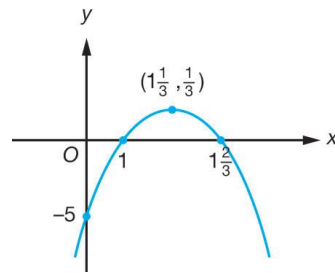
$$(3x-5)(x-1) = 0$$

$$x = \frac{5}{3} \text{ atau } 1$$

Lengkung bersilang dengan paksi-x

pada  $(1, 0)$  dan  $\left(\frac{5}{3}, 0\right)$

(b)



$$\text{3 (a) } g(x) = \frac{1}{2}\left[(x+5)^2 + (x-3)^2\right]$$

$$= \frac{1}{2}(x^2 + 10x + 25 + x^2 - 6x + 9)$$

$$= \frac{1}{2}(2x^2 + 4x + 34)$$

$$= x^2 + 2x + 17$$

$$= x^2 + 2x + \left(\frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 + 17$$

$$= x^2 + 2x + 1 - 1 + 17$$

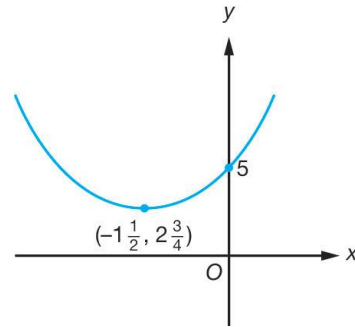
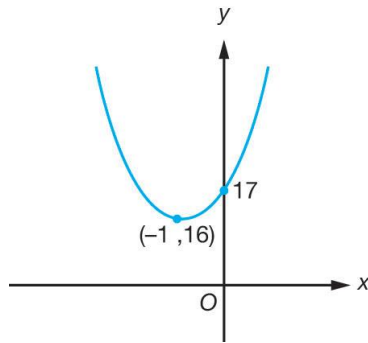
$$= (x+1)^2 + 16$$

Titik minimum ialah  $(-1, 16)$ .

Pintasan-y = 17



(b)



$$\begin{aligned}
 \mathbf{4(a)} \quad f(x) &= x^2 + px + 5 \\
 &= x^2 + px + \left(\frac{p}{2}\right)^2 - \left(\frac{p}{2}\right)^2 + 5 \\
 &= x^2 + px + \frac{p^2}{4} - \frac{p^2}{4} + 5 \\
 &= \left(x + \frac{p}{2}\right)^2 - \frac{p^2}{4} + 5
 \end{aligned}$$

Titik minimum ialah  $\left(-\frac{p}{2}, -\frac{p^2}{4} + 5\right)$ .

Tetapi diberi bahawa titik minimum ialah  $\left(q, \frac{11}{4}\right)$

Dengan perbandingan,

$$\begin{aligned}
 -\frac{p^2}{4} + 5 &= \frac{11}{4} \\
 -p^2 + 20 &= 11 \\
 p^2 &= 9 \\
 p &= 3
 \end{aligned}$$

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

$$\begin{aligned}
 \mathbf{(b)} \quad f(x) &= \left(x + \frac{3}{2}\right)^2 - \frac{3^2}{4} + 5 \\
 &= \left(x + \frac{3}{2}\right)^2 + \frac{11}{4}
 \end{aligned}$$

Titik minimum ialah  $\left(-\frac{3}{2}, \frac{11}{4}\right)$

iaitu  $\left(-1\frac{1}{2}, 2\frac{3}{4}\right)$ .

Pintasan- $y = 5$

$$\begin{aligned}
 \mathbf{5(a)} \quad g(x) &= -x^2 + hx - 4 \\
 &= -(x^2 - hx + 4) \\
 &= -\left[x^2 - hx + \left(\frac{h}{2}\right)^2 - \left(\frac{h}{2}\right)^2 + 4\right] \\
 &= -\left(x^2 - hx + \frac{h^2}{4} - \frac{h^2}{4} + 4\right) \\
 &= -\left[\left(x - \frac{h}{2}\right)^2 - \frac{h^2}{4} + 4\right] \\
 &= -\left(x - \frac{h}{2}\right)^2 + \frac{h^2}{4} - 4
 \end{aligned}$$

Titik maksimum ialah  $\left(\frac{h}{2}, \frac{h^2}{4} - 4\right)$ .

Tetapi diberi bahawa titik maksimum ialah  $(k, -3)$ .

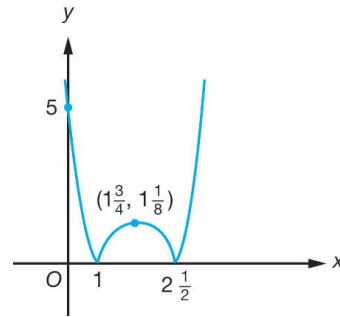
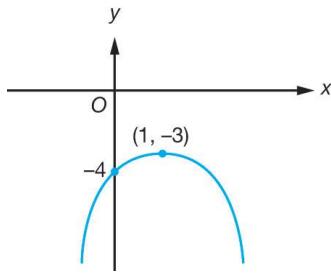
$$\begin{aligned}
 \text{Dengan perbandingan, } \frac{h^2}{4} - 4 &= -3 \\
 h^2 &= 4 \\
 h &= 2
 \end{aligned}$$

$$k = \frac{h}{2} = \frac{2}{2} = 1$$

$$\begin{aligned}
 \mathbf{(b)} \quad &-\left(x - \frac{h}{2}\right)^2 + \frac{h^2}{4} - 4 \\
 &= -\left(x - \frac{2}{2}\right)^2 + \frac{2^2}{4} - 4 \\
 &= -(x-1)^2 - 3
 \end{aligned}$$

Titik maksimum ialah  $(1, -3)$ .

