Solutions (Paper I)

<table>
<tr><td>1 a</td><td>$-38.4(3sf)$</td></tr>
<tr><td>1 b</td><td>364 000</td></tr>
<tr><td>2</td><td>$time\ taken = 0830 - 0715 = 1h\ 15\ min$
$distance = speed \times time = 60 \times 1\frac{15}{60} = 75\ km$</td></tr>
<tr><td>3</td><td>$(x+2)(3x-1) = 0$
$x = -2, or\ \frac{1}{3}$</td></tr>
<tr><td>4</td><td>$deposit = 10\%\ of\ \$1200 = \$120$
$Balance\ to\ pay\ in\ 24\ mths = 1392 - 120 = 1272$
$Monthly\ instalment = 1272 \div 24 = \$53$</td></tr>
<tr><td>5 a</td><td><table><tr><td>2</td><td>16</td><td>56</td></tr><tr><td>2</td><td>8</td><td>28</td></tr><tr><td>2</td><td>4</td><td>14</td></tr><tr><td></td><td>2</td><td>7</td></tr></table>
$LCM = 2 \times 2 \times 2 \times 2 \times 7 = 112$</td></tr>
<tr><td>5 b</td><td>$\sqrt{k} = 2^3 \times 3^2$
$k = 2^6 \times 3^4$</td></tr>
<tr><td>6</td><td>$total\ height\ of\ 7\ boys = 7 \times 1.74 = 12.18$
$total\ height\ of\ 8\ boys = 8 \times 1.76 = 14.08$
$Peter's\ \ height = 14.08 - 12.18 = 1.9\ m$</td></tr>
<tr><td>7</td><td>$volume\ of\ sphere = 7776\ cm^3$
$\frac{4}{3}\pi(2x)^3 = 7776$
$(2x)^3 = 7776 \times \frac{3}{4\pi}$
$2x = \sqrt[3]{\frac{5832}{\pi}}$
$x = \frac{1}{2} \times \frac{18}{\sqrt[3]{\pi}}$
$x = \frac{9}{\sqrt[3]{\pi}}$</td></tr>
</table>

8 a	$y(x+2)\ people$
8 b	$y(13+2) \geq 65$ $15y \geq 65$ $y \geq 4\frac{1}{3}$ $\therefore least\ no\ of\ bumboats = 5.$
9 a	$\frac{(2x)^3}{(3x)^2} \div \frac{18x}{27}$ $= \frac{8x^3}{9x^2} \times \frac{27}{18x}$ $= \frac{4x}{3}\ or\ \frac{4}{3}x$
9 b	$3(2-5y) - 4(y-1)$ $= 6 - 15y - 4y + 4$ $= 2 - 19y$
10 a	$0.74^2 = 0.5476$ $-\frac{7}{4} = -1.75$ $-0.\dot{7}\dot{4} = -0.7474..$ $\sqrt{0.74} = 0.8602..$ $-\frac{7}{4}, -0.\dot{7}\dot{4}, 0.74^2, \sqrt{0.74}$
10 b	$243^y = 2187$ $3^{5y} = 3^7$ $5y = 7$ $y = 1.4$
11 a	$3x - 1 \geq 19$ $3x \geq 20$ $x \geq \frac{20}{3}$
11 b	$\frac{x+1}{2-x} = 3$ $x + 1 = 6 - 3x$ $4x = 5$ $x = 1.25$

12 a	$2\ cm : 0.18\ km$ $= 2\ cm : 18\ 000\ cm$ $= 1 : 9\ 000$
12 b	$length\ scale = 180\ m : 2\ cm$ $= 90\ m : 1\ cm$ $Area\ scale = 90^2\ m^2 : 1^2\ cm^2$ $= 8100\ m^2 : 1\ cm^2$ $50\ m^2 : 50 \div 8100 \approx 0.00617\ cm^2$
13 a	\$460 (from graph)
13 b	$x = \$240$ $y = \frac{800 - 240}{5} = \$112$
14 a	96°
14 b	$360 - 96 - 68 - 105 = 91°$
14 c	$BZ = CZ - BC = 24 - 15 = 9\ cm$
15	Possible answers • Inconsistent scale on the vertical axis exaggerates the difference in Passenger Movements between the years. • Missing axis titles are open to personal interpretation. E.g. 60 on vertical axis can be 60 passengers, 60 thousand passengers or even 60 million passengers.
16	$x = 132 - 68$ (alt. angles, ext. angle of triangle = sum of interior opp. angles) $= 64^o$
17 a	$2(a + 3) - 3b$ $= 2(3x - 1 + 3) - 3(x + 2)$ $= 6x + 4 - 3x - 6$ $= 3x - 2$
17 b	$\frac{a}{2} - \frac{b}{3}$ $= \frac{3x - 1}{2} - \frac{x + 2}{3}$ $= \frac{9x - 3 - 2(x + 2)}{6}$ $= \frac{9x - 3 - 2x - 4}{6}$ $= \frac{7x - 7}{6}$

