

# JAWAPAN

## BAB 4 HUKUM INDEKS

### Inkuiri 1 (Halaman 90)

Hukum indeks	Contoh
$a^m \times a^n = a^{m+n}$	$t^2 \times t^3 = t^{2+3} = t^5$
$a^m \div a^n = a^{m-n}$	$s^8 \div s^3 = s^{8-3} = s^5$
$a^0 = 1$	$u^0 = 1$
$(a^m)^n = a^{mn}$	$(p^9)^2 = p^{18}$
$\sqrt[n]{a} = a^{\frac{1}{n}}$	$\sqrt[3]{c} = c^{\frac{1}{3}}$
$a^m \times b^m = (ab)^m$	$k^4 \times h^4 = (kh)^4$
$\sqrt[n]{a^m} = a^{\frac{m}{n}}$	$\sqrt[2]{y^5} = y^{\frac{5}{2}}$
$\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$	$\frac{r^6}{s^6} = \left(\frac{r}{s}\right)^6$
$a^{-n} = \frac{1}{a^n}$	$d^4 = \frac{1}{d^4}$

**Inkuiri 2 (Halaman 90)****1. Hukum indeks:**

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $(a^m \times a^n)^p = a^{mp} \times a^{np}$
- $a^{\frac{1}{n}}$

**Latih Diri 4.1 (Halaman 92)**

1. (a)  $\frac{5^{3x} \times 5^x}{5^{-x}} = 5^{3x+x-(-x)}$   
 $= 5^{5x}$
- (b)  $\frac{7^{b-2} - 7^b}{7^{b+3}} = \frac{7^b \times 7^{-2} - 7^b}{7^b \times 7^3}$   
 $= \frac{7^b(7^{-2} - 1)}{7^b \times 7^3}$   
 $= 7^{-3}(7^{-2} - 1)$   
 $= 7^{-3+(-2)} - 7^{-3}$   
 $= 7^{-5} - 7^{-3}$   
 $= \frac{1}{7^5} - \frac{1}{7^3}$
- (c)  $\frac{9^{a-3} + 9^{a+4}}{81} = \frac{9^a \times 9^{-3} + 9^a \times 9^4}{9^2}$   
 $= \frac{9^a(9^{-3} + 9^4)}{9^2}$   
 $= 9^a(9^{-5} + 9^2)$
- (d)  $c^4d^3 \times c^3d^5 = c^{4+3}d^{3+5}$   
 $= c^7d^8$
- (e)  $(xy^2)^3 \times x^3y^5 = x^3y^6 \times x^3y^5$   
 $= x^{3+3}y^{6+5}$   
 $= x^6y^{11}$
- (f)  $(7x^{-1})^2 \times (49^{-2}xy)^3 = 49x^{-2} \times 49^{-6}x^3y^3$   
 $= 49^{1+(-6)}x^{-2+3}y^3$   
 $= 49^{-5}xy^3$   
 $= \frac{xy^3}{49^5}$
- (g)  $(3x^2y)^3 \times (x^3)^4 \div x^{16}y^2 = \frac{27x^6y^3 \times x^{12}}{x^{16}y^2}$   
 $= 27x^{6+12-16}y^{3-2}$   
 $= 27x^2y$
- (h)  $(p^2q^{-1})^5 \times q^8 = p^{10}q^{-5} \times q^8$   
 $= p^{10}q^{-5+8}$   
 $= p^{10}q^3$

$$\begin{aligned} \text{(i)} \quad (pq^5)^4 \times p^3 &= p^4 q^{20} \times p^3 \\ &= p^{4+3} q^{20} \\ &= p^7 q^{20} \end{aligned}$$

$$\begin{aligned} \text{(j)} \quad (49^{-2}xy)^3 \div (7xy)^{-2} &= \frac{49^{-6}x^3y^3}{7^{-2}x^{-2}y^{-2}} \\ &= 7^{2(-6) - (-2)} x^{3 - (-2)} y^{3 - (-2)} \\ &= 7^{-10} x^5 y^5 \\ &= \frac{x^5 y^5}{7^{10}} \end{aligned}$$

$$\begin{aligned} \text{(k)} \quad 20x^{-7}y^2 \div 4x^3y^{-4} &= \frac{20x^{-7}y^2}{4x^3y^{-4}} \\ &= 5x^{-7-3}y^{2-(-4)} \\ &= \frac{5y^6}{x^{10}} \end{aligned}$$

$$\begin{aligned} \text{(l)} \quad 6a^7b^{-2} \div 36a^3b^{-4} &= \frac{6a^7b^{-2}}{36a^3b^{-4}} \\ &= \frac{a^{7-3}b^{-2-(-4)}}{6} \\ &= \frac{a^4b^2}{6} \end{aligned}$$

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

$$\begin{aligned} \text{(b)} \quad \frac{4a^3}{a^{-\frac{3}{5}}} &= 4a^3 \div a^{-\frac{3}{5}} \\ &= 4a^{3 - (-\frac{3}{5})} \\ &= 4a^{\frac{18}{5}} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad \sqrt[5]{a^7} \times \sqrt[4]{a^{-9}} &= a^{\frac{7}{5}} \times a^{-\frac{9}{4}} \\ &= a^{\frac{7}{5} + (-\frac{9}{4})} \\ &= a^{-\frac{17}{20}} \\ &= \frac{1}{a^{\frac{17}{20}}} \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad a^{-\frac{3}{2}}(a^{\frac{1}{2}} + 3a^{-\frac{3}{2}} - 3a^{-\frac{5}{2}}) &= (a^{-\frac{3}{2}} \times a^{\frac{1}{2}}) + (a^{-\frac{3}{2}} \times 3a^{-\frac{3}{2}}) - (a^{-\frac{3}{2}} \times 3a^{-\frac{5}{2}}) \\ &= a^{-\frac{3}{2} + \frac{1}{2}} + 3a^{-\frac{3}{2} - \frac{3}{2}} - 3a^{-\frac{3}{2} - \frac{5}{2}} \\ &= a^{-1} + 3a^{-3} - 3a^{-4} \\ &= \frac{1}{a} + \frac{3}{a^3} - \frac{3}{a^4} \end{aligned}$$

$$\begin{aligned} \text{3. (a)} \quad 4^{3a-2} &= 4^{3a} \times 4^{-2} \\ &= \frac{4^{3a}}{4^2} \\ &= \frac{64^a}{16} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 9^{2a+2} &= 9^{2a} \times 9^2 \\ &= 81^a \times 81 \\ &= 81(81^a) \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 7^{3a-4} &= 7^{3a} \times 7^{-4} \\ &= \frac{7^{3a}}{7^4} \\ &= \frac{343^a}{2401} \end{aligned}$$

$$\begin{aligned} 4. \quad 4^{x+2} + 4^{x+1} + 4^x &= (4^x \times 4^2) + (4^x \times 4^1) + 4^x \\ &= 4^x(4^2 + 4^1 + 1) \\ &= 4^x(16 + 4 + 1) \\ &= 4^x(21) \end{aligned}$$

Oleh sebab 21 ialah gandaan bagi 7, maka  $4^{x+2} + 4^{x+1} + 4^x$  boleh dibahagi dengan 7 bagi semua integer positif  $x$ .

### Latih Diri 4.2 (Halaman 94)

$$\begin{aligned} 1. \quad \text{(a)} \quad 4^{x-1} &= 8^{x+3} \\ 2^{2(x-1)} &= 2^{3(x+3)} \\ 2(x-1) &= 3(x+3) \\ 2x-2 &= 3x+9 \\ x &= -11 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 3^{x+3} - 3^{x+2} &= 2 \\ (3^x \times 3^3) - (3^x \times 3^2) &= 2 \\ 3^x(3^3 - 3^2) &= 2 \\ 3^x(18) &= 2 \\ 3^x &= \frac{2}{18} \\ 3^x &= \frac{1}{9} \\ 3^x &= 3^{-2} \\ x &= -2 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 8^{x-3} &= \frac{4^{2x}}{64} \\ 2^{3(x-3)} &= \frac{2^{2(2x)}}{2^6} \\ 2^{3x-9} &= \frac{2^{4x}}{2^6} \\ 2^{3x-9} &= 2^{4x-6} \\ 3x-9 &= 4x-6 \\ x &= -3 \end{aligned}$$

$$\begin{aligned} 2. \quad \text{(a)} \quad h &= 10 \times (0.9)^1 \\ h &= 10 \times (0.9)^0 \\ &= 10 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad h &= 10 \times (0.9)^{10} \\ &= 3.487 \text{ cm} \end{aligned}$$

**Latihan Intensif 4.1 (Halaman 94)**

$$\begin{aligned} 1. \text{ (a) } \frac{y^3(3zx)^2}{9x^3} &= \frac{y^3 3^2 z^2 x^2}{9x^3} \\ &= y^3 z^2 x^{2-3} \\ &= \frac{y^3 z^2}{x} \end{aligned}$$

$$\begin{aligned} \text{(b) } \frac{z^4 y x^2}{z x y^2} &= z^{4-1} y^{1-2} x^{2-1} \\ &= z^3 y^{-1} x \\ &= \frac{x z^3}{y} \end{aligned}$$

$$\begin{aligned} \text{(c) } [(xy)^5 \times 2xy^3]^2 &= [x^5 y^5 \times 2xy^3]^2 \\ &= x^{10} y^{10} \times 4x^2 y^6 \\ &= 4x^{10+2} y^{10+6} \\ &= 4x^{12} y^{16} \end{aligned}$$

$$\begin{aligned} \text{(d) } (ef^2)^3 \div (e^{-2}f^2) &= \frac{e^3 f^6}{e^{-2} f^2} \\ &= e^{3-(-2)} f^{6-2} \\ &= e^5 f^4 \end{aligned}$$

$$\begin{aligned} \text{(e) } 4.2x^4 y^{14} \div 0.6x^9 y^5 &= \frac{4.2x^4 y^{14}}{0.6x^9 y^5} \\ &= 7x^{4-9} y^{14-5} \\ &= 7x^{-5} y^9 \\ &= \frac{7y^9}{x^5} \end{aligned}$$

