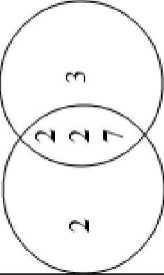
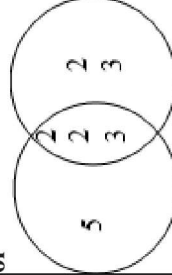


**Unit 2 Higher Tier  
Mark scheme**

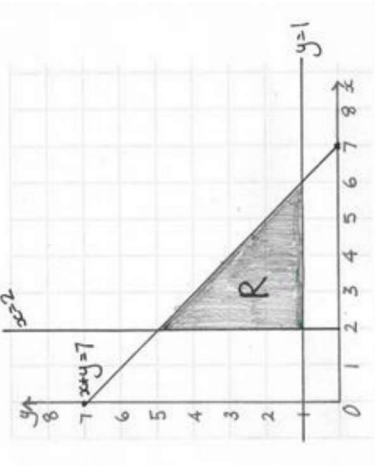
Apart from questions where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
1	$5 \times 12 (= 60)$ <b>or</b> $\frac{15 + 7 - 2 + 23 + x}{5} = 12$ <b>or</b> $\frac{x + "43"}{5} = 12$		3	M1 for a method to find the total of the 5 numbers <b>or</b> setting up an equation in $x$ "43" comes from $15 + 7 - 2 + 23$
	$x + 15 + 7 - 2 + 23 = "60"$ <b>or</b> $x + "43" = "60"$ <b>or</b> $"60" - (15 + 7 - 2 + 23)$			M1 for forming an equation with their 60 <b>or</b> for a complete calculation to find the value of $x$ "43" comes from $15 + 7 - 2 + 23$
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	17		A1
				<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes															
2 (a)	<p>1, 2, 4, 7, 8, 14, 28, 56 and 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84 <b>or</b> 2 2 2 7 and 2 2 3 7</p>  <p><b>or</b></p> <table border="1"> <tr> <td>eg</td> <td></td> <td></td> </tr> <tr> <td>28</td> <td>56</td> <td>84</td> </tr> <tr> <td></td> <td>2</td> <td>3</td> </tr> </table>	eg			28	56	84		2	3		2	<p>M1 for any correct valid method <b>and</b> no errors eg for starting to list at least <b>four</b> different factors of each number <b>and</b> no errors <b>or</b> 2 2 2 7 <b>and</b> 2 2 3 7 seen (may be in a factor tree <b>or</b> a ladder diagram <b>and</b> ignore 1) <b>or</b> a fully correct Venn diagram <b>or</b> other clear method, e.g. table</p>						
eg																			
28	56	84																	
	2	3																	
(b)	<p><i>Working required</i> 60, 120, 180, 240... <b>and</b> 72, 144, 216, 288... <b>or</b> 2 2 3 5 <b>and</b> 2 2 2 3 3</p> <table border="1"> <tr> <td>2</td> <td>60</td> <td>72</td> </tr> <tr> <td>2</td> <td>30</td> <td>36</td> </tr> <tr> <td>3</td> <td>15</td> <td>18</td> </tr> <tr> <td>2</td> <td>5</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td>3</td> </tr> </table> <p><b>or</b></p>  <p><b>or</b> <math>\frac{60 \times 72}{12}</math> <b>or</b> 2, 2, 2, 3, 3, 5 oe</p> <p><i>Working required</i></p>	2	60	72	2	30	36	3	15	18	2	5	6			3	28	2	<p>A1 dep M1 accept <math>2^2 \times 7</math> oe M1 for any correct valid method <b>and</b> no errors eg for starting to list at least <b>four</b> multiples of each number <b>or</b> 2 2 3 5 <b>and</b> 2 2 2 3 3 seen (may be in a factor tree <b>or</b> a ladder diagram <b>and</b> ignore 1) <b>or</b> a fully correct Venn diagram <b>or</b> other clear method, eg. table</p>
2	60	72																	
2	30	36																	
3	15	18																	
2	5	6																	
		3																	
		360		A1 dep M1 accept $2^3 \times 3^2 \times 5$ oe															
				<b>Total 4 marks</b>															

Question	Working	Answer	Mark	Notes
3	$(4^n =)(2^2)^n$ <b>or</b> $(4^n =)2^{2n}$ oe eg $2^k \div 2^{2n} = 2^x$ <b>or</b> $2^k = 4^{\frac{1}{2}k}$ <b>and</b> $2^x = 4^{\frac{1}{2}x}$ oe eg $\frac{4^{\frac{1}{2}k}}{4^{\frac{1}{2}x}} = 4^{\frac{1}{2}x - \frac{1}{2}k}$		2	M1 for writing $4^n$ as $(2^2)^n$ <b>or</b> $2^{2n}$ <b>or</b> for writing each term in terms of 4 ie $2^k = 4^{\frac{1}{2}k}$ <b>and</b> $2^x = 4^{\frac{1}{2}x}$ If these things are seen in working, award this mark even if followed by incorrect working – if not a choice of methods