18 a	$x^2 - 6x + 1$ $= \left(x - \frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 + 1$ $= (x-3)^2 - 8$
18 b	$x^2 - 6x + 1 = 0$ $(x-3)^2 - 8 = 0$ $(x-3)^2 = 8$ $x - 3 = \pm\sqrt{8}$ $x = 3 \pm \sqrt{8}$ $x = 5.83 \ or \ 0.17$
19 a	9, 5, 1
19 b i	$7n - 2$
19 b ii	$14th\ term = 7(14) - 2 = 96$
20 a	3+6+4+2+6+4 = 25
20 b	Position of median = $\left(\frac{25+1}{2}\right)^{th}$ = 13th Median = \$10
20 c	There is no effect on the median amount of pocket money since \$8 is less than the original median (\$10) while \$15 is more than the original median.
21 a	$Interior\ angle\ of\ heptagon\ (7\ sided) = \frac{(7-2)\times 180}{7} = 128\frac{4}{7}°$ $Interior\ angle\ of\ pentagon\ (5\ sided) = \frac{(5-2)\times 180}{5} = 108°$ $x = 360 - 128\frac{4}{7} - 108 = 123\frac{3}{7}° \ or\ 123.4°\ (1dp)$
21 b	$Let\ the\ smallest\ angle\ be\ x.$ $total\ interior\ angles\ of\ hexagon = (6-2)\times 180$ $x + 2x + 2x + 2x + 2x + 2x = 720$ $11x = 720$ $x = 65.5°\ (1dp)$

