

Q	Answer	Mark	Comments
1	$1.5 \times 1.5$ or $\left(\frac{3}{2}\right)^2$	M1	oe  oe improper fraction squared
	$2.25$ or $\frac{9}{4}$ or $2\frac{1}{4}$	A1	oe decimal, improper fraction or mixed number SC1 answer digits 225
	<b>Additional Guidance</b>		
	Ignore attempt to simplify or convert if correct fraction seen		
	Do not allow further work, but condone adjusting place value eg $1.5 \times 1.5 = 2.25$ , $2.25 \div 100 = 0.0225$ (adjusting place value) eg $1.5 \times 1.5 = 2.25$ , $2.25 \times 1.5$ (cubing not squaring)		M1A0 M0A0
	$1.5 \times 1.5 = 3$		M1A0
	$2.25^2$ $225^2$		M1A0 M0A0

Q	Answer	Mark	Comments
2(a)	$\times 4$ and $+ 5$ or $\div \frac{1}{4}$ and $+ 5$ or $+ 1.25$ and $\times 4$ or $+ 1.25$ and $\div \frac{1}{4}$	B1	oe decimals or fractions must be in correct order operator must be before number condone use of words
	<b>Additional Guidance</b>		
	$+ 3x$ and $+ 5$ (oe using the variable)		B0

Q	Answer	Mark	Comments
2(b)	– 8	B1	

Q	Answer	Mark	Comments
2(c)	$\div 6$ or $\times \frac{1}{6}$	B1	
	<b>Additional Guidance</b>		
	– 5x		B0

Q	Answer	Mark	Comments
3	True True False	B3	B2 two correct B1 one correct
	<b>Additional Guidance</b>		
	Accept any indication, but if a tick and crosses are used in the same row, mark the tick		
	A row with more than one tick is incorrect for that row		

Q	Answer	Mark	Comments
4(a)	64	B1	

Q	Answer	Mark	Comments
4(b)	– 4 and – 13	B2	either order B1 first value – 4 or second value – 13 or second value = their first value – 9 SC1 – 13 and – 17

Q	Answer	Mark	Comments
5(a)	8	B1	

Q	Answer	Mark	Comments
5(b)	$3500 \div 20$ or $\frac{3500}{20}$	M1	oe eg $350 \div 2$
	175	A1	SC1 digits 175
	<b>Additional Guidance</b>		
	Ignore units		

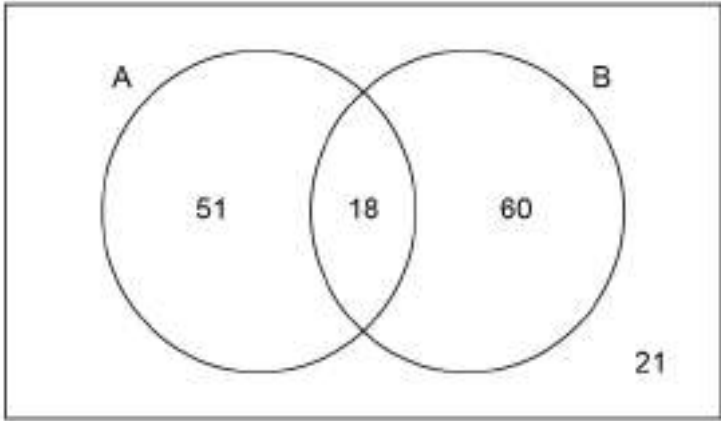
Q	Answer	Mark	Comments
6	Correct conversion of or correct method to convert $1\frac{1}{5}$ to $\frac{12}{10}$ or $1\frac{2}{10}$  with no incorrect conversion of $\frac{3}{10}$  or correct method for or correct result of conversion of both fractions to a common denominator $\neq 10$  or $1 - \frac{1}{10}$  or $1.2 - 0.3$ or $0.9$	M1	
	$\frac{9}{10}$	A1	oe fraction eg $\frac{45}{50}$
	<b>Additional Guidance</b>		
	Ignore incorrect simplifying if correct fraction seen		
	$1\frac{1}{5}$ converted to $1\frac{2}{10}$ and $\frac{3}{10}$ converted to $\frac{6}{10}$		M0