Pintasan- $y = -4$



6 (a)  $f(x) = 2x^2 - 7x + 5$

$$= 2\left(x^2 - \frac{7}{2}x + \frac{5}{2}\right)$$

$$= 2\left[x^2 - \frac{7}{2}x + \left(-\frac{7}{2 \times 2}\right)^2 - \left(-\frac{7}{2 \times 2}\right)^2 + \frac{5}{2}\right]$$

$$= 2\left[x^2 - \frac{7}{2}x + \frac{49}{16} - \frac{49}{16} + \frac{5}{2}\right]$$

$$= 2\left[\left(x - \frac{7}{4}\right)^2 - \frac{9}{16}\right]$$

$$= 2\left(x - \frac{7}{4}\right)^2 - \frac{9}{8}$$

Titik minimum ialah  $\left(\frac{7}{4}, -\frac{9}{8}\right)$ , iaitu

$$\left(1\frac{3}{4}, -1\frac{1}{8}\right).$$

Pintasan-y = 5

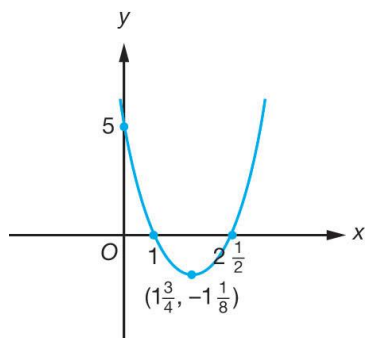
Pada paksi-x,  $y = 0$

$$2x^2 - 7x + 5 = 0$$

$$(x-1)(2x-5) = 0$$

$$x = 1 \text{ atau } \frac{5}{2}$$

Maka, lengkung bersilang dengan paksi-x pada  $(1, 0)$  dan  $\left(2\frac{1}{2}, 0\right)$ .



(b)

7 (a)  $f(x) = -10 + 7x - x^2$

$$= -x^2 + 7x - 10$$

$$= -(x^2 - 7x + 10)$$

$$= -\left[x^2 - 7x + \left(-\frac{7}{2}\right)^2 - \left(-\frac{7}{2}\right)^2 + 10\right]$$

$$= -\left[x^2 - 7x + \frac{49}{4} - \frac{49}{4} + 10\right]$$

$$= -\left[\left(x - \frac{7}{4}\right)^2 - \frac{49}{4} + 10\right]$$

$$= -\left[\left(x - \frac{7}{4}\right)^2 - \frac{9}{4}\right]$$

$$= -\left(x - \frac{7}{4}\right)^2 + \frac{9}{4}$$

Titik maksimum ialah  $\left(\frac{7}{4}, \frac{9}{4}\right)$ , iaitu

$$\left(3\frac{1}{2}, 2\frac{1}{4}\right).$$

Pintasan-y = -10

Pada paksi-x,  $y = 0$

$$-x^2 + 7x - 10 = 0$$

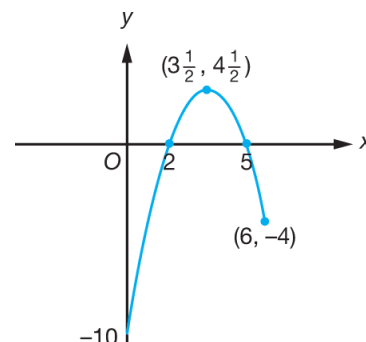
$$x^2 - 7x + 10 = 0$$

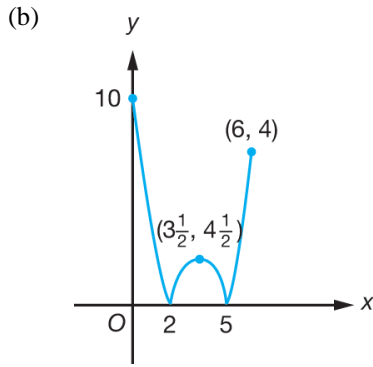
$$(x-2)(x-5) = 0$$

$$x = 2 \text{ atau } 5$$

Maka, lengkung akan bersilang dengan paksi-x pada titik-titik  $(2, 0)$  dan  $(5, 0)$ .

$x$	0	6
$f(x)$	-10	-4





### Praktis Formatif 2.3f

1  $y = m(x-3) - 1 \dots (1)$   
 $y = x^2 - 3x \dots (2)$

Gantikan (2) ke dalam (1) :

$$x^2 - 3x = m(x-3) - 1$$

$$x^2 - 3x = mx - 3m - 1$$

$$x^2 - 3x - mx + 3m + 1 = 0$$

$$a = 1, b = -3 - m, c = 3m + 1$$

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

$$(-3 - m)^2 - 4(1)(3m + 1) < 0$$

$$9 + 6m + m^2 - 12m - 4 < 0$$

$$m^2 - 6m + 5 < 0$$

$$(m - 5)(m - 1) < 0$$

$$m = 5 \text{ atau } 1$$

2  $y = nx - 2 \dots (1)$

$$y = 2x^2 - x \dots (2)$$

Gantikan (2) ke dalam (1) :

$$2x^2 - x = nx - 2$$

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

$$a = 2, b = -1 - n, c = 2$$

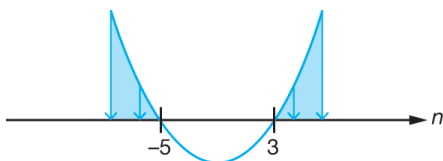
$$(-1 - n)^2 - 4(2)(2) > 0$$

$$b^2 - 16 > 0$$

$$1 + 2n + n^2 - 16 > 0$$

$$n^2 + 2n - 15 > 0$$

$$(n - 3)(n + 5) > 0$$



Julat nilai  $n$  ialah

$$n < -5 \text{ or } n > 3.$$

3  $y = k(x-1) - 1 \dots (1)$

$$y = x^2 - kx + 1 \dots (2)$$

Gantikan (2) ke dalam (1) :

