Mid-year Examination Specimen Paper 1

PART I

1. (a) $5\frac{2}{3} - 2\frac{1}{4} \div 5\frac{2}{5} \times 6 = 5\frac{2}{3} - \left(\frac{9}{4} \div \frac{27}{5}\right) \times 6$

$= 5\frac{2}{3} - \left(\frac{9}{4} \times \frac{5}{27} \times 6\right)$

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

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

$= 5\frac{4}{6} - 2\frac{3}{6}$

$= 3\frac{1}{6}$

(b) $\frac{1.2 \times 0.025}{0.4 \times 50} = \frac{1.2 \times 0.025}{4 \times 5}$

$= 0.0015$

(c) $\frac{2.3^2 + 23 \times \sqrt{0.49}}{9.2 \div 4} = \frac{2.3^2 + 23 \times 0.7}{2.3}$

$= \frac{2.3^2}{2.3} + \frac{23 \times 0.7}{2.3}$

$= 2.3 + 10 \times 0.7$

$= 2.3 + 7$

$= 9.3$

2. $24 \times 27 \times 50 = (2^3 \times 3) \times 3^3 \times (2 \times 5^2)$

$= 2^4 \times 3^4 \times 5^2$

$\sqrt{24 \times 27 \times 50} = \sqrt{2^4 \times 3^4 \times 5^2}$

$= \sqrt{(2^2 \times 3^2 \times 5)^2}$

$= 2^2 \times 3^2 \times 5$

$= 4 \times 9 \times 5$

$= 180$

3. $x = -4, -3, -2, -1, 0, 1$

$y = 4, 5, 6, 7$

(a) Least value $(y - x) =$ min. $y -$ max. x

$= 4 - 1$

$= 3$

(b) Greatest value $\frac{x^2}{2y} = \frac{\text{max. } (x^2)}{\text{min. } (2y)}$

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

$= \frac{16}{8}$

$= 2$

4. When $p = 9$, $r = -17.5$.

$2p + r = \frac{q - 2}{p + 1}$

$2(9) + (-17.5) = \frac{q - 2}{9 + 1}$

$\frac{q - 2}{10} = 18 - 17.5$

$q - 2 = 10(0.5)$

$q = 5 + 2$

$= 7$

5. (a) $2.31 \times 0.00465 = 0.0107415$

≈ 0.011 (2 s. .)

$0.0231 \times 4.65 = (2.31 \div 100) \times (0.00465 \times 1000)$

$= 2.31 \times 0.00465 \times 10$

$\approx 0.011 \times 10$

≈ 0.11

(b) $10\,000 \text{ m}^2 = 1$ a

$425\,011 \text{ m}^2 = 42.5011$ ectars

≈ 43 ectars (nearest ectar)

6. $25 - [1.2 - (-5) \div 20 - 6] \times 2$

$= 25 - [1.2 - (-0.25) - 6] \times 2$

$= 25 - (1.2 + 0.25 - 6) \times 2$

$= 25 - (-4.55) \times 2$

$= 25 - (-9.1)$

$= 25 + 9.1$

$= 34.1$

7. (a) $(3x^3 - 5x^2 + x + 13) - (4x^3 - 7x - 2)$

$= 3x^3 - 5x^2 + x + 13 - 4x^3 + 7x + 2$

$= -x^3 - 5x^2 + 8x + 15$

(b) $\frac{2xy - 1}{x} - \frac{3 - 7y}{4}$

$= \frac{4(2xy - 1) - x(3 - 7y)}{4x}$

$= \frac{8xy - 4 - 3x + 7xy}{4x}$

$= \frac{15xy - 3x - 4}{4x}$

8. (a) Add 4 to the previous term:

$\overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}$

19, 23, 27, 31, 35, 39

(b) Multiply by 3 to the previous term:

$\overset{\times 3}{\frown}\ \overset{\times 3}{\frown}\ \overset{\times 3}{\frown}\ \overset{\times 3}{\frown}\ \overset{\times 3}{\frown}$

2, 6, 18, 54, 162, 486

9. (a) $x = \sqrt[3]{64}$

$= \sqrt[3]{4^3}$

$= 4$

$x^2 = 4^2$

$= 16$

(b) Let the fraction be $\frac{x - 4}{x}$.

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

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

$2x - 10 = x - 1$

$x = 9$

Fraction $= \frac{9 - 4}{9} = \frac{5}{9}$

$\therefore$ The fraction is $\frac{5}{9}$.

10. (a) $3(x - 2) - 4(1 - x) = 8$

$3x - 6 - 4 + 4x = 8$

$7x - 10 = 8$

$7x = 18$

$x = \frac{18}{7}$

$= 2\frac{4}{7}$

(b) $\frac{y+2}{5}+1=\frac{y+1}{2}$

$\frac{y+2+5}{5}=\frac{y+1}{2}$

$2(y+7)=5(y+1)$

$2y+14=5y+5$

$-3y=-9$

$y=3$

11. (a) In 5 years' time, Jane $\rightarrow (n+5)$ years old

Jason $\rightarrow 2(n+5)$ years old

Difference $=2(n+5)-(n+5)$

$=(n+5)$ years

(b) Difference $=13$ years

$n+5=13$

$n=8$

Jason's present age $=2(n+5)-5$

$=2(8+5)-5$

$=26-5$

$=21$ years

12. Perimeter of circle $=d$

$=\frac{22}{7}\times 14$

$=44$ cm

Perimeter of square $=83.6-44$

$=39.6$ cm

Length of square $=$ perimeter $\div 4$

$=39.6\div 4$

$=9.9$ cm

Area of the shaded region

= area of circle − area of square

$=\frac{22}{7}\times 7^2-9.9^2$

$=55.99$

≈ 56.0 cm^2 (3 s.f.)

13. (a) Volume of bottle $=2\times 0.75\ l$

$=1.5\ l$

$=1500$ cm^3

$r^2=1500$ cm^3

$3.142\times r^2\times 15=1500$

$r^2=\frac{1500}{3.142\times 15}$

$r^2\approx 31.8269$

$r\approx 5.6415$

≈ 5.64 cm (2 d.p.)

(b) Surface area in contact with water

$=\frac{1}{2}\times$ curved surface area $+2\times$ area of semicircle

$=\frac{1}{2}\times 2\pi r+2\times\frac{1}{2}\pi r^2$

$=\frac{1}{2}\times 2\times 3.142\times 5.6415\times 15+2\times\frac{1}{2}\times 3.142\times 5.6415^2$

≈ 365.88 cm^2 (2 d.p.)

PART II

1. (a) $79.1\div\sqrt{15.9}-3.01^3\approx 80\div\sqrt{16}-3^3$

$\approx 80\div 4-27$

$\approx 20-27$

≈ -7 (1 s.f.)

(b) $\frac{\sqrt{0.04\times(-0.81)^2}}{5.1}\approx\frac{\sqrt{0.04\times(-0.8)^2}}{5}$

$\approx\frac{\sqrt{0.04\times 0.64}}{5}$

$\approx\frac{0.2\times 0.8}{5}$

≈ 0.032

≈ 0.03 (1 s.f.)

