

ANSWERS TO THE JSC QUESTIONS.[Includes 2016 Q]

Section 1 Calculations; rounding off; standard form and significant figures.

1. (a) $\frac{1}{11} = \underline{0.091}$

(b) $2.1 \times 10^{-2} = \underline{0.021}$

2. $2.1 \times 10^{-2} - 2.1 \times 10^{-3} = 2.1 \times 10^{-2} - 0.21 \times 10^{-2} = \underline{1.89 \times 10^{-2}}$

3. (a) $5(17 - 4) + 6 = 5 \times 13 + 6 = 65 + 6 = 71$

(b) $64 - \sqrt[3]{27} \times 8 = 64 - 3 \times 8 = \underline{40}$

4. $3 - 7 = \underline{-4^\circ\text{C}}$

5. (a) 1.875×10^6

(b) $1875000 \div 5000000 = 0.375 \text{ persons/km}^2$

6. $1.67 \times 10^{-5} = 0.0000167 \text{ g}$

7. $27.0567 \rightarrow \underline{26.06}$ in two d.pl.

8. $2.7 \times 10^{-2} = \underline{0.027}$

Section 2 Sequences and patterns.

1.

Number of squares	1	2	3	<u>5</u>
Number of matches	4	7	<u>10</u>	16

2. (a) (i) Work out $3 \div 3 = \underline{1}$

(ii) Square numbers.

$(5 + 7) \div 3 = \underline{4}$

$(7 + 9 + 11) \div 3 = \underline{9}$

$(9 + 11 + 13 + 15) \div 3 = \underline{16}$

(b) Find x if $x^2 = 1^2 + 4^2 + 8^2 = 1 + 16 + 64 = 81$ so $\underline{x = 9}$ [$x = 9$ or $x = -9$ is a better answer].

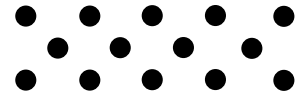
3. (a) 6, 7

(b) 64

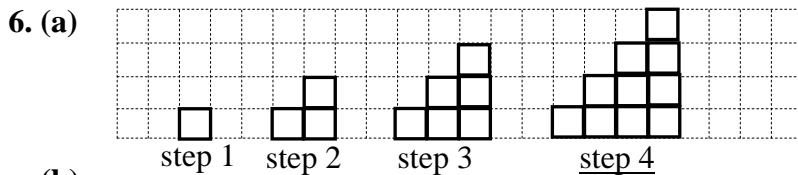
4. (a)

position	1	2	3	4	5
number	4	7	<u>10</u>	13	<u>16</u>

(b) diagram 4:



5. 49



Section 3 Roots; powers; factors and multiples

1. 15

2. (a) (i) 254 (ii) $10.5 \times 7 + 17.5 = \underline{91}$ (iii) 99 (iv) 15

(b) (i) 25 (ii) 49 (iii) 21 [Remark not all numbers fit nicely]

3. (a) 8 (b) 42 (c) 23 (d) 25 (e) 27

4. (a) (i) 2 and 3 (ii) 1; 2; 3 and 6. (iii) 6

(b) LCM of 24 and 30 is 120

5. 56 is a multiple of 7

6. $36 = 2 \times 2 \times 3 \times 3$ or $36 = 2^2 \times 3^2$.

7. LCM of 8 and 7 is 56

8. (a) $216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^3 \times 3^3$ (b) $\sqrt[3]{216} = 6$
 9. (a) 32 (b) 35 (c) 31 or 37 (d) 36

Section 4 Ordinary fractions and percentages.

1. $1 - \frac{3}{5} = \frac{2}{5}$ as percentage: $\frac{2}{5} \times 100 = 40\%$

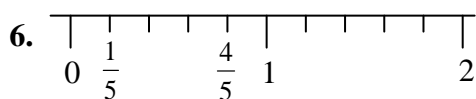
2. $\frac{99}{132} = \frac{33}{44}$

3. (a) $16\ 500 = 1.65 \times 10^4$ (b) $\frac{1}{5} \times 100 = 20\%$ (c) $16\ 500 \times 0.7 = 11\ 550$ (d) $\frac{1}{5} : \frac{1}{4} = 4 : 5$

[This question is not perfectly clear. The sum of the fractions in the second column is more than 1 so maybe some of the regular smokers have lack of physical exercise but in part (d) they are seen as separate people. It is better to avoid such confusion in an exam question.]

4. (a) $0.56 = \frac{56}{100} = \frac{56 \div 4}{100 \div 4} = \frac{14}{25}$ (b) $28\% = \frac{28}{100} = \frac{28 \div 4}{100 \div 4} = \frac{7}{25}$

5. (a) $470\ 000 - 360\ 000 = 110\ 000$ (b) $\% \text{ increase} = \frac{\text{increase}}{\text{old value}} \times 100 = \frac{110\ 000}{360\ 000} \times 100 = 30.6\%$



7. $\frac{45}{100} = \frac{45 \div 5}{100 \div 5} = \frac{9}{20}$

8. $21 \div \frac{3}{13} = 21 \times \frac{13}{3} = 7 \times 13 = 91$

9. $\frac{40-23}{40} \times 100 = \frac{17}{40} \times 100 = \frac{170}{4} = 42.5\%$

10. (a) $0.17 = \frac{17}{100}$ (b) $\frac{1}{4} \times 100 = 25\%$

11. $\frac{40}{100} \times 1\ 100 = 0.4 \times 1\ 100 = \text{N\$}440$

12. $\frac{7.5}{100} \times 88 = 6.6 \text{ kg}$

13. (a) $0.28 \times 3\ 850 = 1\ 078 \text{ books}$ (b) $\frac{140}{3850} = \frac{14}{385} = \frac{2}{55}$ (c) $1.14 \times 3850 = 4\ 389 \text{ books}$

Section 5 Finances; loss; profit.