$$x^2 - kx + 1 = k(x-1) - 1$$

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

$$x^2 - 2kx + k + 2 = 0$$

$$a = 1, b = -2k, k + 2$$

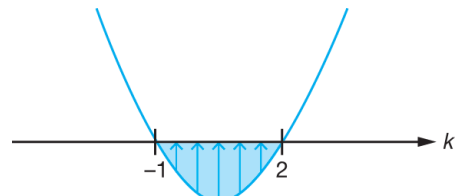
$$b^2 - 4ac < 0$$

$$(-2k)^2 - 4(1)(k + 2) < 0$$

$$4k^2 - 4k - 8 < 0$$

$$k^2 - k - 2 < 0$$

$$(k - 2)(k + 1) < 0$$



4

$$a = 2, b = -2t, c = -3t + 20$$

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

$$(-2t)^2 - 4(2)(20 - 3t) < 0$$

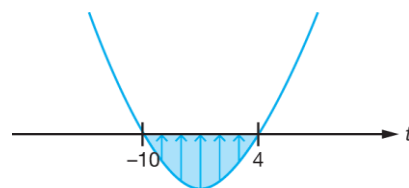
$$4t^2 - 8(20 - 3t) < 0$$

$$t^2 - 2(20 - 3t) < 0$$

$$t^2 - 40 + 6t < 0$$

$$t^2 + 6t - 40 < 0$$

$$(t - 4)(t + 10) < 0$$



Julat nilai  $t$  yang dikehendaki ialah

$$-10 < t < 4.$$

5  $g(x) = -2x^2 + (u + 6)x - 2u - 6$

$$a = -2, b = u + 6, c = -2u - 6$$

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

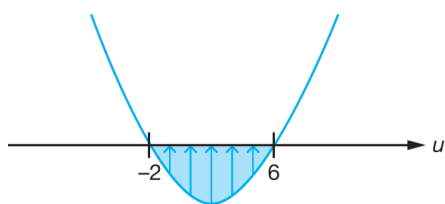
$$(u + 6)^2 - 4(-2)(-2u) < 0$$

$$u^2 + 12u + 36 + 8(-2u - 6) < 0$$

$$u^2 + 12u + 36 - 16u - 48 < 0$$

$$u^2 - 4u - 12 < 0$$

$$(u+2)(u-6) < 0$$



Julat nilai  $u$  yang dikehendaki ialah  $-2 < u < 6$ .

- 6 (a) Apabila  $x=0$ ,  $h(x)=0$ , maka  $c=0$ .  
Apabila  $x=120$ ,  $h(120)=0$ .

$$\begin{aligned} \text{Maka, } h(120) &= a(120)^2 + b(120) = 0 \\ 120a + b &= 0 \dots (1) \end{aligned}$$

Apabila  $x=60$ ,  $h(60)=70$ .

$$\begin{aligned} \text{Maka, } h(60) &= a(60)^2 + b(60) = 70 \\ 3600a + 60b &= 70 \\ 360a + 6b &= 7 \dots (2) \end{aligned}$$

$$\begin{aligned} 360a + 3b &= 0 \dots (1) \times 3 \\ (-) \quad 360a + 6b &= 7 \\ \hline -3b &= -7 \\ b &= \frac{-7}{-3} \\ b &= \frac{7}{3} \end{aligned}$$

Gantikan  $b = \frac{7}{3}$  ke dalam (1) :

$$120a + \frac{7}{3} = 0$$

$$120a = -\frac{7}{3}$$

$$a = -\frac{7}{360}$$

$$\text{Maka, } h(x) = -\frac{7}{360}x^2 + \frac{7}{3}x$$

- (b) Apabila,  $h(x) = 52\frac{1}{2}$ ,

$$52\frac{1}{2} = -\frac{7}{360}x^2 + \frac{7}{3}x$$

$$18\,900 = -7x^2 + 840x^2$$

$$7x^2 - 840x + 18\,900 = 0$$

$$x^2 - 120x + 2700 = 0$$

$$(x-3)(x-90) = 0$$

$$x = 30 \text{ atau } x = 90$$

Maka, apabila lengkung parabola ialah  $52\frac{1}{2}$  m, jarak daripada titik  $P$  ialah 30 m atau 90 m.

### Praktis Sumatif 2

1  $x(3x-2) = 7-5x$

$$3x^2 - 2x + 5x - 7 = 0$$

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

$$x = \frac{-3 \pm \sqrt{3^2 - 4(3)(-7)}}{2(3)}$$

$$x = \frac{-3 \pm \sqrt{93}}{6}$$

$$x = 1.107 \text{ atau } -2.107$$

2  $(k-30)(2k+50) - 1400 = 1.61 \times 10\,000$

$$2k^2 - 10k - 1500 - 1400 - 16\,100 = 0$$

$$2k^2 - 10k - 19\,000 = 0$$

$$k^2 - 5x - 9\,500 = 0$$

$$k = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-9\,500)}}{2(1)}$$

$$k = \frac{5 \pm \sqrt{38\,025}}{2}$$

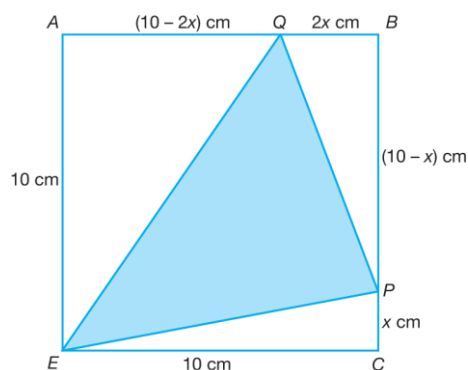
$$k = \frac{5 \pm 195}{2}$$

$$k = -95 \text{ atau } 100$$

$$k = -95 \text{ tidak diterima.}$$

$$k = 100$$

3



(a)  $A(x) = 10(10) - \frac{1}{2}(10)(x) - \frac{1}{2}(10)(10-2x)$

$$- \frac{1}{2}(2x)(10-x)$$

$$= 100 - 5x - 50 + 10x - 10x + x^2$$

$$= x^2 - 5x + 50 \text{ [Tertunjuk]}$$

(b)  $x^2 - 5x + 50 = 44.75$   
 $4x^2 - 20x + 200 = 179$   
 $4x^2 - 20x + 21 = 0$   
 $(2x - 7)(2x - 3) = 0$   
 $x = 3.5$  atau  $x = 1.5$   
 $x = 3.5$  tidak diterima kerana ia tidak memuaskan  $AQ > QB$ .  
Maka,  $x = 1.5$

