

Q	Answer	Mark	Comments
1(a)	diameter	B1	

Q	Answer	Mark	Comments
1(b)	segment	B1	

Q	Answer	Mark	Comments
1(c)	tangent or circumference or arc	B1	

Q	Answer	Mark	Comments
2	Any two of 16×5 or 80 22×15 or 330 13×25 or 325 9×35 or 315	M1	implied by 1050
	(their 80 + their 330 + their 325 + their 315) \div 60	M1dep	oe must be sum of four numbers condone missing final bracket
	17.5 or $\frac{1050}{60}$	A1	oe value eg $17\frac{1}{2}$
Additional Guidance			
M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts			
Ignore simplification or conversion attempt after correct answer seen			
Answer 17 or 18 with 17.5 seen			M2A1
17.5 in working with $10 < v \leq 20$ on answer line			M2A0
17.5 then answer doubled			M2A0

Q	Answer	Mark	Comments
	4 squares shaded so that the grid has exactly two lines of symmetry	B2	B1 4 squares shaded so that the grid has four lines of symmetry or even number of squares shaded so that the grid has exactly two lines of symmetry
Additional Guidance			
	 or or or or or or or 		B2
3	 or 		B1
	 or or 		B1
			B0
	Mark intention		
	Part squares shaded		B0

Q	Answer	Mark	Comments
4	Alternative method 1		
	7 × 4000 ÷ 100 or 280	M2	oe M1 7×4000 or 28000 or $7 \div 100$ or 0.07 or $4000 \div 100$ or 40
	280 and No	A1	oe eg 20 less and No
	Alternative method 2		
	300 × 100 ÷ 4000 or 7.5	M2	oe M1 300×100 or 30000 or $300 \div 4000$ or 0.075 or $100 \div 4000$ or 0.025
	7.5 and No	A1	
	Alternative method 3		
	300 × 100 ÷ 7 or 4285(.7...) or 4286	M2	oe M1 300×100 or 30000 or $300 \div 7$ or [42.8, 42.9] or $100 \div 7$ or [14.2, 14.3]
	[4200, 4300] and No with M2 seen	A1	

Mark scheme and Additional Guidance continue on the next page

4 cont	Alternative method 4				
	7 × 4000 or 28000	M1	oe		
	300 × 100 or 30000	M1	oe		
	28000 and 30000 and No	A1			
	Alternative method 5				
	300 ÷ 4000 or 0.075	M1	oe		
	7 ÷ 100 or 0.07	M1	oe		
	0.075 and 0.07 and No	A1			
	Additional Guidance				
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts				
No may be indicated by selecting the box or a statement in the working lines					
No cannot be implied only by an inequality					
A correct value is sufficient to show working eg 280 and No (except in alt 3)			M2A1		
20 less in alt 1 implies M2					

