

Fully-Worked Solutions

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Section A

1 108, 36, 12, 4, ...

$\div 3$

$\div 3$

$\div 3$

Answer: B

$$\mathbf{2} \quad -6x(y - 4) = -6xy + 24x$$

Answer: C

$$\begin{array}{r|rr} 2m & +5 & +5m \\ (\times) \downarrow & \uparrow (\times) & \\ m & -6 & -12m \\ \hline 2m^2 & -30 & -7m \end{array}$$

Answer: D

$$\begin{aligned} \mathbf{4} \quad x &= 4, y = -3, \\ p &= 8x - 5y \\ p &= 8(4) - 5(-3) \\ &= 32 + 15 \\ &= 47 \end{aligned}$$

Answer: D

Polygon	Number of sides (n)	
A	$n = \frac{360^\circ}{40^\circ} = 9$	✓
B	$n = \frac{360^\circ}{35^\circ} = 10.3$	✗
C	$n = \frac{360^\circ}{55^\circ} = 6.5$	✗
D	$n = \frac{360^\circ}{70^\circ} = 5.1$	✗

Answer: A

$$\begin{aligned} \mathbf{6} \quad PS^2 &= 13^2 - 5^2 \\ PS &= \sqrt{144} \\ PS &= 12 \text{ cm} \\ PSR &= PS + SR \\ &= 12 + 12 \\ &= 24 \text{ cm} \end{aligned}$$

Answer: C

7 Radius of circle = $34 \text{ cm} \div 2$
= 17 cm

$$\begin{aligned} OK^2 + 8^2 &= 17^2 \\ OK^2 &= 17^2 - 8^2 \\ OK &= \sqrt{225} \\ OK &= 15 \text{ cm} \end{aligned}$$

$$\begin{aligned} ON^2 + 15^2 &= 17^2 \\ ON^2 &= 17^2 - 15^2 \\ ON &= \sqrt{64} \\ ON &= 8 \text{ cm} \end{aligned}$$

$$\begin{aligned} KON &= OK + ON \\ &= 15 + 8 \\ &= 23 \text{ cm} \end{aligned}$$

Answer: B

- 8** The net is obtained by opening and laying out all the surfaces. A cone consists of a sector and a circle.

Answer: A

9 Height of cross section = $\sqrt{5^2 - 2.5^2}$
 $= \sqrt{18.75} = 4.33 \text{ cm}$

$$\frac{\text{Width}}{\text{Length}} = \frac{2}{3}$$

$$\frac{5}{\text{Length}} = \frac{2}{3}$$

Length = 7.5 cm

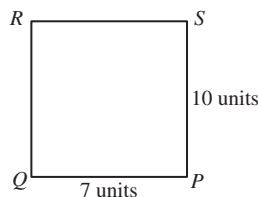
$$\begin{aligned}\text{Volume} &= \left(\frac{1}{2} \times 5 \times 4.33\right) \times 7.5 \\ &= 81.19 \text{ cm}^3\end{aligned}$$

Answer: B

$$\begin{aligned} \mathbf{10} \quad AB^2 &= 9^2 + 4^2 \\ AB &= \sqrt{97} \\ AB &= 9.85 \text{ cm} \end{aligned}$$

Answer: D

11



$$\begin{aligned}\text{Area} &= 10 \times 7 \\ &= 70 \text{ units}^2\end{aligned}$$

Answer: C

$$\begin{aligned} \mathbf{12} \quad f(x) &= 4x \\ f(a) &= 4a = 36 \\ a &= \frac{36}{4} \\ &= 9 \end{aligned}$$

Answer: B

13 Acceleration = -1.94

$$\begin{aligned}\frac{0 - v}{23 - 5} &= -1.94 \\ -v &= -1.94 \times 18 \\ v &= 34.92 \text{ m s}^{-1}\end{aligned}$$

Answer: A

14 Gradient of $PQ = -\frac{3}{2}$

$$\frac{8 - (-4)}{h - 3} = -\frac{3}{2}$$

$$\frac{12}{h-3} = -\frac{3}{2}$$

$$\begin{aligned} -3(h-3) &= 24 \\ h-3 &= -8 \\ h &= -8+3 \\ &= -5 \end{aligned}$$

Answer: A

- 15 D is a transformation because it changes orientation only and does not change shape.