1. $0.54 \times 1100 = \text{N\$}594$

2. $(25 \div 50) \times 100\% = 50\%$

3. $\text{N\$}124.40 \div 4 = \text{N\$}31.10$

4. (a) $160 \div 4 = 40 \text{ hours.}$ (b) $40 \times \text{N\$}3.50 = \text{N\$}140$

5. (a) $9 \times 425 = \text{N\$}3825$ (b) $(595 - 425) \div 425 \times 100 = 40\%$

6. (a) $2.20 \div 4 = \text{N\$}0.55$

(b) $3 \times \text{N\$}3.10 = \text{N\$}9.30$ (c) $\frac{2.43}{16.20} \times 100 = 15\%$

7. (a) $259.95 - 189.95 = \text{N\$}70$ (b) $\frac{70}{259.95} \times 100\% = 26.9\%$

8. (a) $75\ 000 - 50\ 000 = \text{N\$}25\ 000 \text{ profit}$ (b) $\frac{25000}{50000} \times 100\% = 50\% \text{ profit}$

Section 6 Ratio and proportion

1. (a) cola : lemonade = $84 : 54 = 14 : 9$ (b) $28 \div 7 = 4$ so they sold $7 \times 5 = 35 \text{ lemonade}$

2. (a) $5/20 = \frac{1}{4}$ (b) $7/20 \times 12\ 600\ 000 = 4\ 410\ 000 \text{ votes}$

3. (a) $5.5 \times 2.5 = 13.75 \text{ litre}$ (b) (i) $25 - 13.75 = 11.25 \text{ litre}$ (ii) $13.75/25 \times 100 = 55\%$

4. (a) (i) $1176 : 24 = 49 : 1$ (ii) $\frac{24}{1176+24} = \frac{24}{1200} = \frac{1}{50}$ (iii) 98%

(b) 98% means 98 g out of every 100 g so there is $4 \times 98 = 392 \text{ g}$ of iron in 400g of steel.

5. (a) (i) $P : R = 1800 : 2700 = (1800 \div 900) : (2700 \div 900) = 2 : 3$ (ii) $\frac{2}{3} \times 15 = 10 \text{ years old.}$

(b) $\frac{40}{100} \times 1800 = \text{N\$ } 720.$

(c) (i) $0.7 \times 2700 = \text{N\$}1890$

(ii) $\frac{1890}{2700} \times 100 \% = 70\%$ spend so he still has 30%

6. square beads to round beads = $3 : 6 = \underline{1 : 2}$

7. $\frac{4}{7} \times 28 = \underline{16 \text{ girls}}$

8. More men \rightarrow less time so $2 \times 3 = 6$ so time: $3 \div 3 = \underline{1 \text{ day}}$

9. $25 \times 33 = \underline{825 \text{ learners.}}$

10. (a) $0.05 \times 105 = \underline{5.25 \text{ ℓ}}$ of fuel

(b) $5.25 \times 9.98 = \underline{\text{N\$}52.40}$

Section 7 Rate; average speed ;covered distance and distance time graphs.

1. 200 km in 2.5 h that is 400 km in 5 hours = $400 \div 5 = \underline{80\text{km/h}}$

2. (a) (i) 5 km

(ii) $35 - 15 = \underline{20 \text{ minutes}}$

(b) 5 km in 15 minutes is 1 km in 3 minutes = $\frac{1}{3}$ km/minute

3. 100 metres in 25 seconds = 4m/s

4. $4 \times 120 = \underline{480 \text{ km}}$

Section 8 Exchange rate and other rates.

1. $2400 \div 10.24 = \text{US\$ } 234.38$

2. (a) (i) Shop A: $2.56 \times 2 = \underline{\text{N\$}5.12};$

(ii) Shop B: $12.20 \div 2.5 = \underline{\text{N\$ } 4.88}$

(b) Shop B

3. (a) $57780 - 3780 = \underline{\text{N\$ } 54000}$

(b) $\frac{27}{100} (54000 - 40000) = 0.27 \times 14000 = \underline{\text{N\$ } 3780}$

4. Twice as long: $2 \times 7 = \underline{14 \text{ minutes.}}$

5. $420 \times 0.07 = \underline{\text{€}29.40}$

6. $511.50 \div 33 = \text{N\$}15.50 \text{ per m}^3$

7. $2400 \div 18 = \underline{\text{£}133.33}$

8. (a) $12 \times 21\,679 = \underline{\text{N\$ } 260148}$

(b) (i) $260148 - 1200 - 13308 = \underline{\text{N\$}245640}$

(ii) Tax bracket C.

(iii) $9000 + 0.25 \times (245640 - 100001) = \underline{\text{N\$}45409.75}$

Section 9 Conversions of units.