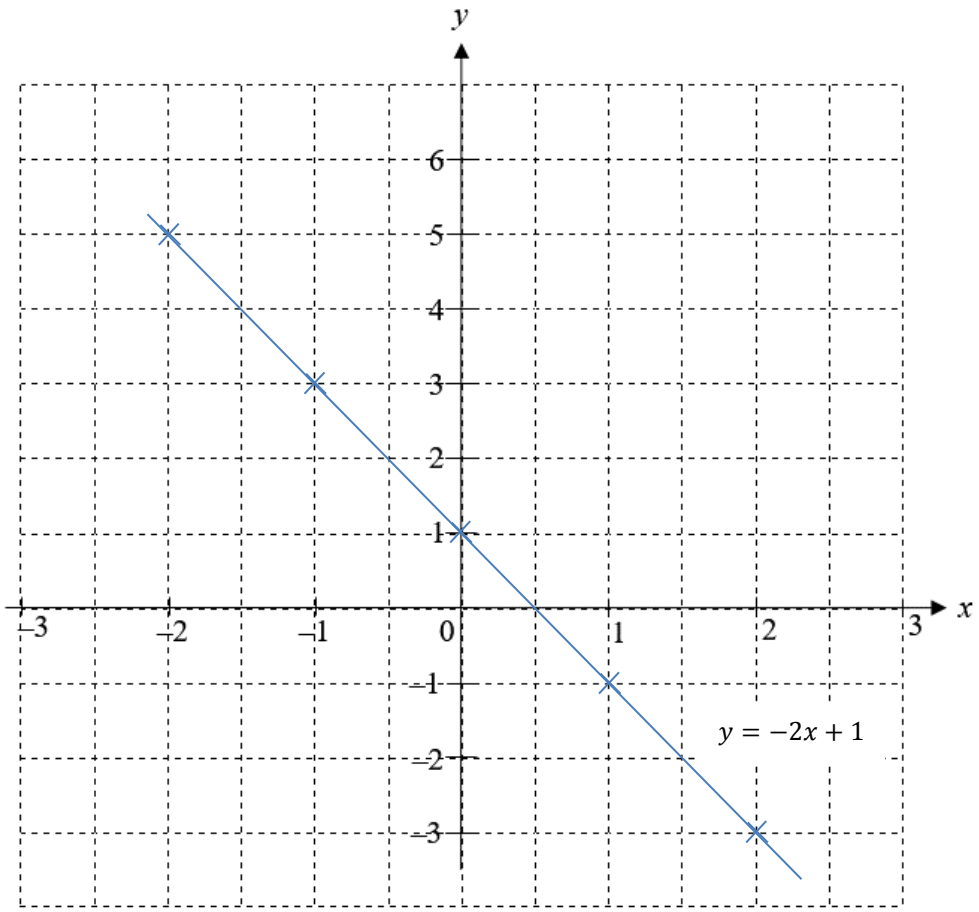
22 a

$y + 2x = 1$

$y = -2x + 1$

x	–2	–1	0	1	**2**
y	5	3	1	**−1**	−3

22 b



22 c

(0.5, 0)

22 d

$gradient\ of\ line = -2$

23 a

$arc\ length\ EF = \frac{75}{360} \times 2\pi(8) = 10.472\ cm$

$perimeter = 10.472 + 8 + 8 = 26.5\ cm$ (to 3 s.f.)