Q	Answer	Mark	Comments
7	$12 \div 4$ or 3	M1	oe may be on the diagram may be seen in a ratio
	$\pi \times \text{their } 3 \times \text{their } 3$ or $9\pi$ or [28.2, 28.3]	M1dep	oe
	$\pi \times 12 \times 12$ or $144\pi$ or [452.1, 452.45]	M1	oe
	$135\pi$	A1	SC2 135
	<b>Additional Guidance</b>		
	Condone eg $\pi 9$ for $9\pi$		
	Condone use of $\frac{22}{7}$ or 3.1 or better for $\pi$ up to M3		
	Answer 135 with $135\pi$ in working Answer 135 without $135\pi$ in working		M1M1M1A0 SC2
	Answer [423.8, 424.3]		M1M1M1A0

Q	Answer	Mark	Comments
8(a)	$10 \times 9$ or 90 or $\frac{10}{15} \times 9$ or $9 \div \frac{15}{10}$ or correct time for any stated number of people other than 10	M1	oe  eg 18 hours for 5 people
	6	A1	SC1 360 (minutes)
	<b>Additional Guidance</b>		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Working may be seen in minutes eg $10 \times 9 \times 60$ or 5400		M1

Q	Answer	Mark	Comments
8(b)	It is not possible to say	B1	

Q	Answer	Mark	Comments
9	$a = 4$	B1	
	$2 + 3b = 20$ or $3b = 18$	M1	
	$b = 6$	A1	

Q	Answer	Mark	Comments
10	51 in A only	B1	
	18 in intersection	B1	
	60 in B only	B1	
	21 outside circles	B1ft	correct or ft 150 – their 51 – their 18 – their 60
	<b>Additional Guidance</b>		
			4 marks
	If the correct numbers are given as fractions with denominator 150 (oe fraction), only withhold the mark in the first instance		
	If the three values inside the circles sum to 150, award the 4th mark for 0 written outside the circles, but not for no value written		
	If the three values inside the circles sum to more than 150, the 4th mark cannot be awarded on ft		

Q	Answer	Mark	Comments	
11	Circles or at least semicircular arcs, radius 4 cm, at both ends connected by horizontal lines at top and bottom	B3	B2 semicircles or at least semicircular arcs, radius 4 cm, at both ends  B1 semicircle or at least semicircular arc, radius 4 cm, at one end  or  correct shape for region with incorrect measurements	
	Additional Guidance			
	Condone parts of circles within the region not erased			
	Condone dotted lines used for (part of) the perimeter			
	All accuracy is $\pm 2$ mm			

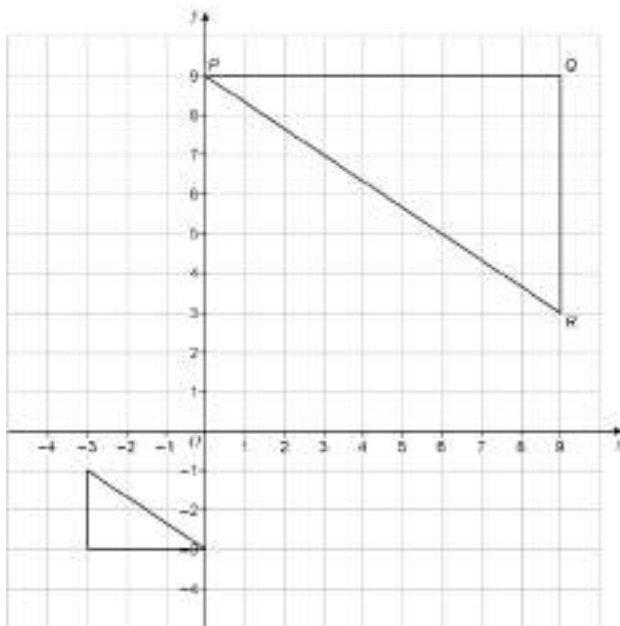
Q	Answer	Mark	Comments
12(a)	Division of 27 by 11 seen with correct evaluation to least 2.4 or division of 5 by 11 seen with correct evaluation to least (0).4 or 2.45...	M1	eg $\begin{array}{r} 2.4 \\ 11 \overline{)27.0000} \end{array}$
	$2.\dot{4}\dot{5}$ or $2.\overline{45}$	A1	condone 2.4545..
	<b>Additional Guidance</b>		
	If the answer is given as 2.4545... there must be at least four digits after the decimal point and at least two dots eg 2.454545.. eg 2.4545		M1A1 M1A0

