GradeMax

Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE

In Mathematics B (4MB1) Paper 01R

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)

- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - awrt – answer which rounds to
  - eeoo – each error or omission

- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.

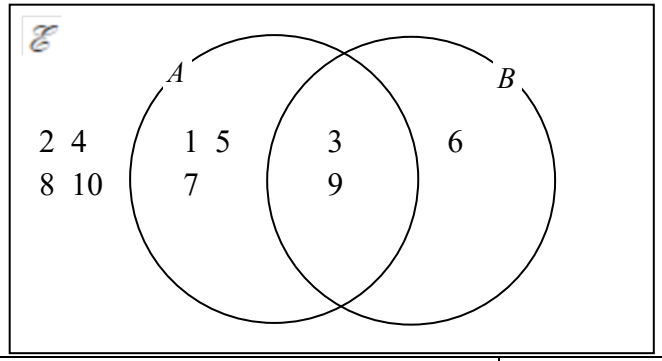
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.
  If there is a choice of methods shown, then award the lowest mark, unless the subsequent working makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

Question		Working	Answer	Mark	Notes
1		$\frac{18}{45}[=0.4]$ oe or $\frac{45}{60}[=0.75]$ oe		2	M1 Speed in km/min or time in hours found. Allow a calculation to be in km/sec ie $\frac{18}{2700}$ Allow for correct fraction or decimal seen. Ignore units written. Look for as part of a calculation eg $\frac{18}{\frac{3}{4}}$
		cas	24		A1 cao
					Total 2 marks

2		1 + 2 [= 3] **and** $\frac{8}{12}+\frac{3}{12}$ oe or $\frac{20}{12}+\frac{27}{12}$ oe		2	M1 Adding whole parts **and** expressing fractional parts with common denominator or expressing as improper fractions with a common denominator. Accept sum with shared denominator or which shows working eg $\frac{2\times4+1\times3}{12}$ eg $\frac{5\times4}{3\times4}+\frac{9\times3}{4\times3}$ Do not accept eg $\frac{2}{3}\times4$ $\frac{1}{4}\times3$ unless clearly recovered.
		wr	$3\frac{11}{12}$		A1 cao isw eg decimals after a correct answer.
					Total 2 marks

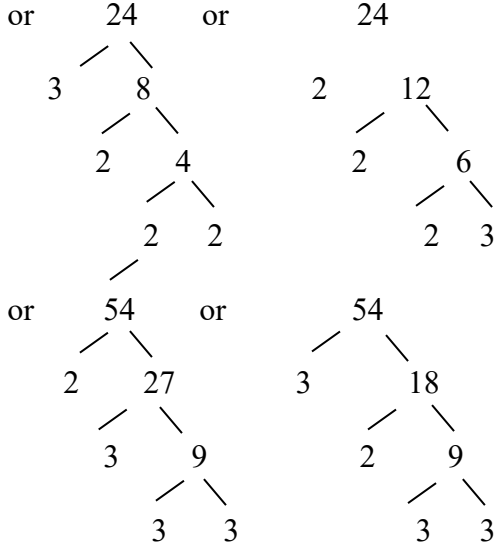
3				2	B2 Fully correct (B1 2 or 3 out of 4 correct regions)
					Total 2 marks

Question		Working	Answer	Mark	Notes
4		Gradient $= \frac{8[-0]}{[0]-6}\left[-\frac{8}{6}=-\frac{4}{3}\right]$ oe or $y = mx + 8$ or $-\frac{4}{3}x$ oe		2	M1 Correct method to find gradient or correct gradient $y = mx + 8$ seen or $-\frac{4}{3}x$ oe seen
		cas	$y = -\frac{4}{3}x + 8$		A1 oe in the form $y = mx + c$ (allow $y = -1.3(33\ldots)x + 8$) For a decimal allow 1.3 or better eg $1.\dot{3}$ or 1.33 Allow 8 to be $\frac{24}{3}$ oe Allow $-\frac{4}{3}x + 8$ on the answer line, only if $y =$ seen at least once in the working.
					Total 2 marks