23 b

$reflex\ angle\ EOF = 360 - 75 = 285°$

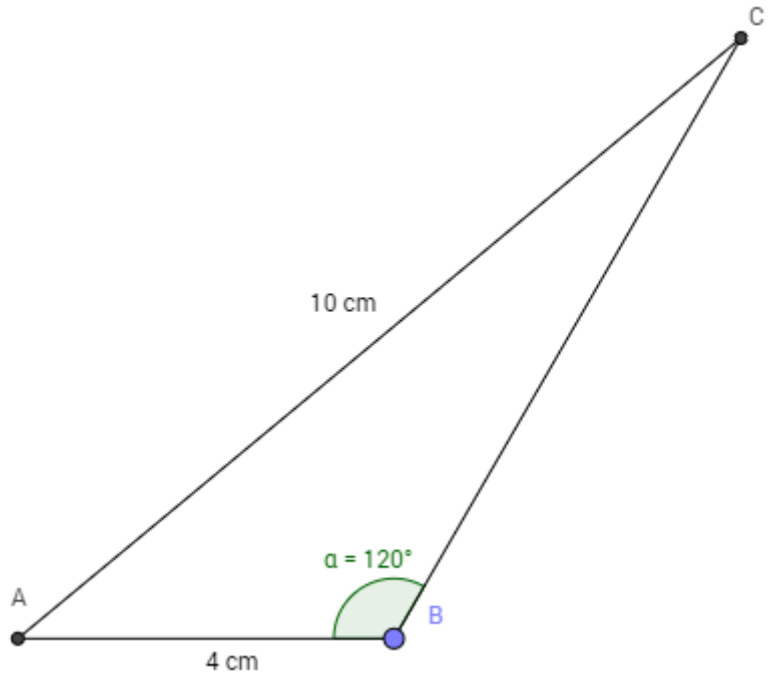
23 c

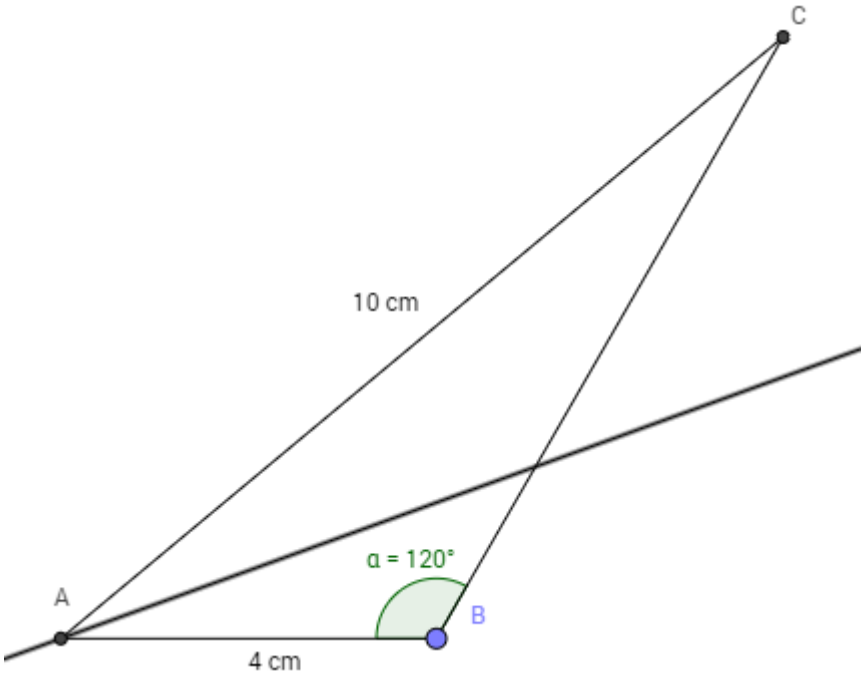
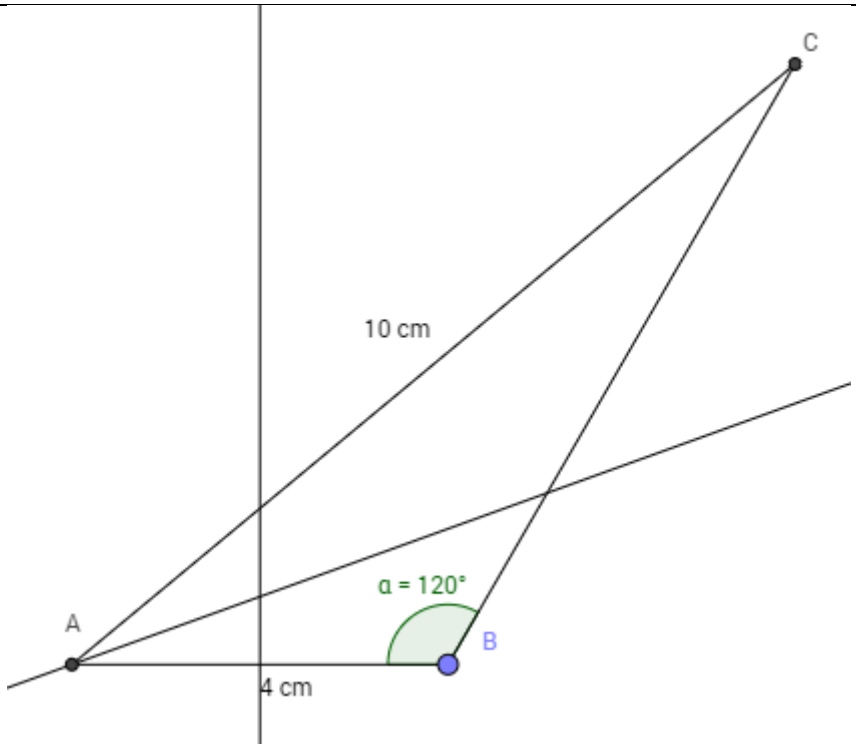
$area\ of\ major\ sector\ EOF = \frac{285}{360}\pi(8)^2 \approx 159\ cm^2$ (to 3 s.f.)

24 a	$PR^2 = 17^2 = 289$ $RQ^2 + PQ^2 = 15^2 + 8^2 = 289$ $since\ PR^2 = RQ^2 + PQ^2, by\ converse\ of\ Pythagoras\ Theorem,$ $therefore\ angle\ PQR\ is\ a\ right\ angle, and\ PQR\ is\ a\ right-angled\ triangle.$
24 b	$\cos(\angle PRS) = -\cos(\angle PRQ) = -\frac{15}{17}$
24 c	$\cos(\angle PRS) = -\frac{15}{17}$ $\angle PRS = \cos^{-1}\left(-\frac{15}{17}\right) = 151.9275131 \approx 151.9°\ (1\ dp)$
24 d	$Area\ of\ triangle\ PSR = \frac{1}{2}(SR)(8) = 28\ cm^2$ $SR = 28 \times 2 \div 8 = 7$ cm