Q	Answer	Mark	Comments
12(b)	<b>Alternative method 1: using <math>x = 0.155...</math></b>		
	Multiplication by a power of 10 with correct result	M1	eg $10x = 1.55...$ or $100x = 15.55...$ or $1000x = 155.55...$ any or no letter
	Correct equation formed from subtraction of two equations to eliminate recurring digits or correct fraction with a decimal numerator	M1dep	eg $9x = 1.4$ or $90x = 14$ or $99x = 15.4$ eg $\frac{15.4}{99}$
	$\frac{7}{45}$	A1	oe fraction eg $\frac{14}{90}$ or $\frac{154}{990}$
	<b>Alternative method 2: using <math>x = 0.055...</math></b>		
	Correct equation formed from subtraction of two equations to eliminate recurring digits or correct fraction, which may include a decimal numerator	M1	eg $9x = 0.5$ or $90x = 5$ or $99x = 5.5$ eg $\frac{55}{990}$ or $\frac{5.5}{99}$
	$\frac{1}{10}$ + their correct fraction, which may include a decimal numerator	M1dep	eg $\frac{1}{10} + \frac{5}{90}$
	$\frac{7}{45}$	A1	oe fraction eg $\frac{14}{90}$ or $\frac{154}{990}$
	<b>Additional Guidance</b>		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore incorrect simplifying if correct fraction seen		
	Unless recovered, recurring decimals must be in correct notation or denoted by at least two repeated digits after the decimal point with at least two dots		

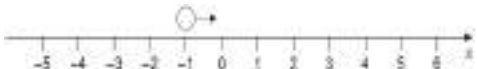


Q	Answer	Mark	Comments
13(a)	$\sqrt{400}$ or 20 or $2^3$ or 8 or $\cos 60^\circ$ or 0.5	M1	oe
	20 and 8 and 0.5	M1	
	56 with correct values	A1	
	<b>Additional Guidance</b>		
	56 seen then rounded to 60		M1M1A1
	28 rounded to 30 then $\frac{30}{0.5}$ leading to 60 as final answer		M1M1A0

Q	Answer	Mark	Comments
13(b)	Any two of It should be $-2 \times 3 \times 7 \times \cos x$ $3^2 + 7^2$ is not $10^2$ $10^2 + 42 \cos x$ is not $142 \cos x$	B2	oe B1 any one error identified SC1 answer should be $\cos x = \frac{33}{42}$ oe or answer should be $\cos x = -\frac{33}{42}$ oe
	<b>Additional Guidance</b>		
	All three errors identified		B2
	Three errors identified with one or two correct		B1
	The second + should be –		B1
	You have to rearrange (to make $\cos x$ the subject)		B0

Q	Answer	Mark	Comments	
14	Triangle with vertices (−3, −1) and (−3, −3) and (0, −3)	B3	B2 triangle of correct size and orientation but incorrect position or correct vertices plotted but no triangle drawn or any negative enlargement with centre (0, 0) B1 triangle of correct size but incorrect orientation or two correct vertices plotted or any negative enlargement with centre not (0, 0)	
	Additional Guidance			
	Mark intention			
	Ignore labelling of vertices on enlarged triangle			
			B3	

Q	Answer	Mark	Comments
15(a)	Correct rearrangement with $-5x$ the subject or $5x$ positive or correct division throughout by 5	M1	eg $-5x \leq 30 - 20$ or $-5x \leq 10$ or $20 \leq 30 + 5x$ or $20 - 30 \leq 5x$ or $-10 \leq 5x$ or $4 - x \leq 6$
	Correct rearrangement with $-x$ the subject or $x$ positive	M1dep	eg $-x \leq 10 \div 5$ or $-x \leq 2$ or $10 \div 5 \geq -x$ or $2 \geq -x$ or $x \geq 10 \div -5$ or $x \geq -\frac{10}{5}$ or $-10 \div 5 \leq x$ or $-\frac{10}{5} \leq x$ or $4 \leq 6 + x$
	$x \geq -2$ or $-2 \leq x$	A1	SC1 for answer $-2$ , which may be seen in an equation or incorrect inequality
	<b>Additional Guidance</b>		
	Allow incorrect signs in working if recovered in final answer		
	Allow $<$ for $\leq$ or $>$ for $\geq$ for method marks		
	Unless recovered, use of $=$ scores maximum SC1		