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	$k - 2n$		A1 allow $2^{k-2n}$
				<b>Total 2 marks</b>

Question	Working	Answer	Mark	Notes
4	$7x + 3x + 8x = 360$ oe $(x =) 360 \div 18 (=20)$ $360 \div (180 - 7 \times "20")$ oe <b>or</b> $360 \div (180 - "140")$ $\frac{(n-2) \times 180}{n} = 7 \times "20"$ oe $360 \div 40$		4	M1 M2 for $7x = 140$ M1 (140 can be on diagram) M1 for $360 \div$ exterior angle
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	9		A1
				<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
5 (a)(i) (ii) (iii)	 <p>Line length 2cm + but shaded area must be enclosed for the mark in (b)</p>		3	B1 $y = 1$ drawn B1 $x = 2$ drawn B1 $x + y = 7$ drawn Allow dashed lines <b>or</b> solid lines for graphs <b>condone lack of labels if unambiguous</b>
(b)			1	B1 correct region shaded – shaded in <b>or</b> out – labelled <b>R</b> or clear intention to be the required region (ft only for one vertical line, one horizontal line <b>and</b> one line with a negative gradient)
<b>Total 4 marks</b>				

Question	Working	Answer	Mark	Notes
6			3	M1 for $d = 9$ or $(c + d) \div 2 = 8$ (algebraically or clearly labelled integers) or $d - a = 4$ (algebraically or clearly labelled integers)
				M1 for two of $a = 5$ or $c = 7$ or $d = 9$ or $(c + d) \div 2 = 8$ (algebraically or clearly labelled integers) or $d - a = 4$ (algebraically or clearly labelled integers)
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	$a = 5, b = 6,$ $c = 7, d = 9$		A1 All correct
				<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes
7	$1.4 = \frac{72}{(\text{area})} \text{ oe}$		4	M1 $1.4 = \frac{72}{(\text{area})} \text{ oe}$
	$(\text{area}) = \frac{72}{1.4} (= \frac{360}{7} = 51.4\dots) \text{ oe}$			M1 $(\text{area}) = \frac{72}{1.4} (= \frac{360}{7} = 51.4\dots) \text{ oe}$
	$"51.4\dots" \times 18 \text{ or}$ $r = \sqrt{\frac{"51.4\dots"}{\pi}} (= 4.046\dots) \text{ and}$ $\pi \times "4.046\dots" \times 18$			M1 "51.4..." $\times 18$ <b>or</b> $r = \sqrt{\frac{"51.4\dots"}{\pi}} (= 4.046\dots) \text{ and}$ $\pi \times "4.046\dots" \times 18$
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	926		A1 Allow 925 – 928
				<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
8 (a)	$1 + 0.04 (= 1.04)$ <b>or</b> $100(\%) + 4(\%) (= 104(\%))$ <b>or</b> $\frac{634\,400}{104} (= 6100)$ <b>oe</b>		3	M1
	$634\,400 \div "1.04"$ <b>or</b> $634\,400 \div "104" \times 100$ <b>or</b> $634\,400 \times 100 \div "104"$ <b>oe</b>			M1
		610 000		A1
(b)	$"0.85" \times "0.85" (= 0.7225)$ <b>oe or</b> $"0.85" - ("0.85" \times 0.15) (= 0.7225)$ <b>or</b> $\frac{100}{"85" \times "85"} (= 72.25)$ <b>oe or</b> [0.85 <b>and</b> 85 must come from correct working]		3	M1 allow use of their amount M2 for eg $200 \times "0.85" \times "0.85" (= "85")$ <b>or</b> $15 + 12.75$
	$1 - "0.7225" \text{ or } 0.2775 \text{ or } 100 - "72.25"$			M1 eg $\frac{200 - "144.5"}{200} (\times 100)$
		27.75		A1 <b>oe</b> allow 27.8 <b>or</b> 28
				<b>Total 6 marks</b>

Question	Working	Answer	Mark	Notes
9 (a)		$8.9 \times 10^{-5}$	1	B1
(b)		83 400	1	B1
				<b>Total 2 marks</b>

