

# JAWAPAN

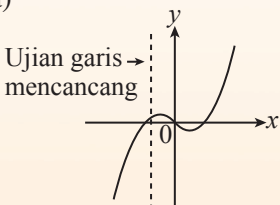
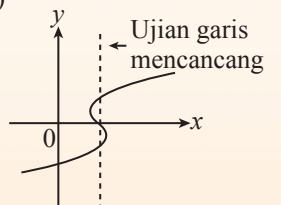
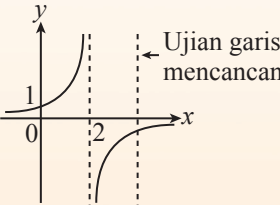
## BAB 1 FUNGSI

### Cabar Minda (Halaman 4)

Bilangan pintasan- $x$  tiada had dan bilangan pintasan- $y$  sebanyak-banyaknya 1.

### Latih Diri 1.1 (Halaman 5 & 6)

- Fungsi kerana setiap objek mempunyai hanya satu imej sahaja walaupun unsur 7 tidak mempunyai objek.
  - Fungsi kerana setiap objek mempunyai hanya satu imej sahaja walaupun unsur 4 mempunyai dua objek.
  - Bukan fungsi kerana objek  $r$  mempunyai dua imej, 8 dan 10.

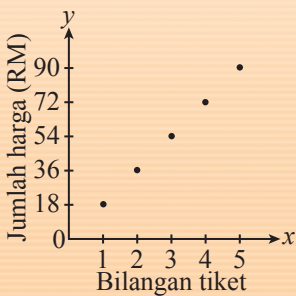
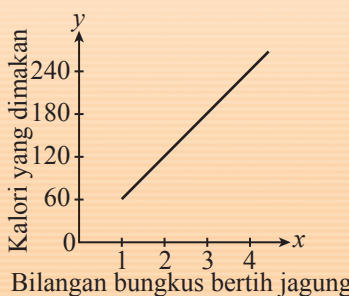
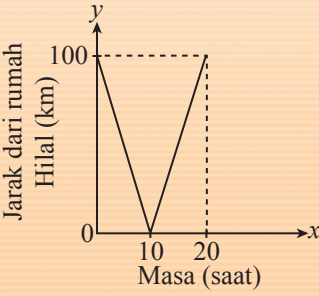
<p>2. (a)</p> 	<p>(b)</p> 	<p>(c)</p> 
<p>Fungsi kerana ujian garis mencancang hanya memotong satu titik sahaja pada graf.</p>	<p>Bukan fungsi kerana ujian garis mencancang memotong lebih daripada satu titik pada graf.</p>	<p>Fungsi kerana ujian garis mencancang hanya memotong satu titik sahaja pada graf kecuali pada <math>x = 2</math> yang tidak memotong pada mana-mana titik.</p>

3. (a)  $h : x \rightarrow \frac{1}{x}, x \neq 0$

(b)  $h : x \rightarrow |x|$

(c)  $h : x \rightarrow x^3$

### Inkuiri 1 (Halaman 6 & 7)

<p>1.</p> 		
Situasi I	Situasi II	Situasi III

2. (a) Graf bagi Situasi I ialah graf diskret manakala graf bagi Situasi II dan Situasi III ialah graf selanjur.

(b)

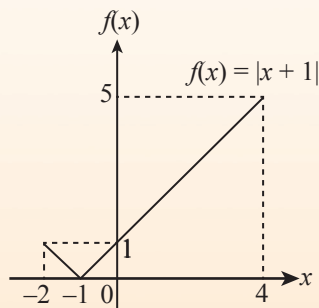
	Situasi I	Situasi II	Situasi III
<b>Domain</b>	$\{1, 2, 3, 4, 5\}$	$1 \leq x \leq 4$	$0 \leq x \leq 20$
<b>Julat</b>	$\{18, 36, 54, 72, 90\}$	$60 \leq y \leq 240$	$0 \leq y \leq 100$

**Latih Diri 1.2 (Halaman 9)**

1. (a) Domain =  $\{-2, -1, 0, 2, 4\}$ , kodomain =  $\{1, 3, 4, 5\}$ , julat =  $\{1, 3, 4, 5\}$   
 (b) Domain =  $\{j, k, l, m\}$ , kodomain =  $\{2, 3, 6, 7, 10\}$ , julat =  $\{3, 7\}$   
 (c) Domain  $f$  ialah  $-3 \leq x \leq 5$ , kodomain dan julat  $f$  ialah  $2 \leq f(x) \leq 6$

2. (a)

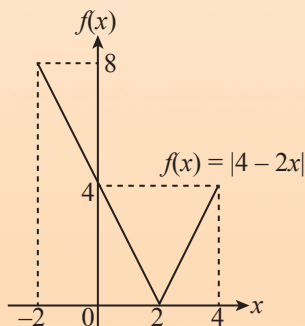
$x$	-2	-1	0	1	2	3	4
$f(x) =  x + 1 $	1	0	1	2	3	4	5
$(x, y)$	(-2, 1)	(-1, 0)	(0, 1)	(1, 2)	(2, 3)	(3, 4)	(4, 5)



Maka, julat  $f$  ialah  $0 \leq f(x) \leq 5$ .

(b)

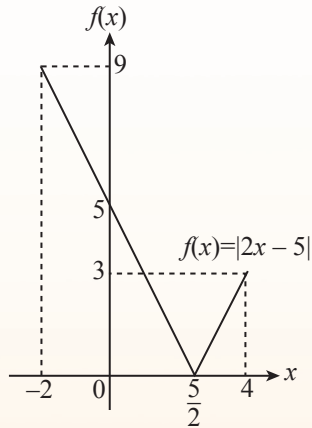
$x$	-2	-1	0	1	2	3	4
$f(x) =  4 - 2x $	8	6	4	2	0	2	4
$(x, y)$	(-2, 8)	(-1, 6)	(0, 4)	(1, 2)	(2, 0)	(3, 2)	(4, 4)



Maka, julat  $f$  ialah  $0 \leq f(x) \leq 8$ .

(c)

$x$	-2	-1	0	1	2	3	4
$f(x) =  2x - 5 $	9	7	5	3	1	1	3
$(x, y)$	$(-2, 9)$	$(-1, 7)$	$(0, 5)$	$(1, 3)$	$(2, 1)$	$(3, 1)$	$(4, 3)$



Maka, julat  $f$  ialah  $0 \leq f(x) \leq 9$ .

### Cabar Minda (Halaman 9)

Jika  $x = 0$ , fungsi  $f: x \rightarrow 3x + \frac{5}{x}$  adalah tidak tertakrif. Jika  $f(x) = \frac{2}{x+3}$ ,  $x \neq k$ , maka nilai  $k$  ialah  $-3$ .

### Latih Diri 1.3 (Halaman 10)

1. (a)  $g(x) = 3 + \frac{6}{x-1}$

$$g(-5) = 3 + \frac{6}{-5-1}$$

$$= 2$$

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

$$= 1$$

$$g\left(\frac{1}{2}\right) = 3 + \frac{6}{\frac{1}{2}-1}$$

$$= -9$$

(b)  $g(b) = 2b$

$$3 + \frac{6}{b-1} = 2b$$

$$3(b-1) + 6 = 2b(b-1)$$

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

$$2b^2 - 5b - 3 = 0$$

$$(2b+1)(b-3) = 0$$

$$2b+1=0 \quad \text{atau} \quad b-3=0$$

$$b = -\frac{1}{2} \quad \text{atau} \quad b = 3$$

Maka, nilai-nilai yang mungkin bagi  $b$  ialah  $-\frac{1}{2}$  dan  $3$ .

$$2. (a) \quad h(x) = \frac{kx-3}{x-1}$$

$$h(2) = 5$$

$$\frac{2k-3}{2-1} = 5$$

$$2k-3 = 5$$

$$2k = 8$$

$$k = 4$$

$$(b) \quad h(x) = \frac{kx-3}{x-1}$$

$$h(3) = k$$

$$\frac{3k-3}{3-1} = k$$

$$3k-3 = 2k$$

$$k = 3$$

$$(c) \quad h(x) = \frac{kx-3}{x-1}$$

$$h(k) = k$$

$$\frac{k^2-3}{k-1} = k$$

$$k^2-3 = k^2-k$$

$$k = 3$$

$$3. (a) \quad f(x) = |4x-3|$$

$$f(-2) = |4(-2)-3|$$

$$= |-8-3|$$

$$= |-11|$$

$$= 11$$

$$f\left(-\frac{1}{2}\right) = \left|4\left(-\frac{1}{2}\right)-3\right|$$

$$= |-2-3|$$

$$= |-5|$$

$$= 5$$

$$(b) \quad f(x) = 1$$

$$|4x-3| = 1$$

$$4x-3 = -1 \quad \text{atau} \quad 4x-3 = 1$$

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

$$x = \frac{2}{4} \quad \text{atau} \quad x = 1$$

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

$$(c) \quad f(x) < 1$$

$$|4x-3| < 1$$

$$-1 < 4x-3 < 1$$

$$2 < 4x < 4$$

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

$$\begin{aligned}
 \text{(d)} \quad & f(x) > 5 \\
 & |4x - 3| > 5 \\
 & 4x - 3 < -5 \quad \text{atau} \quad 4x - 3 > 5 \\
 & 4x < -2 \quad \text{atau} \quad 4x > 8 \\
 & x < -\frac{1}{2} \quad \text{atau} \quad x > 2
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & g(x) = |6 - 2x| \\
 & g(x) = x \\
 & |6 - 2x| = x \\
 & 6 - 2x = -x \quad \text{atau} \quad 6 - 2x = x \\
 & x = 6 \quad \text{atau} \quad 3x = 6 \\
 & \quad \quad \quad x = 2
 \end{aligned}$$

$$\begin{aligned}
 5. \text{ (a)} \quad & f(x) = mx + c \\
 & f(2) = 7 \\
 & 2m + c = 7 \dots \textcircled{1} \\
 & f(4) = -1 \\
 & 4m + c = -1 \dots \textcircled{2} \\
 & \textcircled{2} - \textcircled{1}: 2m = -8 \\
 & \quad \quad m = -4 \\
 & \text{Gantikan } m = -4 \text{ dalam } \textcircled{1}: 2(-4) + c = 7 \\
 & \quad \quad -8 + c = 7 \\
 & \quad \quad c = 15
 \end{aligned}$$