4  $2x^2 - 8x - 3 = 0$   
Punca-punca ialah  $\alpha$  dan  $\beta$ .  
H.T.P =  $\alpha + \beta = \frac{8}{2} = 4$   
H.D.P. =  $\alpha\beta = -\frac{3}{2}$   
Punca-punca baharu ialah  $\alpha(1 - \beta)$  dan  $\beta(1 - \alpha)$ .  
H.T.P =  $\alpha(1 - \beta) + \beta(1 - \alpha)$   
 $= \alpha - \alpha\beta + \beta - \beta\alpha$   
 $= \alpha + \beta - 2\alpha\beta$   
 $= 4 - 2\left(-\frac{3}{2}\right)$   
 $= 4 + 3$   
 $= 7$   
H.D.P. =  $\alpha(1 - \beta)\beta(1 - \alpha)$   
 $= \alpha\beta[(1 - \beta)(1 - \alpha)]$   
 $= \alpha\beta[1 - (\alpha + \beta) + \alpha\beta]$   
 $= -\frac{3}{2}\left[1 - 4 + \left(-\frac{3}{2}\right)\right]$   
 $= \frac{27}{4}$

Persamaan kuadratik baharu ialah

$$x^2 - 7x + \frac{27}{4} = 0$$

$$4x^2 - 28x + 27 = 0$$

5  $x^2 + k = 15x$   
 $x^2 - 15x + k = 0$   
Punca-punca ialah  $2\alpha$  dan  $3\alpha$ .  
H.T.P = 15  
 $2\alpha + 3\alpha = 15$   
 $5\alpha = 15$   
 $\alpha = 3$

H.D.P. =  $k$   
 $(2\alpha)(3\alpha) = k$

$$k = 6\alpha^2$$

$$k = 6(3)^2$$

$$k = 54$$

6 (a)  $hx^2 + kx + 2k = 8x + 4$   
 $hx^2 + kx - 8x + 2k - 4 = 0$   
 $hx^2 + (k - 8)x + 2k - 4 = 0$   
 $a = h, b = k - 8, c = 2k - 4$   
Punca-punca ialah  $k$  dan  $\frac{1}{h}$ .

$$\text{H.T.P} = -\frac{b}{a}$$

$$k + \frac{1}{h} = -\frac{(k - 8)}{h}$$

$$\frac{hk + 1}{h} = -\frac{(k - 8)}{h}$$

$$hk + 1 = -k + 8$$

$$hk + k = 7 \dots (1)$$

$$\text{H.D.P.} = \frac{c}{a}$$

$$\frac{k}{h} = \frac{2k - 4}{h}$$

$$k = 2k - 4$$

$$k = 4$$

Daripada (1) :

$$4h + 4 = 7$$

$$4h = 3$$

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

(b) Punca-punca baharu ialah  $2h = 2\left(\frac{3}{4}\right) = \frac{3}{2}$

dan  $-k = -4$ .

$$\text{H.T.P} = \frac{3}{2} + (-4) = -\frac{5}{2}$$

$$\text{H.D.P.} = \frac{3}{2}(-4) = -6$$

Persamaan kuadratik baharu ialah

$$x^2 + \frac{5}{2}x - 6 = 0$$

$$2x^2 + 5x - 12 = 0$$

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

Punca-punca ialah  $\alpha$  dan  $\beta$ .

$$\alpha + \beta = -2$$

$$\alpha\beta = -5$$

$$x^2 + 4x + q = 0$$

Punca-punca ialah  $\frac{p}{\alpha}$  dan  $\frac{p}{\beta}$ .

$$\begin{aligned} \text{H.T.P} &= \frac{p}{\alpha} + \frac{p}{\beta} \\ &= \frac{p(\alpha + \beta)}{\alpha\beta} \\ &= \frac{p(-2)}{-5} \\ &= \frac{2}{5}p \end{aligned}$$

$$\text{H.T.P} = -\frac{b}{a} = -4$$

Dengan perbandingan,  $\frac{2}{5}p = -4$

$$\begin{aligned} p &= \frac{5}{2}(-4) \\ p &= -10 \end{aligned}$$

$$\begin{aligned} \text{H.D.P.} &= \left(\frac{p}{\alpha}\right)\left(\frac{p}{\beta}\right) \\ &= \frac{p^2}{\alpha\beta} \\ &= \frac{p^2}{-5} \end{aligned}$$

$$\text{H.D.P.} = \frac{c}{a} = q$$

Dengan perbandingan,

$$\begin{aligned} q &= \frac{p^2}{-5} \\ q &= \frac{(-10)^2}{-5} \\ q &= \frac{100}{-5} \\ q &= -20 \end{aligned}$$

**8**  $x^2 + 2mx + 1 = 0$

Punca-punca ialah  $\alpha$  dan  $\beta$ .

$$\begin{aligned} \alpha + \beta &= -2m \\ \alpha\beta &= 1 \end{aligned}$$

$$x^2 + 4x - n = 0$$

Punca-punca ialah  $2\alpha$  dan  $2\beta$ .

$$\begin{aligned} 2\alpha + 2\beta &= -\frac{b}{a} \\ 2(\alpha + \beta) &= -4 \\ 2(-2m) &= -4 \\ -4m &= -4 \\ m &= \frac{-4}{-4} = 1 \end{aligned}$$

$$\begin{aligned} (2\alpha)(2\beta) &= \frac{c}{a} \\ 4\alpha\beta &= -n \\ 4(1) &= -n \\ n &= -4 \end{aligned}$$

**9**  $(x+m)^2 = kx$

$$\begin{aligned} x^2 + 2mx + m^2 - kx &= 0 \\ x^2 + (2m-k)x + m^2 &= 0 \end{aligned}$$

Punca-punca ialah 1 dan 16.

$$\text{H.T.P} = -\frac{b}{a}$$

$$1 + 16 = -(2m - k)$$

$$17 = -2m + k \quad \dots (1)$$

$$\text{H.D.P.} = \frac{c}{a}$$

$$\begin{aligned} 1 \times 16 &= m^2 \\ m &= \pm 4 \end{aligned}$$

Daripada (1) :  
Apabila  $m = 4$ ,  
 $17 = -2(4) + k$   
 $k = 17 + 8$   
 $k = 25$

Daripada (1) :  
Apabila  $m = -4$ ,  
 $17 = -2(-4) + k$   
 $17 = 8 + k$   
 $k = 9$

**10**  $x^2 + 15 = 8x$

$$x^2 - 8x + 15 = 0$$

Punca-punca ialah  $(h+1)$  dan  $(k-2)$ .