1. $20 \times 10\,000 = \underline{200\,000 \text{ m}^2}$

2. $20 \times 10\,000 = \underline{200\,000 \text{ m}^2}$

3. (a) $\frac{3}{4}$ litres = 750 ml

(b) $540\,000 \text{ m}^2 = \underline{54 \text{ ha.}}$

4. length pencil is 11 cm

5. Perimeter = $12 + 8 + 12 + 8 = \underline{40 \text{ cm}}$

6. $1\,250 \text{ cm}^3 = \underline{1.25 \text{ litres.}}$

7. (a) $525 \text{ ha} = \underline{5\,250\,000 \text{ m}^2}$

(b) $2 \text{ ℓ} = \underline{2000 \text{ ml}}$

(c) $7500 \text{ cm}^3 = \underline{7.5 \text{ litres (ℓ)}}$

Section 10 Circles and other area calculations

1. (a) diameter

(b) $C = 2 \pi r = 2 \times \frac{22}{7} \times 7 = \underline{44 \text{ cm}}$

2. Area = $\frac{1}{2}$ base \times height = $30 = \frac{1}{2} h \times 12 \rightarrow$ height = 5 cm [The theorem of Pythagoras can be used as well]

3. Area kite = $\frac{1}{2} \times$ product diagonals = $\frac{1}{2} \times 6 \times 8 = \underline{24 \text{ cm}^2}.$

4. Area circle = $\pi r^2 = \pi \times 21^2 = \frac{22}{7} \times 21 \times 21 = 22 \times 63 = \underline{1386 \text{ cm}^2}$

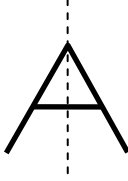

5. (a) trapezium

(b) $\text{Area}_{\text{trapezium}} = \frac{1}{2}h(a + b) = \frac{1}{2} \times 6(5 + 12) = 51 \text{ cm}^2$

Section 11 Angle calculations and bearings.

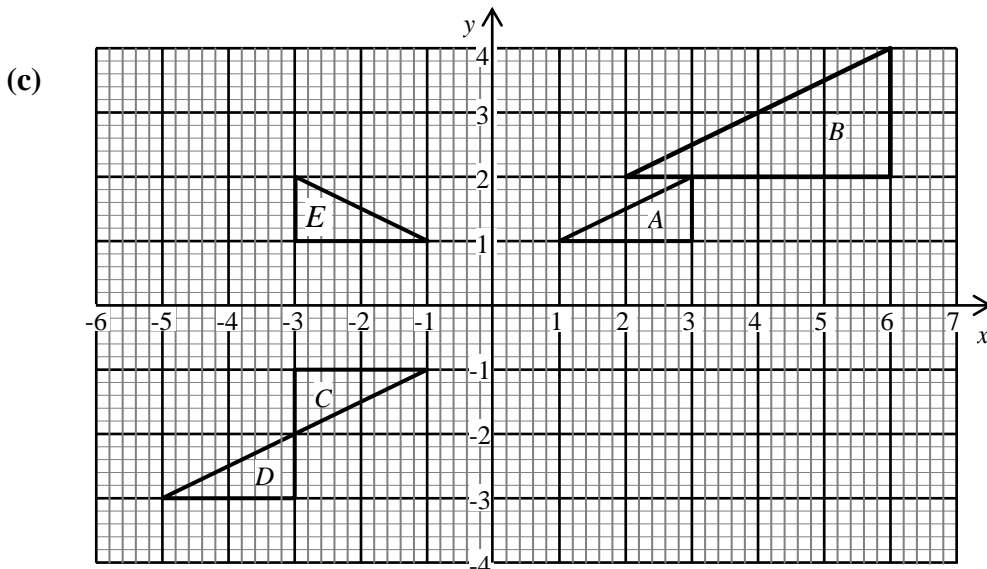
1. (a) $120^\circ \rightarrow$ obtuse angle (b) $200^\circ \rightarrow$ reflex angle
2. (a) kite (b) $x = (360^\circ - 150^\circ - 70^\circ) \div 2 = 140^\circ \div 2 = 70^\circ$
3. (a) $4x + 130 + 2x + 110 = 360$ so $6x = 120 \rightarrow x = 20^\circ$
 (b) (i) $4x = 180 - 20$ so $x = 160 \div 4 = 40^\circ$ (ii) $y = 180 - 118 = 62^\circ$
4. (a) (i) 90° (ii) 3 quadrilateral $\rightarrow 3 \times 360 = 1080^\circ$.
 (b) (i) $x = 360 - (135 + 62) = 163^\circ$ (ii) $y = 180 - 163 = 17^\circ$ [Co-interior angles]
 (c) trapezium
5. (a) (i) $x = 30^\circ$ (ii) $y + 80^\circ + 30^\circ = 180^\circ$ so $y = 70^\circ$
 (b) (i) $a = 70^\circ$ (Alternating angles) (ii) $b = 180 - 70 - 50 = 60^\circ$ (iii) $c = 180 - 50 = 130^\circ$
6. 5 triangles can be drawn inside a seven sided shape \rightarrow sum of the angles = $5 \times 180^\circ = 900^\circ$.
7. (a) $m = 89^\circ$ [Alternating angles] (b) $n = 78^\circ$ [Corresponding angles]
8. $360 \div 40 = 9$ so no of sides is 9.
 [Or use the formula: $(180 - 40) = \frac{(n-2)180}{n}$ or $140n = 180n - 360$ so $40n = 360 \rightarrow n = 9$]
9. (a) (i) $x = 180 - 360 \div 5 = 108^\circ$ (ii) $y = 180 - 108 = 72^\circ$
 (b) $z = 360 - (120 + 85 + 80) = 360 - 285 = 75^\circ$
 (c) $w = 90 - 65 = 25^\circ$