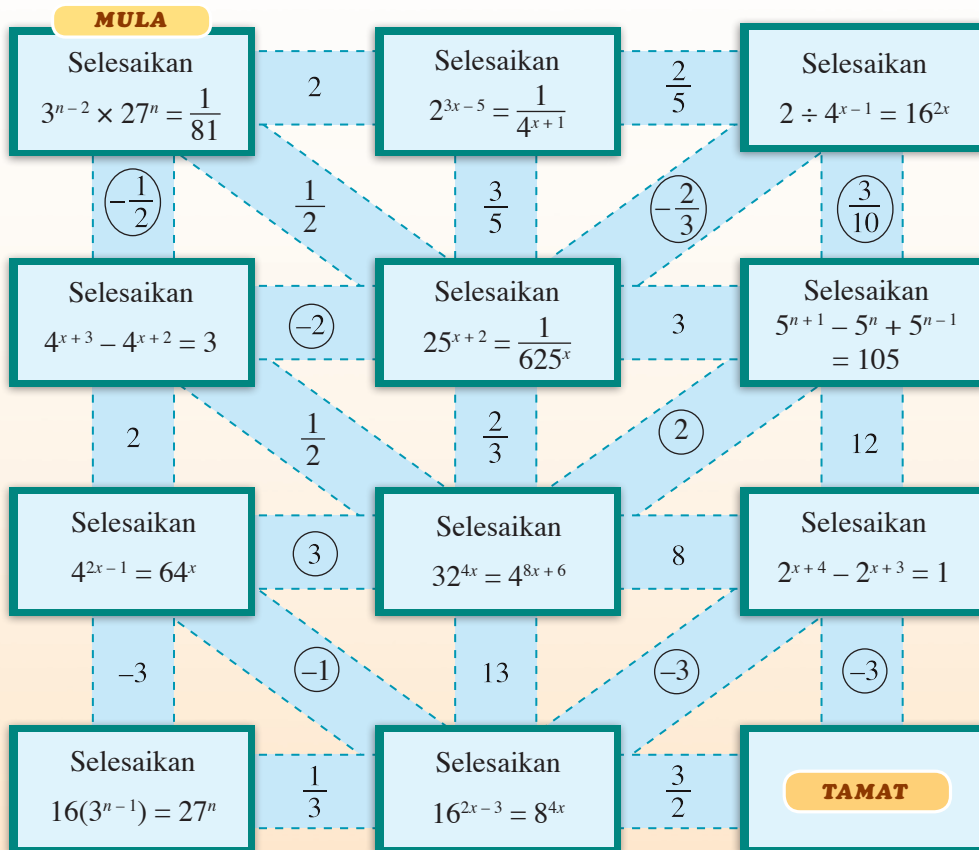
$$\begin{aligned} \text{(f) } (7x^{-1})^2 \times (49^{-2}xy)^3 \div (7xy)^{-2} &= 7^2 x^{-2} \times 7^{-12} x^3 y^3 \div 7^{-2} x^{-2} y^{-2} \\ &= \frac{7^2 x^{-2} \times 7^{-12} x^3 y^3}{7^{-2} x^{-2} y^{-2}} \\ &= 7^{2+(-12)-(-2)} x^{-2+3-(-2)} y^{3-(-2)} \\ &= 7^{-8} x^3 y^5 \\ &= \frac{x^3 y^5}{7^8} \end{aligned}$$

$$\begin{aligned} 2. \quad 2^{x-2} &= 2 \quad (16) \\ 2^{x-2} &= 32 \\ 2^{x-2} &= 2^5 \\ x-2 &= 5 \\ x &= 7 \end{aligned}$$

$$\begin{aligned} 3. \quad 25^x - 5^{3x-4} &= 0 \\ 25^x &= 5^{3x-4} \\ 5^{2x} &= 5^{3x-4} \\ 2x &= 3x-4 \\ -x &= -4 \\ x &= 4 \end{aligned}$$

$$\begin{aligned}
 4. \quad & 4(2^{m+1}) - 16^m = 0 \\
 & 4(2^{m+1}) = 16^m \\
 & 2^2(2^{m+1}) = (2^4)^m \\
 & 2 + m + 1 = 4m \\
 & -3m = -3 \\
 & m = 1
 \end{aligned}$$

5.



6. (a) Anggap  $B = 300(3^t)$   
 Bilangan bakteria selepas 9 minit:  
 $B = 300(3^9)$   
 $= 5\,904\,900$
- (b) Masa dalam minit untuk bilangan bakteria menjadi 72 900  
 $B = 300(3^t)$   
 $72\,900 = 300(3^t)$   
 $3^t = 243$   
 $3^t = 3^5$   
 $t = 5$  minit

7.  $P = A\left(1 + \frac{k}{100}\right)^t$ , dengan  $A = 30$  juta,  $k = 0.03$ ,  $t = 2050 - 2017 = 33$

$$P = 30\,000\,000\left(1 + \frac{3}{100}\right)^{33}$$

$$= 79\,570\,057$$

8.  $P = f(1 + r)^t$ , dengan  $f = 20\,000$ ,  $r = 0.10$ ,  $t = 10$

$$P = 20\,000\left(1 + \frac{10}{100}\right)^{10}$$

$$= \text{RM}51\,874.85$$

### Inkuiri 3 (Halaman 96)

3. Andaikan  $a = 2$ ,  $b = 3$  dan  $c$  ialah hipotenus.

$$c = \sqrt{2^2 + 3^2}$$

$$= \sqrt{13}$$

$$\cos \theta = \frac{2}{\sqrt{13}}$$

### Inkuiri 4 (Halaman 96)

Nombor nisbah	Nombor tak nisbah	
	Surd	Bukan surd
0.333333...	$\sqrt{2}$	$\pi$
0.141414...	$\sqrt[3]{121}$	$e = 2.71828182845\dots$
3.456666...	$\sqrt{\frac{3}{4}}$	
5.8686	$\sqrt{\frac{7}{9}}$	
0.5	$\sqrt[5]{\frac{33}{34}}$	
0.175		
$\sqrt[3]{\frac{1}{8}}$		
1.234567...		
0.5555...		

**Cabar Minda** (Halaman 98)

$$N = \frac{224}{495}$$

$$\begin{array}{r}
 0.45252 \\
 495 \overline{) 2240} \\
 \underline{-1980} \\
 2600 \\
 \underline{-2475} \\
 1250 \\
 \underline{- 990} \\
 2600 \\
 \underline{-2475} \\
 1250 \\
 \underline{- 990} \\
 2600 \\
 \vdots
 \end{array}$$

**Latih Diri 4.3** (Halaman 99)

1. (a) Katakan  $N = 0.787878\dots$  ①

①  $\times 100$ :  $100N = 78.7878\dots$  ②

②  $-$  ①:  $99N = 78$

$$N = \frac{78}{99}$$

Maka,  $0.787878\dots = \frac{26}{33}$

(b) Katakan  $A = 3.57575757$

$$A = 3 + N$$

Anggap  $N = 0.57575757\dots$  ①

①  $\times 100$ :  $100N = 57.575757\dots$  ②

②  $-$  ①:  $99N = 57$

$$N = \frac{57}{99}$$

$$= \frac{19}{33}$$

$$A = 3 + \frac{19}{33}$$

$$= 3\frac{19}{33}$$

Maka,  $3.57575757\dots = 3\frac{19}{33}$

(c) Katakan  $N = 0.345345345\dots$  ①

①  $\times 1\ 000$ :  $1\ 000N = 345.345345\dots$  ②

②  $-$  ①:  $999N = 345$

$$N = \frac{345}{999}$$

$$= \frac{115}{333}$$

Maka,  $0.345345345\dots = \frac{115}{333}$



(d) Katakan  $A = 13.567567567$   
 $A = 13 + N$   
 Anggap  $N = 0.567567567\dots$  ①  
 $1\ 000N = 567.567567\dots$  ②

② - ①:  $999N = 567$   
 $N = \frac{567}{999}$   
 $= \frac{21}{37}$   
 $A = 13 + \frac{21}{37}$   
 $= 13\frac{21}{37}$

Maka,  $13.567567567\dots = 13\frac{21}{37}$

2. (a)  $\sqrt[3]{127} = 5.026525695\dots$   
 $\sqrt[3]{127}$  adalah surd kerana menghasilkan perpuluhan tidak berulang.
- (b)  $\sqrt[4]{1125} = 5.791460926\dots$   
 $\sqrt[4]{1125}$  adalah surd kerana menghasilkan perpuluhan tidak berulang.
- (c)  $\sqrt[6]{\frac{64}{729}} = 0.6666666\dots$   
 $\sqrt[6]{\frac{64}{729}}$  adalah bukan surd kerana menghasilkan perpuluhan berulang.
- (d)  $\sqrt[7]{\frac{79}{897}} = 0.706743939\dots$   
 $\sqrt[7]{\frac{79}{897}}$  adalah surd kerana menghasilkan perpuluhan tidak berulang.

### Inkuiri 5 (Halaman 99)

$a$	$b$	$(a \times b)$	$\sqrt{a}$	$\sqrt{b}$	Nilai $\sqrt{a} \times \sqrt{b}$	$\sqrt{(a \times b)}$	Nilai $\sqrt{(a \times b)}$
2	5	10	$\sqrt{2}$	$\sqrt{5}$	3.162	$\sqrt{10}$	3.162
3	4	12	$\sqrt{3}$	$\sqrt{4}$	3.46410	$\sqrt{12}$	3.46410
5	7	35	$\sqrt{5}$	$\sqrt{7}$	5.91607	$\sqrt{35}$	5.91607
11	13	35	$\sqrt{11}$	$\sqrt{12}$	11.9583	$\sqrt{143}$	11.9583

$a$	$b$	$(a \div b)$	$\sqrt{a}$	$\sqrt{b}$	Nilai $\sqrt{a} \div \sqrt{b}$	$\sqrt{(a \div b)}$	Nilai $\sqrt{(a \div b)}$
10	5	2	$\sqrt{10}$	$\sqrt{5}$	1.414	$\sqrt{2}$	1.414
15	3	5	$\sqrt{15}$	$\sqrt{3}$	1.732	$\sqrt{5}$	1.732
35	5	7	$\sqrt{35}$	$\sqrt{5}$	2.6457	$\sqrt{7}$	2.6457
66	11	6	$\sqrt{66}$	$\sqrt{11}$	2.4495	$\sqrt{6}$	2.4495

**Latih Diri 4.4** (Halaman 101)

1. (a)  $\sqrt{2} \times \sqrt{3} = \sqrt{6}$   
 (c)  $\sqrt{3} \times \sqrt{3} = \sqrt{9}$   
 (e)  $\frac{\sqrt{8}}{\sqrt{3}} = \sqrt{\frac{8}{3}}$   
 (g)  $\frac{\sqrt{20}}{\sqrt{5}} = \sqrt{\frac{20}{5}} = \sqrt{4}$
- (b)  $\sqrt{3} \times \sqrt{5} = \sqrt{15}$   
 (d)  $\sqrt{5} \times \sqrt{6} = \sqrt{30}$   
 (f)  $\frac{\sqrt{18}}{\sqrt{3}} = \sqrt{\frac{18}{3}} = \sqrt{6}$   
 (h)  $\frac{\sqrt{5} \times \sqrt{6}}{\sqrt{3}} = \sqrt{\frac{30}{3}} = \sqrt{10}$

**Inkuiri 6** (Halaman 101)

3.