$$\begin{aligned} \text{H.T.P} &= -\frac{b}{a} \\ (h+1) + (k-2) &= 8 \\ h+k-1 &= 8 \\ h+k &= 9 \\ h &= 9-k \quad \dots (1) \end{aligned}$$

$$\begin{aligned} \text{H.D.P.} &= \frac{c}{a} \\ (h+1)(k-2) &= 15 \\ hk - 2h + k - 2 &= 15 \\ hk - 2h + k &= 17 \quad \dots (2) \end{aligned}$$

Gantikan (1) ke dalam (2) :  
 $k(9-k) - 2(9-k) + k = 17$

$$\begin{aligned}
9k - k^2 - 18 + 2k + k &= 17 \\
-k^2 + 12k - 35 &= 0 \\
k^2 - 12k + 35 &= 0 \\
(k-7)(k-5) &= 0 \\
k &= 7 \text{ atau } 5
\end{aligned}$$

Daripada (1) :  
 Apabila  $k = 7$ ,  
 $h = 9 - k = 9 - 7 = 2$   
 Apabila  $k = 5$ ,  
 $h = 9 - 5 = 4$

Maka,  $k = 7, h = 2$  atau  $k = 5, h = 4$

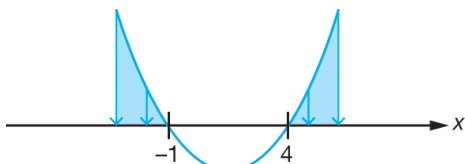
**11**  $y = 2(x-2)^2 + 3q$   
 $y = 2(x^2 - 4x + 4) + 3q$   
 $y = 2x^2 - 8x + 8 + 3q$   
 H.T.P =  $-\frac{-8}{2} = 4 \dots (1)$   
 H.D.P. =  $\frac{8+3q}{2} \dots (2)$

$$\begin{aligned}
y &= x^2 + x - px - 5 \\
y &= x^2 + (1-p)x - 5 \\
\text{H.T.P} &= -\frac{(1-p)}{1} = p-1 \dots (3) \\
\text{H.D.P.} &= -5 \dots (4)
\end{aligned}$$

Menyamakan (1) dan (3) :  
 $p-1 = 4$   
 $p = 5$

Menyamakan (2) dan (4) :  
 $\frac{8+3q}{2} = -5$   
 $3q+8 = -10$   
 $3q = -10-8$   
 $3q = -18$   
 $q = -6$

**12**  $-x(x-4) < x-4$   
 $-x^2 + 4x - x + 4 < 0$   
 $-x^2 + 3x + 4 < 0$   
 $x^2 - 3x - 4 > 0$   
 $(x-4)(x+1) > 0$



Julat nilai  $x$  yang dikehendaki ialah  
 $x < -1$  atau  $x > 4$ .

**13 (a)**  $x(x-4) = 2$   
 $x^2 - 4x - 2 = 0$

(b) H.T.P =  $-\frac{b}{a} = -\left(\frac{-4}{1}\right) = 4$

(c)  $b^2 - 4ac$   
 $= (-4)^2 - 4(-2)$   
 $= 16 + 8$   
 $= 24 (> 0)$

Maka, punca-punca adalah nyata dan berbeza.

**14**  $3x^2 - 2mx = 5 - 4p$

$$\begin{aligned}
3x^2 - 2mx + 4p - 5 &= 0 \\
a = 3, b = -2m, c = 4p - 5 \\
b^2 - 4ac &= 0 \\
(-2m)^2 - 4(3)(4p - 5) &= 0 \\
4m^2 - 48p + 60 &= 0 \\
m^2 - 12p + 15 &= 0 \\
12p &= m^2 + 15 \\
p &= \frac{m^2 + 15}{12}
\end{aligned}$$

**15**  $9x^2 + qx + 1 = 4x$

$$\begin{aligned}
9x^2 + qx - 4x + 1 &= 0 \\
a = 9, b = q - 4, c = 1 \\
b^2 - 4ac &= 0 \\
(q-4)^2 - 4(9)(1) &= 0 \\
q^2 - 8q + 16 - 36 &= 0 \\
q^2 - 8q - 20 &= 0 \\
(q+2)(q-10) &= 0 \\
q &= -2 \text{ atau } 10
\end{aligned}$$

**16**  $f(x) = 2x^2 - px + p + 6$   
 $b^2 - 4ac = 0$   
 $(-p)^2 - 4(2)(p+6) = 0$   
 $p^2 - 8p - 48 = 0$   
 $(p+4)(p-12) = 0$   
 $p = -4 \text{ atau } 12$

17  $g(x) = x^2 + 2kx + 2 - k$

$a = 1, b = 2k, c = 2 - k$

$b^2 - 4ac = 0$

$(2k)^2 - 4(1)(2 - k) = 0$

$4k^2 - 8 + 4k = 0$

$k^2 + k - 2 = 0$

$(k + 2)(k - 1) = 0$

$k = -2$  atau  $1$

18 (a)  $x^2 - 2px + 2p + 3 = 0$

$a = 1, b = -2p, c = 2p + 3$

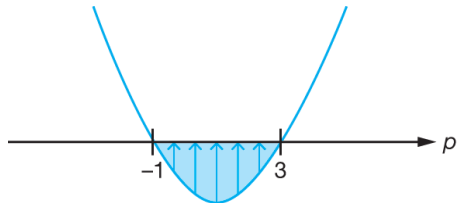
$b^2 - 4ac < 0$

$(-2p)^2 - 4(1)(2p + 3) < 0$

$4p^2 - 8p - 12 < 0$

$p^2 - 2p - 3 < 0$

$(p - 3)(p + 1) < 0$



Julat nilai  $p$  yang dikehendaki ialah

$-1 < p < 3$ .

(b)  $x^2 + 2p^2 + 3p + 2 = 2px + 4x$

$x^2 - 2px - 4x + 2p^2 + 3p + 2 = 0$

$a = 1, b = -2p - 4, c = 2p^2 + 3p + 2$

$b^2 - 4ac > 0$

$(-2p - 4)^2 - 4(1)(2p^2 + 3p + 2) > 0$

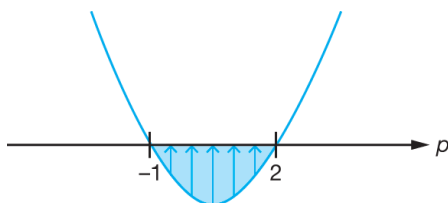
$4p^2 + 16p + 16 - 8p^2 - 12p - 8 > 0$

$-4p^2 + 4p + 8 > 0$

$-p^2 + p + 2 > 0$

$p^2 - p - 2 < 0$

$(p - 2)(p + 1) < 0$



Julat nilai  $p$  yang dikehendaki ialah

$-1 < p < 2$ .