Answer: D

- 16 Under a reflection, the object distance = the image distance. Axis of reflection is $x = 2$.

$$\therefore R(4, -1)$$

Answer: C

- 17 Centre of rotation = $(4, 7)$, clockwise

Answer: C

- 18 C D E F
First $\rightarrow$ Second $\rightarrow$ Third $\rightarrow$ Fourth
Order of rotational symmetry = 4

Answer: D

- 19 Experimental probability = $\frac{52}{120}$
 $= \frac{13}{30}$

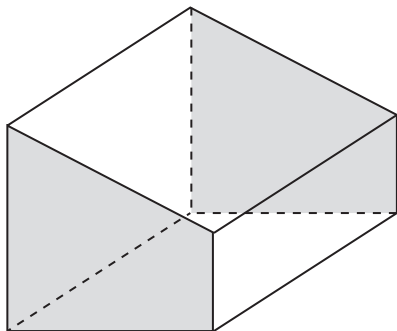
Answer: C

- 20 Probability = $\frac{16}{16+20}$
 $= \frac{16}{36}$
 $= \frac{4}{9}$

Answer: A

Section B

- 1 (a) (i) Total sum of interior angles of a heptagon
 $= (7-2) \times 180^\circ$ (✓)
 $= 900^\circ$
- (ii) Number of sides, $n = \frac{360^\circ}{72^\circ} = 5$ (pentagon)
- (iii) The sum of exterior angles of any polygon is 360° . (✓)
- (b) (i)



The two shaded polygons are congruent and parallel. (True)

(ii)



The two shaded surfaces are circular. The centre surface is curved. (False)

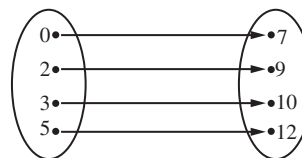
- 2 (a) 98, 89, 80, x , 62, y , ...
-9 -9 -9 -9 -9

$$(i) x = 80 - 9 = 71$$

$$(ii) y = 62 - 9 = 53$$

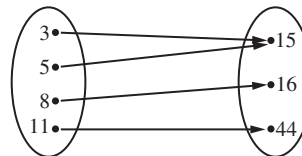
- (b) (i) $20 = 7 + 13(1)$
 $33 = 7 + 13(2)$
 $46 = 7 + 13(3)$
 $59 = 7 + 13(4)$
 $7 + 13n, n = 1, 2, 3, \dots$
- (ii) $7 = 3 + 4(1)^2$
 $19 = 3 + 4(2)^2$
 $39 = 3 + 4(3)^2$
 $67 = 3 + 4(4)^2$
 $3 + 4n^2, n = 1, 2, 3, \dots$

- 3 (a) (i)



One-to-one relation. Therefore, a function. (✓)

- (ii)

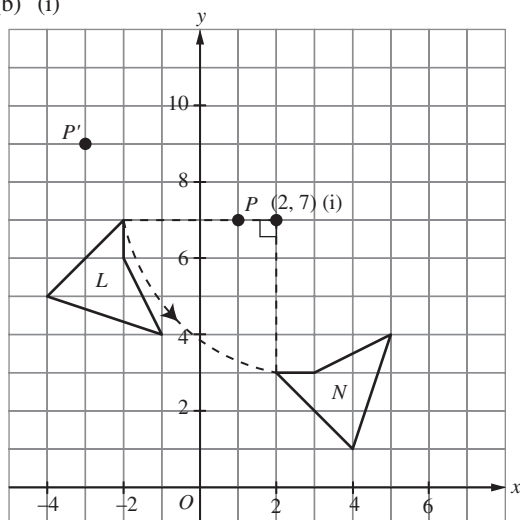


Many-to-one relation. Therefore, a function. (✓)

- (b) • Straight line that has the highest gradient is more vertically inclined.
• Straight line that has the smallest gradient is more horizontally inclined.
 $\therefore CD, EF, GH, AB$

- 4 (a) The images of reflection for P are B and D because B and D have different orientations from P . B and D are laterally inverted.
 $\therefore$ Shade triangles B and D .

(b) (i)



$\therefore (2, 7)$

(ii) $P \rightarrow P': \begin{pmatrix} -4 \\ 2 \end{pmatrix}$

$$\begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} -4 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} - \begin{pmatrix} -4 \\ 2 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ -1 \end{pmatrix}$$

$\therefore (6, -1)$

5 (a) (i) 32 is the mode because it has the highest frequency. Frequency is 3.