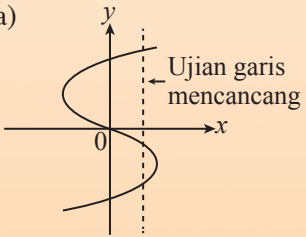
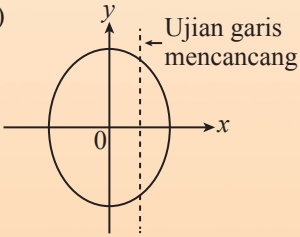
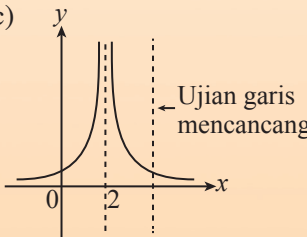
Maka,  $m = -4$  dan  $c = 15$ .

$$\begin{aligned}
 \text{(b)} \quad & f(x) = -4x + 15 \\
 & f(2) = -4(2) + 15 \\
 & \quad = -8 + 15 \\
 & \quad = 7
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & f(x) = x \\
 & -4x + 15 = x \\
 & \quad 5x = 15 \\
 & \quad x = 3
 \end{aligned}$$

### Latihan Intensif 1.1 (Halaman 11)

- Hubungan ini adalah suatu fungsi kerana setiap objek hanya mempunyai satu imej.
  - Hubungan ini bukan suatu fungsi kerana objek  $-4$  mempunyai dua imej.
  - Hubungan ini adalah suatu fungsi kerana setiap objek hanya mempunyai satu imej.
- 

<p>(a)</p> 	<p>(b)</p> 	<p>(c)</p> 
<p>Graf ini bukan suatu fungsi kerana ujian garis mencancang memotong tiga titik pada graf.</p>	<p>Graf ini bukan suatu fungsi kerana ujian garis mencancang memotong dua titik pada graf.</p>	<p>Graf ialah suatu fungsi kerana ujian garis mencancang hanya memotong satu titik pada graf kecuali pada garis <math>x = 2</math>.</p>

3. (a) Hubungan ini adalah suatu fungsi kerana setiap objek hanya mempunyai satu imej sahaja.

(b) Domain =  $\{-7, -6, 6, 7\}$

Julat =  $\{36, 49\}$

(c)  $f: x \rightarrow x^2$

4. (a) Apabila  $x = 5$ ,  $f(5) = |2(5) - 4|$   
 $= |10 - 4|$   
 $= |6|$   
 $= 6$

Maka, nilai  $t = 6$ .

(b) Julat  $f$  ialah  $0 \leq f(x) \leq 6$ .

(c)  $f(x) \leq 4$

$|2x - 4| \leq 4$

$-4 \leq 2x - 4 \leq 4$

$0 \leq 2x \leq 8$

$0 \leq x \leq 4$

Maka, julat nilai  $x$  ialah  $0 \leq x \leq 4$ .

5. (a) (i)  $H(t) = 81 - 9t^2$   
 $H\left(\frac{1}{3}\right) = 81 - 9\left(\frac{1}{3}\right)^2$   
 $= 81 - 1$   
 $= 80 \text{ meter}$

(ii)  $H(1) = 81 - 9(1)^2$   
 $= 81 - 9$   
 $= 72 \text{ meter}$

(iii)  $H(2) = 81 - 9(2)^2$   
 $= 81 - 36$   
 $= 45 \text{ meter}$

(b) Batu itu mencecah tanah apabila  $H(t) = 0$

$H(t) = 0$

$81 - 9t^2 = 0$

$9t^2 - 81 = 0$

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

$3t - 9 = 0$

$3t = 9$

$t = 3$

atau  $3t + 9 = 0$

atau  $3t = -9$

atau  $t = -3$  (Abaikan)

Maka, batu itu mencecah tanah apabila  $t = 3$  saat.

## Inkuiri 2 (Halaman 12)

5. Fungsi  $f[g(x)]$  diperoleh dengan menggantikan fungsi  $g$  ke dalam fungsi  $f$ .

$f(x) = x + 2$

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

$= x^2 + 2$

6. Graf  $f[g(x)]$  berbentuk parabola yang melalui titik minimum.

9. Fungsi  $g[f(x)]$  diperoleh dengan menggantikan fungsi  $f$  ke dalam fungsi  $g$ .

$$\begin{aligned}g(x) &= x^2 \\g[f(x)] &= g(x + 2) \\&= (x + 2)^2 \\&= x^2 + 4x + 4\end{aligned}$$

10. Graf  $g[f(x)]$  berbentuk parabola yang melalui titik minimum.

**Cabar Minda (Halaman 14)**

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

$$\begin{aligned}f[g(x)] &= f(x^2) & g[f(x)] &= g(x) \\&= x^2 & &= x^2\end{aligned}$$

Maka, fungsi  $fg$  dan  $gf$  tidak semestinya sentiasa berbeza.

**Latih Diri 1.4 (Halaman 14)**

1. (a)  $f(x) = 3x$   
(b)  $gf(x) = 2x - 7$

2. (a)  $f(x) = 3x$ ,  $g(x) = 3 - x$

$$\begin{aligned}fg(x) &= f(3 - x) \\&= 3(3 - x) \\&= 9 - 3x\end{aligned}$$

$$fg: x \rightarrow 9 - 3x$$

$$\begin{aligned}gf(x) &= g(3x) \\&= 3 - 3x\end{aligned}$$

$$gf: x \rightarrow 3 - 3x$$

$$\begin{aligned}f^2 &= ff(x) \\&= f(3x) \\&= 3(3x) \\&= 9x\end{aligned}$$

$$f^2: x \rightarrow 9x$$

$$\begin{aligned}g^2 &= gg(x) \\&= g(3 - x) \\&= 3 - (3 - x) \\&= x\end{aligned}$$

$$g^2: x \rightarrow x$$

- (b)  $f(x) = 4 + 2x$ ,  $g(x) = x^2$

$$\begin{aligned}fg(x) &= f(x^2) \\&= 4 + 2(x^2) \\&= 4 + 2x^2\end{aligned}$$

$$fg: x \rightarrow 4 + 2x^2$$

$$\begin{aligned}gf(x) &= g(4 + 2x) \\&= (4 + 2x)^2 \\&= 16 + 16x + 4x^2 \\&= 4x^2 + 16x + 16\end{aligned}$$

$$gf: x \rightarrow 4x^2 + 16x + 16$$

$$\begin{aligned}
 f^2 &= ff(x) \\
 &= f(4 + 2x) \\
 &= 4 + 2(4 + 2x) \\
 &= 4 + 8 + 4x \\
 &= 4x + 12
 \end{aligned}$$

$$f^2: x \rightarrow 4x + 12$$

$$\begin{aligned}
 g^2(x) &= gg(x) \\
 &= g(x^2) \\
 &= (x^2)^2 \\
 &= x^4
 \end{aligned}$$

$$g^2: x \rightarrow x^4$$

$$(c) f(x) = x + 4, g(x) = \frac{6}{x}, x \neq 0$$

$$\begin{aligned}
 fg(x) &= f\left(\frac{6}{x}\right) \\
 &= \frac{6}{x} + 4, x \neq 0
 \end{aligned}$$

$$fg: x \rightarrow \frac{6}{x} + 4, x \neq 0$$

$$\begin{aligned}
 gf(x) &= g(x + 4) \\
 &= \frac{6}{x + 4}, x \neq -4
 \end{aligned}$$

$$gf: x \rightarrow \frac{6}{x + 4}, x \neq -4$$

$$\begin{aligned}
 f^2 &= ff(x) \\
 &= f(x + 4) \\
 &= x + 4 + 4 \\
 &= x + 8
 \end{aligned}$$

$$f^2: x \rightarrow x + 8$$

$$\begin{aligned}
 g^2 &= gg(x) \\
 &= g\left(\frac{6}{x}\right) \\
 &= \frac{\frac{6}{x}}{\frac{6}{x}} \\
 &= x
 \end{aligned}$$

$$g^2: x \rightarrow x$$

$$(d) f(x) = x - 5, g(x) = \frac{1}{x - 1}, x \neq 1$$

$$\begin{aligned}
 fg(x) &= f\left(\frac{1}{x - 1}\right) \\
 &= \frac{1}{x - 1} - 5 \\
 &= \frac{1 - 5x + 5}{x - 1} \\
 &= \frac{6 - 5x}{x - 1}, x \neq 1
 \end{aligned}$$

$$fg: x \rightarrow \frac{6 - 5x}{x - 1}, x \neq 1$$



$$\begin{aligned}
 gf(x) &= g(x-5) \\
 &= \frac{1}{x-5-1} \\
 &= \frac{1}{x-6}, x \neq 6 \\
 gf: x &\rightarrow \frac{1}{x-6}, x \neq 6
 \end{aligned}$$

$$\begin{aligned}
 f^2 &= ff(x) \\
 &= f(x-5) \\
 &= x-5-5 \\
 &= x-10 \\
 f^2: x &\rightarrow x-10 \\
 g^2 &= gg(x) \\
 &= g\left(\frac{1}{x-1}\right) \\
 &= \frac{1}{\frac{1}{x-1}-1} \\
 &= \frac{1}{\frac{1-x+1}{x-1}} \\
 &= \frac{x-1}{2-x}, x \neq 2 \\
 g^2: x &\rightarrow \frac{x-1}{2-x}, x \neq 2
 \end{aligned}$$