Surd yang boleh dipermudah	Surd yang tidak boleh dipermudah
$\sqrt{1}, \sqrt{4}, \sqrt{8}, \sqrt{9}, \sqrt{12}, \sqrt{16}, \sqrt{18}, \sqrt{20},$ $\sqrt{24}, \sqrt{25}, \sqrt{27}, \sqrt{28}, \sqrt{32}, \sqrt{36}, \sqrt{40},$ $\sqrt{44}, \sqrt{45}, \sqrt{48}, \sqrt{49}, \sqrt{50}$	$\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{6}, \sqrt{7}, \sqrt{10}, \sqrt{11}, \sqrt{13}, \sqrt{14},$ $\sqrt{15}, \sqrt{17}, \sqrt{19}, \sqrt{21}, \sqrt{22}, \sqrt{23}, \sqrt{26},$ $\sqrt{29}, \sqrt{30}, \sqrt{31}, \sqrt{33}, \sqrt{34}, \sqrt{35}, \sqrt{37},$ $\sqrt{38}, \sqrt{39}, \sqrt{41}, \sqrt{42}, \sqrt{43}, \sqrt{46}, \sqrt{47}$

4.  $\sqrt{90} = \sqrt{9 \times 10}$   
 $= 3\sqrt{10}$

**Latih Diri 4.5** (Halaman 101)

- |   |  |
|---|--|
| 1. $\sqrt{5} \sqrt{7} = \sqrt{5 \times 7}$<br>$= \sqrt{35}$ <input type="checkbox"/>                                  | $3\sqrt{2} \times 2\sqrt{2} = 6 \times \sqrt{2} \times \sqrt{2}$<br>$= 12$ <input type="checkbox"/>              |
| $\sqrt{260} = \sqrt{4 \times 65}$<br>$= 2\sqrt{65}$ <input checked="" type="checkbox"/>                               | $(\sqrt{16} \sqrt{36})^2 = (\sqrt{576})^2$<br>$= 576$ <input checked="" type="checkbox"/>                        |
| $4\sqrt{7} \times 5\sqrt{7} = 20\sqrt{7} \times \sqrt{7}$<br>$= 140$ <input type="checkbox"/>                         | $\frac{4\sqrt{8}}{2\sqrt{4}} = 2\sqrt{\frac{8}{4}}$<br>$= 2\sqrt{2}$ <input checked="" type="checkbox"/>         |
| $\frac{\sqrt{18}}{\sqrt{3}} = \sqrt{\frac{18}{3}}$<br>$= \sqrt{6}$ <input type="checkbox"/>                           | $\frac{\sqrt{75}}{\sqrt{3}} = \sqrt{\frac{75}{3}}$<br>$= \sqrt{25}$<br>$= 5$ <input checked="" type="checkbox"/> |
| $\frac{30\sqrt{27}}{6\sqrt{3}} = 5\sqrt{\frac{27}{3}}$<br>$= 5\sqrt{9}$<br>$= 15$ <input checked="" type="checkbox"/> | $(\sqrt{81})^2 = 81$ <input checked="" type="checkbox"/>   |

$$2. (a) \sqrt{12} = \sqrt{4 \times 3} \\ = 2\sqrt{3}$$

$$(c) \sqrt{28} = \sqrt{4 \times 7} \\ = 2\sqrt{7}$$

$$(e) \sqrt{45} = \sqrt{9 \times 5} \\ = 3\sqrt{5}$$

$$(g) \sqrt{54} = \sqrt{9 \times 6} \\ = 3\sqrt{6}$$

$$(b) \sqrt{27} = \sqrt{9 \times 3} \\ = 3\sqrt{3}$$

$$(d) \sqrt{32} = \sqrt{16 \times 2} \\ = 4\sqrt{2}$$

$$(f) \sqrt{48} = \sqrt{16 \times 3} \\ = 4\sqrt{3}$$

$$(h) \sqrt{108} = \sqrt{36 \times 3} \\ = 6\sqrt{3}$$

### Inkuiri 7 (Halaman 102)

5. Langkah pengiraan:

(a) Kumpulkan semua surd yang sama

(b) Lakukan penambahan dan penolakan seperti penyelesaian algebra yang lain.

### Latih Diri 4.6 (Halaman 103)

$$1. (a) 3\sqrt{5} + 5\sqrt{5} \\ = \sqrt{5}(3 + 5) \\ = 8\sqrt{5}$$

$$(c) 7\sqrt{7} - 5\sqrt{7} \\ = \sqrt{7}(7 - 5) \\ = 2\sqrt{7}$$

$$(e) \sqrt{5}(4 + 5\sqrt{5}) \\ = 4\sqrt{5} + 5(\sqrt{5} \times \sqrt{5}) \\ = 4\sqrt{5} + 25$$

$$(g) (4 + 5\sqrt{3})(3 + 5\sqrt{3}) = (4 \times 3) + (4 \times 5\sqrt{3}) + (3 \times 5\sqrt{3}) + (5\sqrt{3} \times 5\sqrt{3}) \\ = 12 + 20\sqrt{3} + 15\sqrt{3} + 75 \\ = 87 + 35\sqrt{3}$$

$$(h) (7 - 5\sqrt{7})(3 + 5\sqrt{7}) = (7 \times 3) + (7 \times 5\sqrt{7}) - (3 \times 5\sqrt{7}) - (5\sqrt{7} \times 5\sqrt{7}) \\ = 21 + 35\sqrt{7} - 15\sqrt{7} - 175 \\ = 20\sqrt{7} - 154$$

$$(i) (9 + 5\sqrt{4})(3 - 5\sqrt{4}) = (9 \times 3) - (9 \times 5\sqrt{4}) + (3 \times 5\sqrt{4}) - (5\sqrt{4} \times 5\sqrt{4}) \\ = 27 - 45\sqrt{4} + 15\sqrt{4} - 100 \\ = -133$$

$$2. (a) 5\sqrt{80} = 5\sqrt{16 \times 5} \quad , \quad 2\sqrt{58} = 2\sqrt{29 \times 2} \quad , \quad 9\sqrt{45} = 9\sqrt{9 \times 5} \\ = 20\sqrt{5} \quad \quad \quad = 2\sqrt{58} \quad \quad \quad = 27\sqrt{5}$$

Surd tak serupa

$$(b) 3\sqrt{3} \quad , \quad 4\sqrt{12} = 4\sqrt{4 \times 3} = 8\sqrt{3} \quad , \quad 5\sqrt{27} = 5\sqrt{9 \times 3} = 15\sqrt{3}$$

Surd serupa

$$(c) 2\sqrt{125} = 2\sqrt{25 \times 5} = 10\sqrt{5} \quad , \quad 7\sqrt{5} \quad , \quad -7\sqrt{5}$$

Surd serupa

$$(d) 2\sqrt{12} = 2\sqrt{4 \times 3} = 4\sqrt{3} \quad , \quad 9\sqrt{24} = 9\sqrt{4 \times 6} = 18\sqrt{6} \quad , \quad 8\sqrt{5}$$

Surd tak serupa

$$(e) 3\sqrt{27} = 3\sqrt{9 \times 3} = 9\sqrt{3} \quad , \quad -3\sqrt{27} = -3\sqrt{9 \times 3} = -9\sqrt{3} \quad , \quad -\sqrt{3}$$

Surd serupa

**Cabar Minda** (Halaman 105)

$$1 + \sqrt{3}$$

**Latih Diri 4.7** (Halaman 106)

$$1. (a) \frac{2}{\sqrt{5}} = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

$$(b) \frac{7}{\sqrt{2}} = \frac{7}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{7\sqrt{2}}{2}$$

$$(c) \frac{\sqrt{2}}{\sqrt{5}} = \frac{\sqrt{2}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{10}}{5}$$

$$(d) \frac{\sqrt{3}}{2\sqrt{12}} = \frac{\sqrt{3}}{2\sqrt{12}} \times \frac{2\sqrt{12}}{2\sqrt{12}} = \frac{2\sqrt{36}}{48} = \frac{12}{48} = \frac{1}{4}$$

$$(e) \frac{1 + \sqrt{3}}{\sqrt{12}} = \frac{1 + \sqrt{3}}{\sqrt{12}} \times \frac{\sqrt{12}}{\sqrt{12}} = \frac{\sqrt{12} + \sqrt{36}}{12} = \frac{2\sqrt{3} + 6}{12} = \frac{\sqrt{3}}{6} + \frac{1}{2}$$

$$(f) \frac{3 + \sqrt{2}}{5 - \sqrt{5}} = \frac{3 + \sqrt{2}}{5 - \sqrt{5}} \times \frac{5 + \sqrt{5}}{5 + \sqrt{5}} = \frac{15 + 3\sqrt{5} + 5\sqrt{2} + \sqrt{5}\sqrt{2}}{25 - 5} = \frac{15 + 3\sqrt{5} + 5\sqrt{2} + \sqrt{10}}{20}$$

$$\begin{aligned}
 \text{(g)} \quad \frac{6 - \sqrt{3}}{9 - \sqrt{12}} &= \frac{6 - \sqrt{3}}{9 - \sqrt{12}} \times \frac{9 + \sqrt{12}}{9 + \sqrt{12}} = \frac{54 + 6\sqrt{12} - 9\sqrt{3} - \sqrt{3}\sqrt{12}}{81 - 12} \\
 &= \frac{54 + 6\sqrt{12} - 9\sqrt{3} - \sqrt{36}}{81 - 12} \\
 &= \frac{54 + 12\sqrt{3} - 9\sqrt{3} - 6}{69} \\
 &= \frac{48 + 3\sqrt{3}}{69} \\
 &= \frac{16 + \sqrt{3}}{23}
 \end{aligned}$$