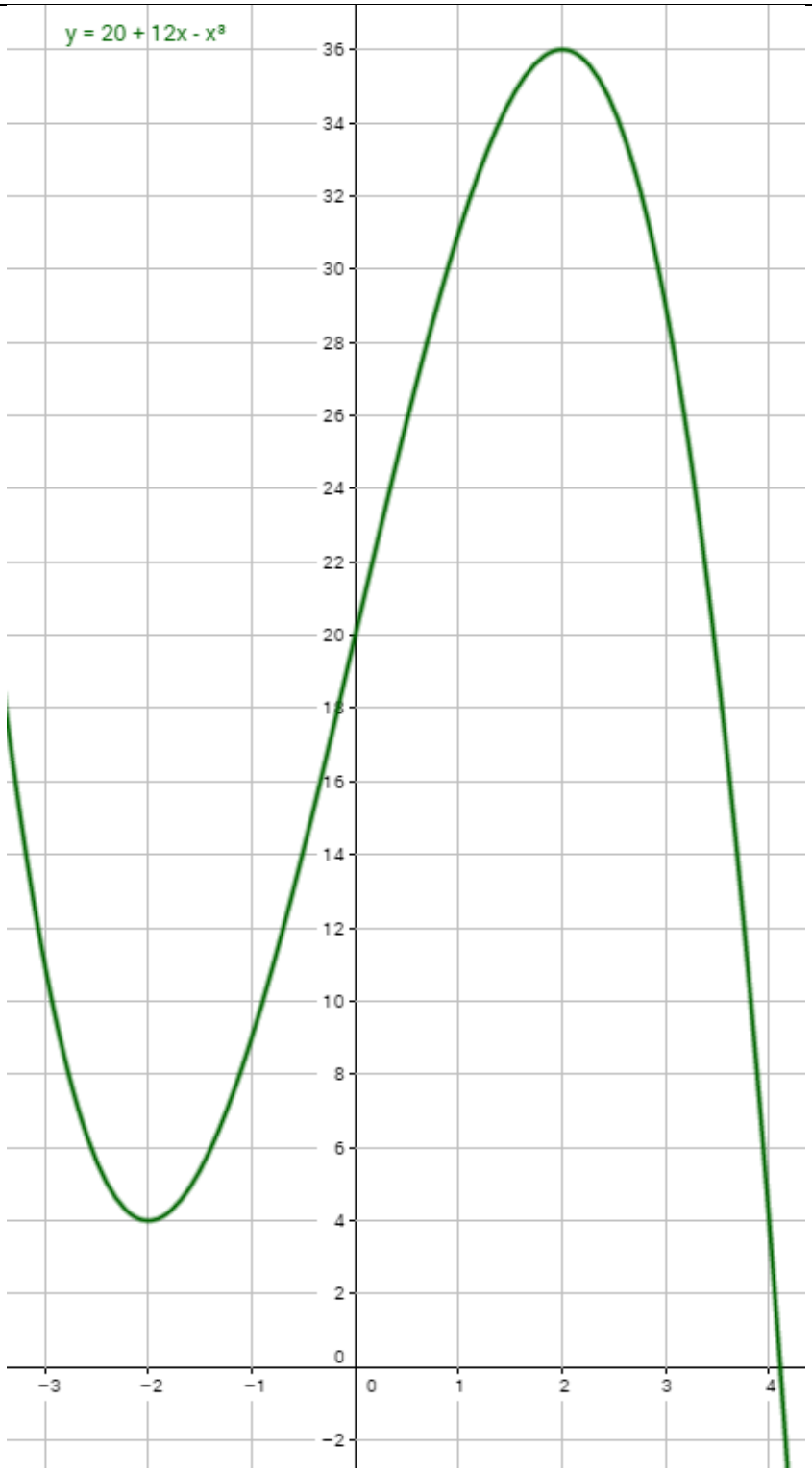
Solutions (Paper II)