2. (a) $\frac{3b}{10}\times\left(-\frac{7}{8}\right)\div\frac{2a^3}{5}=\frac{3b}{\cancel{10}_{2}}\times\left(-\frac{7}{8}\right)\times\frac{\overset{1}{\cancel{5}}}{2a^3}$

$=-\frac{3b\times 7}{2\times 8\times 2a^3}$

$=-\frac{21b}{32a^3}$

(b) When $u=4.5$ and $v=-2$,

$u-v^2=\frac{3-w}{u+1}$

$4.5-(-2)^2=\frac{3-w}{4.5+1}$

$\frac{3-w}{5.5}=4.5-4$

$3-w=5.5(0.5)$

$w=3-2.75$

$=0.25$

3. (a) $18=2\times 3^2$

$34=2\times 17$

HCF $=2$

LCM $=2\times 3^2\times 17$

$=306$

(b) (i)

2	1224
2	612
2	306
3	153
3	51
17	17
	1

$1224=2^3\times 3^2\times 17$

(ii) $1224k=2^3\times 3^2\times 17\times k$

$2^3\times 3^2\times 17\times k=2^4\times 3^2\times 17^2$

$2^3\times 3^2\times 17\times(2\times 17)=2^4\times 3^2\times 17^2$

$k=2\times 17$

$=34$

4. (a) $\sqrt[3]{\frac{0.008\times 125}{0.027}}=\sqrt[3]{\frac{8\times 125}{27}}$

$=\sqrt[3]{\frac{2^3\times 5^3}{3^3}}$

$=\frac{2\times 5}{3}$

$=\frac{10}{3}$

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

(b) $2c - 6d - 12ad + 4ac = 2(c - 3d) - 4a(3d - c)$
$= 2(c - 3d) + 4a(c - 3d)$
$= (c - 3d)(2 + 4a)$
$= 2(c - 3d)(1 + 2a)$

5. (a) $\frac{y-1}{2} - \frac{3-2y}{8} + \frac{y}{12} = \frac{12(y-1) - 3(3-2y) + 2y}{24}$
$= \frac{12y - 12 - 9 + 6y + 2y}{24}$
$= \frac{20y - 21}{24}$

(b) $\frac{1}{x} - \frac{2}{5x} = \frac{1}{2x-1}$
$\frac{5-2}{5x} = \frac{1}{2x-1}$
$\frac{3}{5x} = \frac{1}{2x-1}$
$3(2x - 1) = 5x$
$6x - 3 = 5x$
$x = 3$

6. (a) 10^{th} line: $\frac{1}{10} - \frac{1}{12} = \frac{2}{10 \times 12}$

(b) $\frac{1}{p} - \frac{1}{q} = \frac{1}{180}$
$\frac{1}{p} - \frac{1}{q} = \frac{2}{360}$
$\frac{1}{p} - \frac{1}{q} = \frac{2}{18 \times 20}$
$\frac{1}{18} - \frac{1}{20} = \frac{2}{18 \times 20}$
$\therefore \quad p = 18, \ q = 20$

(c) $\frac{2}{1\times3} + \frac{2}{2\times4} + \frac{2}{3\times5} + \ldots + \frac{2}{21\times23} + \frac{2}{22\times24}$
$= \frac{1}{1} - \cancel{\frac{1}{3}} +$
$\frac{1}{2} - \cancel{\frac{1}{4}} +$
$\cancel{\frac{1}{3}} - \cancel{\frac{1}{5}} +$
$\vdots \quad \vdots$
$\cancel{\frac{1}{20}} - \cancel{\frac{1}{22}} +$
$\cancel{\frac{1}{21}} - \frac{1}{23} +$
$\cancel{\frac{1}{22}} - \frac{1}{24}$
$= \frac{1}{1} + \frac{1}{2} - \frac{1}{23} - \frac{1}{24}$
$= 1\frac{229}{552}$

7. (a) Difference in distance = 45 km
Increased speed = 75 + 15
= 90 km/
90 km/ $\times t$ − 75 km/ $\times t$ = 45 km
$90t - 75t = 45$
$15t = 45$
$t = 3$ h
$\therefore$ required rate is 3 rs.
time arrival = 08 40 + 03 00
= 11 40

(b) Distance of PQ = 75 km/ $\times t$ h
= 75 km/ $\times 3$
= 225 km

8. (a) $AD = \frac{1}{2}AB$
$= \frac{1}{2}(28)$
$= 14$ cm
Perimeter of the shaded region
= perimeter of the rectangle $ABCD$ +
2 × arc length of quadrant
$= 2(AB + AD) + 2 \times \frac{1}{4} \times 2\pi r$
$= 2(28 + 14) + 2 \times \frac{1}{4} \times 2 \times \frac{22}{7} \times 7$
$= 2(42) + 22$
$= 106$ cm

(b) Area of the shaded region
= area of the rectangle
$= 28 \times 14$
$= 392$ cm^2

(c) 19.6 l = 19 600 cm^3
Capacity of container = base area × height
392 × height = 19 600 cm^3
Height = 19 600 ÷ 392
= 50 cm

(d) Original volume of water = $\frac{3}{10} \times 19\,600$
= 5880 cm^3
Volume of water left = 5880 − 4900
= 980 cm^3
Water level = $\frac{\text{volume of water left}}{\text{base area}}$
$= \frac{980 \text{ cm}^3}{392 \text{ cm}^2}$
= 2.5 cm

Mid-year Examination Specimen Paper 2

PART I

1. (a) $(45 - 18 \div 3) \div [8 - (-4) + 1]$
$= (45 - 6) \div (8 + 4 + 1)$
$= 39 \div 13$
$= 3$

(b) $3^2 \times 3 - 3^2 + (-3)^3$
$= 9 \times 3 - 9 + (-27)$
$= 27 - 9 - 27$
$= -9$

2. When $d = 4$, $e = -2$ and $f = -1$,

(a) $de - f = 4(-2) - (-1)$
$= -8 + 1$
$= -7$

(b) $e^2 + 2d - f^3 = (-2)^2 + 2(4) - (-1)^3$
$= 4 + 8 - (-1)$
$= 12 + 1$
$= 13$

(c) $\sqrt{\dfrac{5+7e}{4f-2d^2}} = \sqrt{\dfrac{5+7(-2)}{4(-1)-2(4)^2}}$

$= \sqrt{\dfrac{5-14}{-4-32}}$

$= \sqrt{\dfrac{-9}{-36}}$

$= \sqrt{\dfrac{1}{4}}$

$= \dfrac{1}{2}$

3. (a) $98 = 2 \times 7^2$

$210 = 2 \times 3 \times 5 \times 7$

(b) $98k$ = m ti e 210

$98k = 210n$

$2 \times 7^2 \times k = 2 \times 3 \times 5 \times 7 \times n$

$k = 3 \times 5$

$= 15$

$\therefore$ Least va e $k = 15$

4. (a) $1\dfrac{7}{9} + \dfrac{5}{6} \times \left(-1\dfrac{3}{5}\right)^2 = 1\dfrac{7}{9} + \dfrac{5}{6} \times \left(-\dfrac{8}{5}\right)^2$