Question	Working	Answer	Mark	Notes
10	$300 \div (7 + 5 + 3) (=20)$ <b>clear correct use</b> of $7 + 5 + 3 (= 15)$ eg division at the end by 15 $\left( \frac{"2.8" + "1.8"}{15} \right)$ <b>or</b> correct use of 15 in a fraction eg $\frac{2}{5} \times \frac{7}{15}$		5	M1 (no mark for "15" unless it is used correctly) use of $7 \times 20$ <b>or</b> $140$ <b>or</b> $5 \times 20$ <b>or</b> 100 in further work assumes this mark
	$\frac{2}{5} \times (7 \times "20") (= 56)$ oe eg $0.4 \times 140 (= 56)$ <b>or</b> $\frac{2}{5} \times 7 \left( = \frac{14}{5} = 2.8 \right)$ <b>or</b> eg $\frac{2}{5} \times \frac{7}{15} \left( = \frac{14}{75} = 0.186\dots \right)$			M1 finding $\frac{2}{5}$ of the number of birthday cards <b>or</b> $\frac{2}{5}$ of the share of 7 <b>or</b> $\frac{2}{5}$ of fraction of amount
	$0.36 \times (5 \times "20") (=36)$ <b>or</b> $0.36 \times 5 (= 1.8)$ <b>or</b> eg $\frac{36}{100} \times \frac{5}{15} \left( = \frac{180}{1500} = 0.12 \right)$ oe			M1 finding 36% of anniversary cards <b>or</b> 36% of the share of 5 <b>or</b> 36% of fraction of amount
	$\frac{"56" + "36"}{300}$ <b>or</b> eg $\left( \frac{"2.8" + "1.8"}{15} \right)$ <b>or</b> $\frac{14}{5} + \frac{9}{15}$ $\frac{14}{75} + \frac{180}{1500}$			M1 for any fraction from correct working that isn't simplified <b>or</b> 30.66..% <b>or</b> 0.3066...
	Correct answer scores full marks (unless from obvious incorrect working).	$\frac{23}{75}$		A1 cao
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
11	eg $7x + 3y = 3$ $9x - 3y = 21$ <b>or</b> eg $7x + 3(3x - 7) = 3$ <b>or</b> $7\left(\frac{7+y}{3}\right) + 3y = 3$		3	M1 a correct method to eliminate $x$ <b>or</b> $y$ – multiplying one <b>or</b> both equations so that one variable can be eliminated (allow a total of one error in multiplication) <b>and</b> the correct operation to eliminate <b>or</b> for substitution of one variable into the other equation.
	If first M1 gained then they can substitute an incorrect value if from ‘correct’ method to gain this mark.			M1 dep on M1 for a correct method to calculate the value of other letter eg substitution <b>or</b> starting again with elimination
	<i>Working required</i>	$x = 1.5, y = -2.5$		A1 oe dep on M1
				<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes
12	$\frac{2}{5}x + 0.45x + 405$		5	M1 Do <b>NOT</b> award M1 for eg $\frac{2}{5} + 45(\%) + 405 (= \dots)$ oe
	$\frac{2}{5}x + 0.45x + 405 = x$ oe			M1 for a correct equation
	$(x =) \frac{405}{1 - \frac{2}{5} - 0.45} \left( \frac{405}{\frac{3}{20}} = 2700 \right)$			M1
	$0.45 \times "2700"$			M1
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	1215		A1
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
13 (a)		5	1	B1 cao
(b)	$y(x - 6) = 2x$ <b>or</b> $yx - 6y = 2x$ $x(x - 2) = 6y$		3	M1 for multiplying the denominator
				M1 for isolating the $x$ <b>or</b> $y$ terms <b>and</b> factorising
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	$\frac{6x}{x-2}$		A1 accept $\frac{-6x}{2-x}$ (must be a function of $x$ )
				<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
14 (a)(i)		140	1	B1