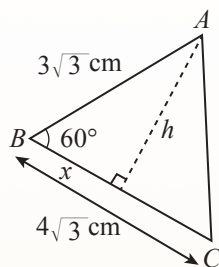
$$\begin{aligned}
 \text{(h)} \quad \frac{3 + \sqrt{2}}{5 - \sqrt{2}} + \frac{4 - \sqrt{3}}{7 + \sqrt{3}} &= \left(\frac{3 + \sqrt{2}}{5 - \sqrt{2}}\right) \times \left(\frac{5 + \sqrt{2}}{5 + \sqrt{2}}\right) + \left(\frac{4 - \sqrt{3}}{7 + \sqrt{3}}\right) \times \left(\frac{7 - \sqrt{3}}{7 - \sqrt{3}}\right) \\
 &= \frac{15 + 3\sqrt{2} + 5\sqrt{2} + 2}{25 + 5\sqrt{2} - 5\sqrt{2} - 2} + \frac{28 - 4\sqrt{3} - 7\sqrt{3} + 3}{49 - 7\sqrt{3} + 7\sqrt{3} - 3} \\
 &= \frac{17 + 8\sqrt{2}}{23} + \frac{31 - 11\sqrt{3}}{46} \\
 &= \frac{2(17 + 8\sqrt{2}) + 31 - 11\sqrt{3}}{46} \\
 &= \frac{34 + 16\sqrt{2} + 31 - 11\sqrt{3}}{46} \\
 &= \frac{65 + 16\sqrt{2} - 11\sqrt{3}}{46}
 \end{aligned}$$

$$\begin{aligned}
 \text{(i)} \quad \frac{7 - \sqrt{5}}{5 + \sqrt{5}} - \frac{6 + \sqrt{3}}{6 - \sqrt{3}} &= \left(\frac{7 - \sqrt{5}}{5 + \sqrt{5}}\right) \times \left(\frac{5 - \sqrt{5}}{5 - \sqrt{5}}\right) - \left(\frac{6 + \sqrt{3}}{6 - \sqrt{3}}\right) \times \left(\frac{6 + \sqrt{3}}{6 + \sqrt{3}}\right) \\
 &= \frac{35 - 7\sqrt{5} - 5\sqrt{5} + 5}{25 - 5\sqrt{5} + 5\sqrt{5} - 5} - \frac{36 + 6\sqrt{3} + 6\sqrt{3} + 3}{36 + 6\sqrt{3} - 6\sqrt{3} - 3} \\
 &= \frac{40 - 12\sqrt{5}}{20} - \frac{39 + 12\sqrt{3}}{33} \\
 &= \frac{4(10 - 3\sqrt{5})}{20} - \frac{3(13 + 4\sqrt{3})}{33} \\
 &= \frac{10 - 3\sqrt{5}}{5} - \frac{13 + 4\sqrt{3}}{11} \\
 &= \frac{11(10 - 3\sqrt{5}) - 5(13 + 4\sqrt{3})}{55} \\
 &= \frac{110 - 33\sqrt{5} - 65 - 20\sqrt{3}}{55} \\
 &= \frac{45 - 33\sqrt{5} - 20\sqrt{3}}{55}
 \end{aligned}$$

**Latih Diri 4.8 (Halaman 106)**

$$\begin{aligned}
 1. \quad h &= \sin 60^\circ \times 3\sqrt{3} \\
 &= \frac{\sqrt{3}}{2} \times 3\sqrt{3} \\
 &= \frac{9}{2}
 \end{aligned}$$

$$\begin{aligned}
 x &= \cos 60^\circ \times 3\sqrt{3} \\
 &= \frac{1}{2} \times 3\sqrt{3} \\
 &= \frac{3\sqrt{3}}{2}
 \end{aligned}$$



$$\begin{aligned}
 AC^2 &= h^2 + (4\sqrt{3} - x)^2 \\
 &= \left(\frac{9}{2}\right)^2 + \left(4\sqrt{3} - \frac{3\sqrt{3}}{2}\right)^2 \\
 &= \frac{81}{4} + \frac{75}{4} \\
 &= 39
 \end{aligned}$$

$$AC = \sqrt{39} \text{ cm}$$

$$\begin{aligned}
 2. \quad (a) \text{ Luas} &= \frac{1}{2}(5 - 2\sqrt{2})(5 + 2\sqrt{2}) \\
 &= \frac{1}{2}(25 + 10\sqrt{2} - 10\sqrt{2} - 8) \\
 &= \frac{1}{2} \times 17 \\
 &= \frac{17}{2} \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad AC^2 &= (5 - 2\sqrt{2})^2 + (5 + 2\sqrt{2})^2 \\
 &= (25 - 20\sqrt{2} + 8) + (25 + 20\sqrt{2} + 8) \\
 &= 50 + 16 \\
 &= 66
 \end{aligned}$$

$$AC = \sqrt{66} \text{ cm}$$

$$\begin{aligned}
 3. \quad 2 + 3\sqrt{y} &= 6\sqrt{3} + 5 \\
 3\sqrt{y} &= 6\sqrt{3} + 3 \\
 \sqrt{y} &= \frac{6\sqrt{3} + 3}{3} \\
 y &= \left(\frac{6\sqrt{3} + 3}{3}\right)^2 \\
 &= \frac{108 + 36\sqrt{3} + 9}{9} \\
 &= \frac{117 + 36\sqrt{3}}{9} \\
 &= 13 + 4\sqrt{3}
 \end{aligned}$$

4. (a)  $\sqrt{2-7x} + 2x = 0$

$$\sqrt{2-7x} = -2x$$

Kuasa duakan kedua-dua belah

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

$$4x^2 + 7x - 2 = 0$$

$$(4x - 1)(x + 2) = 0$$

$$x = \frac{1}{4} \text{ (Abaikan) } \quad \text{atau} \quad x = -2$$

Maka,  $x = -2$ .

(b)  $\sqrt{2x+1} + \sqrt{2x-1} = 2$

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

Kuasa duakan kedua-dua belah

$$2x + 1 = 4 - 4\sqrt{2x-1} + 2x - 1$$

$$4\sqrt{2x-1} = 2$$

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

Kuasa duakan kedua-dua belah

$$2x - 1 = \frac{1}{4}$$

$$2x = \frac{5}{4}$$

$$x = \frac{5}{8}$$

(c)  $\sqrt{4x+3} - \sqrt{4x-1} = 2$

$$\sqrt{4x+3} = 2 + \sqrt{4x-1}$$

Kuasa duakan kedua-dua belah

$$4x + 3 = 4 + 4\sqrt{4x-1} + 4x - 1$$

$$4\sqrt{4x-1} = 0$$

Kuasa duakan kedua-dua belah

$$4x - 1 = 0$$

$$4x = 1$$

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

**Latihan Intensif 4.2 (Halaman 108)**

1. (a)  $\sqrt{5} \times \sqrt{11} = \sqrt{55}$

(b)  $\sqrt{7} \times \sqrt{10} = \sqrt{70}$

(c)  $\frac{\sqrt{27}}{\sqrt{18}} = \sqrt{\frac{27}{18}}$

(d)  $\frac{\sqrt{48}}{\sqrt{8}} = \sqrt{\frac{48}{8}}$

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

$$= \sqrt{6}$$

$$2. (a) \sqrt{24} = \sqrt{4} \times \sqrt{6} \\ = 2\sqrt{6}$$

$$(c) \frac{\sqrt{54}}{\sqrt{3}} = \sqrt{\frac{54}{3}} \\ = \sqrt{18} \\ = \sqrt{9} \times \sqrt{2} \\ = 3\sqrt{2}$$

$$3. (a) 3\sqrt{10} + 5\sqrt{10} = 8\sqrt{10}$$

$$(c) 13\sqrt{13} - 2\sqrt{13} = 11\sqrt{13}$$

$$(e) 3\sqrt{27} - \sqrt{72} = 3\sqrt{9 \times 3} - \sqrt{72} \\ = 3\sqrt{9 \times 3} - \sqrt{9 \times 8} \\ = 9\sqrt{3} - 3\sqrt{4 \times 2} \\ = 9\sqrt{3} - 6\sqrt{2}$$

$$(g) 3\sqrt{15} \times 7\sqrt{5} = 21\sqrt{15 \times 5} \\ = 21\sqrt{75} \\ = 21\sqrt{25 \times 3} \\ = 105\sqrt{3}$$

$$(i) \sqrt{4}(2\sqrt{3}) - 5\sqrt{3} = 2\sqrt{12} - 5\sqrt{3} \\ = 2\sqrt{4 \times 3} - 5\sqrt{3} \\ = 4\sqrt{3} - 5\sqrt{3} \\ = -\sqrt{3}$$

$$(k) \sqrt{5}(7 - 5\sqrt{5}) = 7\sqrt{5} - 25$$

$$(m) (7 + 5\sqrt{7})(3 - 5\sqrt{7}) \\ = 21 - 35\sqrt{7} + 15\sqrt{7} - 175 \\ = -154 - 20\sqrt{7}$$

$$(o) \frac{\sqrt{112}}{\sqrt{7}} = \sqrt{\frac{112}{7}} \\ = \sqrt{16} \\ = 4$$

$$(b) \sqrt{162} = \sqrt{81} \times \sqrt{2} \\ = 9\sqrt{2}$$

$$(d) \left(\frac{2\sqrt{6}}{3}\right)^2 = \frac{4 \times 6}{9} \\ = \frac{24}{9} \\ = \frac{8}{3} \\ = \frac{4}{3}\sqrt{4}$$

$$(b) 6\sqrt{11} - \sqrt{11} = 5\sqrt{11}$$

$$(d) 2\sqrt{45} + \sqrt{20} = 2\sqrt{9 \times 5} + \sqrt{4 \times 5} \\ = 6\sqrt{5} + 2\sqrt{5} \\ = 8\sqrt{5}$$