Q	Answer	Mark	Comments
15(b)	Hollow circle at $-1$ with an arrow to the right 	B1	mark intention circle and arrow can be above, on or below the line

Q	Answer	Mark	Comments
16	Valid reason	B1	see examples below
	$8 \leq w < 9$	B1	condone 8.9 for 9
	<b>Additional Guidance</b>		
	<b>Reasons</b>		
	These are the bounds for rounding to 8		B1
	This is the error interval for the nearest whole number		B1
	The number must begin with 8 for it to truncate to 8		B1
	The number cannot be less than 8		B1
	When a number is truncated it gets smaller		B1
	$w$ is being made lower, not higher		B1
	When a number is truncated the decimals are removed		B1
	The values have to be whole numbers/the bounds shouldn't be decimals (with no decimals in their bounds)		B1
	7.5 would truncate to 7		B1
	7.5 is wrong with 8 given as the correct lower bound or 8.5 is wrong with 9 given as the correct upper bound		B1
	7.5 is wrong or 8.5 is wrong without the appropriate correct bound		B0

Q	Answer	Mark	Comments
17(a)	$(r =) 36\pi \div 2\pi$ or $(r =) 36 \div 2$ or $(r =) 18$ or $(36\pi \div 2\pi)^2$ or $(36 \div 2)^2$ or $18^2$ or 324	M1	
	$x^2 + y^2 = 18^2$ or $x^2 + y^2 = 324$	A1	
	<b>Additional Guidance</b>		
	$x^2 + y^2 = 18$ or $a^2 + b^2 = 18$		M1A0
	$a^2 + b^2 = 18^2$ or $a^2 + b^2 = 324$		M1A0
	Allow $x^2 + y^2 = 18^2$ followed by an incorrect evaluation of $18^2$ eg $x^2 + y^2 = 18^2$ , $18 \times 18 = 506$ , $x^2 + y^2 = 506$		M1A1

Q	Answer	Mark	Comments
17(b)	<b>Alternative method 1: uses the gradient with either point to work out the intercept</b>		
	$\frac{0 - (-5)}{15 - 30}$ or $-\frac{1}{3}$	M1	oe
	their $-\frac{1}{3} \times 15 + c = 0$ or their $-\frac{1}{3} \times 30 + c = -5$	M1dep	oe
	$(m =) -\frac{1}{3}$ and $(c =) 0 + \frac{1}{3} \times 15$ or $(m =) -\frac{1}{3}$ and $(c =) -5 + \frac{1}{3} \times 30$ or $(m =) -\frac{1}{3}$ and $(c =) 5$	M1dep	oe equation in $c$ or expression for $c$
	$y = -\frac{1}{3}x + 5$ or $x + 3y - 15 = 0$	A1	oe equation with terms collected
	<b>Alternative method 2: uses the gradient with <math>y - y_1 = m(x - x_1)</math></b>		
	$\frac{0 - (-5)}{15 - 30}$ or $-\frac{1}{3}$	M1	oe
	$y - 0 = \text{their } -\frac{1}{3}(x - 15)$ or $y - (-5) = \text{their } -\frac{1}{3}(x - 30)$	M1dep	oe
	$y = -\frac{1}{3}x + 5$ or $x + 3y - 15 = 0$	A2	oe equation with terms collected A1 $(m =) -\frac{1}{3}$ and $(c =) 5$