3.  $f(x) = 3x + 4$ ,  $g(x) = x^2 + 6$

$$\begin{aligned}
 fg(x) &= f(x^2 + 6) \\
 &= 3(x^2 + 6) + 4 \\
 &= 3x^2 + 18 + 4 \\
 &= 3x^2 + 22
 \end{aligned}$$

$$\begin{aligned}
 gf(x) &= g(3x + 4) \\
 &= (3x + 4)^2 + 6 \\
 &= 9x^2 + 24x + 16 + 6 \\
 &= 9x^2 + 24x + 22
 \end{aligned}$$

(a)  $f = g$

$$\begin{aligned}
 3x + 4 &= x^2 + 6 \\
 x^2 - 3x + 2 &= 0 \\
 (x-1)(x-2) &= 0 \\
 x-1 &= 0 \quad \text{atau} \quad x-2 = 0 \\
 x &= 1 \quad \text{atau} \quad x = 2
 \end{aligned}$$

(b)  $fg = gf$

$$\begin{aligned}
 3x^2 + 22 &= 9x^2 + 24x + 22 \\
 6x^2 + 24x &= 0 \\
 6x(x+4) &= 0 \\
 6x &= 0 \quad \text{atau} \quad x+4 = 0 \\
 x &= 0 \quad \text{atau} \quad x = -4
 \end{aligned}$$

4. Diberi  $f(x) = ax + b$ ,  $f^2(x) = 4x - 9$

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

$$4x - 9 = f(ax + b)$$

$$4x - 9 = a(ax + b) + b$$

$$4x - 9 = a^2x + ab + b$$

Samakan pekali:

$$a^2 = 4$$

$$a = \pm\sqrt{4}$$

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

Apabila  $a = -2$ ,  $-2b + b = -9$

$$b = 9$$

Apabila  $a = 2$ ,  $2b + b = -9$

$$3b = -9$$

$$b = -3$$

Maka,  $a = -2$ ,  $b = 9$  atau  $a = 2$ ,  $b = -3$ .

5.  $f(x) = 3x + k$ ,  $g(x) = 2h - 3x$

$$fg = gf$$

$$f(2h - 3x) = g(3x + k)$$

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

$$6h - 9x + k = 2h - 9x - 3k$$

$$4h = -4k$$

$$h = -k$$

### Latih Diri 1.5 (Halaman 15)

1. (a)  $f(x) = 2x + 1$ ,  $g(x) = \frac{x}{x-1}$ ,  $x \neq 1$

$$fg(x) = f\left(\frac{x}{x-1}\right)$$

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

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

$$= \frac{3x - 1}{x - 1}, x \neq 1$$

$$fg(3) = \frac{3(3) - 1}{3 - 1}$$

$$= \frac{8}{2}$$

$$= 4$$

- (b)  $f(x) = 5x + 6$ ,  $g(x) = 2x - 1$

$$gf(x) = g(5x + 6)$$

$$= 2(5x + 6) - 1$$

$$= 10x + 12 - 1$$

$$= 10x + 11$$

$$gf\left(-\frac{1}{5}\right) = 10\left(-\frac{1}{5}\right) + 11$$

$$= -2 + 11$$

$$= 9$$

$$(c) f(x) = \frac{x+1}{x-3}, x \neq 3, g(x) = \frac{6}{x-2}, x \neq 2$$

$$\begin{aligned} f^2(x) &= f\left(\frac{x+1}{x-3}\right) \\ &= \frac{\frac{x+1}{x-3} + 1}{\frac{x+1}{x-3} - 3} \\ &= \frac{x+1+x-3}{x-3} \div \frac{x+1-3x+9}{x-3} \\ &= \frac{2x-2}{x-3} \times \frac{x-3}{10-2x} \\ &= \frac{2x-2}{10-2x} \\ &= \frac{x-1}{5-x}, x \neq 5 \end{aligned}$$

$$\begin{aligned} f^2(4) &= \frac{4-1}{5-4} \\ &= 3 \end{aligned}$$

$$\begin{aligned} g^2(x) &= g\left(\frac{6}{x-2}\right) \\ &= \frac{\frac{6}{x-2}}{\frac{6}{x-2} - 2} \\ &= 6 \div \frac{6-2x+4}{x-2} \\ &= 6 \times \frac{x-2}{10-2x} \\ &= \frac{6x-12}{10-2x} \\ &= \frac{3x-6}{5-x}, x \neq 5 \end{aligned}$$

$$\begin{aligned} g^2\left(\frac{1}{2}\right) &= \frac{3\left(\frac{1}{2}\right) - 6}{5 - \left(\frac{1}{2}\right)} \\ &= \frac{-9}{2} \div \frac{9}{2} \\ &= -1 \end{aligned}$$

$$(d) f(x) = x^2 - 4, g(x) = \frac{2}{x-2}, x \neq 2$$

$$\begin{aligned} f^2(x) &= f(x^2 - 4) \\ &= (x^2 - 4)^2 - 4 \\ &= x^4 - 8x^2 + 16 - 4 \\ &= x^4 - 8x^2 + 12 \end{aligned}$$

$$\begin{aligned} f^2(-1) &= (-1)^4 - 8(-1)^2 + 12 \\ &= 1 - 8 + 12 \\ &= 5 \end{aligned}$$

$$\begin{aligned}
 g^2(x) &= g\left(\frac{2}{x-2}\right) \\
 &= \frac{2}{\frac{2}{x-2} - 2} \\
 &= 2 \div \frac{2-2x+4}{x-2} \\
 &= 2 \times \frac{x-2}{6-2x} \\
 &= \frac{x-2}{3-x}, x \neq 3 \\
 g^2(1) &= \frac{1-2}{3-1} \\
 &= -\frac{1}{2}
 \end{aligned}$$

2. (a)  $f(x) = 2x - 5$ ,  $g(x) = \frac{10}{x}$ ,  $x \neq 0$

$$fg(x) = 5$$

$$f\left(\frac{10}{x}\right) = 5$$

$$2\left(\frac{10}{x}\right) - 5 = 5$$

$$20 - 5x = 5x$$

$$10x = 20$$

$$x = 2$$

(b)  $f(x) = x^2 - 1$ ,  $g(x) = 2x + 1$

$$gf(x) = 7$$

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

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

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

$$2x^2 = 8$$

$$x^2 = 4$$

$$x = \pm\sqrt{4}$$

$$x = -2, x = 2$$

(c)  $f(x) = 3x - 2$ ,  $f^2(x) = 10$

$$f^2(x) = 10$$

$$f(3x - 2) = 10$$

$$3(3x - 2) - 2 = 10$$

$$9x - 6 - 2 = 10$$

$$9x = 18$$

$$x = 2$$

$$\begin{aligned}
 \text{(d) } g(x) &= \frac{2}{x-2}, x \neq 2, g^2(x) = -\frac{1}{2} \\
 g^2(x) &= -\frac{1}{2} \\
 g\left(\frac{2}{x-2}\right) &= -\frac{1}{2} \\
 \frac{2}{\frac{2}{x-2}-2} &= -\frac{1}{2} \\
 2 \div \frac{2-2x+4}{x-2} &= -\frac{1}{2} \\
 2 \times \frac{x-2}{6-2x} &= -\frac{1}{2} \\
 \frac{x-2}{3-x} &= -\frac{1}{2} \\
 2(x-2) &= -(3-x) \\
 2x-4 &= -3+x \\
 x &= 1
 \end{aligned}$$

### Latih Diri 1.6 (Halaman 16)

1. (a) Diberi  $f(x) = x - 3$ ,  $fg(x) = 2x^2 - 4x + 7$

$$fg(x) = 2x^2 - 4x + 7$$

$$g(x) - 3 = 2x^2 - 4x + 7$$

$$g(x) = 2x^2 - 4x + 10$$

$$g: x \rightarrow 2x^2 - 4x + 10$$

- (b) Diberi  $f(x) = x^2 + 1$ ,  $fg(x) = x^2 + 4x + 5$

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

$$[g(x)]^2 + 1 = x^2 + 4x + 5$$

$$[g(x)]^2 = x^2 + 4x + 4$$

$$[g(x)]^2 = (x + 2)^2$$

$$g(x) = x + 2$$

$$g: x \rightarrow x + 2$$

2. (a) Diberi  $f(x) = x + 1$ ,  $gf(x) = x^2 - 2x - 3$

$$gf(x) = x^2 - 2x - 3$$

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

$$\text{Katakan } y = x + 1$$

$$x = y - 1$$

$$g(y) = (y - 1)^2 - 2(y - 1) - 3$$

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

$$= y^2 - 4y$$

$$\text{Maka, } g(x) = x^2 - 4x \text{ atau } g: x \rightarrow x^2 - 4x$$

- (b) Diberi  $f(x) = x^2 + 3$ ,  $gf(x) = 2x^2 + 3$

$$gf(x) = 2x^2 + 3$$

$$g(x^2 + 3) = 2x^2 + 3$$

$$\text{Katakan } y = x^2 + 3$$

$$x^2 = y - 3$$

$$x = \sqrt{y - 3}$$

$$\begin{aligned}
 g(y) &= 2(\sqrt{y-3})^2 + 3 \\
 &= 2(y-3) + 3 \\
 &= 2y - 6 + 3 \\
 &= 2y - 3
 \end{aligned}$$