Q	Answer	Mark	Comments
5	X is directly proportional to $\frac{1}{Y}$	B1	

Q	Answer	Mark	Comments
6	Alternative method 1 $1.7^2 - 1.5^2 = 0.64$ and $\sqrt{0.64} = 0.8$ or $2.89 - 2.25 = 0.64$ and $\sqrt{0.64} = 0.8$	B2	accept $0.8^2 = 0.64$ for $\sqrt{0.64} = 0.8$ accept $\sqrt{1.7^2 - 1.5^2} = 0.8$ for B2 accept $1.7^2 - 1.5^2 = 0.8^2$ for B2 B1 1.7^2 and 1.5^2 oe
	Alternative method 2 $1.7^2 - 0.8^2 = 2.25$ and $\sqrt{2.25} = 1.5$ or $2.89 - 0.64 = 2.25$ and $\sqrt{2.25} = 1.5$	B2	accept $1.5^2 = 2.25$ for $\sqrt{2.25} = 1.5$ accept $\sqrt{1.7^2 - 0.8^2} = 1.5$ for B2 accept $1.7^2 - 0.8^2 = 1.5^2$ for B2 B1 1.7^2 and 0.8^2 oe
	Alternative method 3 $0.8^2 + 1.5^2 = 2.89$ and $\sqrt{2.89} = 1.7$ or $0.64 + 2.25 = 2.89$ and $\sqrt{2.89} = 1.7$	B2	accept $1.7^2 = 2.89$ for $\sqrt{2.89} = 1.7$ accept $\sqrt{0.8^2 + 1.5^2} = 1.7$ for B2 accept $0.8^2 + 1.5^2 = 1.7^2$ for B2 B1 0.8^2 and 1.5^2 oe
	Additional Guidance B1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts $1.7^2 - 1.5^2 = 0.64 \quad x^2 = 0.64 \quad x = 0.8$ Max B1 if any incorrect statement seen eg $1.7^2 - 1.5^2 = \sqrt{0.64} = 0.8$ Accept 1.7×1.7 for 1.7^2 etc Condone eg 1.5cm^2 and 1.7cm^2 for 1.5^2 and 1.7^2 for B1 but must be recovered for B2 $0.64 \div 0.8 = 0.8$ is equivalent to $\sqrt{0.64} = 0.8$		

Q	Answer	Mark	Comments
7(a)	125 × 0.32 or 40 or 80 × 0.35 or 28	M1	oe
	12	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		M0

Q	Answer	Mark	Comments
7(b)	No and valid reason involving the number of trials	B1	eg reasons she didn't do the most she did fewer spins Beth did more they should use all 205 spins
	Additional Guidance		
	Ignore irrelevant or incorrect statements alongside a correct statement as long as not contradictory		B1
	eg1 No and Beth did most but she could have done more		B1
	eg2 No and Beth has more number of spins so there is a higher probability of landing on heads		B1
	eg3 No and Beth did most spins but Lynn did more		B0
	Allow 'she' to refer to Lynn unless clearly referring to Beth		B1
	eg No and Because she tried 125 times however Lynn tried only 80 times		B1
	No and She did not do as many spins so her answer is less accurate than Beth's		B1
	No and Beth spun the wheel more times. Therefore her probability would be lower		B1
	No and Beth spun more times so her final outcome will be higher		B1
	No and Beth did 125 spins and Lynn did 80 spins		B0
	No and Beth did 125 spins so she has more chance of being accurate		B0

Q	Answer	Mark	Comments
8	digits $537 \div$ digits 895 or answer with only digit 6	M1	eg $537 \div 895$ or $537 \div 895000$ or $537 \div 0.895$ or 0.006 or 6000
	0.6 or $\frac{3}{5}$	A1	oe value eg $\frac{537}{895}$
Additional Guidance			
Ignore simplification or conversion attempt after correct answer seen			
Condone eg $537 \div 895000^3$ for M1 but must be recovered for A1			

Q	Answer	Mark	Comments
9	$8.5 \text{ m} \leq \text{length} < 9.5 \text{ m}$	B2	oe B1 8.5 or 9.5 in correct position SC1 $9.5 \text{ m} \leq \text{length} < 8.5 \text{ m}$
	Additional Guidance		
Accept 9.49 for 9.5			
Accept eg 8.50 for 8.5			

Q	Answer	Mark	Comments
10	1 + 0.2 or 1.2 or 100(%) + 20(%) or 120(%)	M1	oe eg $x + 0.2x$ implied by eg $20\% = 64000$ or $10\% = 32000$
	384 000 ÷ 1.2 or 384 000 ÷ 120 ($\times 100$) or 3200 ($\times 100$)	M1dep	oe eg 64000×5 or 32000×10
	320 000	A1	
	Additional Guidance		
M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts			
460 800 is M0 unless 1.2 oe seen			
Correct answer followed by further work		M2A0	

Q	Answer	Mark	Comments
11	x^3y or yx^3	B1	
	$5xy^3$ or $5y^3x$	B1	
	$5x^2y^2$ or $5y^2x^2$	B1	
	Additional Guidance		
Mark the answer lines unless blank			
Do not allow transcription errors			