$= 1\dfrac{7}{9} + \dfrac{5}{6} \times \dfrac{64}{25}$

$= 1\dfrac{7}{9} + \dfrac{32}{15}$

$= 1\dfrac{7}{9} + 2\dfrac{2}{15}$

$= 1\dfrac{35}{45} + 2\dfrac{6}{45}$

$= 3\dfrac{41}{45}$

(b) $4.5 + 3.2\dot{3}\dot{2} - 2.\dot{1}$

$= 4.5 + 3.232323\ldots - 2.111111\ldots$

$= 7.732323\ldots - 2.111111\ldots$

$= 5.6212121\ldots$

$= 5.62\dot{1}\dot{2}$

5. (a) $3a < 27$

$a < 27 \div 3$

$a < 9$

(b) $5 - 2b > \dfrac{1}{3}$

$-2b > \dfrac{1}{3} - 5$

$-2b > -\dfrac{14}{3}$

$b < -\dfrac{14}{3} \div (-2)$

$b < \dfrac{14}{3} \times \dfrac{1}{2}$

$b < \dfrac{7}{3}$

$b < 2\dfrac{1}{3}$

(c) $\dfrac{2}{9}c + 4 < -6$

$\dfrac{2}{9}c < -6 - 4$

$c < -10 \times \dfrac{9}{2}$

$c < -45$

6. (a) $3x + \dfrac{x}{2} - \dfrac{4-5x}{7}$

$= \dfrac{14(3x) + 7x - 2(4-5x)}{14}$

$= \dfrac{42x + 7x - 8 + 10x}{14}$

$= \dfrac{59x - 8}{14}$

(b) $4ay - 2a + 4b(5 - 10y)$

$= 2a(2y - 1) + 20b(1 - 2y)$

$= 2a(2y - 1) - 20b(2y - 1)$

$= (2y - 1)(2a - 20b)$

$= 2(2y - 1)(a - 10b)$

7. (a) $32, \overset{+2}{\frown}\ 34, \overset{-4}{\frown}\ 30, \overset{+2}{\frown}\ 32, \overset{-4}{\frown}\ 28, \overset{+2}{\frown}\ \underline{30}, \overset{-4}{\frown}\ \underline{26}$

(b) N merat r = den minat r t e revi s term

Den minat r = s m t e n merat r and t e den minat r t e revi s term

$\dfrac{1}{2}, \dfrac{2}{3}, \dfrac{3}{5}, \dfrac{5}{8}, \underline{\dfrac{8}{13}}, \underline{\dfrac{13}{21}}$

8. (a) $1 - \dfrac{2}{3}x = 0$

$-\dfrac{2}{3}x = -1$

$x = \dfrac{3}{2}$

$= 1\dfrac{1}{2}$

(b) $3.2x - 8.1 = 1.6(1 - x)$

$3.2x - 8.1 = 1.6 - 1.6x$

$3.2x + 1.6x = 1.6 + 8.1$

$4.8x = 9.7$

$x = \dfrac{97}{48}$

$= 2\dfrac{1}{48}$

(c) $\dfrac{x-1}{2} + 5 = \dfrac{1}{2} - \dfrac{3-12x}{6}$

$\dfrac{x-1+5(2)}{2} = \dfrac{1(3) - (3-12x)}{6}$

$\dfrac{x-1+10}{2} = \dfrac{3-3+12x}{6}$

$3(x+9) = 1(12x)$

$3(x+9) = 12x$

$3x + 27 = 12x$

$-9x = -27$

$x = 3$

9. At first: Let the number be x,
the other number is $(x - 8)$.

After: Number $= \frac{3}{4}x$

Number $-$ number $= 8$

$$(x - 8) - \frac{3}{4}x = 8$$

$$\frac{4(x - 8) - 3x}{4} = 8$$

$$4x - 32 - 3x = 32$$

$$x = 32 + 32$$

$$= 64$$

At first: Number $= 64$

Number $= 64 - 8 = 56$

Total $= 64 + 56 = 120$

10. (a) Volume of water in the tank

$= 0.4 \times$ volume of cube

$= 0.4 \times 6^3$

$= 86.4 \text{ cm}^3$

Capacity of cylindrical beaker $= \frac{1}{2} \times 86.4$

$= 43.2 \text{ cm}^3$

(b) Capacity of beaker $= 43.2 \text{ cm}^3$

$$r^2h = 43.2 \text{ cm}^3$$

Since $r = h$, $\quad \times r^2 \times r = 43.2$

$$r^3 = \frac{43.2}{}$$

$$r^3 \approx 13.751$$

$$r \approx 2.3958 \text{ cm}$$

$$\approx 23.958 \text{ mm}$$

$$\approx 24 \text{ mm}$$

(nearest mm)

11. (a) Cross-sectional area = area of the trapezium

$$= \frac{1}{2} \times (50 + 110) \times 40$$

$$= 3200 \text{ cm}^2$$

(b) Length of the prism $= \frac{\text{volume of the prism}}{\text{cross-sectional area}}$

$$= \frac{80\,000 \text{ cm}^3}{3200 \text{ cm}^2}$$

$$= 25 \text{ cm}$$

(c) Surface area of prism

$= 2(3200) + 50(25) + 2(50 \times 25) + (110 \times 25)$

$= 12\,900 \text{ cm}^2$

Total cost $= \frac{12 \times 12\,900 \text{ cm}^2}{500 \text{ cm}^2} \times \$1$

$= \$309.60$

PART II

1. (a) Fraction of the remaining money after giving his wife

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

$= \frac{3}{5}$

Fraction of his savings

$= \frac{1}{6} \times \frac{3}{5}$

$= \frac{1}{10}$

Fraction of the amount received by his 3 children

$= 2 \times \frac{1}{10}$

$= \frac{1}{5}$

Fraction of the amount left

$= 1 - \frac{2}{5} - \frac{1}{10} - \frac{1}{5}$

$= \frac{3}{10}$

$\therefore$ He has left $\frac{3}{10}$ of his monthly income.

(b) Monthly income

$= \$450 \times \frac{10}{3}$

$= \$1500$

(c) Amount received by his wife

$= \frac{2}{5} \times \$1500$

$= \$600$

Amount received by each child

$= \left(\frac{1}{5} \times \$1500\right) \div 3$

$= \$300 \div 3$

$= \$100$

Difference

= amount received by his wife – amount received by each child

$= \$600 - \$100$

$= \$500$

$\therefore$ His wife receives \$500 more than each child.