Maka,  $g(x) = 2x - 3$  atau  $g: x \rightarrow 2x - 3$

3. (a) Diberi  $h(x) = \frac{8}{x}$ ,  $hg(x) = 4x$

$$hg(x) = 4x$$

$$\frac{8}{g(x)} = 4x$$

$$g(x) = \frac{8}{4x}$$

$$= \frac{2}{x}, x \neq 0$$

$$g: x \rightarrow \frac{2}{x}, x \neq 0$$

- (b)  $gh(x) = 6$

$$g\left(\frac{8}{x}\right) = 6$$

$$\frac{2}{\left(\frac{8}{x}\right)} = 6$$

$$\frac{x}{4} = 6$$

$$x = 24$$

4. (a) Diberi  $g(x) = 3x$ ,  $fg(x) = 9x - 7$

$$fg(x) = 9x - 7$$

$$f(3x) = 9x - 7$$

Katakan  $y = 3x$

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

$$f(y) = 9\left(\frac{y}{3}\right) - 7$$

$$= 3y - 7$$

Maka,  $f(x) = 3x - 7$

- (b)  $gf(x) = g(3x - 7)$

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

$$= 9x - 21$$

$$gf(2) = 9(2) - 21$$

$$= 18 - 21$$

$$= -3$$

**Latih Diri 1.7 (Halaman 18)**

1. (a) Diberi  $f(x) = \frac{x}{x+1}$ ,  $x \neq -1$

$$f^2(x) = f[f(x)]$$

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

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

$$= \frac{x}{x+1} \div \frac{x+x+1}{x+1}$$

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

$$= \frac{x}{2x+1}, x \neq -\frac{1}{2}$$

$$f^3(x) = f[f^2(x)]$$

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

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

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

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

$$= \frac{x}{3x+1}, x \neq -\frac{1}{3}$$

$$f^4(x) = f[f^3(x)]$$

$$= f\left(\frac{x}{3x+1}\right)$$

$$= \frac{\left(\frac{x}{3x+1}\right)}{\left(\frac{x}{3x+1} + 1\right)}$$

$$= \frac{x}{3x+1} \div \frac{x+3x+1}{3x+1}$$

$$= \frac{x}{3x+1} \times \frac{3x+1}{4x+1}$$

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

(b)  $f^{20}(x) = \frac{x}{20x+1}, x \neq -\frac{1}{20}$

$f^{23}(x) = \frac{x}{23x+1}, x \neq -\frac{1}{23}$

2. (a) Diberi  $f(x) = \frac{1}{x}$ ,  $x \neq 0$

$$f^2(x) = f[f(x)]$$

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

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

$$= x$$

$$f^3(x) = f[f^2(x)]$$

$$= f(x)$$

$$= \frac{1}{x}, x \neq 0$$

$$f^4(x) = f[f^3(x)]$$

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

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

$$= x$$

(b)  $f^{40}(2) = 2$

$f^{43}(2) = \frac{1}{2}$

3. (a)  $Ar(t) = A[r(t)]$

$$= A\left(\frac{2}{3}t^3\right)$$

$$= 4\pi\left(\frac{2}{3}t^3\right)^2$$

$$= 4\pi\left(\frac{4}{9}t^6\right)$$

$$= \frac{16}{9}\pi t^6$$

- (b) Apabila  $t = 2$ ,

$$A(2) = \frac{16}{9}\pi(2^6)$$

$$= 113\frac{7}{9}\pi \text{ m}^2$$

4. (a) (i)  $v(t) = 200 + 100t$

(ii)  $v = \pi r^2 h$

$$h = \frac{v}{\pi r^2}$$

(iii)  $h v(t) = h(200 + 100t)$   
 $= \frac{200 + 100t}{\pi r^2}$

Apabila jejari,  $r = 20$  cm,

$$h v(t) = \frac{200 + 100t}{\pi(20)^2}$$

$$= \frac{2 + t}{4\pi}$$

(b) Apabila  $t = 20$ ,

$$h(20) = \frac{2 + 20}{4\pi}$$

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

$$= 1.75 \text{ cm}$$

5. (a)  $r(t) = 3 \times t$   
 $= 3t$

(b)  $Ar(t)$  ialah luas riak air, dalam  $\text{cm}^2$ , sebagai fungsi masa,  $t$ , dalam saat.

(c)  $A = \pi r^2$

$$Ar(t) = A[r(t)]$$

$$= \pi(3t)^2$$

$$= 9\pi t^2$$

Apabila  $t = 30$ ,

$$Ar(30) = 9\pi(30^2)$$

$$= 8100\pi \text{ cm}^2$$

### Latihan Intensif 1.2 (Halaman 19)

1. Diberi  $f(x) = 2x - 1$ ,  $g(x) = \frac{x}{x+1}$ ,  $x \neq -1$

(a)  $fg(x) = f\left(\frac{x}{x+1}\right)$

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

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

$$= \frac{x-1}{x+1}, x \neq -1$$

$$gf(x) = g(2x - 1)$$

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

$$= \frac{2x - 1}{2x}, x \neq 0$$



$$(b) fg(2) = \frac{2-1}{2+1}$$

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

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

$$= 2$$

$$(c) \quad fg = gf$$

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

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

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

$$3x = 1$$

$$x = \frac{1}{3}$$

2. Diberi  $f(x) = \frac{x}{x-1}$ ,  $x \neq 1$ ,  $g(x) = hx + k$ ,  $g(3) = 8$ ,  $gf(2) = 5$

$$(a) \quad g(3) = 8$$

$$3h + k = 8 \dots \textcircled{1}$$

$$gf(2) = 5$$

$$g(2) = 5$$

$$2h + k = 5 \dots \textcircled{2}$$

$$\textcircled{1} - \textcircled{2}: h = 3$$

Masukkan  $h = 3$  ke dalam  $\textcircled{1}$ .

$$3(3) + k = 8$$

$$9 + k = 8$$

$$k = -1$$

Maka,  $h = 3$  dan  $k = -1$ .

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

$$f(3a-1) = 3$$

$$\frac{3a-1}{3a-1-1} = 3$$

$$\frac{3a-1}{3a-2} = 3$$

$$3a-1 = 9a-6$$

$$6a = 5$$

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

3. Diberi  $f(x) = ax - b$ ,  $g(x) = x + 4$ ,  $fg(2) = 9$ ,  $gf\left(\frac{1}{2}\right) = 2$

$$fg(2) = 9$$

$$f(2+4) = 9$$

$$f(6) = 9$$

$$6a - b = 9 \dots \textcircled{1}$$

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

$$g\left(\frac{1}{2}a - b\right) = 2$$

$$\frac{1}{2}a - b + 4 = 2$$

$$a - 2b = -4$$

$$a = 2b - 4 \dots \textcircled{2}$$

Gantikan  $\textcircled{2}$  ke dalam  $\textcircled{1}$ .

$$6(2b - 4) - b = 9$$

$$12b - 24 - b = 9$$

$$11b = 33$$

$$b = 3$$

Gantikan  $b = 3$  ke dalam  $\textcircled{2}$ .

$$a = 2(3) - 4$$

$$= 6 - 4$$

$$= 2$$

Maka,  $a = 2$  dan  $b = 3$ .

4. Diberi  $f(x) = \frac{2}{x-3}$ ,  $x \neq 3$ ,  $g(x) = hx^2 + k$

(a) Diberi  $g(2) = 5$ ,  $gf(1) = -1$

$$g(2) = 5$$

$$(2^2)h + k = 5$$

$$4h + k = 5 \dots \textcircled{1}$$

$$gf(1) = -1$$

$$g(-1) = -1$$

$$h + k = -1 \dots \textcircled{2}$$

$$\textcircled{1} - \textcircled{2}: 3h = 6$$

$$h = 2$$

Gantikan  $h = 2$  ke dalam  $\textcircled{1}$ .

$$4(2) + k = 5$$

$$k = 5 - 8$$

$$= -3$$

Maka,  $h = 2$  dan  $k = -3$ .

$$(b) gf(x) = g\left(\frac{2}{x-3}\right)$$

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

$$= 2\left(\frac{4}{x^2 - 6x + 9}\right) - 3$$

$$= \frac{8 - 3x^2 + 18x - 27}{x^2 - 6x + 9}$$

$$= \frac{-3x^2 + 18x - 19}{(x-3)^2}, x \neq 3$$

5. Diberi  $f(x) = ax + b$ ,  $f^3(x) = 27x + 13$

(a)  $f^2(x) = f(ax + b)$

$$= a(ax + b) + b$$

$$= a^2x + ab + b$$

$$f^3(x) = f[f^2(x)]$$

$$= f(a^2x + ab + b)$$

$$= a(a^2x + ab + b) + b$$

$$= a^3x + a^2b + ab + b$$

Secara perbandingan,

$$a^3x + a^2b + ab + b = 27x + 13$$

$$a^3 = 27 \quad \text{dan} \quad a^2b + ab + b = 13$$

$$a = 3 \quad 9b + 3b + b = 13$$

$$13b = 13$$

$$b = 1$$

Maka,  $a = 3$  dan  $b = 1$ .

$$\begin{aligned} \text{(b)} \quad f^4(x) &= f[f^3(x)] \\ &= f(27x + 13) \\ &= 3(27x + 13) + 1 \\ &= 81x + 39 + 1 \\ &= 81x + 40 \end{aligned}$$

6. (a)  $A(x) = x^2$

$$V(A) = 10A$$

$$\begin{aligned} \text{(b)} \quad VA(x) &= V[A(x)] \\ &= 10x^2 \\ &= 10A \end{aligned}$$

7. Diberi  $f(x) = x + 6$

$$\begin{aligned} \text{(a)} \quad fg(x) &= 2x^2 - 3x - 7 \\ g(x) + 6 &= 2x^2 - 3x - 7 \\ g(x) &= 2x^2 - 3x - 13 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad gf(x) &= x^2 + 4 \\ g(x + 6) &= x^2 + 4 \\ \text{Katakan } y &= x + 6 \\ x &= y - 6 \\ g(y) &= (y - 6)^2 + 4 \\ &= y^2 - 12y + 36 + 4 \\ &= y^2 - 12y + 40 \end{aligned}$$

$$\text{Maka, } g(x) = x^2 - 12x + 40$$

$$\begin{aligned} \text{(c)} \quad gf(x) &= 8 - x \\ g(x + 6) &= 8 - x \\ \text{Katakan } y &= x + 6 \\ x &= y - 6 \end{aligned}$$

$$\begin{aligned} g(y) &= 8 - (y - 6) \\ &= 14 - y \end{aligned}$$

$$\text{Maka, } g(x) = 14 - x$$

8. (a)  $g : x \rightarrow \frac{x-1}{3}$

$$\text{(b)} \quad f\left(\frac{x-1}{3}\right) = x^2 - 3x + 6$$

$$\begin{aligned} \text{Katakan } y &= \frac{x-1}{3} \\ x &= 3y + 1 \end{aligned}$$

$$\begin{aligned} f(y) &= (3y + 1)^2 - 3(3y + 1) + 6 \\ &= 9y^2 + 6y + 1 - 9y - 3 + 6 \\ &= 9y^2 - 3y + 4 \end{aligned}$$