(ii) Median $= T_7 + T_8$

$$= \frac{32 + 36}{2}$$

$$= 34$$

(b) If each of the data is multiplied by 2, then

(i) New mean $= 2 \times \text{Original mean}$

$$= 2 \times 15$$

$$= 30$$

(ii) New median $= 2 \times \text{Original median}$

$$= 2 \times 18$$

$$= 36$$

Section C

1 (a) (i) $6x - 18x^2 = 6x(1 - 3x)$

(ii) $25y^2 - 81 = (5y)^2 - 9^2$
 $= (5y + 9)(5y - 9)$

(iii) $2x^2 + 2xy - 7x - 7y$
 $= 2x(x + y) - 7(x + y)$
 $= (2x - 7)(x + y)$

(b) (i) 24, 41, 58, 75, ...

$$+17 \quad +17 \quad +17$$

$$24 = 7 + 17(1)$$

$$41 = 7 + 17(2)$$

$$58 = 7 + 17(3)$$

$$75 = 7 + 17(4)$$

$$\text{Pattern} = 7 + 17n, n = 1, 2, 3, \dots$$

(ii) $7 + 17n = 245$

$$17n = 245 - 7$$

$$n = \frac{238}{17}$$

$$= 14$$

$$\therefore T_{14} = 245$$

(c) $\frac{5}{4mn} - \frac{m}{8n^2} = \frac{5(2n)}{4mn(2n)} - \frac{m(m)}{8n^2(m)}$
 $= \frac{10n}{8mn^2} - \frac{m^2}{8mn^2}$
 $= \frac{10n - m^2}{8mn^2}$

2 (a) (i) $v = u + 4a$

$$4a = v - u$$

$$a = \frac{v - u}{4}$$

(ii) $\frac{2}{5}x = \frac{3}{4}(20) - 3$

$$\frac{2}{5}x = 15 - 3$$

$$x = \frac{5}{2} \times 12$$

$$= 30$$

(b) (i) Length of wire $= \frac{135^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 14$

$$= 33 \text{ cm}$$

(ii) Circumference $= 33$

$$2 \times \frac{22}{7} \times r = 33$$

$$r = \frac{33 \times 7}{44}$$

$$= 5.25 \text{ cm}$$

(c) $A = (4a + 5)(3b - 1)$

$$A = 12ab - 4a + 15b - 5$$

$$A + 4a + 5 = 12ab + 15b$$

$$A + 4a + 5 = 3b(4a + 5)$$

$$b = \frac{A + 4a + 5}{3(4a + 5)}$$

3 (a) (i) Chord

(ii) Minor sector

(iii) Minor segment

(b) $\frac{1}{3} \times 12 \times 10 \times h = 760$

$$40h = 760$$

$$h = \frac{760}{40}$$

$$= 19$$

(c) Total surface area $= 1\,430 \text{ cm}^2$

$$\pi r^2 + 2\pi rh + \pi rs = 1\,430$$

$$\left(\frac{22}{7} \times 7^2\right) + \left(2 \times \frac{22}{7} \times 7 \times 21\right) + \left(\frac{22}{7} \times 7 \times x\right) = 1\,430$$

$$154 + 924 + 22x = 1\,430$$

$$22x = 1\,430 - 1\,078$$

$$22x = 352$$

$$= \frac{352}{22}$$

$$= 16$$

- 4 (a) $Q = \text{Midpoint of } PR$

$$(2, m) = \left(\frac{-3 + n}{2}, \frac{2 + 8}{2} \right)$$

$$(2, m) = \left(\frac{-3 + n}{2}, 5 \right)$$

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

$$-3 + n = 4$$

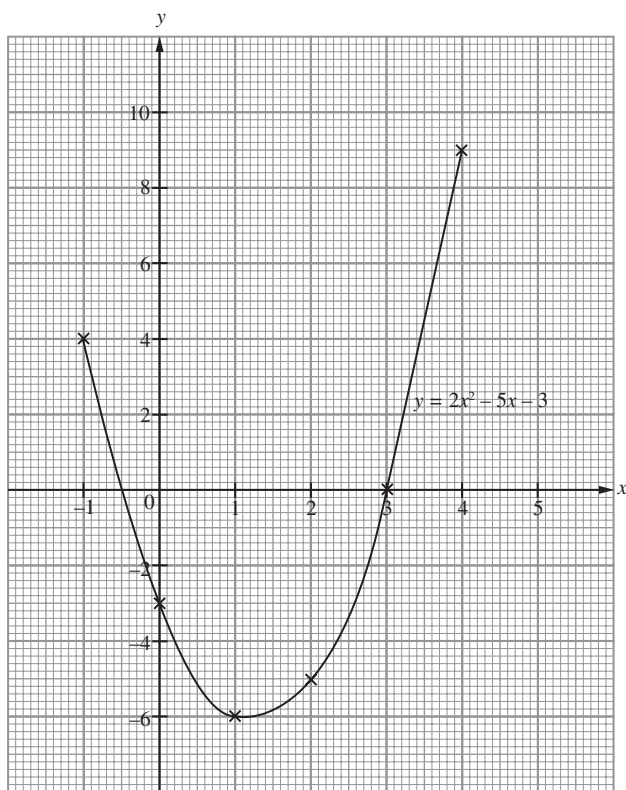
$$n = 7$$

(b) (i) $y = 2(1)^2 - 5(1) - 3$

$$= 2 - 5 - 3$$

$$= -6$$

(ii)