Q	Answer	Mark	Comments
12	Alternative method 1		
	(guitars \Rightarrow) $80 \div 2$ or 40	M1	oe
	their $40 \div (3 + 4 + 1)$ or 5	M1dep	oe
	3 \times their 5	M1dep	oe $\frac{3}{3+4+1} \times 40$ is M3
	15	A1	
	Alternative method 2		
	80 \div $(3 + 4 + 1)$ or 10	M1	oe
	3 \times their 10 or 30	M1dep	oe
	their $30 \div 2$	M1dep	oe
	15	A1	
Alternative method 3	(guitars \Rightarrow) $80 \div 2$ or 40	M1	oe
	$x + \frac{4}{3}x + \frac{1}{3}x =$ their 40	M1dep	oe equation with x as number of keyboards
	$\frac{14}{3}x =$ their 40	M1dep	oe equation in form $ax = b$
	15	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Other algebraic approaches are possible eg (guitars \Rightarrow) $80 \div 2$ or 40 M1 $3x + 4x + x =$ their 40 but does not score 2nd M1 until $(x =)$ their $40 \div (3 + 4 + 1)$		

Q	Answer	Mark	Comments
13	$\tan 38 = \frac{h}{15}$ or $\left(\frac{15}{\cos 38}\right)^2 - 15^2$ or [137.3, 137.342]	M1	oe eg $\tan (90 - 38) = \frac{15}{h}$ or $\frac{\sin 38}{h} = \frac{\sin 52}{15}$ any letter or phrase for h eg opposite
	$15 \times \tan 38$ or $\sqrt{\left(\frac{15}{\cos 38}\right)^2 - 15^2}$ or [11.7, 11.72]		oe eg $15 \div \tan (90 - 38)$ or $\frac{15 \sin 38}{\sin 52}$
	$\sin x = \frac{\text{their}[11.7, 11.72]}{14}$ or $\sin x = [0.835, 0.84]$	M1dep	oe eg $\sin x = \frac{\sin 90}{14} \times \text{their}[11.7, 11.72]$ implied by $\sin^{-1}[0.835, 0.84]$
	[56.6, 57.14012]		A1
Additional Guidance			
Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts			

Q	Answer	Mark	Comments
14	No and valid explanation	B1	eg No and $0.8 \times 0.9 = 0.72$ or No and saves 28% or No and 10% is off a smaller amount
	Additional Guidance		
	A value may be used in an explanation eg $0.9 \times 0.8 \times 200 = 144$ and $0.7 \times 200 = 140$ so No	B1	
	2nd discount is reducing an already reduced price so No	B1	
	10% off reduced price is not 10% off original price and No	B1	
	Cannot just add the percentages as they are of different amounts so No	B1	
	10% of the already reduced price is not 10% on top of the 20% discount	B1	
	No and 30% is too much	B0	
	Incorrect overall percentage saving stated eg No and saves 22%	B0	

Q	Answer	Mark	Comments	
14		B4	<p>B3 correct equation eg $2x + 5x + 6 + 5x + 6 = 180$ or $5x + 6 = 90 - x$ or $2x + 90 - x + 5x + 6 = 180$ or $5x + 6 = 174 - 7x$</p> <p>B2 correct expressions for two angles or two different correct expressions for the same angle</p> <p>B1 correct expression for one angle</p>	
15	Additional Guidance			
	<p>Correct expressions for angles (which may be seen on the diagram) include</p> <p>angle $AQC = 2x$</p> <p>angle $APQ = 5x + 6$</p> <p>angle $AQP = 5x + 6$</p> <p>angle $APQ = \frac{180 - 2x}{2}$ or $90 - x$</p> <p>angle $AQP = \frac{180 - 2x}{2}$ or $90 - x$</p> <p>angle $APQ = 180 - 2x - (5x + 6)$ or $174 - 7x$</p> <p>angle $AQP = 180 - 2x - (5x + 6)$ or $174 - 7x$</p> <p>angle $QPB = 180 - (5x + 6)$ or $174 - 5x$</p> <p>angle $ZPB = 5x + 6$ (Z is the end of line QP produced)</p> <p>angle $ZPA = 180 - (5x + 6)$ or $174 - 5x$ (Z is the end of line QP produced)</p>			
	<p>B2 may be awarded for the same expression for two different angles</p> <p>eg angle $APQ = 5x + 6$ and angle $AQP = 5x + 6$</p>			B2
	<p>Accept eg AQP for angle AQP</p>			
	<p>Do not accept eg (angle) P for angle APQ unless shown on the diagram</p>			
	<p>Ignore reasons</p>			