Gantikan  $y$  dengan  $x$ ,

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

$$\text{Maka, } f: x \rightarrow 9x^2 - 3x + 4$$

9. Diberi  $f(x) = px + q$ ,  $f^3(x) = 8x - 7$

(a)  $f(x) = px + q$

$$f^2(x) = f[f(x)]$$

$$= f(px + q)$$

$$= p(px + q) + q$$

$$= p^2x + pq + q$$

$$f^3(x) = f[f^2(x)]$$

$$= f(p^2x + pq + q)$$

$$= p(p^2x + pq + q) + q$$

$$= p^3x + p^2q + pq + q$$

Secara perbandingan,

$$p^3x + p^2q + pq + q = 8x - 7$$

$$p^3 = 8 \quad \text{dan} \quad p^2q + pq + q = -7$$

$$p = 2 \quad 4q + 2q + q = -7$$

$$7q = -7$$

$$q = -1$$

Maka,  $p = 2$  dan  $q = -1$ .

(b)  $f^4(x) = f[f^3(x)]$

$$= f(8x - 7)$$

$$= 2(8x - 7) - 1$$

$$= 16x - 14 - 1$$

$$= 16x - 15$$

(c)  $f(x) = 2x - 1$

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

$$f^3(x) = 8x - 7$$

$$f^4(x) = 16x - 15$$

$$\text{Maka, } f^n(x) = 2^n x + 1 - 2^n$$

10.  $CN(t) = C(100t - 5t^2)$

$$= 15\,000 + 8\,000(100t - 5t^2)$$

$$= 15\,000 + 800\,000t - 40\,000t^2$$

### Inkuiri 3 (Halaman 20)

3. Ya, setiap graf fungsi dan graf fungsi songsangannya adalah bersimetri terhadap garis  $h(x) = x$ , iaitu garis  $y = x$ .

### Latih Diri 1.8 (Halaman 21)

1. (a)  $f(4) = -5$  (b)  $f^{-1}(-1) = 6$  (c)  $f^{-1}(2) = -2$  (d)  $f^{-1}(-5) = 4$

2. Diberi  $g(x) = \frac{5}{2-x}$ ,  $x \neq 2$  dan  $h(x) = 3x + 6$

(a)  $g(12) = \frac{5}{2-12}$   
 $= -\frac{1}{2}$

(b) Katakan  $a = g^{-1}(4)$

$$g(a) = 4$$

$$\frac{5}{2-a} = 4$$

$$5 = 8 - 4a$$

$$4a = 3$$

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

$$\text{Maka, } g^{-1}(4) = \frac{3}{4}$$

(c)  $h(-1) = 3(-1) + 6$   
 $= 3$

(d) Katakan  $a = h^{-1}(9)$

$$h(a) = 9$$

$$3a + 6 = 9$$

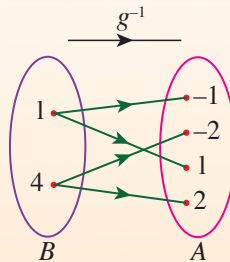
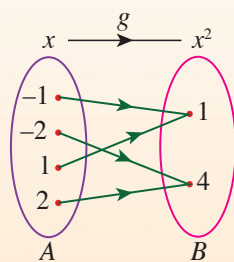
$$3a = 3$$

$$a = 1$$

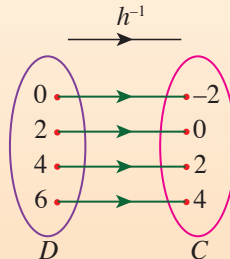
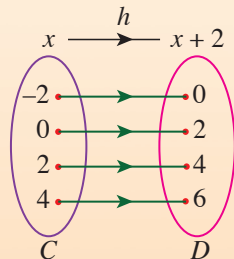
$$\text{Maka, } h^{-1}(9) = 1$$

#### Inkuiri 4 (Halaman 22)

1. (a)



(b)



2.  $g^{-1}$  bukan suatu fungsi kerana terdapat objek yang mempunyai dua imej.  $h^{-1}$  ialah suatu fungsi kerana setiap objek mempunyai satu imej sahaja.

3. Jenis fungsi yang boleh menghasilkan fungsi songsang ialah fungsi satu dengan satu.

#### Inkuiri 5 (Halaman 23)

2.

$$\begin{aligned} f(1) &= 1 \\ f(2) &= 3 \\ f(3) &= 5 \\ f(4) &= 7 \end{aligned}$$

$$\begin{aligned} g(1) &= 1 \\ g(3) &= 2 \\ g(5) &= 3 \\ g(7) &= 4 \end{aligned}$$

$$\begin{aligned} gf(1) &= g(1) = 1 \\ fg(1) &= f(1) = 1 \end{aligned}$$

$$\begin{aligned} gf(2) &= g(3) = 2 \\ fg(3) &= f(2) = 3 \end{aligned}$$

$$\begin{aligned} gf(3) &= g(5) = 3 \\ fg(5) &= f(3) = 5 \end{aligned}$$

$$\begin{aligned} gf(4) &= g(7) = 4 \\ fg(7) &= f(4) = 7 \end{aligned}$$

3.  $fg(x) = x$  dengan  $x$  berada dalam domain  $g$  dan  $gf(x) = x$  dengan  $x$  berada dalam domain  $f$ .

#### Inkuiri 6 (Halaman 23)

4.

Graf	Domain	Julat
Graf fungsi $f$	$0 \leq x \leq 8$	$0 \leq f(x) \leq 4$
Graf fungsi $g$	$0 \leq x \leq 4$	$0 \leq f(x) \leq 8$

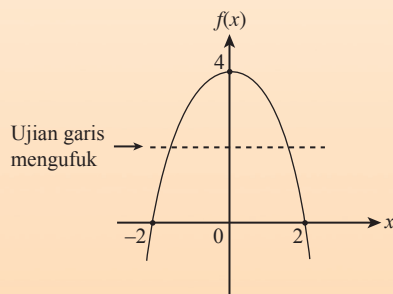
5. Jika dua fungsi  $f$  dan  $g$  ialah fungsi songsang antara satu sama lain, maka domain  $f =$  julat  $g$  dan domain  $g =$  julat  $f$ .
6. Graf  $g$  adalah pantulan graf  $f$  pada garis  $y = x$ .

#### Inkuiri 7 (Halaman 24)

4. Untuk mana-mana nombor nyata,  $a$  dan  $b$ , jika titik  $(a, b)$  berada pada graf  $f$ , maka titik  $(b, a)$  berada pada graf  $g$ , iaitu songsangan bagi graf  $f$ . Titik  $(b, a)$  di atas graf  $g$  ialah pantulan titik  $(a, b)$  di atas graf  $f$  pada garis  $y = x$ .

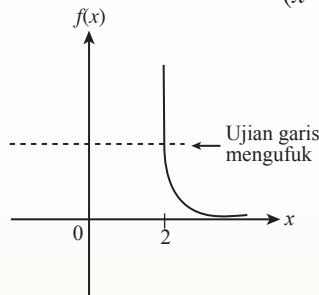
#### Latih Diri 1.9 (Halaman 26)

1. (a) Fungsi ini memetakan satu unsur dalam domain kepada hanya satu unsur dalam kodomain. Songsangan fungsi ini juga memetakan setiap unsur dalam kodomain kepada hanya satu unsur dalam domain. Maka, fungsi ini mempunyai songsangan.
- (b) Fungsi ini memetakan satu unsur dalam domain kepada hanya satu unsur dalam kodomain tetapi terdapat unsur dalam kodomain yang dipetakan kepada dua unsur dalam domain. Maka, fungsi ini tidak mempunyai songsangan.
- (c) Apabila ujian garis mengufuk dilakukan, garis mengufuk memotong dua titik pada graf. Ini menunjukkan bahawa fungsi ini bukan fungsi satu dengan satu. Maka, fungsi ini tidak mempunyai songsangan.
- (d) Jenis fungsi ini ialah fungsi satu dengan satu. Maka, fungsi ini mempunyai songsangan.
- (e) Jenis fungsi ini ialah fungsi banyak dengan satu dan songsangannya pula ialah fungsi satu dengan banyak. Maka, fungsi ini tidak mempunyai songsangan.
- (f) Graf bagi fungsi  $f(x) = 4 - x^2$  dilakar seperti berikut.



Apabila ujian garis mengufuk dilakukan, garis mengufuk memotong dua titik pada graf. Ini menunjukkan bahawa fungsi ini bukan fungsi satu dengan satu dan tidak mempunyai songsangan.

- (g) Graf bagi fungsi  $f(x) = \frac{1}{(x-2)^2}$ ,  $x > 2$  dilakar seperti berikut.



Apabila ujian garis mengufuk dilakukan, garis mengufuk memotong hanya satu titik pada graf. Ini menunjukkan bahawa fungsi ini adalah fungsi satu dengan satu dan mempunyai songsangan.

2. (a) Diberi  $f(x) = 3x - 2$ ,  $g(x) = \frac{x+2}{3}$

$$\begin{aligned} fg(x) &= f\left(\frac{x+2}{3}\right) \\ &= 3\left(\frac{x+2}{3}\right) - 2 \\ &= x \end{aligned}$$

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

Maka, fungsi  $f$  dan  $g$  ialah fungsi songsang antara satu sama lain.