Section 12 Symmetry

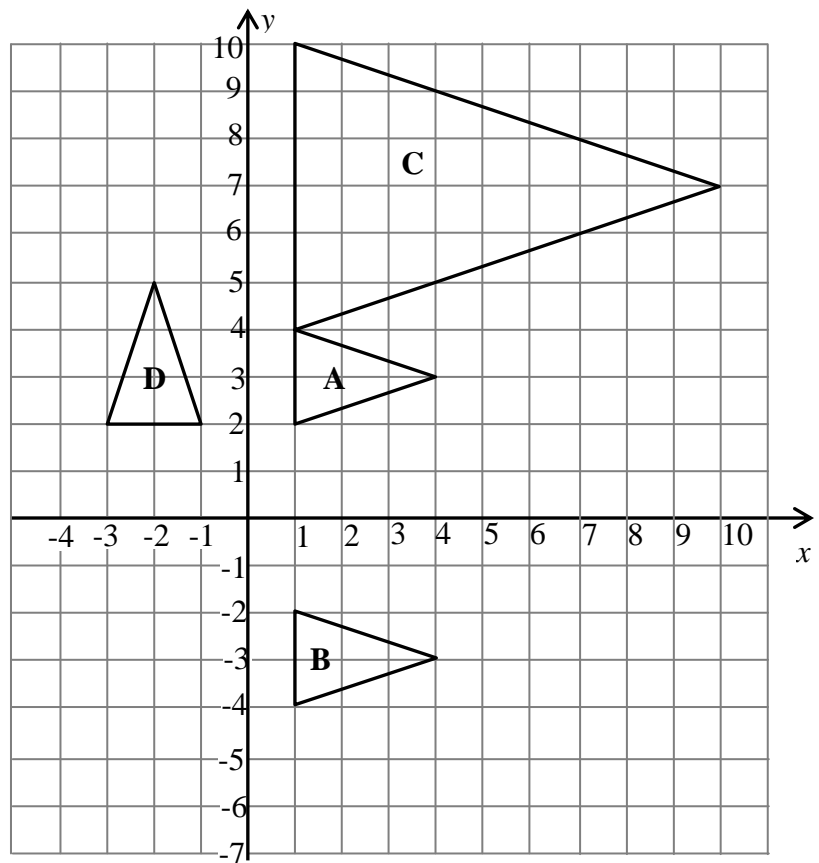
1. (a) order is 2 (b) 
2. (a) 8
 (b) 3 quadrilateral $\rightarrow 3 \times 360 = 1080^\circ$
 (c) interior angle = $1080^\circ \div 8 = 135^\circ$
 (d) exterior angle = $180 - 135 = 45^\circ$
3. (a) (i) Only the letter H (ii) S (b) 

Section 13 Transformations

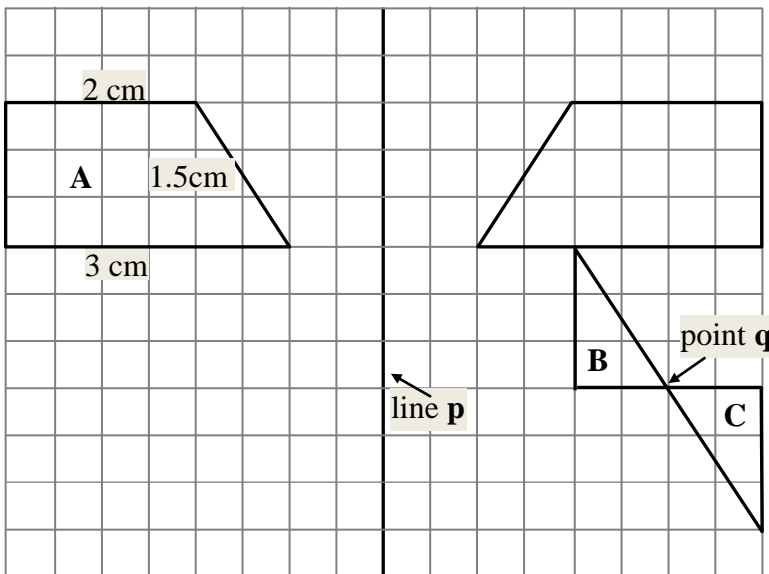
1. (a) 18 cm (b) scale factor is 6
2. (a) Centre is (0, 0) or origin; factor 2 (b) Rotation of 180° about intersecting point. (-3, -2)



3. (a) See grid
 (b) (i) Scale factor is 3.
 (ii) Centre is (1, 1)
 (c) Rotation of 90° anticlockwise
 About (0, 1).



4. (a) (i) Trapezium (ii) Area shape $A = \frac{1}{2}h(a + b) = \frac{1}{2} \times 1.5 \times (2 + 3) = 3.75 \text{ cm}^2$ (iii) see diagram.



B is mapped onto C by a rotation of 180° about point q.