Question 17(b) continues on the next page

17b cont	<b>Alternative method 3: finds gradient and y-intercept separately</b>		
	$\frac{0 - (-5)}{15 - 30}$ or $-\frac{1}{3}$	M1	oe
	(y-intercept =) (0, 5) or $c = 5$	M1	
	$y = -\frac{1}{3}x + 5$ or $x + 3y - 15 = 0$	A2	oe equation with terms collected A1 $(m =) -\frac{1}{3}$ and $(c =) 5$
	<b>Alternative method 4: simultaneous equations using both points</b>		
	Correct elimination of one variable	M1	eg $0 = 15m + c$ and $-5 = 30m + c$ and $15m - 30m = 0 - (-5)$ or $-15m = 5$ or $m = -\frac{1}{3}$
	Correct substitution into a correct equation	M1dep	eg $0 = 15 \times -\frac{1}{3} + c$
	$y = -\frac{1}{3}x + 5$ or $x + 3y - 15 = 0$	A2	oe equation with terms collected A1 $(m =) -\frac{1}{3}$ and $(c =) 5$
	<b>Additional Guidance</b>		
	Allow an equivalent fraction for $-\frac{1}{3}$ throughout		
	As a decimal, allow $-0.33$ or better for $-\frac{1}{3}$ for the method marks, but correct recurring notation or at least $-0.33..$ is needed for the A mark		
	In alts 1 and 2, do not allow use of the negative inverse of their gradient		M1 max

Q	Answer	Mark	Comments
18(a)	$(x + 4)^2 - 21$	B2	condone $a = 4$ and $b = 21$ B1 $(x + 4)^2 \dots$ or $a = 4$
	<b>Additional Guidance</b>		
	Ignore further work after a correct answer eg $(x + 4)^2 - 21$ followed by $a = 4$ and $b = -21$		B2

Q	Answer	Mark	Comments
18(b)	$(7, 8)$	B2	B1 for each coordinate
	<b>Additional Guidance</b>		



Q	Answer	Mark	Comments
19(a)	<b>Alternative method 1: multiplies <math>(x + 2)(2x + 3)</math> first</b>		
	$2x^2 + 3x + 4x + 6$ or $2x^2 + 7x + 6$	M1	oe four terms with at least three correct implied by $2x^2 + 7x + k$ or $px^2 + 7x + 6$ where $k$ and $p$ are a non-zero constants may be seen in a grid
	$6x^3 + 9x^2 + 12x^2 + 18x + 8x^2 + 12x + 16x + 24$ or $6x^3 + 21x^2 + 18x + 8x^2 + 28x + 24$	M1dep	oe full expansion with correct multiplication of their 3 or 4 terms by $3x$ or $4$ may be seen in a grid
	$6x^3 + 29x^2 + 46x + 24$	A1	
	<b>Alternative method 2: multiplies <math>(2x + 3)(3x + 4)</math> first</b>		
	$6x^2 + 8x + 9x + 12$ or $6x^2 + 17x + 12$	M1	oe four terms with at least three correct implied by $6x^2 + 17x + k$ or $px^2 + 17x + 12$ where $k$ and $p$ are non-zero constants may be seen in a grid
	$6x^3 + 8x^2 + 9x^2 + 12x + 12x^2 + 16x + 18x + 24$ or $6x^3 + 17x^2 + 12x + 12x^2 + 34x + 24$	M1dep	oe full expansion with correct multiplication of their 3 or 4 terms by $x$ or $2$ may be seen in a grid
	$6x^3 + 29x^2 + 46x + 24$	A1	

Question 19(a) continues on the next page

19(a) cont	<b>Alternative method 3: multiplies <math>(x + 2)(3x + 4)</math> first</b>		
	$3x^2 + 4x + 6x + 8$ or $3x^2 + 10x + 8$	M1	oe four terms with at least three correct implied by $3x^2 + 10x + k$ or $px^2 + 10x + 8$ where $k$ and $p$ are non-zero constants may be seen in a grid
	$6x^3 + 8x^2 + 12x^2 + 16x + 9x^2 + 12x + 18x + 24$ or $6x^3 + 20x^2 + 16x + 9x^2 + 30x + 24$	M1dep	oe full expansion with correct multiplication of their 3 or 4 terms by $2x$ or 3 may be seen in a grid
	$6x^3 + 29x^2 + 46x + 24$	A1	
	<b>Additional Guidance</b>		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Terms may be in any order throughout		
	For method marks, terms may be given in a table, with minus signs shown where necessary		
	2nd M1 A full expansion will be 8 terms if 4 terms are used in first expansion A full expansion will be 6 terms if 3 terms are used in first expansion		
	1st M1 scored with a 4-term expansion followed by incorrect simplification to 3 terms can still score the 2nd M1 using their 3 terms eg $2x^2 + 3x + 4x + 6 = 2x^2 + 9x + 6$ ( $9x$ should be $7x$ ) $(2x^2 + 9x + 6)(3x + 4) = 6x^3 + 27x^2 + 18x + 8x^2 + 36x + 24$		M1 M1