- (b) Diberi  $f(x) = \frac{2x}{x-3}$ ,  $g(x) = \frac{3x}{x-2}$

$$\begin{aligned} fg(x) &= f\left(\frac{3x}{x-2}\right) \\ &= \frac{2\left(\frac{3x}{x-2}\right)}{\left(\frac{3x}{x-2}\right) - 3} \\ &= \frac{6x}{x-2} \div \frac{3x-3x+6}{x-2} \\ &= \frac{6x}{x-2} \times \frac{x-2}{6} \\ &= x \end{aligned}$$

$$\begin{aligned} gf(x) &= g\left(\frac{2x}{x-3}\right) \\ &= \frac{3\left(\frac{2x}{x-3}\right)}{\left(\frac{2x}{x-3}\right) - 2} \\ &= \frac{6x}{x-3} \div \frac{2x-2x+6}{x-3} \\ &= \frac{6x}{x-3} \times \frac{x-3}{6} \\ &= x \end{aligned}$$

Maka, fungsi  $f$  dan  $g$  ialah fungsi songsang antara satu sama lain.

- (c) Diberi  $f(x) = \frac{2}{x-3}$ ,  $g(x) = \frac{3x-2}{x}$

$$\begin{aligned} fg(x) &= f\left(\frac{3x-2}{x}\right) \\ &= \frac{2}{\left(\frac{3x-2}{x}\right) - 3} \\ &= 2 \div \frac{3x-2-3x}{x} \\ &= 2 \times \frac{x}{-2} \\ &= -x \end{aligned}$$

$$\begin{aligned} gf(x) &= g\left(\frac{2}{x-3}\right) \\ &= \frac{3\left(\frac{2}{x-3}\right) - 2}{\left(\frac{2}{x-3}\right)} \\ &= \frac{6-2x+6}{x-3} \div \frac{2}{x-3} \\ &= \frac{12-2x}{x-3} \times \frac{x-3}{2} \\ &= 6-x \end{aligned}$$

Maka, fungsi  $f$  dan  $g$  bukan fungsi songsang antara satu sama lain.

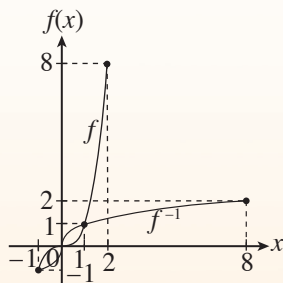
(d) Diberi  $f(x) = 2 + 5x$ ,  $g(x) = \frac{x-5}{2}$

$$\begin{aligned} fg(x) &= f\left(\frac{x-5}{2}\right) \\ &= 2 + 5\left(\frac{x-5}{2}\right) \\ &= \frac{4 + 5x - 25}{2} \\ &= \frac{5x - 21}{2} \end{aligned}$$

$$\begin{aligned} gf(x) &= g(2 + 5x) \\ &= \frac{2 + 5x - 5}{2} \\ &= \frac{5x - 3}{2} \end{aligned}$$

Maka, fungsi  $f$  dan  $g$  bukan fungsi songsang antara satu sama lain.

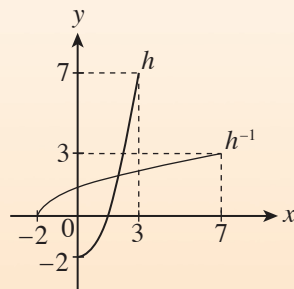
3. Diberi  $f(x) = x^3$  untuk domain  $-1 \leq x \leq 2$ .



Domain bagi fungsi  $f^{-1}$  ialah  $-1 \leq x \leq 8$  dan julatnya ialah  $-1 \leq f^{-1}(x) \leq 2$ .

4. Diberi  $h(x) = x^2 - 2$  untuk domain  $0 \leq x \leq 3$ .

(a)



(b) Domain bagi fungsi  $h^{-1}$  ialah  $-2 \leq x \leq 7$ .

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

$$x^2 - 2 = \sqrt{x + 2}$$

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

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

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

Apabila  $x = 1$ , sebelah kiri  $= 1^4 - 4(1)^2 - 1 + 2$   
 $= -2$

$\neq$  sebelah kanan

Apabila  $x = 2$ , sebelah kiri  $= 2^4 - 4(2)^2 - 2 + 2$   
 $= 0$

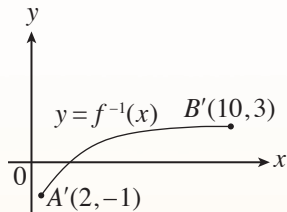
$=$  sebelah kanan

Maka, nilai  $x$  ialah 2.



5. (a)  $P'(\frac{1}{2}, -2)$   
 (b)  $Q'(-3, 1)$   
 (c)  $R'(5, 4)$   
 (d)  $S'(-8, -6)$

6. (a)



(b)  $a = 1, b = 4$

**Latih Diri 1.10 (Halaman 28)**

1. (a) Diberi  $f(x) = 2x - 5$

Katakan  $y = 2x - 5$

$$2x = y + 5$$

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

Oleh sebab  $x = f^{-1}(y)$ ,

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

$$= \frac{y + 5}{2}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

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

Maka,  $f^{-1} : x \rightarrow \frac{x + 5}{2}$ .

- (b) Diberi  $f(x) = \frac{3}{x}, x \neq 0$

Katakan  $y = \frac{3}{x}$

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

Oleh sebab  $x = f^{-1}(y)$ ,

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

$$= \frac{3}{y}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{3}{x}$$

Maka,  $f^{-1} : x \rightarrow \frac{3}{x}, x \neq 0$ .

(c) Diberi  $f(x) = \frac{4}{x-1}, x \neq 1$

Katakan  $y = \frac{4}{x-1}$

$$x-1 = \frac{4}{y}$$

$$x = \frac{4+y}{y}$$

Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned} f^{-1}(y) &= x \\ &= \frac{4+y}{y} \end{aligned}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

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

Maka,  $f^{-1} : x \rightarrow \frac{4+x}{x}, x \neq 0$ .

(d) Diberi  $f(x) = \frac{5x}{x-6}, x \neq 6$

Katakan  $y = \frac{5x}{x-6}$

$$y(x-6) = 5x$$

$$xy - 6y = 5x$$

$$xy - 5x = 6y$$

$$x(y-5) = 6y$$

$$x = \frac{6y}{y-5}$$

Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned} f^{-1}(y) &= x \\ &= \frac{6y}{y-5} \end{aligned}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{6x}{x-5}$$

Maka,  $f^{-1} : x \rightarrow \frac{6x}{x-5}, x \neq 5$ .

(e) Diberi  $f(x) = \frac{x+9}{x-8}, x \neq 8$

Katakan  $y = \frac{x+9}{x-8}$

$$y(x-8) = x+9$$

$$xy - 8y = x+9$$

$$xy - x = 8y+9$$

$$x(y-1) = 8y+9$$

$$x = \frac{8y+9}{y-1}$$

Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned}f^{-1}(y) &= x \\&= \frac{8y + 9}{y - 1}\end{aligned}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{8x + 9}{x - 1}$$

Maka,  $f^{-1} : x \rightarrow \frac{8x + 9}{x - 1}, x \neq 1$ .

(f) Diberi  $f(x) = \frac{2x - 3}{2x - 1}, x \neq \frac{1}{2}$

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

$$y(2x - 1) = 2x - 3$$

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

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

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

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

Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned}f^{-1}(y) &= x \\&= \frac{y - 3}{2y - 2}\end{aligned}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{x - 3}{2x - 2}$$

Maka,  $f^{-1} : x \rightarrow \frac{x - 3}{2x - 2}, x \neq 1$ .

2. (a) Diberi  $f(x) = \frac{3 - x}{2x}, x \neq 0$

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

$$2xy = 3 - x$$

$$2xy + x = 3$$

$$x(2y + 1) = 3$$

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

Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned}f^{-1}(y) &= x \\&= \frac{3}{2y + 1}\end{aligned}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{3}{2x + 1}, x \neq -\frac{1}{2}$$

Maka,  $f^{-1}(4) = \frac{3}{2(4) + 1}$

$$= \frac{3}{9}$$

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

$$(b) \quad f(x) = f^{-1}(x)$$

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

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

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

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

$$(2x+3)(x-1) = 0$$

$$2x+3=0 \quad \text{atau} \quad x-1=0$$

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

Nilai-nilai yang mungkin bagi  $x$  ialah  $-\frac{3}{2}$  dan 1.

3. Diberi  $h(x) = 4x + a$  dan  $h^{-1}(x) = 2bx + \frac{5}{8}$

$$h(x) = 4x + a$$

$$\text{Katakan } y = 4x + a$$

$$4x = y - a$$

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

$$\text{Oleh sebab } x = h^{-1}(y),$$

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

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

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$h^{-1}(x) = \frac{x-a}{4}$$

Samakan fungsi  $h^{-1}$ ,

$$\frac{x-a}{4} = 2bx + \frac{5}{8}$$

$$\frac{x}{4} - \frac{a}{4} = 2bx + \frac{5}{8}$$

$$\frac{1}{4} = 2b \quad \text{dan} \quad -\frac{a}{4} = \frac{5}{8}$$

$$8b = 1 \quad -8a = 20$$

$$b = \frac{1}{8} \quad a = -\frac{20}{8}$$

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

Maka,  $a = -\frac{5}{2}$  dan  $b = \frac{1}{8}$ .