2. (a) $2xy - 6x\left(1 + \frac{3}{2}x - 7y\right) = 2xy - 6x - 9x^2 + 42xy$

$= -9x^2 - 6x + 44xy$

(b) $4a(2b - 6) - (3 - b) = 8a(b - 3) + (b - 3)$

$= (b - 3)(8a + 1)$

(c) $2 - \frac{4}{z^2} = -0.25$

$$-\frac{4}{z^2} = -0.25 - 2$$

$$\frac{4}{z^2} = 2.25$$

$$2.25z^2 = 4$$

$$z^2 = 4 \div 2.25$$

$$z^2 = \frac{16}{9}$$

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

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

3. en = 44, $= 3\frac{1}{7}$, L = 49 and r = 5,

$$= 4\sqrt{\frac{L}{R-r}}$$

$$44 = 4 \times \frac{22}{7} \times \sqrt{\frac{49}{R-5}}$$

$$\frac{88}{7} \times \sqrt{\frac{49}{R-5}} = 44$$

$$\sqrt{\frac{49}{R-5}} = 44 \times \frac{7}{88}$$

$$\sqrt{\frac{49}{R-5}} = \frac{7}{2}$$

$$\frac{49}{R-5} = \left(\frac{7}{2}\right)^2$$

$$\frac{49}{R-5} = \frac{49}{4}$$

$$49(4) = 49(R-5)$$

$$R - 5 = 4$$

$$R = 9$$

4. (a) 1.51

(b) −2.15

5. (a) $5.2 \times 0.00845 = (0.052 \times 100) \times \frac{84.5}{10\,000}$

$= 0.052 \times 84.5 \div 100$

$= 4.394 \div 100$

$= 0.04394$

(b) $\frac{0.04394}{8.45} = \frac{4.394 \div 100}{84.5 \div 10}$

$= \frac{4.394}{84.5} \div 10$

$= 0.052 \div 10$

$= 0.0052$

6. Let t e mass a arce be x grams.

Mass a b x $= \frac{5x + 550}{2} = (2.5x + 275)$ grams

ta mass 5 b xes and 2 arce s = 6015

$5(2.5x + 275) + 2x = 6015$

$12.5x + 1375 + 2x = 6015$

$14.5x = 6015 - 1375$

$14.5x = 4640$

$x = 320$

Mass a arce = 320

Mass a b x = 2.5(320) + 275 = 1075

Di erence = 1075 − 320 = 755

7. (a) Perimeter t e sq are = 1.55 × 4

= 6.2 m

Arc en t t e semicirc e = 6.2 + 0.4

= 6.6 m

$\frac{1}{2} \times$ d = 6.6 m

$\frac{1}{2} \times \frac{22}{7} \times$ diameter = 6.6 m

Diameter $= 6.6 \times \frac{7}{11}$

= 4.2 m

∴ e diameter t e semicirc e is 4.2 m.

(b) Area of the semicircle $= \frac{1}{2} \times r^2$

$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{4.2}{2}\right)^2$

$= 6.93 \text{ m}^2$

8. (a)

1	1	2
2	2	4
3	4	8
4	8	16
…	…	…
9	256	512

(b) (i) $d = 2^{n-1}$

(ii) $T = 2d$

$= 2 \times 2^{n-1}$

$= 2^n$

(c) In *Figure* 21, $n = 21$

N mber $\Delta s = 2^{21}$

= 2 097 152

9. (a) $30 = 2 \times 3 \times 5$

$36 = 2^2 \times 3^2$

$40 = 2^3 \times 5$

$LCM = 2^3 \times 3^2 \times 5$

$= 8 \times 9 \times 5$

= 360

(b) M de $X \rightarrow$ 30 m nt s

M de $Y \rightarrow$ 3 years = 36 m nt s

M de $Z \rightarrow$ 3 years 4 m nt s = 40 m nt s

e t ree m de s cars wi be a nc ed t et er 360 m nt s a ter Jan ary 2007.

360 months = 30 years

Date = Jan ary 2037

10. (a) Arc en t a q adrant $= \frac{1}{4} \times 2 \times \frac{22}{7} \times 1.4$

= 2.2 m

Perimeter = 2(2.2) + 4(1.4) + 2.0

= 12 m

(b) (i) Interna radi s = 4.2 cm ÷ 2

= 2.1 cm

Externa radi s = 2.1 + 0.7

= 2.8 cm

V me t e bamb = 161.7 cm^3

$(R^2 - r^2) = 161.7$

$\frac{22}{7} \times (2.8^2 - 2.1^2) \times$ en t = 161.7

$10.78 \times$ en t = 161.7

Len t $= \frac{161.7}{10.78}$

= 15 cm

(ii) S r ace area

$= 2$ R $+ 2$ r $- 2 \times (R^2 - r^2)$

$= 2 \times \frac{22}{7} \times 2.8 \times 15 + 2 \times \frac{22}{7} \times 2.1 \times 15 +$

$2 \times \frac{22}{7}(2.8^2 - 2.1^2)$

= 483.56

$\approx 484 \text{ cm}^2$ (3 s.f.)

Final-year Examination Specimen Paper 1

PART I

1.

2	592 704
2	296 352
2	148 176
2	74 088
2	37 044
2	18 522
3	9 261
3	3 087
3	1 029
7	343
7	49
7	7
	1

$592\,704 = 2^6 \times 3^3 \times 7^3$

$\sqrt[3]{592\,704} = \sqrt[3]{2^6 \times 3^3 \times 7^3}$

$= \sqrt[3]{(2^2 \times 3 \times 7)^3}$

$= 2^2 \times 3 \times 7$

$= 84$

2. $3(2x - 4) + \frac{2}{3}(3 - 6y) - (1 - x) - 2(y - x)$

$= 6x - 12 + 2 - 4y - 1 + x - 2y + 2x$

$= 9x - 6y - 11$

3. $3\frac{2}{5} - \sqrt{\frac{25 \times 49}{144}} \div 1\frac{3}{4} = 3\frac{2}{5} - \sqrt{\frac{5^2 \times 7^2}{12^2}} \div \frac{7}{4}$

$= 3\frac{2}{5} - \frac{5 \times 7}{12} \times \frac{4}{7}$

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

$= 2\frac{21}{15} - 1\frac{10}{15}$

$= 1\frac{11}{15}$

4. $\frac{3.981 \div \sqrt{101.112}}{(-1.99)^2} \approx \frac{4 \div \sqrt{100}}{(-2)^2}$

$\approx \frac{4 \div 10}{4}$

≈ 0.1 (1 s.f.)

5. (a) $234\,915 \text{ cm} = 2349.15 \text{ m}$

$= 2.34915 \text{ km}$

$\approx 2 \text{ km}$ (nearest km)

(b) $1 \text{ km} = 1000 \text{ m}$

$1 \text{ km}^2 = 1\,000\,000 \text{ m}^2$

$1 \text{ km}^2 = 100 \text{ ha}$

$0.019501 \text{ km}^2 = 0.019501 \times 100 \text{ ha}$

$= 1.9501 \text{ ha}$

$= 2.0 \text{ ha}$ (2 s.f.)