$$(f) \sqrt{18} + \sqrt{27} = \sqrt{9 \times 2} + \sqrt{9 \times 3} \\ = 3\sqrt{2} + 3\sqrt{3}$$

$$(h) \sqrt{72} \times 4\sqrt{15} = 4\sqrt{1080} \\ = 4\sqrt{36 \times 30} \\ = 24\sqrt{30}$$

$$(j) \sqrt{7}(3 + 7\sqrt{7}) = 3\sqrt{7} + 49$$

$$(l) (3 + 3\sqrt{7})(3 + 5\sqrt{7}) = 9 + 15\sqrt{7} + 9\sqrt{7} + 105 \\ = 114 + 24\sqrt{7}$$

$$(n) (7 - 5\sqrt{5})(3 - 5\sqrt{5}) \\ = 21 - 35\sqrt{5} - 15\sqrt{5} + 125 \\ = 146 - 50\sqrt{5}$$

$$(p) \frac{\sqrt{12}}{\sqrt{108}} = \sqrt{\frac{12}{108}} \\ = \sqrt{\frac{1}{9}} \\ = \frac{1}{3}$$



$$\begin{aligned}
 \text{(q)} \quad \frac{\sqrt{88}}{2\sqrt{11}} &= \frac{1}{2}\sqrt{\frac{88}{11}} \\
 &= \frac{1}{2}\sqrt{8} \\
 &= \frac{1}{2}\sqrt{4 \times 2} \\
 &= \sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(r)} \quad \frac{9\sqrt{20}}{3\sqrt{5}} &= 3\sqrt{\frac{20}{5}} \\
 &= 3\sqrt{4} \\
 &= 6
 \end{aligned}$$

4. Diberi  $A = 3\sqrt{5} + 7\sqrt{3}$ ,  $B = 2\sqrt{5} - 7\sqrt{7}$ ,  $C = 2\sqrt{3} - 9\sqrt{8}$

$$\begin{aligned}
 \text{(a)} \quad A + B &= 3\sqrt{5} + 7\sqrt{3} + 2\sqrt{5} - 7\sqrt{7} \\
 &= 5\sqrt{5} + 7\sqrt{3} - 7\sqrt{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad A - C &= (3\sqrt{5} + 7\sqrt{3}) - (2\sqrt{3} - 9\sqrt{8}) \\
 &= 3\sqrt{5} + 5\sqrt{3} + 9\sqrt{8} \\
 &= 3\sqrt{5} + 5\sqrt{3} + 18\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad 3A + 2B &= 3(3\sqrt{5} + 7\sqrt{3}) + 2(2\sqrt{5} - 7\sqrt{7}) \\
 &= 9\sqrt{5} + 21\sqrt{3} + 4\sqrt{5} - 14\sqrt{7} \\
 &= 13\sqrt{5} + 21\sqrt{3} - 14\sqrt{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad 3A + B - 2C &= 3(3\sqrt{5} + 7\sqrt{3}) + (2\sqrt{5} - 7\sqrt{7}) - 2(2\sqrt{3} - 9\sqrt{8}) \\
 &= 9\sqrt{5} + 21\sqrt{3} + 2\sqrt{5} - 7\sqrt{7} - 4\sqrt{3} + 18\sqrt{8} \\
 &= 11\sqrt{5} + 17\sqrt{3} - 7\sqrt{7} + 18\sqrt{8} \\
 &= 11\sqrt{5} + 17\sqrt{3} - 7\sqrt{7} + 36\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{5. (a)} \quad \frac{2}{\sqrt{5}} &= \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \\
 &= \frac{2\sqrt{5}}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad \frac{4}{3-\sqrt{5}} &= \frac{4}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}} \\
 &= \frac{12+4\sqrt{5}}{9-5} \\
 &= 3 + \sqrt{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad \frac{4}{3-3\sqrt{5}} &= \frac{4}{3-3\sqrt{5}} \times \frac{3+3\sqrt{5}}{3+3\sqrt{5}} \\
 &= \frac{12+12\sqrt{5}}{9-45} \\
 &= \frac{12+12\sqrt{5}}{-36} \\
 &= -\frac{(1+\sqrt{5})}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad \frac{5}{2\sqrt{3}-\sqrt{2}} &= \frac{5}{2\sqrt{3}-\sqrt{2}} \times \frac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}} \\
 &= \frac{10\sqrt{3}+5\sqrt{2}}{12-2} \\
 &= \frac{10\sqrt{3}+5\sqrt{2}}{10} \\
 &= \sqrt{3} + \frac{\sqrt{2}}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(e)} \quad \frac{4 + \sqrt{5}}{3 - \sqrt{5}} &= \frac{4 + \sqrt{5}}{3 - \sqrt{5}} \times \frac{3 + \sqrt{5}}{3 + \sqrt{5}} \\
 &= \frac{12 + 4\sqrt{5} + 3\sqrt{5} + 5}{9 - 5} \\
 &= \frac{17 + 7\sqrt{5}}{4}
 \end{aligned}$$

$$\begin{aligned}
 \text{(f)} \quad \frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} + \sqrt{7}} &= \frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} + \sqrt{7}} \times \frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} - \sqrt{7}} \\
 &= \frac{3 - \sqrt{3}\sqrt{7} - \sqrt{3}\sqrt{7} + 7}{3 - 7} \\
 &= \frac{10 - 2\sqrt{21}}{-4} \\
 &= \frac{-5 + \sqrt{21}}{2}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{(b)} \quad \frac{2}{\sqrt{7} + \sqrt{2}} + \frac{1}{\sqrt{7} - \sqrt{2}} &= \frac{2(\sqrt{7} - \sqrt{2}) + \sqrt{7} + \sqrt{2}}{(\sqrt{7} + \sqrt{2})(\sqrt{7} - \sqrt{2})} \\
 &= \frac{2\sqrt{7} - 2\sqrt{2} + \sqrt{7} + \sqrt{2}}{7 - 2} \\
 &= \frac{3\sqrt{7} - \sqrt{2}}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad \frac{2}{4 - \sqrt{3}} + \frac{1}{4 + \sqrt{3}} &= \frac{2(4 + \sqrt{3}) + 4 - \sqrt{3}}{16 - 3} \\
 &= \frac{8 + 2\sqrt{3} + 4 - \sqrt{3}}{13} \\
 &= \frac{12 + \sqrt{3}}{13}
 \end{aligned}$$

$$\text{7. } (\sqrt{5} + \sqrt{2})p = 8 + \sqrt{10}$$

$$\begin{aligned}
 p &= \frac{8 + \sqrt{10}}{\sqrt{5} + \sqrt{2}} \times \frac{\sqrt{5} - \sqrt{2}}{\sqrt{5} - \sqrt{2}} \\
 &= \frac{8\sqrt{5} - 8\sqrt{2} + \sqrt{50} - \sqrt{20}}{5 - 2} \\
 &= \frac{8\sqrt{5} - 8\sqrt{2} + 5\sqrt{2} - 2\sqrt{5}}{5 - 2} \\
 &= \frac{6\sqrt{5} - 3\sqrt{2}}{3} \\
 &= (2\sqrt{5} - \sqrt{2}) \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 8. \text{ (a) } \tan x &= \frac{3 + \sqrt{2}}{1 + 2\sqrt{2}} \\
 &= \frac{3 + \sqrt{2}}{1 + 2\sqrt{2}} \times \frac{1 - 2\sqrt{2}}{1 - 2\sqrt{2}} \\
 &= \frac{3 - 6\sqrt{2} + \sqrt{2} - 4}{1 - 8} \\
 &= \frac{-1 - 5\sqrt{2}}{-7} \\
 &= \frac{1 + 5\sqrt{2}}{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Luas} &= \frac{1}{2} \times (3 + \sqrt{2}) \times (1 + 2\sqrt{2}) \\
 &= \frac{1}{2} \times (3 + 6\sqrt{2} + \sqrt{2} + 4) \\
 &= \frac{1}{2} \times (7 + 7\sqrt{2}) \\
 &= \left( \frac{7 + 7\sqrt{2}}{2} \right) \text{ cm}^2
 \end{aligned}$$

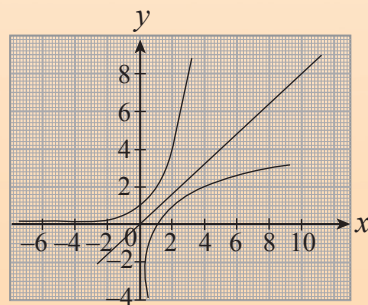
### Inkuiri 8 (Halaman 109)

7. Nilai logaritma bagi suatu nombor negatif dan sifar tidak dapat ditentukan.
8. (a)  $\log_a 1 = 0$  adalah sah.  
 (b)  $\log_a a = 1$  adalah sah.