5. Factor is 3
 6. Reflection in the y-axis [or $x = 0$]
 7. (a) Centre: (3, 2) (b) enlargement factor 3; centre (-1, 0)

Section 14 Algebra

1. (a) (i) $t^2 \times t^6 = t^8$ (ii) $4(3x + 2) = 12x + 8$
 (b) $3(2x - 1) = 3$ or $6x - 3 = 3$ or $6x = 6 \rightarrow x = 1$
 2. (a) $-3 \leq x \leq 2$ (b) -3
 3. (a) $4x + 20$ (b) $9x + 5 = 4x + 20$ (c) $5x = 15 \rightarrow x = 3 \text{ kg}$
 4. (a) $3x^2 + 5xy + 4x^2 - 9xy = 7x^2 - 4xy$ (b) $9a(2a^2 - 3ab - 1) = 18a^3 - 27a^2b - 9a$

5. (a) $y = 4 \times 8 + 12 \times 2 = 56$

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

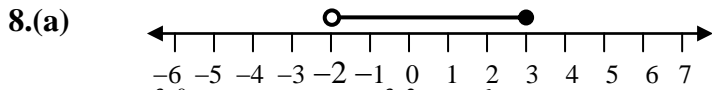
6. (a) $x + 25$

(b) (i) $x + x + 25 = 51$ or $2x + 25 = 51$

(ii) $2x = 26 \rightarrow x = 13$ years

7. (a) $3x - 9xy = 3x(1 - 3y)$

(b) $3y - 7 = y + 4$ or $2y = 11 \rightarrow y = 5.5$



(b) $16m - 4 - 9m = 17$ or $7m = 21 \rightarrow m = 3$

(c) (i) $(2x^3)^0 = 1$ (ii) $(2x^3)^2 = 4x^6$

9. 4

10. (a) $3x = 15$

(b) $x = 5.$

11. $3y + 4x + 2y - 6x = -2x + 5y$

12. (a) $\frac{12a^3b^6c}{6a^2b} = 2ab^5c$

(b) $22x + 11xy = 11x(2 + y)$

13. (a) $2x^2 \times 14y = 28x^2y$

(b) $2(3x - 1) = 4(x - 3)$ or $6x - 2 = 4x - 12 \rightarrow 2x = -10 \rightarrow x = -5.$

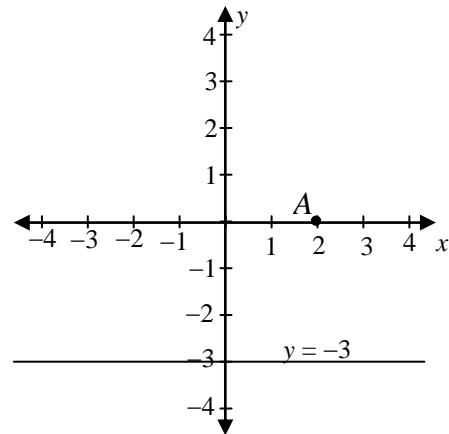
14.(a) $x + 6$

(b) $x + x + 6 = 24$ or $2x + 6 = 24$

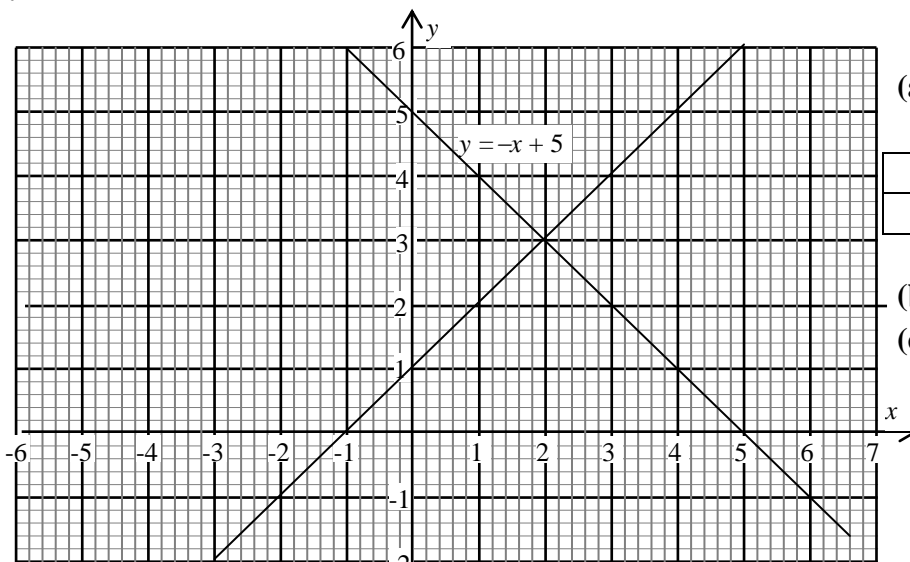
(c) $2x + 6 = 24 \rightarrow 2x = 18 \rightarrow x = 9.$

Section 15 Coordinate geometry

1. (a) see diagram \rightarrow (b) as well.



2.