6. When $a = -3$, $b = 4$ and $c = -1$,

(a) $b - a - c^3 = 4 - (-3) - (-1)^3$

$= 4 + 3 - (-1)$

$= 7 + 1$

$= 8$

(b) $\frac{b}{2c} - a = \frac{4}{2(-1)} - (-3)$

$= -2 + 3$

$= 1$

(c) $\sqrt{\frac{b}{3ac}} = \sqrt{\frac{4}{3(-3)(-1)}}$

$= \sqrt{\frac{4}{9}}$

$= \frac{2}{3}$

7. $4x + 12 > 4$

$4x > -8$

$x > -2$

$\frac{7}{2}y - 14 < 0$

$\frac{7}{2}y < 14$

$y < 14 \times \frac{2}{7}$

$y < 4$

(a) Greatest value of $(y - x)$ = max. y − min. x

$= 3 - (-1)$

$= 3 + 1$

$= 4$

(b) Least value of $\frac{x^2}{y} = \frac{\text{min. } x^2}{\text{max. } y}$

$= \frac{0^2}{3}$

$= 0$

8. $108\% \rightarrow \$59.40$

$100\% \rightarrow ?$

Mark price $= \frac{100}{108} \times \$59.40$

$= \$55$

Extra $= \frac{10\% - 8\%}{100\%} \times \$55$

$= \$1.10$

9. 5 men × 4 days × 8 hours → 20 rooms

n men × 5 days × 12 hours → 60 rooms

$\frac{n \text{ men} \times 5 \text{ days} \times 12 \text{ hours}}{5 \text{ men} \times 4 \text{ days} \times 8 \text{ hours}} = \frac{60}{20}$

$n = \frac{60}{20} \times \frac{5 \text{ men} \times 4 \text{ days} \times 8 \text{ hours}}{5 \text{ days} \times 12 \text{ hours}}$

$= 8$

Extra number of workers = 8 − 5 = 3

∴ He needs to employ 3 more workers.

10. 12 families → 12 pairs of parents = 24 adults

Number of adults : number of children = 2 : 3

= 24 : 36

Number of children − number of adults = 36 − 24

= 12

∴ There are 12 more children than the adults.

11. (a) (i) When $x = -2$, $y = 2 - \frac{4}{5}(-2)$

$= 2 + 1\frac{3}{5}$

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

(ii) When $x = 3$, $y = 2 - \frac{4}{5}(3)$

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

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

(b) When $y = 10$, $2 - \frac{4}{5}x = 10$

$-\frac{4}{5}x = 8$

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

$= -10$

12. (a) Length of the rectangle $= x$ m

Width of the rectangle $= (x - 4)$ m

Perimeter of the rectangle $= 2[x + (x - 4)]$

$= 2(2x - 4)$

$= (4x - 8)$ cm

Perimeter of the square $= \frac{3}{7}(4x - 8)$ cm

Perimeter of the shaded region

$= (4x - 8) + \frac{3}{7}(4x - 8)$

$= \frac{10}{7}(4x - 8)$ cm

(b) Perimeter = 40 cm

$\frac{10}{7}(4x - 8) = 40$

$4x - 8 = 40\left(\frac{7}{10}\right)$

$4x = 28 + 8$

$x = 36 \div 4$

$= 9$

(c) Perimeter of the square $= \frac{3}{7}[4(9) - 8] = 12$ cm

Length of the square $= 12 \div 4 = 3$ cm

The dimension of the rectangle is 9 cm by 5 cm.

Area of the shaded region $= 9(5) - 3^2$

$= 45 - 9$

$= 36$ cm^2

13. (a) $5x + x + 90^\circ + 90^\circ = 360^\circ$

$6x + 180^\circ = 360^\circ$

$6x = 180^\circ$

$x = 30^\circ$

(b) % of carbohydrate $= \frac{5 \times 30^\circ}{360^\circ} \times 100\%$

$= 41.7\%$ (3 s.f.)

(c) Angle (carbohydrate − protein) $= 5(30^\circ) - 90^\circ$

$= 60^\circ$

$60^\circ \rightarrow 1.2$ kg

$360^\circ \rightarrow$?

Total mass $= \frac{360^\circ}{60^\circ} \times 1.2$ kg

$= 7.2$ kg

14. (a) $\angle QTR = \angle QRT$

$= 180^\circ - 145^\circ$ (adj. ∠s on a str. line)

$= 35^\circ$

$\angle TQR = 180^\circ - 2(35^\circ)$ (∠s sum of Δ)

$= 110^\circ$

(b) $\angle QRS = \angle PQR$ (alt ∠s, PQ // RS)

$= 360^\circ - 90^\circ - 110^\circ$ (∠s at a point)

$= 160^\circ$

$\angle TRS = \angle QRS - \angle QRT$ (adj. ∠s)

$= 160^\circ - 35^\circ$

$= 125^\circ$

PART II

1. (a) Amount saved (1st \$500) $= \frac{5}{100} \times \$500$

$= \$25$

Amount saved (remaining \$370) $= \frac{7}{100} \times \$370$

$= \$25.90$

Total $= \$25 + \$25.90$

$= \$50.90$

∴ He can save \$50.90.

(b) He enjoys 5% discount fat.

Amount saved $= \frac{5}{100} \times \$(450 + 420) = \$43.50$

Extra $= \$50.90 - \$43.50 = \$7.40$

∴ He needs to pay an extra of \$7.40.

(c) 1st \$500 → 95%

2nd \$500 → 93%

Remaining → 90%

$\frac{95}{100} \times \$500 = \$475$

$\frac{93}{100} \times \$500 = \$465$

$\$994 - \$475 - \$465 = \$54$

90% → \$54

100% → ?

$\frac{100}{90} \times \$54 = \$60$

Total amount before discount = \$500 + \$500 + \$60

= \$1060

2. (a) $\frac{5y - 2}{y} - 6 = 0$

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

$5y - 2 = 6y$

$y = -2$

$y^2 + 4 = (-2)^2 + 4$

$= 4 + 4$

$= 8$

(b) $\frac{3 + z}{2} - \frac{4z - 1}{3} + \frac{1}{6} = 0$

$\frac{3(3 + z) - 2(4z - 1) + 1}{6} = 0$

$9 + 3z - 8z + 2 + 1 = 0$

$-5z + 12 = 0$

$12 = 5z$

$z = \frac{12}{5}$

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

3. (a) 7 minutes = 7 × 60 = 420 seconds

Volume of water = 400 × 420 = 168 000 cm^3

Capacity of the cylindrical tank = $\frac{11}{5}$ × 168 000

= 369 600 cm^3

Height of the tank = $\frac{\text{capacity of the tank}}{\text{base area}}$

= $\frac{369\,600}{\frac{22}{7} \times 28^2}$

= 150 cm

(b) Surface area

= $\frac{5}{11}$ of the curved S.A. + area of the circle

= $\frac{5}{11} \times 2\ \text{rh} + \ \text{r}^2$

= $\frac{5}{11} \times 2 \times \frac{22}{7} \times 28 \times 150 + \frac{22}{7} \times 28^2$

= 14 464 cm^2

(c) Volume of the cubic tank = 369 600 − 168 000

= 201 600 cm^3

Length = $\sqrt[3]{201\,600}$

≈ 58.636

≈ 58.64 cm (2 d.p.)