### Inkuiri 9 (Halaman 111)

$x$	-3	-2	-1	0	1	2	3
$y$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8

$x$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
$y$	-3	-2	-1	0	1	2	3



**Latih Diri 4.9 (Halaman 113)**

1. (a)  $3^4 = 81$   
 $\log_3 81 = 4$
- (c)  $5^3 = 125$   
 $\log_5 125 = 3$
2. (a)  $\log_{10} 10\,000 = 4$   
 $10^4 = 10\,000$
- (c)  $\log_2 128 = 7$   
 $2^7 = 128$
3. (a)  $\log_{10} 9 = 0.9542$
- (c)  $\log_{10} \left(\frac{5}{6}\right)^3 = -0.2375$
- (e)  $\log_3 81 = x$   
 $3^x = 81$   
 $3^x = 3^4$   
 $x = 4$
- (g)  $\log_{10} 100\,000 = x$   
 $10^x = 100\,000$   
 $10^x = 10^5$   
 $x = 5$
- (b)  $2^7 = 128$   
 $\log_2 128 = 7$
- (d)  $6^3 = 216$   
 $\log_6 216 = 3$
- (b)  $\log_{10} 0.0001 = -4$   
 $10^{-4} = 0.0001$
- (d)  $\log_4 64 = 3$   
 $4^3 = 64$
- (b)  $\log_{10} 99 = 1.996$
- (d)  $\log_2 64 = x$   
 $2^x = 64$   
 $2^x = 2^6$   
 $x = 6$
- (f)  $\log_4 256 = x$   
 $4^x = 256$   
 $4^x = 4^4$   
 $x = 4$
4. (a)  $\log_2 x = 5$   
 $2^5 = x$   
 $x = 32$
- (b)  $\log_8 x = 3$   
 $8^3 = x$   
 $x = 512$
- (c)  $\log_2 x = 8$   
 $2^8 = x$   
 $x = 256$
5. (a) antilog 2.1423 = 138.78
- (b) antilog 1.3923 = 24.68
- (c) antilog 3.7457 = 5568.01
- (d) antilog (-3.3923) = 0.0004052
- (e) antilog (-2.5676) = 0.002706
- (f) antilog (-4.5555) = 0.00002783

**Inkuiri 10 (Halaman 113)**

4. Jika  $a$ ,  $x$  dan  $y$  ialah positif dan  $a \neq 1$ , maka
- (a)  $\log_a xy = \log_a x + \log_a y$  (Hukum hasil darab)
- (b)  $\log_a \frac{x}{y} = \log_a x - \log_a y$  (Hukum hasil darab)
- (c)  $\log_a x^n = n \log_a x$  untuk sebarang nombor nyata  $n$  (Hukum kuasa)

**Latih Diri 4.10 (Halaman 115)**

1. (a)  $\log_7 1\frac{1}{4} = \log_7 \frac{5}{4}$   
 $= \log_7 5 - \log_7 4$   
 $= 0.827 - 0.712$   
 $= 0.115$
- (b)  $\log_7 28 = \log_7 (7 \times 4)$   
 $= \log_7 7 + \log_7 4$   
 $= 1 + 0.712$   
 $= 1.712$

$$\begin{aligned}
 \text{(c) } \log_7 100 &= \log_7 (25 \times 4) \\
 &= \log_7 5^2 + \log_7 4 \\
 &= 2 \log_7 5 + \log_7 4 \\
 &= 2(0.827) + 0.712 \\
 &= 2.366
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) } \log_7 0.25 &= \log_7 \left(\frac{1}{4}\right) \\
 &= \log_7 1 - \log_7 4 \\
 &= -0.712
 \end{aligned}$$

$$\begin{aligned}
 \text{2. (a) } \log_3 21 + \log_3 18 - \log_3 14 &= \log_3 (21 \times 18 \div 14) \\
 &= \log_3 27 \\
 &= \log_3 3^3 \\
 &= 3 \log_3 3 \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } 2 \log_4 2 - \frac{1}{2} \log_4 9 + \log_4 12 &= \log_4 (2^2 \times 12 \div 9^{\frac{1}{2}}) \\
 &= \log_4 16 \\
 &= \log_4 4^2 \\
 &= 2 \log_4 4 \\
 &= 2
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_2 7 + \log_2 12 - \log_2 21 &= \log_2 (7 \times 12 \div 21) \\
 &= \log_2 4 \\
 &= \log_2 2^2 \\
 &= 2 \log_2 2 \\
 &= 2
 \end{aligned}$$

### Cabar Minda (Halaman 116)

- (a)  $\log_{10} (-6)$  adalah tidak tertakrif.  
 (b)  $\log_{-10} (6)$  adalah tidak tertakrif.

### Latih Diri 4.11 (Halaman 116)

$$1. \text{ (a) } \log_2 x + \log_2 y^2 = \log_2 xy^2$$

$$\begin{aligned}
 \text{(b) } \log_b x - 3 \log_b y &= \log_b x - \log_b y^3 \\
 &= \log_b \left(\frac{x}{y^3}\right)
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_2 x + 3 \log_2 y &= \log_2 x + \log_2 y^3 \\
 &= \log_2 xy^3
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) } \frac{1}{2} \log_4 x + 2 - 3 \log_4 y &= \log_4 x^{\frac{1}{2}} + \log_4 4^2 - \log_4 y^3 \\
 &= \log_4 \left(\frac{16\sqrt{x}}{y^3}\right)
 \end{aligned}$$

$$\begin{aligned}
 \text{(e) } \log_3 m^4 + 2 \log_3 n - \log_3 m &= \log_3 m^4 + \log_3 n^2 - \log_3 m \\
 &= \log_3 \left(\frac{m^4 n^2}{m}\right) \\
 &= \log_3 m^3 n^2
 \end{aligned}$$

$$\begin{aligned}
 \text{2. (a) } \log_2 10 &= \log_2 (2 \times 5) \\
 &= \log_2 2 + \log_2 5 \\
 &= 1 + q
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \log_2 45 &= \log_2 (9 \times 5) \\
 &= \log_2 3^2 + \log_2 5 \\
 &= 2 \log_2 3 + \log_2 5 \\
 &= 2p + q
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_2 \sqrt{15} &= \log_2 15^{\frac{1}{2}} \\
 &= \frac{1}{2} \log_2 (3 \times 5) \\
 &= \frac{1}{2} \log_2 3 + \frac{1}{2} \log_2 5 \\
 &= \frac{1}{2}p + \frac{1}{2}q \\
 &= \frac{1}{2}(p + q)
 \end{aligned}$$

**Cabar Minda** (Halaman 117)

$$\begin{aligned}
 \log_5 20 &= \frac{\log_{10} 20}{\log_{10} 5} \\
 &= \frac{1.30103}{0.69897} \\
 &= 1.8614
 \end{aligned}$$

$$\begin{aligned}
 \log_5 20 &= \frac{\log_e 20}{\log_e 5} \\
 &= \frac{2.99573}{1.60944} \\
 &= 1.8614
 \end{aligned}$$

**Latih Diri 4.12** (Halaman 118)

$$\begin{aligned}
 \text{1. (a) } \log_3 22 &= \frac{\log_{10} 22}{\log_{10} 3} \\
 &= \frac{1.3424}{0.4771} \\
 &= 2.8137
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \log_6 1.32 &= \frac{\log_{10} 1.32}{\log_{10} 6} \\
 &= \frac{0.1206}{0.7782} \\
 &= 0.1550
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_5 18 &= \frac{\log_{10} 18}{\log_{10} 5} \\
 &= \frac{1.2553}{0.6990} \\
 &= 1.7959
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) } \log_4 0.815 &= \frac{\log_{10} 0.815}{\log_{10} 4} \\
 &= \frac{-0.0888}{0.6021} \\
 &= -0.1475
 \end{aligned}$$

$$\begin{aligned}
 \text{2. (a) } \log_7 225 &= \frac{\log_e 225}{\log_e 7} \\
 &= \frac{5.4161}{1.9459} \\
 &= 2.7833
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \log_9 324 &= \frac{\log_e 324}{\log_e 9} \\
 &= \frac{5.7807}{2.1972} \\
 &= 2.6309
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_{20} 379 &= \frac{\log_e 379}{\log_e 20} \\
 &= \frac{5.9375}{2.9957} \\
 &= 1.9820
 \end{aligned}$$

$$\begin{aligned}
 \text{3. (a) } \log_2 9 &= \frac{\log_3 9}{\log_3 2} \\
 &= \frac{\log_3 3^2}{\log_3 2} \\
 &= \frac{2}{t}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \log_9 8 &= \frac{\log_3 8}{\log_3 9} \\
 &= \frac{\log_3 2^3}{\log_3 3^2} \\
 &= \frac{3 \log_3 2}{2 \log_3 3} \\
 &= \frac{3t}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_2 18 &= \frac{\log_3 18}{\log_3 2} \\
 &= \frac{\log_3 (9 \times 2)}{\log_3 2} \\
 &= \frac{\log_3 9 + \log_3 2}{\log_3 2} \\
 &= \frac{2 \log_3 3 + \log_3 2}{\log_3 2} \\
 &= \frac{2 + t}{t}
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) } \log_2 \frac{9}{4} &= \frac{\log_3 \frac{9}{4}}{\log_3 2} \\
 &= \frac{\log_3 9 - \log_3 4}{\log_3 2} \\
 &= \frac{\log_3 3^2 - \log_3 2^2}{\log_3 2} \\
 &= \frac{2 \log_3 3 - 2 \log_3 2}{\log_3 2} \\
 &= \frac{2 - 2t}{t}
 \end{aligned}$$

$$\begin{aligned}
 \text{4. (a) } \log_4 m^2 n^3 &= \frac{\log_2 m^2 n^3}{\log_2 4} \\
 &= \frac{\log_2 m^2 + \log_2 n^3}{\log_2 2^2} \\
 &= \frac{2 \log_2 m + 3 \log_2 n}{2 \log_2 2} \\
 &= \frac{2a + 3b}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \log_8 \frac{m}{n^2} &= \frac{\log_2 \left(\frac{m}{n^2}\right)}{\log_2 8} \\
 &= \frac{\log_2 m - \log_2 n^2}{\log_2 2^3} \\
 &= \frac{\log_2 m - 2 \log_2 n}{3 \log_2 2} \\
 &= \frac{a - 2b}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } \log_{mn} 8n &= \frac{\log_2 8n}{\log_2 mn} \\
 &= \frac{\log_2 2^3 + \log_2 n}{\log_2 m + \log_2 n} \\
 &= \frac{3 + b}{a + b}
 \end{aligned}$$