Q	Answer	Mark	Comments
16	$x^2 + 2x - 5x - 10$ or $x^2 - 3x - 10$	M1	oe quadratic expression 4 terms with at least 3 correct (terms may be seen in a grid) implied by $x^2 - 3x + k$
	their $(x^2 + 2x - 5x - 10) - 6x (= 0)$ or their $(x^2 - 3x - 10) - 6x (= 0)$ or $x^2 - 9x - 10 (= 0)$	M1dep	accept eg $-x^2 + 9x + 10 (= 0)$ accept oe equations in the form $px^2 + qx = r$ eg $x^2 - 9x = 10$
	$(x + 1)(x - 10) (= 0)$ or $\frac{-9 \pm \sqrt{(-9)^2 - 4 \times 1 \times -10}}{2 \times 1}$ or $\frac{9 \pm 11}{2}$	M1	oe ft their 3-term quadratic which cannot be $x^2 - 3x - 10$
	-1 and 10	A1	must have both solutions
Additional Guidance			
-1 and 10 without working			M3A1
In the quadratic formula 9^2 is equivalent to $(-9)^2$ but do not accept -9^2 unless recovered			
$x^2 - 3x - 10 = 6x$ $x^2 + 3x - 10 = 0$ $(x + 5)(x - 2) = 0$			M1 M0dep M1
If first M1 is awarded for 4 terms that are incorrectly simplified to 3 terms, the 2nd M1 can be awarded using the incorrect simplification eg $x^2 + 2x - 5x - 10 = x^2 - 7x - 10$ $x^2 - 7x - 10 - 6x (= 0)$			M1 M1dep

Q	Answer	Mark	Comments
17	(gradient $LM =$) 4 or (gradient $ST =$) $-\frac{1}{4}$	M1	oe do not allow inclusion of x unless recovered
	Yes and valid reason	A1	valid reasons include $-\frac{1}{4}$ is the negative reciprocal of 4 $-\frac{1}{4} \times 4 = -1$ $-1 \div (-\frac{1}{4}) = 4$

Q	Answer	Mark	Comments
	2 11 37 82 100	B1	may be implied by plots
18(a)	Correct cf diagram with points joined with a smooth curve or lines	B2ft	$\pm \frac{1}{2}$ small square ft their cf values which must be increasing for B2 or B1 B1ft cf diagram with all points plotted at their heights but not at correct horizontal positions or cf diagram with all points plotted at correct horizontal positions with at least 4 of their heights correct or all points plotted correctly at their heights but cf diagram not drawn or drawn poorly
Additional Guidance			
Ignore diagram to the left of their (40, 2)			
For B2ft the diagram must end at (200, their 100) unless followed by a horizontal line			
Histogram only			Max B1B0
Histogram and cf diagram			Mark the cf diagram