4. (a) Ordinary : medisave : special

10 : 3

5 : 8

50 : 15 : 24

(b) Ordinary − special → (50 − 24) parts

$13 000 → 26 parts

Ordinary → $\frac{50}{26}$ × $13 000 = $25 000

Medisave → $\frac{15}{26}$ × $13 000 = $7500

Special → $\frac{24}{26}$ × $13 000 = $12 000

(c) 100% − 40% = 60% → $25 000

100% → ?

Ordinary (before withdrawal) = $\frac{100}{60}$ × $25 000

= $41 666.67

5. (a) (i) 180° − 30° = 150°

180° − 70° = 110°

Sum of the int. ∠s of a pentagon

= (5 − 2) × 180°

= 540°

$2x + 5x + 3x + 150° + 110° = 540°$

$10x + 260° = 540°$

$10x = 280°$

$x = 28°$

(ii) Greatest ext. ∠ = 180° − 2x

= 180° − 2(28°)

= 124°

(b) Each ext. ∠ = $\frac{180°}{3 + 1}$

= 45°

Number of sides = $\frac{360°}{45°}$

= 8

∴ The polygon is a regular octagon.

6. **(See diagram 6. on page S10)**

7.

x	–2	0	1
$y = 3 - 2x$	7	3	1
$y = 3x + 8$	2	8	11

(See diagram 7. on page S11)

8. (a) $x + x + 30° + 30° + 150° = 360°$

$2x + 210° = 360°$

$2x = 150°$

$x = 75°$

(b) Number of hours (piano) = $\frac{30°}{360°}$ × 24 = 2

(c) Angle (school – homework) = (75° + 30°) – 75°

= 30°

% (school – homework) = $\frac{30°}{360°}$ × 100%

= 8.3% (2 s.f.)

Final-year Examination Specimen Paper 2

PART I

1. (a) 0.04 = $\frac{4}{100} = \frac{1}{25}$

(b) (i) 0.281 × 4.13 ÷ 0.074 = 15.68283 …

≈ 16 (2 s.f.)

(ii) 0.281 × 4.13 ÷ 0.074 = 15.68283 …

≈ 15.683 (3 d.p.)

2. 4 − 5 × [3 − (−1) × 2 ÷ 4 − 8]

= 4 − 5 × [3 − (−2) ÷ 4 − 8]

= 4 − 5 × [3 − (−0.5) − 8]

= 4 − 5 × (3 + 0.5 − 8)

= 4 − 5 × (−4.5)

= 4 + 22.5

= 26.5

3. $\frac{1}{2} - \left(2 + \frac{3}{4}\right) \div \left(1 - \frac{5}{2}\right) = \frac{1}{2} - \frac{11}{4} \div \left(-\frac{3}{2}\right)$

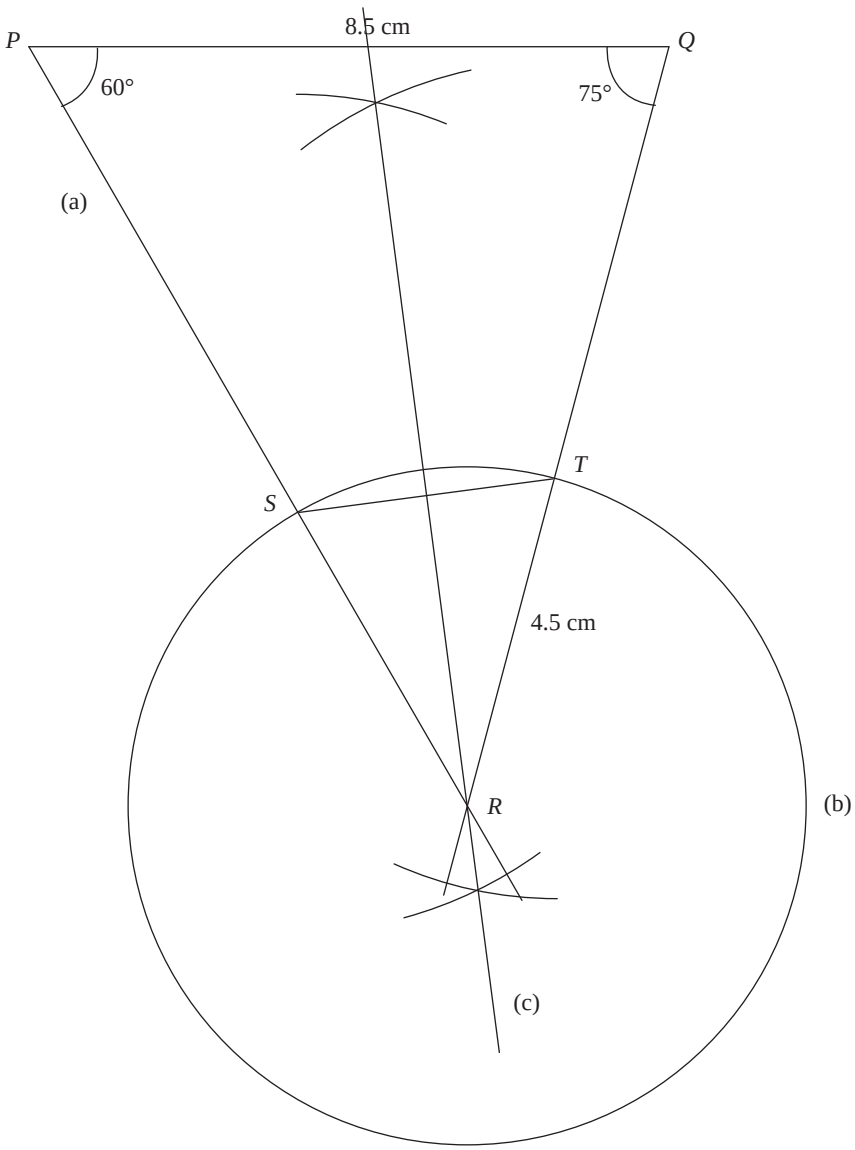
$= \frac{1}{2} - \frac{11}{4} \times \left(-\frac{2}{3}\right)$