**Latih Diri 4.13 (Halaman 120)**

$$\begin{aligned}
 \text{1. (a) } \quad &4^{2x-1} = 7^x \\
 &(2x - 1) \log 4 = x \log 7 \\
 &2x \log 4 - \log 4 = x \log 7 \\
 &2x \log 4 - x \log 7 = \log 4 \\
 &x(2 \log 4 - \log 7) = \log 4 \\
 &x = \frac{\log 4}{2 \log 4 - \log 7} \\
 &= \frac{0.6021}{1.2041 - 0.8451} \\
 &= 1.677
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & 5^{2x-1} = 79^{x-1} \\
 & (2x-1) \log 5 = (x-1) \log 79 \\
 & 2x \log 5 - \log 5 = x \log 79 - \log 79 \\
 & 2x \log 5 - x \log 79 = \log 5 - \log 79 \\
 & x(2 \log 5 - \log 79) = \log 5 - \log 79 \\
 & x = \frac{\log 5 - \log 79}{2 \log 5 - \log 79} \\
 & = \frac{0.6990 - 1.8976}{1.3979 - 1.8976} \\
 & = 2.399
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & 7^{3x-1} = 50^x \\
 & (3x-1) \log 7 = x \log 50 \\
 & 3x \log 7 - \log 7 = x \log 50 \\
 & 3x \log 7 - x \log 50 = \log 7 \\
 & x(3 \log 7 - \log 50) = \log 7 \\
 & x = \frac{\log 7}{3 \log 7 - \log 50} \\
 & = \frac{0.8451}{2.5353 - 1.6990} \\
 & = 1.011
 \end{aligned}$$

$$\begin{aligned}
 \text{2. (a)} \quad & \ln(5x+2) = 15 \\
 & \log_e(5x+2) = 15 \\
 & e^{15} = 5x+2 \\
 & 3269017.372 = 5x+2 \\
 & 5x = 3269017.372 - 2 \\
 & x = \frac{3269015.372}{5} \\
 & = 653803.075
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & 30e^{2x+2} = 145 \\
 & e^{2x+3} = \frac{145}{30} \\
 & e^{2x+3} = 4.8333 \\
 & \ln e^{2x+3} = \ln 4.8333 \\
 & (2x+3) \ln e = \ln 4.8333 \\
 & 2x = \ln 4.8333 - 3 \\
 & x = \frac{-1.4245}{2} \\
 & x = -0.712
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & 5e^{3x-4} = 35 \\
 & e^{3x-4} = \frac{35}{5} \\
 & = 7 \\
 & \ln e^{3x-4} = \ln 7 \\
 & (3x-4) \ln e = \ln 7 \\
 & 3x = \ln 7 + 4 \\
 & x = \frac{5.9460}{3} \\
 & x = 1.982
 \end{aligned}$$



$$\begin{aligned}
 \text{(d)} \quad \ln(3x - 2) &= 4 \\
 \log_e(3x - 2) &= 4 \\
 e^4 &= 3x - 2 \\
 54.5982 &= 3x - 2 \\
 3x &= 54.5982 + 2 \\
 &= \frac{56.5982}{3} \\
 &= 18.866
 \end{aligned}$$

$$\begin{aligned}
 \text{(e)} \quad 41 - e^{2x} &= 5 \\
 e^{2x} &= 41 - 5 \\
 \ln e^{2x} &= \ln 36 \\
 2x \ln e &= \ln 36 \\
 x &= \frac{\ln 36}{2} \\
 &= \frac{3.5835}{2} \\
 x &= 1.792
 \end{aligned}$$

$$\begin{aligned}
 \text{(f)} \quad \ln(x + 1)^2 &= 4 \\
 (x + 1)^2 &= e^4 \\
 (x + 1) &= \pm e^2 \\
 x &= e^2 - 1 & x &= -e^2 - 1 \\
 &= 7.3891 - 1 & &= -7.3891 - 1 \\
 &= 6.389 & &= -8.389
 \end{aligned}$$

$$\begin{aligned}
 3. \quad H &= 260\,000 \left(\frac{9}{8}\right)^n \\
 260\,000 \left(\frac{9}{8}\right)^n &> 300\,000 \\
 \left(\frac{9}{8}\right)^n &> \frac{30}{26} \\
 n \log \frac{9}{8} &> \log \frac{30}{26} \\
 n &> \frac{\log \frac{30}{26}}{\log \frac{9}{8}} \\
 n &> 1.2150
 \end{aligned}$$

Bilangan tahun minimum supaya harga rumah tersebut melebihi RM300 000 ialah 2 tahun.

$$\begin{aligned}
 4. \quad S &= 2000(1 + 0.07)^n \\
 2000(1 + 0.07)^n &> 4\,000 \\
 (1 + 0.07)^n &> 2 \\
 n \log(1 + 0.07) &> \log 2 \\
 n &> \frac{\log 2}{\log(1 + 0.07)} \\
 &> \frac{0.3010}{0.0294} \\
 &> 10.2381
 \end{aligned}$$

Bilangan tahun minimum untuk jumlah simpanannya melebihi RM4 000 ialah 11 tahun.

$$\begin{aligned}
5. \quad W &= 4000(1.1)^n \\
4000(1.1)^n &> 5100 \\
(1.1)^n &> \frac{5100}{4000} \\
n \log 1.1 &> \log \frac{5100}{4000} \\
n &> \frac{\log 1.275}{\log 1.1} \\
&> \frac{0.1055}{0.0414} \\
n &> 2.5483
\end{aligned}$$

Bilangan tahun wang Encik Chong melebihi RM5 100 buat pertama kali ialah 3 tahun.

$$\begin{aligned}
6. \quad P &= 760e^{-0.125h} \\
760e^{-0.125h} &= 380 \\
e^{-0.125h} &= \frac{380}{760} \\
-0.125h \log e &= \log \frac{1}{2} \\
h &= \frac{\log \frac{1}{2}}{-0.125 \log e} \\
&= \frac{-0.3010}{-0.0543} \\
&= 5.543 \text{ km}
\end{aligned}$$

### Latihan Intensif 4.3 (Halaman 121)

$$\begin{aligned}
1. \quad \log_5 1 &= 0 \\
\log_7 75 &= \frac{\log_5 75}{\log_5 7} \\
&= \frac{\log_5 (25 \times 3)}{\log_5 7} \\
&= \frac{\log_5 25 + \log_5 3}{\log_5 7} \\
&= \frac{2 + 0.683}{1.209} \\
&= 2.219 \\
2. \quad \log_a \left( \frac{45}{a^3} \right) &= \log_a 45 - \log_a a^3 \\
&= \log_a (3^2 \times 5) - 3 \log_a a \\
&= 2 \log_a 3 + \log_a 5 - 3 \\
&= 2x + y - 3
\end{aligned}$$

$$\begin{aligned}
 3. \log_4 8 + \log_r \sqrt{r} &= \frac{\log_2 8}{\log_2 4} + \log_r r^{\frac{1}{2}} \\
 &= \frac{\log_2 8}{\log_2 4} + \frac{1}{2} \log_r r \\
 &= \frac{\log_2 2^3}{\log_2 2^2} + \frac{1}{2} \log_r r \\
 &= \frac{3}{2} + \frac{1}{2} \\
 &= 2
 \end{aligned}$$

$$\begin{aligned}
 4. \frac{\log_{12} 49 \times \log_{64} 12}{\log_{16} 7} &= \frac{\frac{\log 49}{\log 12} \times \frac{\log 12}{\log 64}}{\frac{\log 7}{\log 16}} \\
 &= \frac{\log 49 \times \log 16}{\log 64 \times \log 7} \\
 &= \frac{\log 7^2 \times \log 4^2}{\log 4^3 \times \log 7} \\
 &= \frac{4}{3}
 \end{aligned}$$

$$5. \log_{10} x = 2 \quad , \quad \log_{10} y = -1 \\
 x = 10^2 \quad \quad \quad y = 10^{-1}$$

$$\begin{aligned}
 xy - 100y^2 &= 10^2 \times 10^{-1} - 100 \times (10^{-1})^2 \\
 &= 10^{2-1} - 10^2 \times 10^{-2} \\
 &= 10 - 10^0 \\
 &= 10 - 1 \\
 &= 9 \text{ (terbukti)}
 \end{aligned}$$

$$\begin{aligned}
 6. \log_5 4.9 &= \log_5 \left( \frac{49}{10} \right) \\
 &= \log_5 49 - \log_5 10 \\
 &= \log_5 7^2 - \log_5 (2 \times 5) \\
 &= 2 \log_5 7 - \log_5 2 - \log_5 5 \\
 &= 2p - m - 1
 \end{aligned}$$

$$\begin{aligned}
 7. \log_2 (2x + 1) - 5 \log_4 x^2 + 4 \log_2 x &= \log_2 (2x + 1) + \log_2 x^4 - 5 \log_4 x^2 \\
 &= \log_2 (2x + 1)x^4 - 5 \frac{\log_2 x^2}{\log_2 4} \\
 &= \log_2 (2x^5 + x^4) - \frac{5}{2} \log_2 x^2 \\
 &= \log_2 \frac{(2x^5 + x^4)}{(x^2)^{\frac{5}{2}}} \\
 &= \log_2 \left( \frac{2x^5 + x^4}{x^5} \right) \\
 &= \log_2 \left( 2 + \frac{1}{x} \right)
 \end{aligned}$$

$$\begin{aligned}
8. \log_2 xy &= 2 + 3 \log_2 x - \log_2 y \\
&= \log_2 4 + \log_2 x^3 - \log_2 y \\
&= \log_2 \left( \frac{4x^3}{y} \right) \\
xy &= \frac{4x^3}{y} \\
y^2 &= 4x^2 \\
y &= 2x
\end{aligned}$$

$$\begin{aligned}
9. \log_4 \left( \frac{8b}{c} \right) &= \frac{\log_2 \left( \frac{8b}{c} \right)}{\log_2 4} \\
&= \frac{1}{2} (\log_2 8 + \log_2 b - \log_2 c) \\
&= \frac{1}{2} (3 + x - y)
\end{aligned}$$

$$10. (a) 10 \log_{10} \left( \frac{10^{-7}}{P_0} \right) = 50$$

$$\log_{10} \left( \frac{10^{-7}}{P_0} \right) = 5$$

$$\frac{10^{-7}}{P_0} = 10^5$$

$$P_0 = \frac{10^{-7}}{10^5}$$

$$P_0 = 10^{-12} \text{ Watt}$$

(b) Mesin pencuci pinggan : Pam air panas

$$62 : 50$$

$$31 : 25$$

$$(c) d = 10 \log_{10} \left( \frac{P}{P_0} \right)$$

$$= 10 \log_{10} \left( \frac{100}{10^{-12}} \right)$$

$$= 10 \log_{10} 10^{14}$$

$$= 140$$

Kuasa yang melebihi 140 desibel akan menyakiti telinga manusia.

$$11. (a) P = 2\,500\,000e^{0.04(0)}$$

$$= 2\,500\,000$$

$$(b) P = 2\,500\,000e^{0.04(10)}$$

$$= 3\,729\,561$$

Maka, populasi negara itu pada tahun 2030 ialah 3 729 561.

$$(c) 2\,500\,000e^{0.04t} > 50\,000\,000$$

$$e^{0.04t} > \frac{50\,000\,000}{2\,500\,000}$$

$$e^{0.04t} > 20$$

$$0.04t \log e > \log 20$$

$$t > \frac{\log 20}{0.04 \times \log e}$$

$$> 74.8933$$

$$= 75$$

2020 + 75 = 2095. Maka, populasi negara itu melebihi 50 000 000 pada tahun 2095.