(ii)		opposite angles of a cyclic quadrilateral (add to 180°) or	1	B1 dep on B1 in (a)(i) <b>or</b> seeing 180 – 40 with no contradiction or eg angle at centre is double (2 ×) angle at circumference. <b>or</b> <b>and</b> angles around a point ( <b>or</b> point 360)
(b)	$A\hat{D}B = 66$ <b>or</b> $A\hat{B}O = 90 - 66 (=24)$ <b>or</b> $B\hat{A}O = 90 - 66 (=24)$ <b>or</b> $O\hat{D}B = \frac{180 - 80}{2} (=50)$ <b>or</b> $DO\hat{B}$ reflex = 280		3	M1 Clearly labelled in working <b>or</b> shown on diagram
	For 2 of: $A\hat{D}B = 66$ <b>or</b> $A\hat{B}O = 90 - 66 (=24)$ <b>or</b> $B\hat{A}O = 90 - 66 (=24)$ <b>or</b> $O\hat{D}B = \frac{180 - 80}{2} (=50)$ $DO\hat{B}$ reflex = 280			M1 award M2 for 360 – (280 + 40 + 24) <b>or</b>
	Correct answer scores full marks (unless from obvious incorrect working).	16		A1
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
15 (a)	<i>If a graph is ascending, you can ft for the marks in parts (b), (c) an (d) – method should be shown by way of marks on the axes for all but the median in part (b).</i>	Correct cf graph	2	B2 <b>(use overlay)</b> Fully correct cf graph – points at ends of intervals <b>and</b> joined with curve <b>or</b> line segments. B1 for 6 or 7 points plotted correctly at ends of intervals not joined <b>or</b> for 6 <b>or</b> 7 points from table plotted consistently within each interval (eg at lower bound of interval <b>or</b> midpoint of interval) at their correct heights <b>and</b> joined with smooth curve <b>or</b> line segments. ignore the curve < age 20
(b)		26 – 28	1	B1 ft If out of range ft their graph
(c)	eg readings at 15 <b>and</b> 45 from the vertical axis eg LQ = 19 – 21 eg UQ = 45 - 47 <b>(the reading at 45 is 45/46 so be careful with the award of this mark)</b>		2	M1 ft For use of 15 <b>and</b> 45 <b>or</b> 15.25 <b>and</b> 45.75 (eg reading of 21 <b>and</b> 46 stated <b>or</b> indicated by marks on horizontal axis that correspond to 15 ( <b>or</b> 15.25) <b>and</b> 45 ( <b>or</b> 45.75) on the vertical axis <b>or</b> correct readings ft their cf graph provided method to show readings is shown)
(d)	<i>Correct answer scores full marks (unless from obvious incorrect working).</i> eg reading of 49 <b>or</b> 50 from cf axis <b>must be a whole number</b> <i>Correct answer scores full marks (unless from obvious incorrect working).</i>	24 - 28  10 <b>or</b> 11	2	A1 ft Any value in range (if out of range ft their cf graph reading across at 15 <b>and</b> 45 <b>or</b> but method must be shown) M1 ft For correct reading at 55 eg 50 (ft from incorrect graph if method shown (lines up <b>and</b> across)) A1 If out of range ft their cf curve if method shown
				<b>Total 7 marks</b>

Question	Working	Answer	Mark	Notes
16	$M = kh^3$ oe <b>or</b> $4 = k \times 0.5^3$ oe  $k = \frac{4}{0.5^3}$ <b>or</b> $k = \frac{4}{0.125}$ <b>or</b> $k = 32$		4	M1 $k \neq 1$ <b>and</b> where $k$ could be any letter M1 Allow this for M2 if $M = kh^3$ is not written oe <b>or</b> $\frac{500}{4} = \frac{h^3}{0.5^3}$ (= $125 \times 0.5^3$ ) oe
	$h = \sqrt[3]{\frac{500}{0.32}}$ <b>or</b> $h = \sqrt[3]{\frac{500 \times 0.5^3}{4}}$ <b>or</b> $h = \sqrt[3]{15.625}$ <b>or</b> $h = 5 \times 0.5$			M1 for a correct expression for $h$ using correct values <b>or</b> a value of $k$ from a completely correct method