(a) Complete the table of values for the equation $y = x + 1.$

x	-2	0	2	<u>4</u>
y	<u>-1</u>	1	3	5

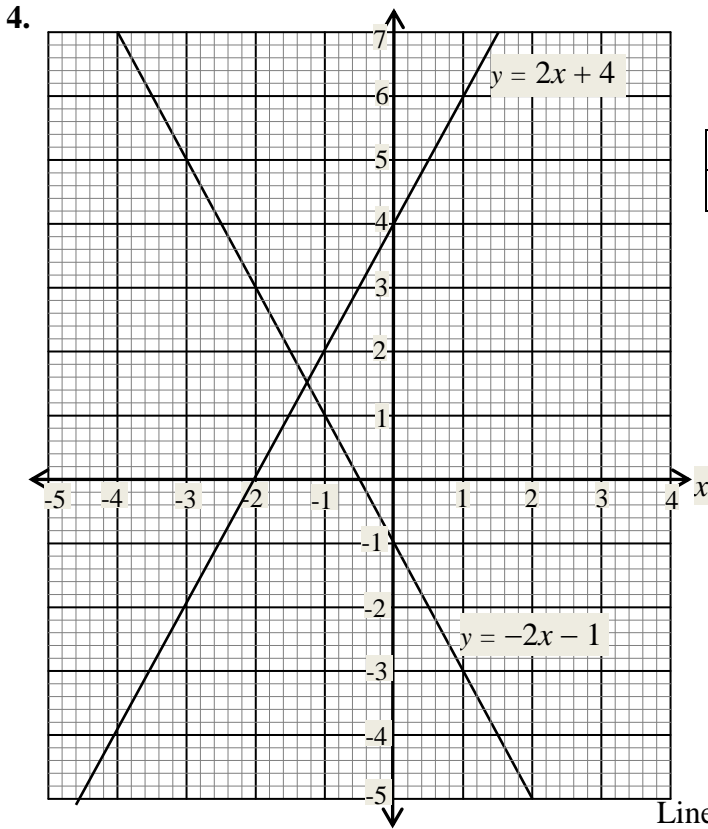
(b) See diagram

(c) (2, 3)

3. (a) (i) $x = -3$

(ii) $y = 2$

(b) (-3, 2)



(a) The y-intercept is 4

(b) Complete the table below for $y = -2x - 1$

x	-4	-3	-2	0	2
y	7	<u>5</u>	3	<u>-1</u>	-5

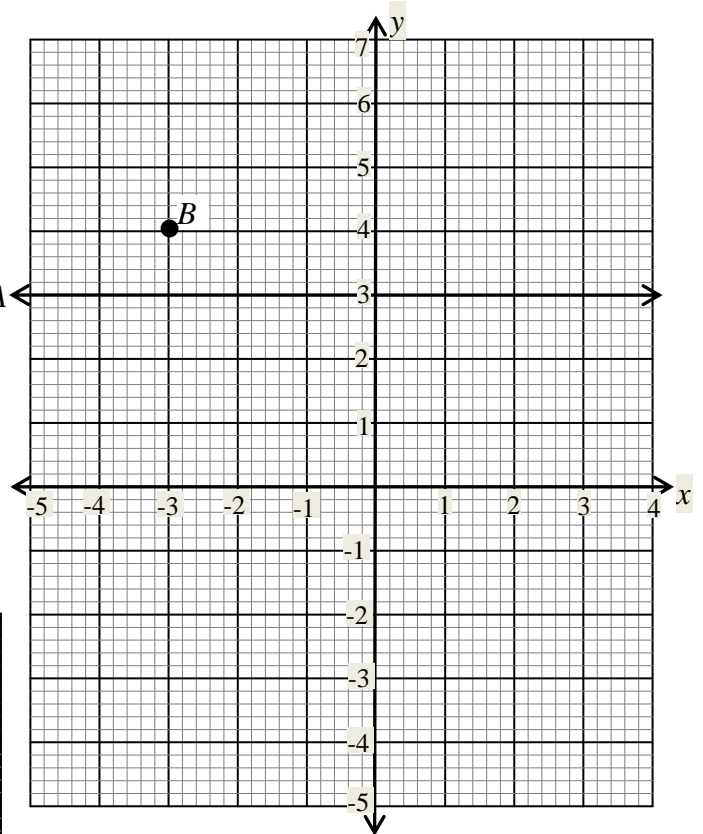
(c) See grid.