$= \frac{1}{2} + \frac{11}{6}$

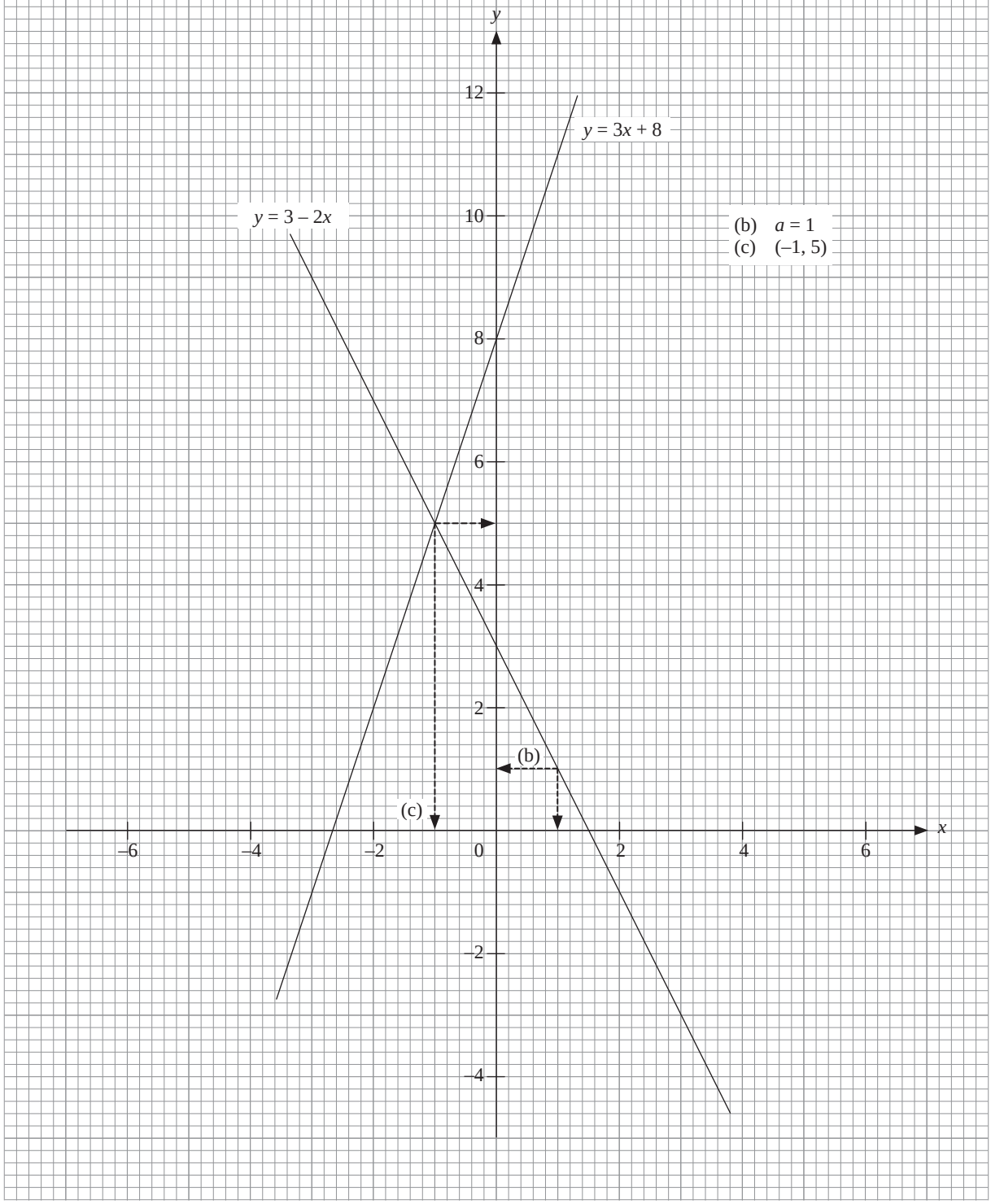
$= \frac{3 + 11}{6}$

$= \frac{7}{3}$

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



x	–2	0	1
$y = 3 - 2x$	7	3	1
$y = 3x + 8$	2	8	11



(b) $a = 1$
(c) $(-1, 5)$

4. (a) $5 \mid 2\ 2\ 0\ 5$
$3 \mid 4\ 4\ 1$
$3 \mid 1\ 4\ 7$
$7 \mid 4\ 9$
$7 \mid 7$
1

$2205 = 3^2 \times 5 \times 7^2$

(b) $6 = 2 \times 3$
$8 = 2^3$
$\text{LCM} = 2^3 \times 3$
$= 24$
$2205n = 3^2 \times 5 \times 7^2 \times n$
$2205n = 24k$
$3^2 \times 5 \times 7^2 \times n = 2^3 \times 3 \times k$
Least value of $n = 2^3$
$= 8$

5. (a) $3 + \frac{m-1}{6} - \frac{2(m-2)}{5}$
$= \frac{3(30) + 5(m-1) - 12(m-2)}{30}$
$= \frac{90 + 5m - 5 - 12m + 24}{30}$
$= \frac{109 - 7m}{30}$

(b) $\frac{1}{2}ab - \frac{3}{2}ac - 6c + 2b = \frac{1}{2}a(b - 3c) - 2(3c - b)$
$= \frac{1}{2}a(b - 3c) + 2(b - 3c)$
$= (b - 3c)\left(\frac{1}{2}a + 2\right)$
$= \frac{1}{2}(b - 3c)(a + 4)$

6. $\frac{2}{5}(x - 2) - \frac{1}{3}(1 + 2x) = -3$
$\frac{2(x-2)}{5} - \frac{1+2x}{3} = -3$
$\frac{6(x-2) - 5(1+2x)}{15} = -3$
$6x - 12 - 5 - 10x = -3(15)$
$-4x - 17 = -45$
$-4x = -28$
$x = 7$
$x^2 = 7^2$
$= 49$

7. (a) $\angle KLM = 110^\circ - 28^\circ$ (ext. $\angle$s)
$= 82^\circ$
$\angle KNM = \angle KLM$ (opp. $\angle$s)
$= 82^\circ$

(b) $\angle PQM = \angle LKQ$ (alt. $\angle$s, $KL \parallel NQ$)
$= 28^\circ$

8. $107\% \rightarrow \$1273.30$
$100\% \rightarrow ?$
Discounted price (exclude GST) $= \frac{100}{107} \times \$1273.30$
$= \$1190$
$85\% \rightarrow \$1190$
$100\% \rightarrow ?$
Original price $= \frac{100}{85} \times \$1190$
$= \$1400$
Original price + GST $= \frac{107}{100} \times \$1400$
$= \$1498$
Amount saved $= \$1498 - \$1273.30$
$= \$224.70$

9. (a) Sum $= \frac{4+5}{4+6+5} \times 360^\circ$
$= \frac{9}{15} \times 360^\circ$
$= 216^\circ$

(b) $\% = \frac{\text{sector C}}{\text{sector A}} \times 100\%$
$= \frac{5}{4} \times 100\%$
$= 125\%$

10. (a) $\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$
$\frac{3}{7}$ of the water in the bottle $= 190 + 500$
$= 690$ ml
$\frac{2}{7}$ of the water in the bottle $= \frac{2}{3} \times 690$ ml
$= 460$ ml
$\therefore$ 460 ml of water was transferred.

(b) Amount of water in the bottle (at first) $= \frac{7}{3} \times 690$
$= 1610$ ml
Amount of water in the pail (at first) $= 500$ ml
Amount of water in the bottle : amount of water in the pail
$= 1610 : 500$
$= 161 : 50$

11. (a) Let the fraction be $\frac{x-4}{x}$.
$\frac{x-4}{x} + 1 = \frac{x - 4 + x}{x}$
$= \frac{2x - 4}{x}$
Numerator = 7 + denominator
$2x - 4 = 7 + x$
$x = 11$
$\therefore$ The original fraction is $\frac{7}{11}$.