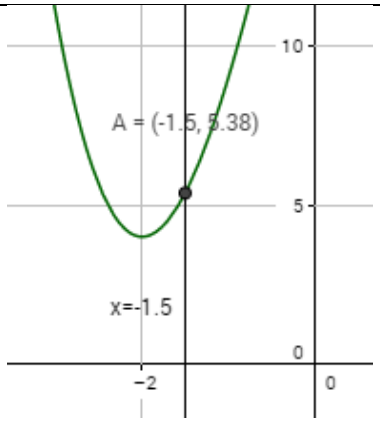
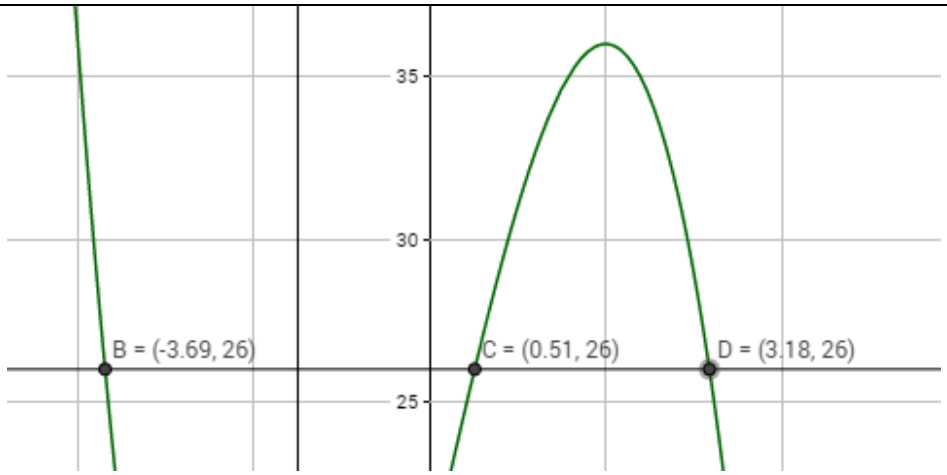
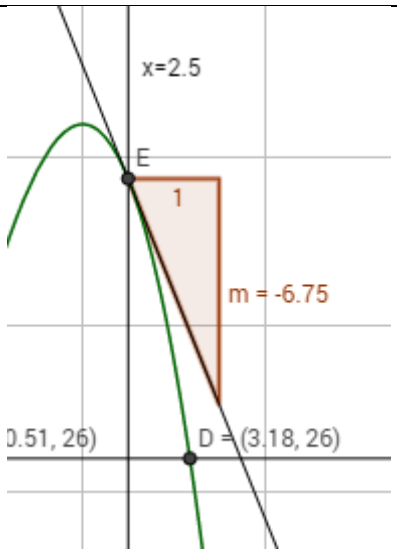
1		$Motorcycles = 360 - 126 - 90 = 144°$ $No\ of\ motorcyles = \frac{144}{360} \times 2200 = 880$
2	a	$Tom\ received = \frac{3}{10} \times 10400 = \$3120$
2	b	$profit\ in\ 2015 = 1.25 \times 10400 = 13000$ $Robin\ received = \frac{7}{10} \times 13000 = \$9100$
3	a	$BC = x + 6\ cm$
3	b	$Area\ of\ triangle = 56\ cm^2$ $\frac{1}{2}(x)(x+6) = 56$ $x^2 + 6x - 112 = 0$ $x = 8\ cm\ \ or\ -14(rej)$
3	c	$Longest\ side = AC = \sqrt{8^2 + 14^2} \approx 16.1\ cm$ Perimeter = 16.1 + 8 + 14 = 38.1 cm $(3sf)$
4	a	$simple\ interest = (800)\left(\frac{1.3}{100}\right)\left(\frac{16}{12}\right) \approx \$13.87$
4	b	$compound\ interest = (800)\left(1 + \frac{1.3}{100} \times \frac{1}{12}\right)^{16} - 800 \approx \$13.98$
5	a	$Let\ y = \frac{k}{x^3}\ where\ k\ is\ a\ constant$ $100 = \frac{k}{2^3}$ $k = 800$ $\therefore y = \frac{800}{x^3}$
5	b	$y = \frac{800}{4^3} = 12.5$
5	c	$6.4 = \frac{800}{x^3}$ $x = \sqrt[3]{\frac{800}{6.4}} = 5$

6	a	$V = \frac{4}{3}\pi r^3$ $r^3 = \frac{3V}{4\pi}$ $r = \sqrt[3]{\frac{3V}{4\pi}}$
6	b	$2x = 5y + 10$ $2x - 5y = 10 \ldots\ldots\ldots (1)$ $x + 2y = 23 \ldots\ldots\ldots (2)$ $from\ (2) : x = -2y + 23 \ldots\ldots\ldots (3)$ $sub\ (3)\ into\ (1) :\ 2(-2y + 23) - 5y = 10$ $-4y + 46 - 5y = 10$ $-9y = -36$ $y = 4$ $sub\ y = 4\ into\ (3) : x = -2(4) + 23 = 15$ $\therefore x = 15, y = 4$
7	a	

7 b	 Construction lines must be visible.
7 c	 Construction lines must be visible.