Q	Answer	Mark	Comments
18(b)	Correct median for their cumulative frequency diagram	B1ft	ft their diagram which must be increasing $\pm \frac{1}{2}$ small square
	Correct comparison of their type P median with 126	B1ft	answers must be in context eg P lasts longer or P is better
	Correct interquartile range for their cumulative frequency diagram	B1ft	ft their diagram which must be increasing $\pm \frac{1}{2}$ small square
	Correct comparison of their type P interquartile range with 57	B1ft	answers must be in context eg P is more consistent or P is more reliable or Q is more varied
Additional Guidance			
2nd and 4th marks - ignore irrelevant or incorrect statements alongside a correct statement as long as not contradictory eg (P median = 132) P lasts longer by 8 (error) minutes			2nd B1
P's average is bigger			2nd B0
P's median is greater			2nd B0
P's spread is smaller			4th B0
P's IQR is lower			4th B0
Q is more spread out			4th B0
2nd and 4th marks can be awarded even if their diagram is not increasing			
2nd and 4th marks can be awarded even if the methods used for P's median and IQR are incorrect			

Q	Answer	Mark	Comments
19	Alternative method 1 : starts by working out area of phone screen $15 \div 6$ or 2.5 or $6 \div 15$ or 0.4 or $420 \div 15$ or 28		
	$420 \div (15 \div 6)^2$ or $420 \times (6 \div 15)^2$ or $420 \div 15 \times (6 \div 15) \times 6$ or 67.2	M1 M1dep	oe oe
	their $67.2 \times \frac{7000}{100^2}$	M2dep	oe M1dep their $67.2 \div 100^2$ or 0.00672 or their 67.2×7000 or 470 400 M1 $\frac{7000}{100^2}$ or 0.7
	47(.04)	A1	SC3 digits 4704

Mark scheme and Additional Guidance continue on the next page

Q19 cont	Alternative method 2 : starts by working out cost of tablet screen		
	$420 \times \frac{7000}{100^2}$ or 294	M2	oe M1 $420 \div 100^2$ or 0.042 or 420×7000 or 2940 000 or $\frac{7000}{100^2}$ or 0.7
	15 ÷ 6 or 2.5 or 6 ÷ 15 or 0.4	M1	oe
	their $294 \div (15 \div 6)^2$ or their $294 \times (6 \div 15)^2$	M1dep	oe dep on M3
	47(.04)	A1	SC3 digits 4704
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
20	$8 = \frac{24}{u_1} + 4$	M1	oe eg $4 = \frac{24}{u_1}$ accept u_1 replaced by a different variable eg x
	$u_1 = 6$	A1	do not accept $x = 6$ in working with nothing on answer line for u_1
	$u_3 = 7$	B1	SC1 $u_1 = 7$ and $u_3 = 7\frac{3}{7}$ or $\frac{52}{7}$ or [7.4, 7.43] or $u_1 = 7$ and $u_3 = 7\frac{3}{13}$ or $\frac{94}{13}$ or [7.2, 7.231]
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Embedded u_1 eg $8 = \frac{24}{6} + 4$		M1

Q	Answer	Mark	Comments
21(a)	Draws a tangent at 2 seconds and [1.5, 2.5]	B2	B1 draws tangent at 2 seconds

Q	Answer	Mark	Comments
21(b)	[88, 95]	B3	B2 (area under curve =) [16, 22] or (area under horizontal =) 48 and (area under diagonal =) 24 implied by 72 B1 (area under horizontal =) 48 or (area under diagonal =) 24
Additional Guidance			
For B2 and B1 areas may be seen on the diagram			

Q	Answer	Mark	Comments
21(c)	Underestimate and valid reason involving area under the graph	B1ft	ft their area in (b)