- (c) Area of $PQR = 33 \text{ units}^2$

$$\frac{1}{2} \times PQ \times h = 33$$

$$\frac{1}{2} \times (8 - 2) \times h = 33$$

$$3h = 33$$

$$h = 11$$

y-coordinate of $R = 7 - 11$

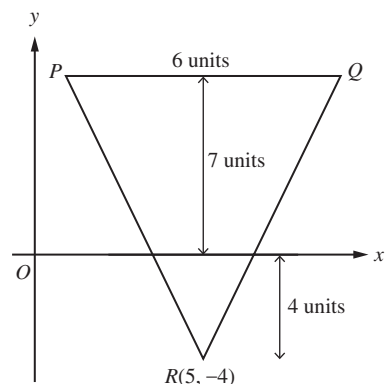
$$= -4$$

$$\text{Midpoint of } PQ = \left(\frac{2 + 8}{2}, 7 \right)$$

$$= (5, 7)$$

x-coordinate of $R = 5$

$$\therefore R(5, -4)$$



- 5 (a) $1705 - 0935 = 730$

Time = 7.5 hours

$$\text{Average speed} = \frac{540 \text{ km}}{7.5 \text{ h}} = 72 \text{ km/h}$$

(b) $S = \{(K, 4)(K, 7)(N, 4)(N, 7)(O, 4)(O, 7)(W, 4)(W, 7)\}$

(i) $\{O, 7\}$

$$P(\text{vowel and prime number}) = \frac{1}{8}$$

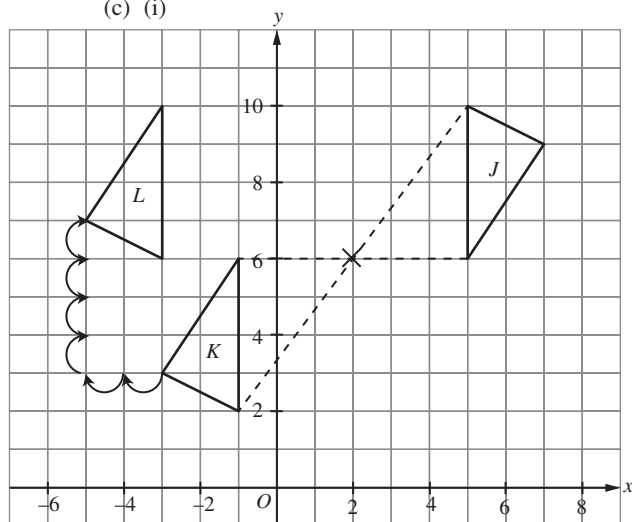
(ii) $\{(K, 4), (N, 4), (W, 4)\}$

$$P(\text{consonant and even number}) = \frac{3}{8}$$

(iii) $\{(W, 4)\}$

$$P(\text{letter W and number 4}) = \frac{1}{8}$$

(c) (i)



(ii) Rotation of 180° about the centre $(1, 8)$

- 6 (a) (i) 41 – 50

(ii)

Marks	Midpoint (x)	Frequency (f)	fx
21 – 30	25.5	4	102
31 – 40	35.5	9	319.5
41 – 50	45.5	12	546
51 – 60	55.5	3	166.5
		$\Sigma f = 28$	$\Sigma fx = 1134$

$$\text{Mean} = \frac{1\ 134}{28}$$

$$= 40.5$$

$$\begin{aligned} \text{(b) (i) } x + 5 + y + 11 + 6 &= 36 \\ x + y &= 36 - 22 \\ &= 14 \end{aligned}$$

$$\begin{aligned} \text{(ii) } x = 4, 4 + y &= 14 \\ y &= 10 \end{aligned}$$

x	3	6	9	12	13	
f	4	5	10	11	6	$\Sigma f = 36$
fx	12	30	90	132	78	$\Sigma fx = 342$

$$\begin{aligned} \text{(a) Mean} &= \frac{342}{36} \\ &= 9.5 \text{ kg} \end{aligned}$$

$$\text{(b) Median} = \text{Average data} \left[\left(\frac{36}{2} \right)^{\text{th}} \text{ and } \left(\frac{36}{2} + 1 \right)^{\text{th}} \right]$$

$$= \text{Average data at } (18^{\text{th}} \text{ and } 19^{\text{th}})$$

$$= \frac{T_{18} + T_{19}}{2}$$

$$= \frac{9 + 9}{2}$$

$$= 9 \text{ kg}$$

$$\text{Mode} = 12 \text{ kg}$$