Q	Answer	Mark	Comments
19(b)	Substitution of $x = 100$ into their cubic expansion of at least three terms	M1	eg with part (a) correct, $6 \times 100^3 + 29 \times 100^2 + 46 \times 100 + 24$ or $6\,000\,000 + 290\,000 + 4600 + 24$
	6 294 624	A1ft	ft their cubic expansion, which must contain at least 3 terms
	<b>Additional Guidance</b>		
	Ignore any rounding or truncation after correct answer seen		
	6 294 624 from long multiplication		M1A1

Q	Answer	Mark	Comments
20(a)	$\frac{\sqrt{121}\sqrt{3}}{\sqrt{3}}$ or $\frac{11\sqrt{3}}{\sqrt{3}}$ or $\sqrt{121}$ or $\frac{\sqrt{363}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ or $\frac{\sqrt{363}\sqrt{3}}{3}$ or $\frac{11\sqrt{3}\sqrt{3}}{3}$ or $\frac{\sqrt{1089}}{3}$	M1	oe with at least partial simplification of the numerator  oe with correct method to rationalise the denominator rationalised
	11 and $\frac{\sqrt{121}\sqrt{3}}{\sqrt{3}}$ or $\frac{11\sqrt{3}}{\sqrt{3}}$ or $\sqrt{121}$ or 11 and $\frac{11\sqrt{3}\sqrt{3}}{3}$ or $\frac{\sqrt{1089}}{3}$	A1	
	<b>Additional Guidance</b>		
	For M1, allow multiplication or division by $\sqrt{1}$ throughout		

Q	Answer	Mark	Comments
20(b)	Correct expression with rationalisation of denominator seen or used	M1	eg $\frac{20}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{20\sqrt{5}}{5}$ or $\frac{4 \times \sqrt{5} \times \sqrt{5}}{\sqrt{5}}$ or $\frac{4\sqrt{5}}{1}$
	$4\sqrt{5}$	A1	

Q	Answer	Mark	Comments
21(a)	258.69	B1	

Q	Answer	Mark	Comments
21(b)	180 – 78.69 or 101.31 or 360 – 78.69 or 281.31	M1	oe
	101.31 and 281.31	A1	either order
	<b>Additional Guidance</b>		
	–78.69, 101.31 and 281.31		M1A0

Q	Answer	Mark	Comments
22	$7^{2n} \rightarrow x^2$ $7^{n+1} \rightarrow 7x$ $7^{\frac{1}{2}n} \rightarrow \sqrt{x}$	B3	B1 each correct match
	Additional Guidance		
			B3
	Two lines from a box on the left is incorrect for that box		

Q	Answer	Mark	Comments
23(a)	$y = x^2 + 2$	B1	oe equation eg $y - 2 = x^2$
	<b>Additional Guidance</b>		
	In (a), (b) and (c), on otherwise correct answers only withhold the mark for the first missing $y =$		

Q	Answer	Mark	Comments
23(b)	$y = -x^2$	B1	oe equation eg $y + x^2 = 0$
	<b>Additional Guidance</b>		
	In (a), (b) and (c), on otherwise correct answers only withhold the mark for the first missing $y =$		

Q	Answer	Mark	Comments
23(c)	$y = (x - 3)^2$	B1	oe equation eg $y = x^2 - 6x + 9$
	<b>Additional Guidance</b>		
	In (a), (b) and (c), on otherwise correct answers only withhold the mark for the first missing $y =$		
	Ignore an incorrect expansion after the correct equation is seen		B1