19 (a)  $f(x) = (1 - m)x^2 - 4mx + 9$

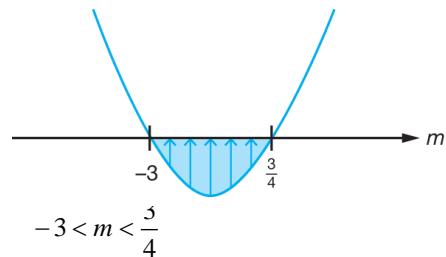
$b^2 - 4ac < 0$

$(-4m)^2 - 4(1 - m)(9) < 0$

$16m^2 + 36m - 36 < 0$

$4m^2 + 9m - 9 < 0$

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



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

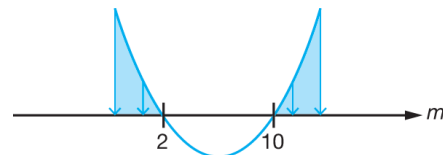
$b^2 - 4ac > 0$

$[-(m + 2)]^2 - 4(4)(m - 1) > 0$

$m^2 + 4m + 4 - 16m + 16 > 0$

$m^2 - 12m + 20 > 0$

$(m - 2)(m - 10) > 0$



Julat nilai  $m$  yang dikehendaki ialah

$m < 2$  atau  $m > 10$ .

20  $3x^2 - 3x + 4 + q(2x^2 - x - 1) = 0$

$3x^2 - 3x + 4 + 2qx^2 - qx - q = 0$

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

$b^2 - 4ac < 0$

$(-3 - q)^2 - 4(2q + 3)(4 - q) < 0$

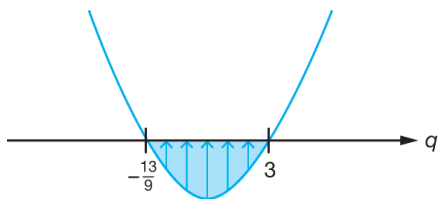
$9 + 6q + q^2 - 4(-2q^2 + 5q + 12) < 0$

$9 + 6q + q^2 + 8q^2 - 20q - 48 < 0$

$9q^2 - 14q - 39 < 0$

$(q - 3)(9q + 13) < 0$





Julat nilai  $q$  yang dikehendaki ialah

$$-\frac{13}{9} < q < 3.$$

$$\begin{aligned} 21 \text{ (a)} \quad f(x) &= -x^2 + 4kx - 5k^2 - 1 \\ f(x) &= -(x^2 - 4kx + 5k^2 + 1) \\ f(x) &= -\left[x^2 - 4kx + (-2k)^2 - (-2k)^2 + 5k^2 + 1\right] \\ f(x) &= -\left[x^2 - 4kx + (4k^2) - (4k^2) + 5k^2 + 1\right] \\ f(x) &= -\left[(x - 2k)^2 + k^2 + 1\right] \\ f(x) &= -(x - 2k)^2 - k^2 - 1 \end{aligned}$$

Nilai maksimum  $f(x)$  ialah  $-k^2 - 1$   
apabila  $x - 2k = 0 \Rightarrow x = 2k$ .

Tetapi diberi bahawa nilai maksimum  $f(x)$   
ialah  $-r^2 - 2k$ .

Dengan perbandingan,

$$\begin{aligned} -k^2 - 1 &= -r^2 - 2k \\ r^2 &= k^2 - 2k + 1 \\ r^2 &= (k - 1)^2 \\ r &= k - 1 \text{ [Tertunjuk]} \end{aligned}$$

(b) Persamaan paksi simetri ialah  $x = 2k$ .  
Tetapi diberi bahawa persamaan paksi  
simetri ialah  $x = r^2 - 1$ .

Dengan perbandingan,

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

Gantikan  $r = k - 1$  ke dalam (1):

$$\begin{aligned} (k - 1)^2 - 1 &= 2k \\ k^2 - 2k + 1 - 1 - 2k &= 0 \\ k^2 - 4k &= 0 \\ k(k - 4) &= 0 \end{aligned}$$

Diberi  $k \neq 0$ , maka  $k = 4$   
Oleh itu,  $r = k - 1 = 4 - 1 = 3$

22 (a)  $f(x) = a(x - p)^2 + q$   
Oleh sebab  $f(x)$  mempunyai nilai  
maksimum, maka  $a < 0$ .

$$(b) \quad f(x) = a(x - 2)^2 + 3$$

Tetapi diberi bahawa

$$f(x) = a(x - p)^2 + q.$$

Dengan perbandingan,  $p = 2$  dan  $q = 3$ .

$$\begin{aligned} (c) \quad f(x) &= -2(x - 2)^2 + 3 \\ &= -2(x^2 - 4x + 4) + 3 \\ &= -2x^2 + 8x - 5 \end{aligned}$$

$$(d) \text{ (i)} \quad f(x) = 2x^2 - 8x + 5 \leftarrow \begin{array}{l} \text{Tanda setiap} \\ \text{sebutan diubah.} \end{array}$$

$$\text{(ii)} \quad f(x) = -2x^2 - 8x - 5 \leftarrow \begin{array}{l} \text{Tanda pekali } x \text{ diubah.} \end{array}$$

$$\begin{aligned} 23 \text{ (a)} \quad h(x) &= -x^2 + 6x - 8 \\ &= -(x^2 - 6x + 8) \\ &= -\left[x^2 - 6x + \left(\frac{-6}{2}\right)^2 - \left(\frac{-6}{2}\right)^2 + 8\right] \\ &= -(x^2 - 6x + 9 - 9 + 8) \\ &= -[(x - 3)^2 - 1] \\ &= -(x - 3)^2 + 1 \end{aligned}$$

Maka,  $p = 1$

(b) Titik maksimum ialah (3, 1).