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	2.5		A1 oe
				<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
17	$8t$ <b>or</b> $\pm 125t^2$ oe  $8t - 125t^2$ oe <b>or</b> $8t - \frac{125}{t^2}$ oe  $8t - 125t^{-2} = 0$ <b>and</b> $(t =) \sqrt[3]{\frac{125}{8}} (= 2.5)$		5	M1 for differentiating one term correctly A1 for both terms correct
	$4(2.5) + 2.5$			M1 for equating their $8t \pm at^{-2}$ oe <b>or</b> $bt \pm 125t^{-2}$ oe to zero <b>and</b> solving for $t$ ie must have correct powers of $t$ <b>and</b> at least one correct coefficient <b>and</b> correct isolation of $t$
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	75		M1 dep on previous M mark for substituting into $s$
				A1
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
18	$(2y + 5)(y - 6) \text{ or}$ $\frac{- -7 \pm \sqrt{(-7)^2 - 4 \times 2 \times -30}}{2 \times 2}$ $2 \left[ \left( y - \frac{7}{4} \right)^2 - \frac{49}{16} \right] - 30 (= 0) \text{ oe}$		3	<p>M1 A correct method to solve the quadratic - allow factorisation that gives 2 out of 3 terms correct when expanded <b>or</b> use of quadratic formula – if using formula, allow one sign error <b>and</b> allow if simplified as far as <math>\frac{7 \pm \sqrt{49^2 + 240}}{4}</math> <b>or</b> use of completing the square with one sign error as far as shown</p>
	$(y =) 6, (y =) -2.5$ <i>Working required</i>	$-2.5 \leq y \leq 6$		<p>A1 Correct critical values <b>dep on M1</b></p> <p>A1 oe eg <math>y \geq -2.5</math> (and) <math>y \leq 6</math> <b>or</b> <math>[-2.5, 6]</math> (do not penalise change of variable eg <math>y</math> to <math>x</math>) <b>dep on M1</b></p>
				<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes
19	<p>(Length sf) <math>\sqrt[3]{0.8}</math> (<math>=0.928\dots</math>) <b>or</b> <math>\sqrt[3]{1.25}</math> (<math>=1.07\dots</math>)  <b>or</b> <math>\sqrt[3]{4} : \sqrt[3]{5}</math> oe</p> <p>(Area sf) <math>(\sqrt[3]{0.8})^2</math> (0.861...) <b>or</b> 86.1...(%)  <b>or</b> <math>(\sqrt[3]{1.25})^2</math> (<math>=1.16\dots</math>) <b>or</b> 116...(%) <b>or</b> <math>(\sqrt[3]{4})^2 : (\sqrt[3]{5})^2</math>  oe</p> <p>eg (<math>k =</math>) <math>(1 - "0.861\dots") \times 100</math> <b>or</b> <math>(100 - "86.1\dots")</math>  <b>or</b> <math>100 - \frac{100}{"1.16"}</math> <b>or</b> <math>100 - \frac{100}{"116"}</math> <math>\times 100</math>  <b>or</b> <math>100 - 100 \times \frac{(\sqrt[3]{4})^2}{(\sqrt[3]{5})^2}</math></p>	13.8	4	<p>M1 for a correct linear scale factor</p> <p>M1 for a correct area scale factor</p> <p>M1 for a method to find the percentage reduction</p>
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>			A1 accept 13.7 – 13.9
				<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
20	$(3+2y)^2 - y^2 + 2(3+2y) = 10$ $x^2 - \left(\frac{x-3}{2}\right) + 2x = 10$ eg $3y^2 + 16y + 5 (=0)$ $3x^2 + 14x = 49$ eg $(3y+1)(y+5) (=0)$ $3(x-7)(x+7) (=0)$ <b>or</b> $\frac{-16 \pm \sqrt{16^2 - 4 \times 3 \times 5}}{2 \times 3}$ <b>or</b> $3 \left[ \left(y + \frac{8}{3}\right)^2 - \left(\frac{8}{3}\right)^2 \right] + 5 (=0)$ (should give $(y =) -\frac{1}{3}, -5$ ) <b>or</b> $\frac{-14 \pm \sqrt{14^2 - 4 \times 3 \times (-49)}}{2 \times 3}$ <b>or</b> $3 \left[ \left(x + \frac{7}{3}\right)^2 - \left(\frac{7}{3}\right)^2 \right] - 49 (=0)$ (should give $(x =) -\frac{7}{3}, -7$ )	$x = \frac{7}{3}, y =$ $-\frac{1}{3}$ $x = -7, y =$ $-5$	5	M1 for using correct substitution of a linear equation into the quadratic – all terms shown correctly A1 for a correct 3 term quadratic M1 dep on M1 method to solve <b>their</b> 3 term quadratic using any correct method (allow one sign error <b>and</b> some simplification – allow as far as eg $\frac{-16 \pm \sqrt{256 - 60}}{6}$ <b>or</b> $\frac{-14 \pm \sqrt{196 + 588}}{6}$ <b>or</b> if factorising allow brackets which expanded give 2 out of 3 terms correct) <b>or</b> correct values for $x$ <b>or</b> correct values for $y$ M1 fit dep on previous M1 for substituting <b>their</b> 2 found values of $x$ <b>or</b> $y$ in a suitable equation (use 2dp <b>or</b> better for substitution) <b>or</b> fully correct values for the other variable (correct labels for $x/y$ ) A1 dep on M1 (allow coordinates) must be paired correctly allow $x = -7, y = -5$ $x = 2.33(3...), y = -0.33(3...)$
	<i>Working required</i>			
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
21	$(a =) \frac{14}{3 \times \frac{7}{4y-3} - 7}$ $(a =) \frac{14(4y-3)}{21-7(4y-3)} \text{ oe}$ eg $\frac{56y-42}{21-28y+21}$ Correct answer scores full marks (unless from obvious incorrect working).	$\frac{4y-3}{3-2y}$	3	M1 For a correct substitution M1 or for a correct but unsimplified answer in the form $\frac{m}{n}$ is the denominator should be simplified to remove the fraction A1 oe but must be simplified
<b>Total 3 marks</b>				

Question	Working	Answer	Mark	Notes
21 ALT	$x = \frac{14+7a}{3a} \text{ and}$ $\frac{14+7a}{3a} = \frac{7}{4y-3}$ $a(42-28y) = 56y-42 \text{ oe eg}$ $(a =) \frac{56y-42}{21-28y+21}$ $(a =) \frac{56y-42}{21-28y+21}$	$\frac{4y-3}{3-2y}$	3	M1 For rearranging 'x' to be in terms of a and equating two expressions for a M1 or for a correct but unsimplified answer in the form $\frac{m}{n}$ A1 oe but must be simplified
<b>Total 3 marks</b>				

Question	Working	Answer	Mark	Notes
22	$580\pi = \pi \times 20 \times l$ or $(l =) \frac{580\pi}{20\pi} (= 29)$ $\sqrt{29^2 - 20^2} (= \sqrt{441 - 21})$ $\left( \frac{1}{2} \times \frac{4}{3} \times \pi \times 20^3 \right) + \left( \frac{1}{3} \times \pi \times 20^2 \times 21 \right)$ or $\frac{16\,000}{3}\pi + \frac{8400}{3}\pi$ or $\frac{16\,000}{3}\pi + 2800\pi$		5	M1 for correct substitution into $A = \pi r l$ M1
				M1
				M1 for a complete method (Award M4 for 8133.3..... if $\frac{24\,400}{3}$ is not seen)
	<i>Correct answer scores full marks (unless from obvious incorrect working).</i>	$\frac{24\,400}{3}$		A1 8133.3 or 8133 $\frac{1}{3}$ (as exact form was requested) SC B4 for an answer of 25551(.62....) if no method shown
			<b>Total 5 marks</b>	

Question	Working	Answer	Mark	Notes