4. (a)  $f^{-1}(x) = 6x + 7$

$$\text{Katakan } x = 6y + 7$$

$$6y = x - 7$$

$$y = \frac{x-7}{6}$$

$$\text{Maka, } f: x \rightarrow \frac{x-7}{6}$$

$$(b) f^{-1}(x) = \frac{2-x}{5}$$

$$\text{Katakan } x = \frac{2-y}{5}$$

$$5x = 2 - y$$

$$y = 2 - 5x$$

$$\text{Maka, } f: x \rightarrow 2 - 5x$$

$$(c) f^{-1}(x) = \frac{3x}{x-3}, x \neq 3$$

$$\text{Katakan } x = \frac{3y}{y-3}$$

$$xy - 3x = 3y$$

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

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

$$\text{Maka, } f: x \rightarrow \frac{3x}{x-3}, x \neq 3$$

$$5. \text{ Diberi } g^{-1}(x) = \frac{4}{2-x}, x \neq k$$

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

$$x=2$$

$$\text{Maka, } k=2.$$

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

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

$$2x - xy = 4$$

$$xy = 2x - 4$$

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

$$g(x) = \frac{2x-4}{x}, x \neq 0$$

$$\text{Maka, } g\left(\frac{1}{2}\right) = \frac{2\left(\frac{1}{2}\right) - 4}{\left(\frac{1}{2}\right)} = -6$$

### Latihan Intensif 1.3 (Halaman 29)

$$1. (a) f(2) = 5$$

$$(b) g(5) = 8$$

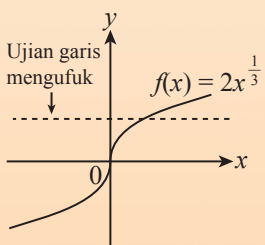
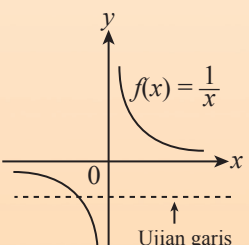
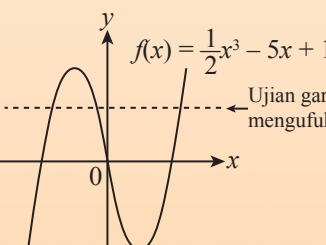
$$(c) gf(2) = 8$$

$$(d) f^{-1}(5) = 2$$

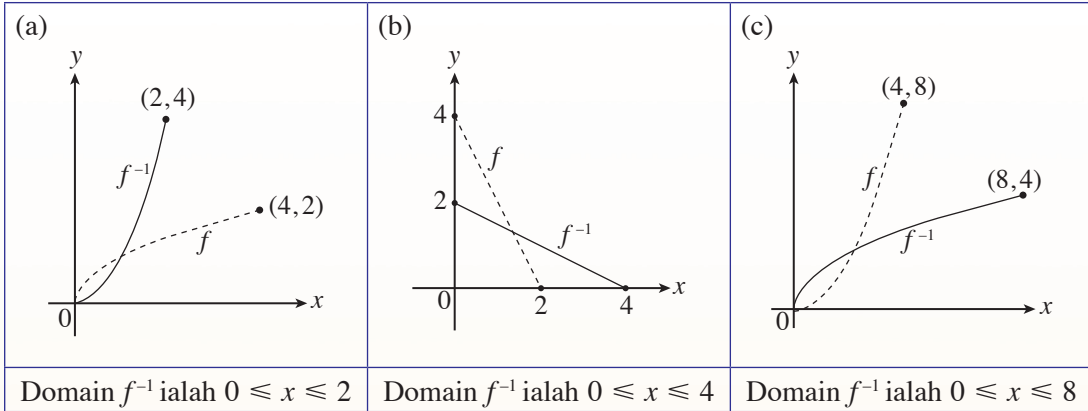
$$(e) g^{-1}(8) = 5$$

$$(f) f^{-1}g^{-1}(8) = 2$$

2.

<p>(a)</p> 	<p>(b)</p> 	<p>(c)</p> 
<p>Fungsi ini mempunyai fungsi songsang kerana garis mengufuk memotong hanya satu titik sahaja pada graf.</p>	<p>Fungsi ini mempunyai fungsi songsang kerana garis mengufuk memotong hanya satu titik sahaja pada graf.</p>	<p>Fungsi ini tidak mempunyai fungsi songsang kerana garis mengufuk memotong lebih daripada satu titik pada graf.</p>

3.



4. (a) Diberi  $f(x) = \frac{2x+h}{x-3}$ ,  $x \neq 3$  dan  $f(4) = 13$

$$f(4) = 13$$

$$\frac{2(4)+h}{4-3} = 13$$

$$8+h=13$$

$$h=5$$

(b) Katakan  $y = \frac{2x+5}{x-3}$

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

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

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

$$x = \frac{3y+5}{y-2}$$

Oleh sebab  $x = f^{-1}(y)$ ,

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

$$= \frac{3y+5}{y-2}$$

Gantikan pemboleh ubah  $y$  dengan  $x$ ,

$$f^{-1}(x) = \frac{3x+5}{x-2}, x \neq 2$$

$$\text{Maka, } f^{-1}(3) = \frac{3(3)+5}{3-2}$$

$$= 14$$

(c)  $f^{-1}(m) = 2$

$$\frac{3m+5}{m-2} = 2$$

$$3m+5 = 2m-4$$

$$m = -9$$

5. Diberi  $h^{-1}(x) = \frac{2}{3-x}, x \neq 3$

(a) Katakan  $x = \frac{2}{3-y}$

$$3x - xy = 2$$

$$xy = 3x - 2$$

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

Maka,  $h(x) = \frac{3x-2}{x}, x \neq 0$

(b)  $h(x) = 2$

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

$$3x - 2 = 2x$$

$$x = 2$$

6. Diberi  $f(x) = 4x - 17, g(x) = \frac{5}{2x-7}, x \neq 3\frac{1}{2}$

$$f(x) = 4x - 17$$

Katakan  $y = 4x - 17$

$$4x = y + 17$$

$$x = \frac{y+17}{4}$$

Oleh sebab  $x = f^{-1}(y),$

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

$$= \frac{y+17}{4}$$

Maka,  $f^{-1}(x) = \frac{x+17}{4}$

$$g(x) = \frac{5}{2x-7}$$

Katakan  $y = \frac{5}{2x-7}$

$$2xy - 7y = 5$$

$$2xy = 5 + 7y$$

$$x = \frac{5+7y}{2y}$$

Oleh sebab  $x = g^{-1}(y),$

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

$$= \frac{5+7y}{2y}$$

Maka,  $g^{-1}(x) = \frac{5+7x}{2x}$

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

$$\frac{x+17}{4} = \frac{5+7x}{2x}$$

$$2x(x+17) = 4(5+7x)$$

$$2x^2 + 34x = 20 + 28x$$

$$2x^2 + 6x - 20 = 0$$

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

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

$$x+5=0 \quad \text{atau} \quad x-2=0$$

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

7. (a) Diberi  $f(x) = \frac{17}{20}(220-x)$

Katakan  $y = \frac{17}{20}(220-x)$

$$\frac{20}{17}y = 220 - x$$

$$x = 220 - \frac{20}{17}y$$

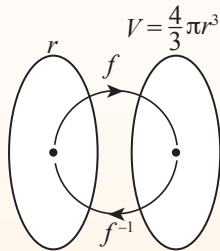
Oleh sebab  $x = f^{-1}(y)$ ,

$$\begin{aligned} f^{-1}(y) &= x \\ &= 220 - \frac{20}{17}y \end{aligned}$$

Maka,  $f^{-1}(x) = 220 - \frac{20}{17}x$

$$\begin{aligned} \text{(b) } f(16) &= \frac{17}{20}(220 - 16) \\ &= 173.4 \end{aligned}$$

8. Diberi  $V = \frac{4}{3}\pi r^3$   
(a)



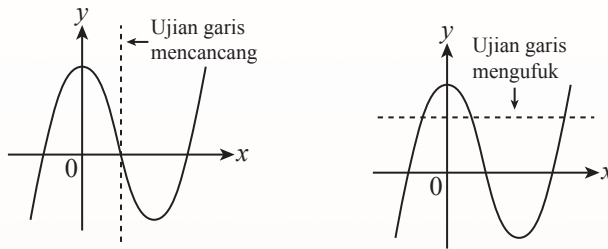
$$\begin{aligned} \text{(b) } \frac{4}{3}\pi r^3 &= \frac{1}{2} \\ r^3 &= \frac{1}{2} \left( \frac{3}{4\pi} \right) \\ &= \frac{3}{8\pi} \\ r &= \sqrt[3]{\frac{3}{8\pi}} \\ &= 0.49 \text{ cm} \end{aligned}$$

### Latihan Pengukuhan

1. (a) (i) 1  
(ii) 6, 8, 9  
(b) Ya kerana setiap objek hanya mempunyai satu imej.  
(c) Domain = {2, 6, 7, 8, 9}  
Kodomain = {1, 4, 5}  
Julat = {1, 4}
2. (a)  $(-2)^2 - 1 = 3$   
 $2^2 - 1 = 3$   
 $4^2 - 1 = 15$   
 $6^2 - 1 = 35$   
Maka,  $m = 35$ .  
(b)  $h : x \rightarrow x^2 - 1$



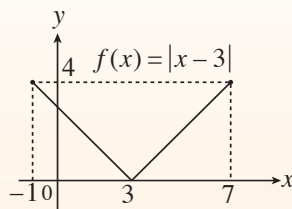
3.



Graf ini ialah suatu fungsi kerana ujian garis mencancang memotong hanya satu titik sahaja pada graf tetapi bukan fungsi satu dengan satu kerana ujian garis mengufuk memotong lebih daripada satu titik pada graf.

4. Diberi  $f(x) = |x - 3|$  untuk domain  $-1 \leq x \leq 7$ ,

(a)



Julat bagi fungsi  $f$  ialah  $0 \leq f(x) \leq 4$ .

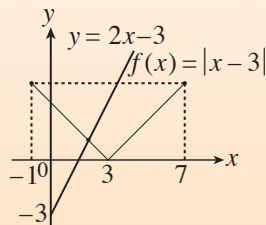
(b)  $f(x) \leq 2$

$$|x - 3| \leq 2$$

$$-2 \leq x - 3 \leq 2$$

$$1 \leq x \leq 5$$

(c)



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

$$x - 3 = -(2x - 3) \quad \text{atau} \quad x - 3 = 2x - 3$$

$$3x = 6$$

$$x = 2$$

Maka,  $x = 2$ .