Pintasan- $y = -8$

Pada paksi- $x$ ,  $y = 0$

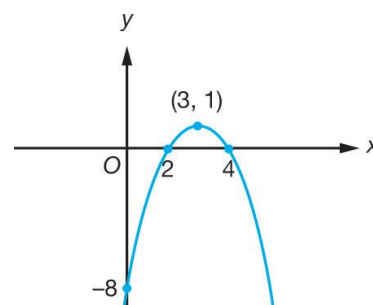
$$-x^2 + 8x - 8 = 0$$

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

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

$$x = 2 \text{ atau } 4$$

Maka, lengkung bersilang dengan  
paksi- $x$  pada (2, 0) dan (4, 0).

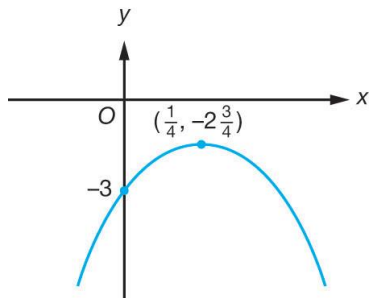


$$\begin{aligned} 24 \text{ (a)} \quad f(x) &= 2x - 3 - 4x^2 \\ &= -4x^2 + 2x - 3 \\ &= -4\left(x^2 - \frac{1}{2}x + \frac{3}{4}\right) \\ &= -4\left[x^2 - \frac{1}{2}x + \left(\frac{-1}{(2)(2)}\right)^2 - \left(\frac{-1}{(2)(2)}\right)^2 + \frac{3}{4}\right] \\ &= -4\left(x^2 - \frac{1}{2}x + \frac{1}{16} - \frac{1}{16} + \frac{3}{4}\right) \\ &= -4\left[\left(x - \frac{1}{4}\right)^2 + \frac{11}{16}\right] \end{aligned}$$

$$= -4\left(x - \frac{1}{4}\right)^2 - \frac{11}{4}$$

Nilai maksimum =  $-\frac{11}{4}$  apabila  $x = \frac{1}{4}$

(b) Pintasan- $y = -3$



25 (a)  $f(x) = 4 - 3x - x^2$

$$\begin{aligned} &= -x^2 - 3x + 4 \\ &= -(x^2 + 3x - 4) \\ &= -\left[x^2 + 3x + \left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2 - 4\right] \\ &= -\left(x^2 + 3x + \frac{9}{4} - \frac{9}{4} - 4\right) \\ &= -\left[\left(x + \frac{3}{2}\right)^2 - \frac{25}{4}\right] \\ &= -\left(x + \frac{3}{2}\right)^2 + \frac{25}{4} \end{aligned}$$

Maka, titik maksimum ialah

$$\left(-\frac{3}{2}, \frac{25}{4}\right), \text{ iaitu } \left(-1\frac{1}{2}, 6\frac{1}{4}\right).$$

(b) Pintasan- $y = 4$

Pada paksi- $x$ ,  $y = 0$

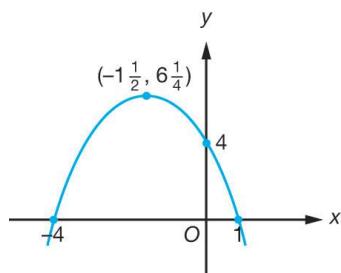
$$-x^2 - 3x + 4 = 0$$

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

$$(x + 4)(x - 1) = 0$$

$$x = -4 \text{ atau } x = 1$$

Maka, lengkung bersilang dengan paksi- $x$  pada  $(-4, 0)$  dan  $(1, 0)$ .



26 (a)  $f(x) = x^2 - x - 6$

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

Pintasan- $y = -6$

Pintasan- $x = -2$  dan  $3$

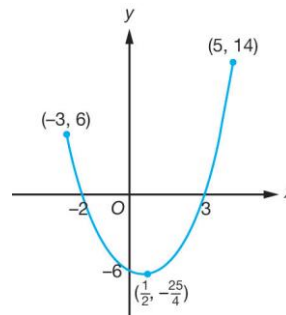
$$f(x) = x^2 - x - 6$$

$$= x^2 - x + \left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right)^2 - 6$$

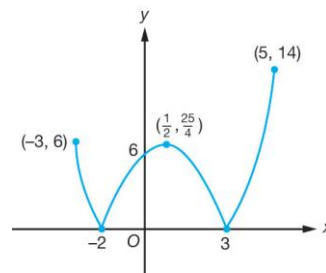
$$= x^2 - x + \frac{1}{4} - \frac{1}{4} - 6$$

$$= \left(x - \frac{1}{2}\right)^2 - \frac{25}{4}$$

$x$	$-3$	$5$
$f(x)$	$6$	$14$



(b)



27  $h(x) = -x^2 - 4kx + 5k$

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

$$= -\left[x^2 + 4kx + \left(\frac{4k}{2}\right)^2 - \left(\frac{4k}{2}\right)^2 - 5k\right]$$

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

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

Nilai maksimum = 6

$$-4k^2 - 5k = 6$$

$$4k^2 + 5k + 6 = 0$$

$$(4k - 3)(k + 2) = 0$$

$$k = \frac{3}{4} \text{ atau } -2$$

$$\begin{aligned} h(x) &= -x^2 - 4(-2)x - 10 \\ &= -x^2 + 8x - 10 \\ &= -(x^2 - 8x + 10) \\ &= -\left[x^2 - 8x + \left(\frac{-8}{2}\right) - \left(\frac{-8}{2}\right) + 10\right] \\ &= (x^2 - 8x + 16 - 16 + 10) \\ &= (x-4)^2 - 6 \end{aligned}$$

Titik maksimum ialah (4, -6).

Pintasan-y = -10

Pada paksi-x, y = 0.

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

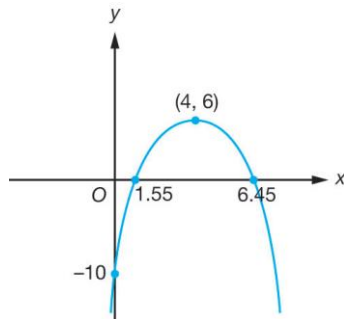
$$x^2 - 8x + 10 = 0$$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(1)(10)}}{2(1)}$$

$$x = \frac{8 \pm \sqrt{24}}{2}$$

$$x = 6.45 \text{ atau } 1.55$$

Maka, lengkung bersilang dengan paksi-x pada (1.55, 0) dan (6.45, 0).