23	$\overrightarrow{OP} = 4\mathbf{a} + 2\mathbf{a} + 8\mathbf{b} (= 6\mathbf{a} + 8\mathbf{b})$ oe or $\overrightarrow{PO} = -6\mathbf{a} - 8\mathbf{b}$ oe or $\overrightarrow{AB} = 6\mathbf{b} - 4\mathbf{a}$ oe or $\overrightarrow{BA} = 4\mathbf{a} - 6\mathbf{b}$ oe or $\overrightarrow{BP} = 6\mathbf{a} + 2\mathbf{b}$ oe or $\overrightarrow{PB} = -6\mathbf{a} - 2\mathbf{b}$ oe  $\overrightarrow{OQ} = 4\mathbf{a} + \lambda(6\mathbf{b} - 4\mathbf{a})$ oe or $6\mathbf{b} + \lambda(4\mathbf{a} - 6\mathbf{b})$ oe or $x(6\mathbf{a} + 8\mathbf{b})$ oe or $\overrightarrow{BQ} = \mu(4\mathbf{a} - 6\mathbf{b})$ oe or $-6\mathbf{b} + \lambda(6\mathbf{a} + 8\mathbf{b})$ oe or $4\mathbf{a} - 6\mathbf{b} + x(6\mathbf{b} - 4\mathbf{a})$ oe or $\overrightarrow{AQ} = y(6\mathbf{b} - 4\mathbf{a})$ oe or $-4\mathbf{a} + x(6\mathbf{a} + 8\mathbf{b})$ oe or $6\mathbf{b} - 4\mathbf{a} + \mu(4\mathbf{a} - 6\mathbf{b})$ oe or $2\mathbf{a} + 8\mathbf{b} + m(6\mathbf{a} + 8\mathbf{b})$ or $\overrightarrow{QP} = \lambda(6\mathbf{a} + 8\mathbf{b})$ oe or $\mu(4\mathbf{a} - 6\mathbf{b}) + 2\mathbf{a} + 8\mathbf{b}$ oe		5	M1 oe for one of $\overrightarrow{OP}$ or $\overrightarrow{PO}$ or $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or $\overrightarrow{BP}$ or $\overrightarrow{PB}$ (may be seen as part of another vector calculation)  M1 for one of $\overrightarrow{OQ}$ or $\overrightarrow{QO}$ or $\overrightarrow{BQ}$ or $\overrightarrow{QB}$ or $\overrightarrow{AQ}$ or $\overrightarrow{AQ}$ or $\overrightarrow{QP}$ or $\overrightarrow{PQ}$
				M1 for a second correct expression for the same vector or for two correct expressions for parallel vectors eg 2 of $\overrightarrow{OQ}$ , $\overrightarrow{OP}$ , $\overrightarrow{QP}$ oe and using ratios to form an equation in one variable that can lead to a solution eg $\overrightarrow{OQ} = 4\mathbf{a} + k(6\mathbf{b} - 4\mathbf{a})$ and $\overrightarrow{QP} = 2\mathbf{a} + 8\mathbf{b} - k(6\mathbf{b} - 4\mathbf{a})$



Question	Working	Answer	Mark	Notes
24	$(S_{10} =) \frac{10}{2}(2a + 9d)$ <b>or</b> $(S_5 =) \frac{5}{2}(2a + 4d)$ <b>oe or</b> $a + 7d = 45$ $\frac{10}{2}(2a + 9d) = 4 \times \frac{5}{2}(2a + 4d)$ <b>oe</b> $eg d = 2a$ <b>oe or</b> $a = \frac{d}{2}$ <b>oe</b> <b>or</b> $a + 7d = 45$ <b>oe and</b> $eg 10a - 5d = 0$ <b>oe</b> <b>or</b> <b>eg</b> $\frac{10}{2}(2(45 - 7d) + 9d) = 4 \times \frac{5}{2}(2(45 - 7d) + 4d)$ <b>oe</b> <b>or</b> $5d = 10(45 - 7d)$ <b>oe</b> <b>eg</b> $a + 7(2a) = 45$ <b>or</b> $d = 6$ <b>or</b> <b>or</b> $70a - 35d = 0$ $5a + 35d = 225$ Adding $(75a = 225)$  <i>Working required</i>		5	M1 for a correct expression for the sum of the first 10 terms ( $S_{10}$ ) <b>or</b> the first 5 terms ( $S_5$ ) <b>or</b> a correct equation for the 8 <sup>th</sup> term Take 9 as their 10 – 1 <b>and</b> 4 as their 5 – 1 <b>and</b> 7 as their 8 – 1 M1 for a correct equation relating $S_{10}$ <b>and</b> $S_5$ M1 (dep on M1) for $d$ in terms of $a$ , <b>or</b> vice-versa (must be correct) <b>or</b> for $a + 7d = 45$ <b>oe and</b> correctly reducing the equation relating $S_{10}$ <b>and</b> $S_5$ to an equation with one term in $a$ <b>and</b> one term in $d$ <b>eg</b> $10a - 5d = 0$ <b>oe</b> <b>or</b> substituting a correct expression into their correct equation to obtain an equation in just $d$ M1 (dep on M2) for a correct equation in just $a$ <b>or</b> for $d = 6$ <b>or</b> for a correct method to eliminate $a$ <b>or</b> $d$ : coefficients of $a$ <b>or</b> $d$ the same <b>and</b> correct operation to eliminate selected variable (condone 1 arithmetical error)
		3	A1	Dep on M3
			<b>Total 5 marks</b>	