(b) $\frac{7}{11} = 0.636363...$
$= 0.\dot{6}\dot{3}$

12. (a) Volume of the cube $= 6^3$
$= 216 \text{ cm}^3$

Base radius of the cylinder $= \frac{6}{4}$
$= \frac{3}{2}$

Volume of the cylinder $= \frac{22}{7} \times \left(\frac{3}{2}\right)^2 (13 - 6)$
$= 49.5 \text{ cm}^3$

Volume of the solid $= 216 + 49.5$
$= 265.5$
$= 266 \text{ cm}^3$ (3 s.f.)

(b) Total surface area of the solid
= total surface area of the cube + curved surface area of the cylinder
$= 6(\text{length})^2 + 2\ rh$
$= 6(6 \times 6) + 2 \times \frac{22}{7} \times \frac{3}{2} \times (13 - 6)$
$= 282 \text{ cm}^2$

13. (a) % (grade less than 3) = 37.5%

$\frac{3 + x}{40} \times 100\% = 37.5\%$

$3 + x = \frac{37.5 \times 40}{100}$

$x = 15 - 3$
$= 12$

$y = 40 - 3 - 12 - 13 - 5$
$= 7$

(b) Angle (grade 2) $= \frac{12}{40} \times 360^\circ$
$= 108^\circ$

14. (a) Distance jogged = speed × time
$= 1.2 \text{ m/s} \times (2 \times 60) \text{ s}$
$= 144 \text{ m}$

Perimeter of the field $= 144 \div 3$
$= 48 \text{ m}$

(b) Speed $= \frac{\text{distance}}{\text{time}}$
$= \frac{144 \text{ m}}{(60 + 30) \text{ s}}$
$= \frac{144}{90}$
$= 1.6 \text{ m/s}$

Difference $= 1.6 - 1.2$
$= 0.4 \text{ m/s}$

$\therefore$ He must jog 0.4 m/s faster.

PART II

1. (a) $\frac{3}{2} + 3t - \frac{4t - 5}{8t} = \frac{3(4t) + 3t(8t) - (4t - 5)}{8t}$

$= \frac{12t + 24t^2 - 4t + 5}{8t}$

$= \frac{24t^2 + 8t + 5}{8t}$

(b) $\frac{1}{5}(2s - 1) - \frac{2}{3}(7 - s) + 6 = 0$

$\frac{2s - 1}{5} - \frac{2(7 - s)}{3} + 6 = 0$

$\frac{3(2s - 1) - 10(7 - s) + 6(15)}{15} = 0$

$\frac{6s - 3 - 70 + 10s + 90}{15} = 0$

$16s + 17 = 0$

$16s = -17$

$s = -1\frac{1}{16}$

2. (a) Now, sum = 35 years old
t years' time, sum $= 35 + t + t$
$= (35 + 2t)$ years old

Fiona's age $= \frac{35 + 2t}{3}$

Jane's age $= \frac{2(35 + 2t)}{3}$

Difference $= \frac{2(35 + 2t)}{3} - \frac{35 + 2t}{3}$

$= \frac{(35 + 2t)(2 - 1)}{3}$

$= \frac{35 + 2t}{3}$

(b) Difference = 15 years

$\frac{35 + 2t}{3} = 15$

$35 + 2t = 15(3)$

$2t = 45 - 35$

$t = 10 \div 2$
$= 5$

3. (a) Area of the circle $= \frac{22}{7} \times 7^2 = 154 \text{ cm}^2$

Area of ADE + area of BCE $= \frac{16 - 11}{11} \times 154$

$= \frac{5}{11} \times 154$

$= 70 \text{ cm}^2$

Area of the trapezium $ABCD = 70 + \frac{1}{2}(154)$
$= 147 \text{ cm}^2$

$\frac{1}{2} \times (AB + DC) \times \text{height} = 147$

$\frac{1}{2} \times (14 + DC) \times 7 = 147$

$14 + DC = \frac{147 \times 2}{7}$

$DC = 42 - 14$
$= 28 \text{ cm}$

(b) Area of the figure
= area of the semicircle + area of the trapezium
$= \frac{1}{2}(154) + 147$
$= 224 \text{ cm}^2$

4. (a) Sum of ext. $\angle$s $= 360^\circ$

$(n - 2) \times 32^\circ + 46^\circ + 58^\circ = 360^\circ$

$(n - 2) \times 32^\circ = 360^\circ - 104^\circ$

$n - 2 = 256^\circ \div 32^\circ$

$n = 8 + 2$

$= 10$

(b) (i) $\angle RLP = 180^\circ - 40^\circ - 32^\circ$ (adj. $\angle$s on a str. line)

$= 108^\circ$

$x = \angle SPQ$

$= \angle RLP$ (corr. $\angle$s, LR // MS)

$= 108^\circ$

(ii) $y = 42^\circ - 32^\circ$ (ext. $\angle$)

$= 10^\circ$

5. (a) $y = 2 - 1.5x$

When $x = n$, $y = 2n$.

$2n = 2 - 1.5n$

$2n + 1.5n = 2$

$3.5n = 2$

$n = \frac{4}{7}$

(b) (i) $y = 4x + k$

When $x = 0.5$, $y = -4$.

$-4 = 4(0.5) + k$

$2 + k = -4$

$k = -6$

(ii) $y = 4x - 6$

When $x = -3$, $y = 4(-3) - 6$

$= -12 - 6$

$= -18$

6. **(See diagram 6. on page S15)**

7. (a) Percentage increase $= \frac{56 - 50}{50} \times 100\%$

$= 12\%$

(b) Year 2013

(c) This graph is not fairly represented because the vertical axis does not start from zero. It gives readers a wrong impression that there is a large increase of accidents from 2008 to 2013.

(d) With the seemingly large increase in accidents, drivers will be made more aware of the increase in accidents resulting from drinking liquor and driving.

8. (a) Home → Tampines → Stop → Home

14 25 30 min 17 25

17 25 − 14 25 = 3 hours

Total time travelled = 3 hours − 30 min

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

(b) Let the distance be x km.

$T_1 + T_2 = 2\frac{1}{2}$ hours

$\frac{x}{90} + \frac{x}{60} = \frac{5}{2}$

$\frac{2x + 3x}{180} = \frac{5}{2}$

$2(5x) = 5(180)$

$x = 900 \div 10$

$= 90$

$\therefore$ The distance between her house and Tampines is 90 km.

(c) Time taken (house to Tampines) $= \frac{x}{90}$

$= \frac{90}{90}$

$= 1$ hour

Time (15 min shorter) $= 1 - \frac{1}{4}$

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

Speed needed $= \frac{\text{distance}}{\text{time}}$

$= 90 \text{ km} \div \frac{3}{4} \text{ h}$

$= 120$ km/h

6. (a) $BC \approx 6.2$ cm

(b) $CS \approx 7.2$ cm

(c) Area $= BC \times CS$

$\approx 6.2 \times 7.2$

≈ 44.64

$\approx 44.6 \text{ cm}^2$