Q	Answer	Mark	Comments
	$(n - 15)^2$	M1	
	$(n - 15)^2 - 15^2 + 236$ or $(n - 15)^2 - 225 + 236$ or $(n - 15)^2 + 11$	M1dep	may be embedded in or implied by an inequality or equation eg $(n - 15)^2 - 15^2 + 236 = 10$ $(n - 15)^2 - 15^2 + 236 > 10$ $(n - 15)^2 > -1$
	Valid explanation with M1 seen	A1	eg M1 seen and all the terms must be 11 or more or $(n - 15)^2 \geq 0$ and 11 is added
22 Additional Guidance			
	Condone a different letter used eg x		
	M2 and all the terms must be greater than 11		M2A0
	M2 and the 15th term is the smallest		M2A0
	Least term is 11 with no working for completing the square		M0
	M2 and squaring a bracket always has two digits then adding 11 means it has at least two digits		M2A0
	$(n - 15)(n - 15)$ is equivalent to $(n - 15)^2$		
	$(n - 15n)^2$		M0
	Ignore incorrect work after M2 eg $(n - 15)^2 + 11 = 0$		M2
	Condone $(n - 15)^2$ is positive and 11 is added		M2A1

Q	Answer	Mark	Comments
23(a)	Alternative method 1		
	angle $ACB = 53$	M1	may be seen on diagram
	106	A1	
	Alternative method 2		
	angle $OAB = 90 - 53$ or 37 or angle $OBA = 90 - 53$ or 37	M1	may be seen on diagram
	106	A1	
	Additional Guidance		
	Accept eg ACB for angle ACB		
	Accept (angle) C for angle ACB		
	Do not accept eg (angle) A for angle OAB unless shown on the diagram		
	Ignore reasons		

Q	Answer	Mark	Comments
23(b)	$g = 180 - 63$ or 117	M1	may be seen on diagram
	$f = \text{their } 117 \div 3 \times 2$ or 78	M1dep	oe may be seen on diagram
	$h = 180 - \text{their } 78$ or 102	M1dep	may be seen on diagram equivalent ratios to $13 : 17$ implies M3
	$13 : 17$	A1	accept $1 : \frac{17}{13}$ or $\frac{13}{17} : 1$
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore reasons		

Q	Answer	Mark	Comments
24	Response showing that GD bisects angle ADF and all reasons	B4	B3 response showing that GD bisects angle ADF B2 correct expressions for two angles in terms of x (angles must be above AD) or two correct statements about a pair of angles (angles must be above AD) B1 correct expression for one angle in terms of x (angle must be above AD) or one correct statement about a pair of angles (angles must be above AD)

Additional Guidance is on the next page

Additional Guidance	
24 cont	<p>Correct expressions for angles (which may be seen on the diagram) include</p> <p>angle $DAG = x$</p> <p>angle $ADF = 180 - x$</p> <p>angle $ADG = \frac{180 - x}{2}$ or $90 - \frac{x}{2}$</p> <p>angle $AGD = \frac{180 - x}{2}$ or $90 - \frac{x}{2}$</p> <p>angle $GDF = 180 - x - \frac{180 - x}{2}$ or $\frac{180 - x}{2}$ or $90 - \frac{x}{2}$</p> <p>angle $DGF = \frac{x}{2}$</p>
	<p>Expressions must be explicit eg do not accept angle $ADF + x = 180$ unless recovered</p>
	<p>Correct statements about a pair of angles include</p> <p>angle $AGD = \text{angle } GDF$</p> <p>angle $AGD = \text{angle } ADG$</p> <p>angle $ADG = \text{angle } GDF$</p> <p>angle $AGD = 90 - \text{angle } DGF$</p> <p>angle $GDF = 90 - \text{angle } DGF$</p>
	<p>Accept eg angle AGD and angle ADG both labelled y as a correct statement about a pair of angles</p>
	<p>Accept eg DAG for angle DAG</p>
	<p>Do not accept a single upper case letter for an angle unless shown on the diagram</p>
	<p>For up to B2 allow assumption that GD bisects angle ADF</p>
	<p>Reasons needed will depend on the approach used and will include some of</p> <p>alternate angles (are equal)</p> <p>(base) angles of isosceles triangle (are equal)</p> <p>angles in rectangle are 90</p> <p>angles of triangle (add up to 180)</p> <p>(adjacent) angles on a (straight) line (add to 180)</p>