8	a	$(11,3)\ , (-3,-9), (-5,5)$
8	b	$equation\ of\ PQ$: $y-4=\frac{4-(-2)}{3-(-4)}(x-3)$ $y=\frac{6}{7}x-\frac{18}{7}+4$ $y=\frac{6}{7}x+\frac{10}{7}$
8	c	$when\ x=0,$ $y=\frac{10}{7}$. $\therefore y-intercept=\left(0,\frac{10}{7}\right)$ $when\ y=0,$ $\frac{6}{7}x=-\frac{10}{7}$ $x=-\frac{10}{6}=-\frac{5}{3}$ $\therefore x-intercept=\left(-\frac{5}{3},0\right)$

9	a	$p = 20 + 12(-2) - (-2)^3 = 4$
9	b	

9	c i	 Accept y = 5.3, 5.35, 5.4, 5.45
9	c ii	 Accept x = –3.75, –3.7, –3.65, –3.6 0.45, 0.5, 0.55 3.1, 3.15, 3.2, 3.25
9	c iii	 $gradient = -6.75 \pm \pm 1$

10 a

$surface\ area\ of\ hemisphere = \frac{1}{2}(4)\pi(3)^2 = 18\pi\ cm^2$

$curved\ surface\ area\ of\ cylinder = 2\pi(3)(5) = 30\pi\ cm^2$

$Total\ internal\ surface\ area\ of\ room = 18\pi + 30\pi = 48\pi\ cm^2$

10 b

$vol\ of\ hemisphere = \frac{1}{2}\left(\frac{4}{3}\right)\pi(3)^3 = 18\pi\ cm^3$

$vol\ of\ cylinder = \pi(3)^2(5) = 45\pi\ cm^3$

$vol\ of\ seal = 45\pi + 18\pi = 63\pi\ cm^3$

10 c

Weight using Agate = $2.64 \times 63\pi = 522.5$ g

Weight using Shoushan = $3.34 \times 63\pi = 661.1$ g

Weight using Jade = $3.25 \times 63\pi = 6.43.2$ g

Jade and Agate could be used.

11 a i

Weight (kg)	$30 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$	$60 < x \leq 70$	
Class Mark (x)	35	45	55	65	
Frequency (f)	1	12	17	3	$\sum f = 33$
fx	35	540	935	195	$\sum fx = 1705$
fx^2	1225	24300	51425	12675	$\sum fx^2 = 89625$

(calculator function method without working is also accepted, no need to do above table, but must show below steps)

$mean\ weight, \bar{x} = \frac{\sum fx}{\sum f} = \frac{1705}{33} = 51\frac{2}{3}\ kg$

11 a ii

$Standard\ deviation = \sqrt{\frac{\sum fx^2}{\sum f} - (\bar{x})^2}$

$= \sqrt{\frac{89625}{33} - \left(\frac{1705}{33}\right)^2}$

$= 6.82\ kg\ (3sf)$

11 a iii

Class B's students are generally heavier since the mean weight for class B is higher than class A.

Class A's students's weights are more widely spread than Class B since Class A's Standard deviation is higher than class B.

11	b	$P(diff\ colours)$ $= P(G,R) + P(R,G)$ $= \frac{14}{30} \times \frac{16}{29} + \frac{16}{30} \times \frac{14}{29}$ $= \frac{224}{435}$
12	a	$angle\ OZY = 62°\ (alt\ angles)$ $angle\ ZOY = 180 - 2(62) = 56°\quad (isos\ triangle)$ $bearing\ of\ X\ from\ O = 62 + 56 + 90 = 208°$
12	b	$YZ = \sqrt{120^2 + 120^2 - 2(120)(120)\cos 56°} = 112.6731751 \approx 113\ m\ (3sf)$
12	c	$Area\ of\ triangle\ OYZ = \frac{1}{2}(120)(120)\sin 56° = 5969.070522 \approx 5970\ m^2$
12	d	$Let\ the\ shortest\ distance\ from\ Z\ to\ OY\ be\ h.$ $Area\ of\ triangle\ OYZ = 5969.070522$ $\frac{1}{2}(OY)(h) = 5969.070522$ $h = \frac{5969.070522 \times 2}{120}$ $= 99.48451$ $\approx 99.5\ m$