5. (a) $y = 3$

(b) see diagram $\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow$

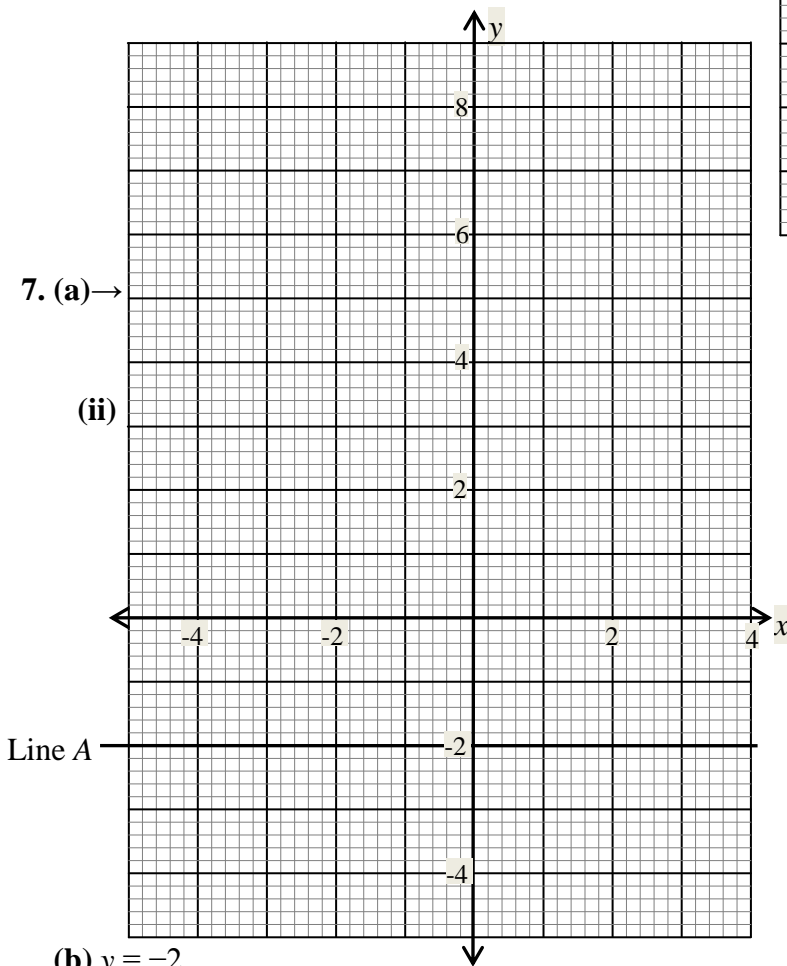
6. (a) N\$160

(b) 28 books



7. (a) \rightarrow

(ii)



(b) $y = -2$.

(i)

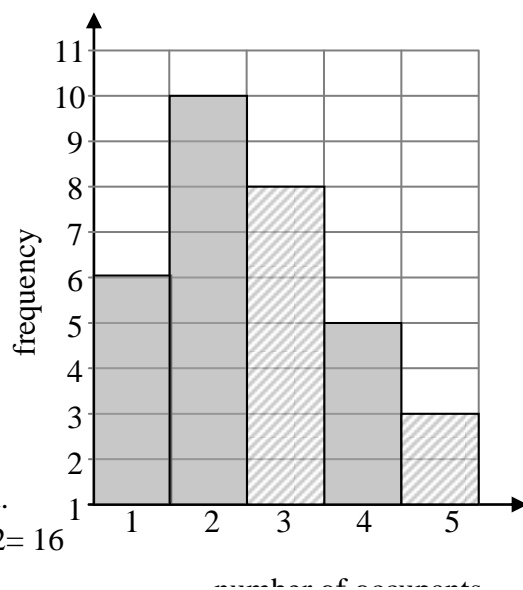
x	-3	-2	0	2	3
y	-3	<u>-1</u>	3	7	<u>9</u>

Section 16 Statistics

1. (a) $(63 + 32 + 34 + 64 + 32 + 27 + 35) \div 7 = \underline{32.9}$ (b) mode is 32 (c) median is 34
 2. (a) 6 men (b) $2 + 6 + 9 + 16 + 10 + 3 + 2 = \underline{48 \text{ men}}$
 3. (a) (b) Median height is 1.4 m (c) mean is 1.45 m (d) $\frac{3}{15} = \frac{1}{5}$

Height (m)	frequency	$h \times f$
1.2	1	1.2
1.3	<u>3</u>	3.9
1.4	3	4.2
1.5	<u>3</u>	4.5
1.6	5	8

4. (a) (i) mode: 2 occupants (c)
 (ii) median: 3 occupants.
 (b) $\text{average} = [(1 \times 6) + (2 \times 10) + (3 \times 8) + (4 \times 7) + (5 \times 3)] \div 34 = \underline{2.7 \text{ occupants}}$



5. (a) 2-4 km
 (b) 2 learners
 6. (a) February (b) 5 months (c) $36 \div 12 = 3 \text{ b.d.}$
 7. (a) (i) mode is 16 (ii) median is 10 (iii) range is 18 - 2 = 16
 (b) $\frac{3}{15} = \frac{1}{5}$

Section 17 Trigonometry and Pythagoras.

1. (a) $\sin \hat{ABC} = \frac{3}{5}$ (b) $\tan \hat{ACB} = \frac{4}{3}$
 2. (a) $\text{angle } TAL = 180^\circ - 90^\circ - 3^\circ = \underline{87^\circ}$ (b) $\tan TAL = \tan 87^\circ = \frac{TL}{100}$ so $TL = 100 \times \tan 87^\circ = \underline{1908 \text{ m}}$
 3. $c = \sqrt{(24^2 + 10^2)} = \sqrt{(576 + 100)} = \sqrt{676} = \underline{26}$
 4. (a) $90 - 40 = \underline{50^\circ}$ (b) $\sin 50^\circ = 5/\text{dist}$ so $\text{dist} = 5 \div \sin 50^\circ = \underline{6.53 \text{ km}}$
 5. (a) $x = 36.9^\circ$ [Use cos] (b) $AB = \sqrt{(10^2 - 8^2)} = \sqrt{36} = \underline{6 \text{ cm.}}$
 6. $AC = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = \underline{13 \text{ cm}}$
 7. (a) $\cos 55^\circ = \frac{x}{r}$ (b) $\tan 35^\circ = \frac{x}{y}$
 8. (a) bearing 090° (b) $\sin 28^\circ = 3/LW$ so $LW = 3 \div \sin 28^\circ = \underline{6.39 \text{ m}}$

Section 18 Comparing numbers

1. (a) $5^3 < 3^5$ (b) $-3 - (-5) > -3 + (-5)$ (c) $9(17 - 8) = 9 \times 17 - 9 \times 8$ (d) $\frac{3}{4} > 0.6$
 2. (a) $\frac{5}{8} > \frac{5}{9}$ (b) $\frac{3}{4} = 75\%$ (c) $6^2 < 2^6$ (d) $-3.7 < -3.5$
 3. -3 °C
 4. 0.3 < 0.33 < 0.35
 5. $\frac{5}{7} \frac{5}{3} \frac{5}{2}$
 6. (a) $100 > 100^0$ (b) $\frac{1}{7} < \frac{1}{3}$ (c) $0.375 = \frac{3}{8}$ (d) $88\% > \frac{7}{8}$

Section 19 Interest and hire purchase.