28 (a)  $f(x) = x^2 + hx + 5$

$$= \left(x + hx + \left(\frac{h}{2}\right)^2 - \left(\frac{h}{2}\right)^2 + 5\right)$$

$$= \left(x + \frac{h}{2}\right)^2 - \frac{h^2}{4} + 5$$

Diberi  $h(x) = (x+k)^2 + \frac{11}{4}$ .

Dengan perbandingan,

$$-\frac{h^2}{4} + 5 = \frac{11}{4}$$

$$-\frac{h^2}{4} = -\frac{9}{3}$$

$$h = -3 \text{ [Diberi } h < 0\text{]}$$

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

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

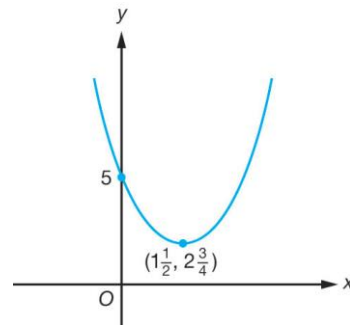
(b) Apabila  $h = -3$ ,  $k = -\frac{3}{2}$ ,

$$f(x) = \left(x - \frac{3}{2}\right)^2 + \frac{11}{4}$$

Titik maksimum ialah  $\left(\frac{3}{2}, \frac{11}{4}\right)$ , iaitu

$$\left(1\frac{1}{2}, 2\frac{3}{4}\right)$$

Pintasan-y = 5



29 (a) Titik tengah bagi (1, 0) dan (5, 0) ialah

$$\left(\frac{1+5}{2}, 0\right), \text{ iaitu } (3, 0).$$

Nilai maksimum ialah 8.

Oleh itu, (3, 8) ialah titik maksimum.

Maka,  $f(x) = -2(x-3)^2 + 8$ .

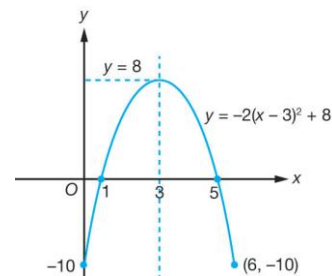
Tetapi diberi bahawa

$$f(x) = -2(x-h)^2 - 2k.$$

Dengan perbandingan,  $h = 3$  dan

$$-2k = 8 \Rightarrow k = -4.$$

(b) Pintasan-y ialah 8 dan pintasan-x ialah 1 dan 5.



(c)  $f(x) = -2(x-3)^2 + 8$

Jika graf dipantulkan pada paksi-x, tanda setiap sebutan diubah. Maka,

$$f(x) = 2(x-3)^2 - 8$$

(d)  $f(x) = a(x-h)^2 + k$

Jika graf dipantulkan pada paksi-y, tanda  $h$  diubah. Maka

$$f(x) = -2(x+3)^2 + 8$$

30  $y = px + 4 \dots (1)$

$$y = x^2 - 4x + 5 \dots (2)$$

Gantikan (2) ke dalam (1) :

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

$$x^2 - 4x - px + 1 = 0$$

$$a = 1, b = -4 - p, c = 1$$

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

$$(-p-4)^2 - 4 = 0$$

$$p^2 + 8x + 16 - 4 = 0$$

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

$$(p+2)(p+6) = 0$$

$$p = -2 \text{ atau } -6$$

31  $y = h - 2x \dots (1)$

$$y^2 + xy + 8 = 0 \dots (2)$$

Gantikan (1) ke dalam (2) :

$$(h-2x)^2 + x(h-2x) + 8 = 0$$

$$h^2 - 4hx + 4x^2 + hx - 2x^2 + 8 = 0$$

$$2x^2 - 3hx + h^2 + 8 = 0$$

$$a = 2, b = -3h, ch^2 + 8$$

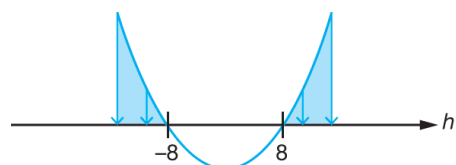
$$b^2 - 4ac > 0$$

$$(-3h)^2 - 4(2)(h^2 + 8) > 0$$

$$9h^2 - 8h^2 - 64 > 0$$

$$h^2 - 64 > 0$$

$$(h+8)(h-8) > 0$$



Julat nilai  $h$  yang dikehendaki ialah

$$h < -8 \text{ atau } h > 8.$$

32  $y = x + k \dots (1)$

$$y^2 + x^2 = 2 \dots (2)$$

Gantikan (1) ke dalam (2) :

$$(x+k)^2 + x^2 = 2$$

$$x^2 + 2kx + k^2 + x^2 - 2 = 0$$

$$2x^2 + 2kx + k^2 - 2 = 0$$

$$a = 2, b = 2k, c = k^2 - 2$$

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

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

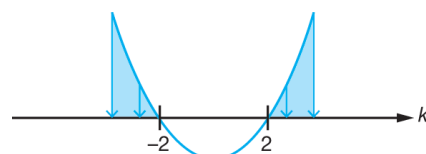
$$4k^2 - 8k^2 + 16 < 0$$

$$-4k^2 + 16 < 0$$

$$4k^2 - 16 > 0$$

$$k^2 - 4 > 0$$

$$(k+2)(k-2) > 0$$



Julat nilai  $k$  yang dikehendaki ialah

$$k < -2 \text{ atau } k > 2.$$

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

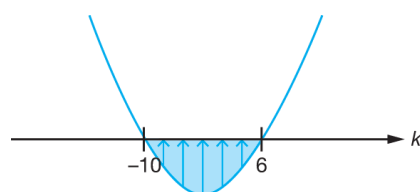
$$b^2 - 4ac < 0$$

$$(k-2)^2 - 4(1)(16-2k) < 0$$

$$k^2 - 4k + 4 - 64 + 8k < 0$$

$$k^2 + 4k - 60 < 0$$

$$(k-6)(k+10) < 0$$



Julat nilai  $k$  yang dikehendaki ialah

$$-10 < k < 6.$$

Tetapi diberi bahawa  $m < k < n$ .

Dengan perbandingan,  $m = -10$  dan

$$n = 6.$$