5. Diberi  $f(x) = hx + \frac{k}{x}$ ,  $x \neq 0$

(a)  $f(2) = 17$

$$2h + \frac{k}{2} = 17$$

$$4h + k = 34$$

$$k = 34 - 4h \dots \textcircled{1}$$

$$f(3) = 23$$

$$3h + \frac{k}{3} = 23$$

$$9h + k = 69 \dots \textcircled{2}$$

Masukkan  $\textcircled{1}$  ke dalam  $\textcircled{2}$ .

$$9h + 34 - 4h = 69$$

$$5h = 35$$

$$h = 7$$

Masukkan  $h = 7$  ke dalam  $\textcircled{1}$ .

$$k = 34 - 4(7)$$

$$= 34 - 28$$

$$= 6$$

Maka,  $h = 7$  dan  $k = 6$ .

$$\begin{aligned} \text{(b) } f(6) &= 7(6) + \frac{6}{6} \\ &= 43 \end{aligned}$$

6. Diberi  $f(x) = \frac{x+2}{x-2}$ ,  $x \neq 2$ ,  $g(x) = mx + c$ ,  $g^{-1}(2) = f(3)$ ,  $gf^{-1}(2) = 5$

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

$$\text{Katakan } y = \frac{x+2}{x-2}$$

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

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

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

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

$$\text{Maka, } f^{-1}(x) = \frac{2 + 2x}{x - 1}, x \neq 1$$

$$g(x) = mx + c$$

$$\text{Katakan } y = mx + c$$

$$mx = y - c$$

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

$$\text{Maka, } g^{-1}(x) = \frac{x - c}{m}$$

$$g^{-1}(2) = f(3)$$

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

$$2 - c = 5m$$

$$5m + c = 2 \dots \textcircled{1}$$

$$gf^{-1}(2) = 5$$

$$g(6) = 5$$

$$6m + c = 5 \dots \textcircled{2}$$

$$\textcircled{2} - \textcircled{1}: m = 3$$

Gantikan  $m = 3$  ke dalam  $\textcircled{1}$ .

$$5(3) + c = 2$$

$$c = -13$$

Maka,  $m = 3$  dan  $c = -13$ .

7. (a) (i)  $f(x) = 3x - 2$

Katakan  $y = 3x - 2$

$$3x = y + 2$$

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

Maka, fungsi yang memetakan set  $B$  kepada set  $A$  ialah  $f^{-1}(x) = \frac{x + 2}{3}$ .

(ii)  $gf(x) = 6x + 1$

$$g(3x - 2) = 6x + 1$$

Katakan  $y = 3x - 2$

$$3x = y + 2$$

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

$$g(y) = 6\left(\frac{y + 2}{3}\right) + 1$$

$$= 2y + 5$$

Maka,  $g(x) = 2x + 5$

(b)  $fg(x) = 4x - 3$

$$f(2x + 5) = 4x - 3$$

$$3(2x + 5) - 2 = 4x - 3$$

$$6x + 15 - 2 = 4x - 3$$

$$2x = -16$$

$$x = -8$$

8. Diberi  $f(x) = \frac{m}{x - 1} + n$ ,  $x \neq k$ ,  $f(2) = 3$ ,  $f(3) = 2$

(a)  $k = 1$

(b)  $f(2) = 3$

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

$$m + n = 3 \dots \textcircled{1}$$

$$f(3) = 2$$

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

$$m + 2n = 4 \dots \textcircled{2}$$

$$\textcircled{2} - \textcircled{1}: n = 1$$

Gantikan  $n = 1$  ke dalam  $\textcircled{1}$ .

$$m + 1 = 3$$

$$m = 2$$

Maka,  $m = 2$  dan  $n = 1$ .

(c)  $f^2(x) = f[f(x)]$

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

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

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

$$= x - 1 + 1$$

$$= x$$

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

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

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

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

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

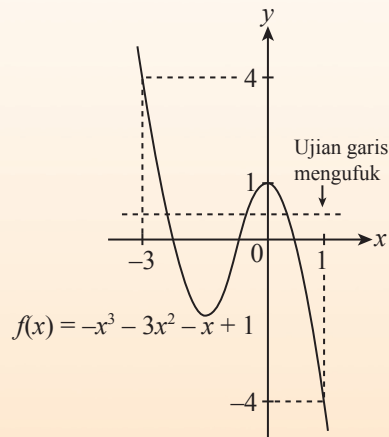
$$f^{-1}(x) = \frac{2}{x-1} + 1, x \neq 1$$

$$\begin{aligned} \text{Maka, } f^{-1}(2) &= \frac{2}{2-1} + 1 \\ &= 3 \end{aligned}$$

9. (a) (i) Fungsi selanjut

$$(ii) -4 \leq f(x) \leq 4$$

(b)



Graf  $f$  tidak mempunyai fungsi songsang kerana ujian garis mengufuk memotong lebih daripada satu titik pada graf.

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

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

11. Graf tidak semestinya bersilang pada garis  $y = x$  jika graf bagi suatu fungsi dan songsangannya bersilang. Kedua-dua graf ini mungkin bersilang pada garis yang lain.

$$12. \text{ Diberi } f(x) = \frac{ax+b}{cx+d}$$

$$\text{Katakan } y = \frac{ax+b}{cx+d}$$

$$cxy + dy = ax + b$$

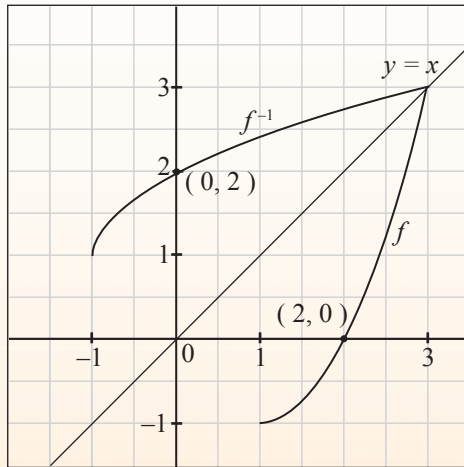
$$x(cy - a) = b - dy$$

$$x = \frac{b - dy}{cy - a}$$

$$f^{-1}(x) = \frac{b - dx}{cx - a}, x \neq \frac{a}{c}$$

- (a) (i)  $f(x) = \frac{x+8}{x-5}$ , dengan  $a = 1, b = 8, c = 1$  dan  $d = -5$   
 $f^{-1}(x) = \frac{8+5x}{x-1}, x \neq 1$
- (ii)  $f(x) = \frac{2x-3}{x+4}$ , dengan  $a = 2, b = -3, c = 1$  dan  $d = 4$   
 $f^{-1}(x) = \frac{-3-4x}{x-2}, x \neq 2$
- (b)  $f = f^{-1}$  jika  $a = -d$ .

13. (a) (i) (ii)



Julat  $f$  ialah  $-1 \leq f(x) \leq 3$  dan domain  $f^{-1}$  ialah  $-1 \leq x \leq 3$ .

(b) Julat  $f = \text{domain } f^{-1}$  dan domain  $f = \text{Julat } f^{-1}$ .

(i) Ya

(ii) Ya. Mana-mana titik  $(b, a)$  di atas graf  $f^{-1}$  ialah pantulan titik  $(a, b)$  di atas graf pada garis  $y = x$ .

14. (a)  $p = 100 - \frac{1}{4}x$

$$\frac{1}{4}x = 100 - p$$

$$x = 400 - 4p$$

dan  $C = \frac{\sqrt{x}}{25} + 600$

Apabila  $x = 400 - 4p$ ,

$$C = \frac{\sqrt{400 - 4p}}{25} + 600$$

$$= \frac{\sqrt{4(100 - p)}}{25} + 600$$

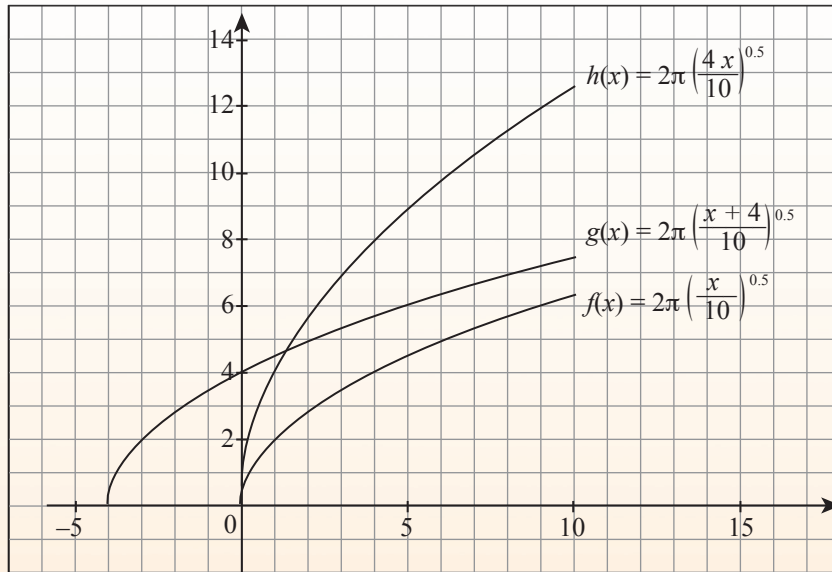
$$= \frac{2\sqrt{100 - p}}{25} + 600$$

Jadi,  $C = \frac{2\sqrt{100 - p}}{25} + 600$

(b) Apabila  $p = 36$ ,

$$\begin{aligned} C &= \frac{2\sqrt{100 - 36}}{25} + 600 \\ &= 0.64 + 600 \\ &= 600.64 \end{aligned}$$

15.



Tempoh ayunan bandul,  $T$  bergantung pada panjang bandul,  $l$ . Jika panjang bertambah, tempoh ayunannya juga bertambah.