1. (a) $3 \times 48 \times 15 = \underline{\text{N\$}2160}$ (b) $4800 + 2160 = \underline{\text{N\$}6960}$
 2. (a) $\frac{3}{4} \times 5000 = \underline{\text{N\$}3750}$ (b) $3750(1 + 0.04)^3 = \underline{\text{N\$}4218.24}$
 3. (a) $\frac{20}{100} \times 2660 = \underline{\text{N\$}532}$ (b) $532 + 16 \times 165 = \underline{\text{N\$}3172}$ (c) $3172 - 2660 = \underline{\text{N\$}512}$
 4. $P_t = P_0(1 + r/100)^t = 800 \times 1.05^2 = \text{N\$}882$ so Ben has N\$882 after 2 years.

5. $0.045 \times 3 \times 8500 = \text{N\$}1147.50$

6. $40000 + 60 \times 8674 = \text{N\$}560440$

7. (a) $\frac{4}{5} \times 200000 = \text{N\$}160\,000$

(b) (i) $200\,000 - 160\,000 = \text{N\$}40\,000$

(ii) $40000(1 + 0.085)^3 = 40000 \times 1.085^3 = \text{N\$}51091.57$

Section 20 Interpretation of bills.

1. (a) $31665 - 31445 = \text{220 units}$

(c) $601.45 \times 1.12 = \text{N\$}673.62$

(b) $601.45 - 578.00 = \text{N\$}33.45$

2.(a) (i) $92\,795 - 92\,475 = \text{320 units}$

(b) (i) $\text{N\$}23.65$

(ii) $5885 - 31 = \text{5854 kl}$

(ii) $\frac{1}{2000}$

(iii) $201.50 \div 31 = \text{N\$}6.50 \text{ per kl}$

Section 21 Volume calculations

1.(a) (i) Cereal box is a cuboid.

(b) $\text{Volume} = \pi r^2 h = \frac{22}{7} \times 4^2 \times 14 = \text{704 cm}^3$

(ii) Football is a sphere

(c) $704 \text{ cm}^3 = \text{0.704 litres}$

2. (a) $C = 2\pi r = 2 \times \frac{22}{7} \times 7 = \text{44 cm}$

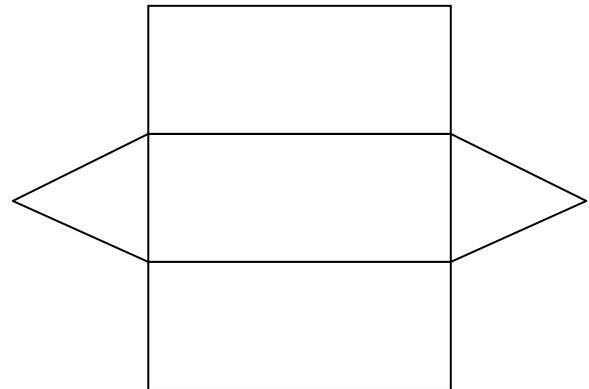
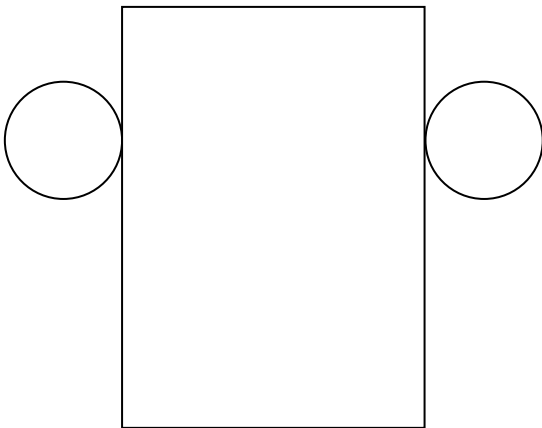
(c) $l \times w \times h = 13 \times 4 \times 7 = \text{364 cm}^3$

(b) $\text{Area} = \frac{1}{2} h(a + b) = \frac{1}{2} \times 5 \times (8 + 3) = \text{27.5 cm}^2$

(d) $6333.5 \text{ cm}^3 = \text{6.3335 litres}$

3. Length of one side = $\sqrt[3]{125} = \text{5 cm}$

4.



5. (a) Use the formula $V_{\text{Cyl}} = \pi r^2 h$ so $200200 = \frac{22}{7} \times 35 \times 35 \times h$ or $200200 = 22 \times 5 \times 35h \rightarrow h = \text{52 cm}$

(b) Volume is $3 \times 3 \times 8 = \text{72 m}^3$

Section 22 Probability

1. (a) Probability = $\frac{1}{9}$

(b) Probability = $\frac{2}{9}$

(c) Probability = $\frac{4}{9}$

2. (a) Probability = $\frac{4}{9}$

(b) Probability = $\frac{2}{9}$

3. (a) Probability = $\frac{2}{7}$

(b) Probability = 0