**Latih Diri 4.14 (Halaman 123)**

1.  $A = 1\,000 \times 2^{0.7n}$   
 $5\,000 = 1\,000 \times 2^{0.7n}$   
 $2^{0.7n} = 5$   
 $\log 2^{0.7n} = \log 5$   
 $0.7n \log 2 = \log 5$   
 $n = \frac{\log 5}{0.7 \log 2}$   
 $= 3.3170$

Maka, masa yang diambil oleh serangga untuk menyerang kawasan seluas 5 000 hektar ialah 3 minggu 2 hari.

2. (a)  $I = 32 \times 4^{-0}$   
 $= 32 \text{ amp}$   
(b) (i)  $I = 32 \times 4^{-1}$   
 $= 8 \text{ amp}$   
(ii)  $I = 32 \times 4^{-2}$   
 $= 2 \text{ amp}$   
(c)  $0.5 = 32 \times 4^{-t}$   
 $4^{-t} = \frac{0.5}{32}$   
 $4^t = 64$   
 $\log 4^t = \log 64$   
 $t = \frac{\log 64}{\log 4}$   
 $t = 3 \text{ saat}$

**Latihan Intensif 4.4 (Halaman 123)**

1. (a)  $W = 1\,000(1.09)^5$   
 $= 1538.62$

Maka, jumlah wang Encik Ramasamy selepas 5 tahun ialah RM1 538.62

(b)  $1\,200 = 1\,000(1.09)^t$   
 $1.09^t = \frac{1\,200}{1\,000}$   
 $1.09^t = 1.2$   
 $t \log 1.09 = \log 1.2$   
 $t = \frac{\log 1.2}{\log 1.09}$   
 $= 2.1156$

Maka, masa yang diperlukan oleh Encik Ramasamy untuk memperoleh RM1 200 ialah 2.116 tahun.

2. (a)  $W(t) = 50 \times 2^{-0.0002(0)}$   
 $= 50$

Maka, jisim asal uranium ialah 50 gram.

$$\begin{aligned}
 \text{(b)} \quad 8 &= 50 \times 2^{-0.0002t} \\
 2^{-0.0002t} &= \frac{8}{50} \\
 2^{-0.0002t} &= 0.16 \\
 -0.0002t \log 2 &= \log 0.16 \\
 t &= \frac{\log 0.16}{-0.0002 \log 2} \\
 &= 13219.2810
 \end{aligned}$$

Maka, masa yang diperlukan untuk jisim uranium berbaki 8 gram ialah 13219.2810 tahun.

$$\begin{aligned}
 \text{3. (a)} \quad J &= 25 \times e^{0.1t} \\
 25 \times e^{0.1t} &= 50 \\
 e^{0.1t} &= \frac{50}{25} \\
 e^{0.1t} &= 2 \\
 0.1t \ln e &= \ln 2 \\
 t &= \frac{\ln 2}{0.1} \\
 &= 10 \ln 2
 \end{aligned}$$

Maka,  $t = 10 \ln 2$  jam.

$$\begin{aligned}
 \text{(b)} \quad t &= 10 \ln 2 \\
 &= 10 \times 0.6931 \\
 &= 6.931 \\
 \text{Maka, } t &= 6.93 \text{ jam.}
 \end{aligned}$$

### Latihan Pengukuhan (Halaman 124)

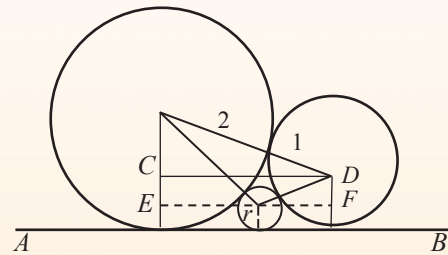
$$\begin{aligned}
 \text{1.} \quad 4^{2x-1} + 4^{2x} &= 4 \\
 4^{2x} \left( \frac{1}{4} + 1 \right) &= 4 \\
 4^{2x}(1.25) &= 4 \\
 4^{2x} &= \frac{4}{1.25} \\
 4^{2x} &= 3.2 \\
 2x \log 4 &= \log 3.2 \\
 x &= \frac{\log 3.2}{2 \log 4} \\
 &= \frac{0.5051}{1.2041} \\
 &= 0.4194 \\
 \text{2.} \quad 5^{n+1} - 5^n + 5^{n-1} &= 105 \\
 5^n \times 5 - 5^n + \frac{5^n}{5} &= 105 \\
 5^n \left( 5 - 1 + \frac{1}{5} \right) &= 105 \\
 5^n(4.2) &= 105 \\
 5^n &= \frac{105}{4.2} \\
 &= 25 \\
 5^n &= 5^2 \\
 n &= 2
 \end{aligned}$$

$$\begin{aligned}
 3. \quad \sqrt{5}x - \sqrt{3}x &= \sqrt{7} \\
 x(\sqrt{5} - \sqrt{3}) &= \sqrt{7} \\
 x &= \frac{\sqrt{7}}{\sqrt{5} - \sqrt{3}} \\
 &= \frac{\sqrt{7}}{\sqrt{5} - \sqrt{3}} \times \frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} + \sqrt{3}} \\
 &= \frac{\sqrt{7}(\sqrt{5} + \sqrt{3})}{5 - 3} \\
 &= \frac{\sqrt{35} + \sqrt{21}}{2}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad \log_x a + \log_x \frac{1}{a} &= t \\
 \log_x \left( a \times \frac{1}{a} \right) &= t \\
 \log_x 1 &= t \\
 t &= 0
 \end{aligned}$$

5. Katakan jejari bagi bulatan kecil ialah  $r$ .

$$\begin{aligned}
 CD &= \sqrt{3^2 - 1^2} \\
 &= \sqrt{8}
 \end{aligned}$$



$$EF = CD$$

$$\begin{aligned}
 \sqrt{(2+r)^2 - (2-r)^2} + \sqrt{(1+r)^2 - (1-r)^2} &= \sqrt{8} \\
 \sqrt{4+4r+r^2-4+4r-r^2} + \sqrt{1+2r+r^2-1+2r-r^2} &= \sqrt{8} \\
 \sqrt{8r} + \sqrt{4r} &= \sqrt{8} \\
 (\sqrt{8r} + \sqrt{4r})^2 &= (\sqrt{8})^2 \\
 8r + 2\sqrt{8r}\sqrt{4r} + 4r &= 8 \\
 12r + 2r\sqrt{32} &= 8 \\
 r(12 + 2\sqrt{32}) &= 8 \\
 r &= \frac{8}{12 + 8\sqrt{2}}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad (a) \quad T &= 100(0.9)^x \\
 &= 100(0.9)^5 \\
 &= 59.05^\circ\text{C}
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad 100(0.9)^x &= 80 \\
 (0.9)^x &= \frac{80}{100} \\
 &= 0.8 \\
 x \log 0.9 &= \log 0.8 \\
 x &= \frac{\log 0.8}{\log 0.9} \\
 &= 2.12 \text{ saat}
 \end{aligned}$$

$$7. \text{RM}60\,000 \left(\frac{7}{8}\right)^n < \text{RM}20\,000$$

$$\left(\frac{7}{8}\right)^n < \frac{20\,000}{60\,000}$$

$$n \log \frac{7}{8} < \log \frac{1}{3}$$

$$n > \frac{\log \frac{1}{3}}{\log \frac{7}{8}}$$

$$n > 8.2274$$

$$n = 9 \text{ tahun}$$

Maka bilangan tahun apabila harga kereta itu kurang daripada RM20 000 buat pertama kali ialah 9 tahun.

$$8. \log_x 3 = s$$

$$x^s = 3$$

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

$$\log_{\sqrt{y}} 9 = t$$

$$(\sqrt{y})^t = 9$$

$$y = 9^{\frac{2}{t}}$$

$$\log_9 x^3 y = \log_9 x^3 + \log_9 y$$

$$= \log_9 \left(3^{\frac{1}{s}}\right)^3 + \log_9 \left(9^{\frac{2}{t}}\right)$$

$$= \frac{3}{s} \log_9 3 + \frac{2}{t} \log_9 9$$

$$= \frac{3}{s} \left(\frac{\log 3}{\log 9}\right) + \frac{2}{t}$$

$$= \frac{3}{s} \left(\frac{1}{2}\right) + \frac{2}{t}$$

$$= \frac{3}{2s} + \frac{2}{t}$$

$$9. 3(9^x) = 27^y \dots \textcircled{1}$$

$$\log_2 y = 2 + \log_2 (x - 2) \dots \textcircled{2}$$

Daripada  $\textcircled{1}$ ,  $3(3^{2x}) = 3^{3y}$

$$1 + 2x = 3y \dots \textcircled{3}$$

Daripada  $\textcircled{2}$ ,  $\log_2 y = \log_2 4 + \log_2 (x - 2)$

$$\log_2 y = \log_2 4(x - 2)$$

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

$$y = 4x - 8 \dots \textcircled{4}$$

Gantikan  $\textcircled{4}$  ke dalam  $\textcircled{3}$ .

$$1 + 2x = 3(4x - 8)$$

$$1 + 2x = 12x - 24$$

$$10x = 25$$

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



Gantikan  $x = \frac{5}{2}$  ke dalam 4.

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

10.  $x \log_{10} \left(1 - \frac{2}{y}\right) = \log_{10} p - \log_{10} q$

$$x \log_{10} \left(1 - \frac{2}{y}\right) = \log_{10} \frac{p}{q}$$

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

$$\left(1 - \frac{2}{20}\right)^x = \frac{10\,000}{100\,000}$$

$$x \log \left(\frac{18}{20}\right) = \log \frac{10\,000}{100\,000}$$

$$x = \frac{-1}{-0.04576}$$

$$= 21.85 \text{ tahun}$$