5		$\frac{3-(-4)}{3^2+(-4)^2}$		2	M1 Substitute into formula, must have correct signs, accept $\frac{3+4}{3^2+4^2}$ or $\frac{3+4}{9+16}$ or $\frac{7}{n}$ or $\frac{m}{25}$ m, n are integers Missing brackets may be recovered.
		cas	$\frac{7}{25}$ oe		A1 oe eg 0.28 isw after correct answer seen
					Total 2 marks

Question		Working	Answer	Mark	Notes
6		$\frac{1}{2}\times(x+10)\times 5=45$ oe		3	M1 forming correct equation in x Allow any correct equation where there is already a partial rearrangement. Eg $\frac{1}{2}\times(x+10)=9$ Eg $(x+10)=\frac{45\times 2}{5}$ Condone splitting into a rectangle and 2 triangles or 2 rectangles as follows: $45=\left[2\times\frac{1}{2}\right]\times 5\left(\frac{10-x}{2}\right)+5x$ Condone use of eg a or b for x
		$[x=]\frac{2\times 45}{5}-10$ oe			M1 dep on previous M1 correct order of operations to isolate x May imply the previous method mark This may be done in stages.
		cas	8		A1 cao
					Total 3 marks

7	(a)		$\begin{pmatrix}4 & 2\\ 2 & 1\end{pmatrix}$	2	B2 Fully correct (B1 2 or 3 values correct)
	(b)		3	1	B1 cao 3 only
					Total 3 marks

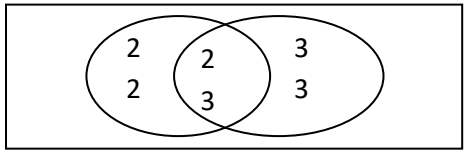
<table>
<tr>
<td>8</td>
<td>(a)</td>
<td>$24 = 2^3 \times 3$ or $54 = 2 \times 3^3$
or $24 = 2^2 \times 6$ or $54 = 6 \times 3^2$
or
 

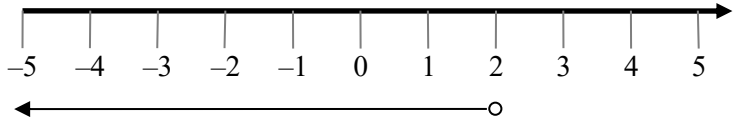
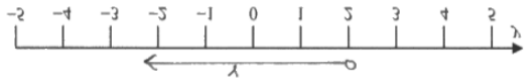
or

or

or

or
<table>
<tr><td>2</td><td>24</td><td>54</td></tr>
<tr><td>3</td><td>12</td><td>27</td></tr>
<tr><td></td><td>4</td><td>9</td></tr>
</table>
or
<table>
<tr><td>3</td><td>24</td><td>54</td></tr>
<tr><td>2</td><td>8</td><td>18</td></tr>
<tr><td></td><td>4</td><td>9</td></tr>
</table>

or complete list of factors of 24 and 54
or
 
</td>
<td></td>
<td>2</td>
<td>M1 correct attempt to split either 24 or 54 into prime factors or prime factor tree (which may stop at last two factors)
eg 54
2 27
3 9
or diagram as shown, with prime factorisation as far as 4 and 9
or complete list of factors of 24 and 54
(condone 1, 24 and 54 not present)
or correct Venn diagram as shown (can be missing the rectangle).
Award for working seen in part (b) if not awarded in (a)</td>
</tr>
<tr>
<td></td><td></td><td>wr</td><td>6</td><td></td><td>A1 cao do not accept 2×3</td>
</tr>
<tr>
<td></td><td>(b)</td><td></td><td>216</td><td>1</td><td>B1 cao do not accept $2^3 \times 3^3$</td>
</tr>
<tr>
<td></td><td></td><td></td><td></td><td></td><td>Total 3 marks</td>
</tr>
</table>

Question		Working	Answer	Mark	Notes
9	(a)	$4x < 13 - 3$ or $4x < 10$ oe eg $2x < 5$ eg $3 - 13 < -4x$ or $\frac{3}{4} + \frac{[4]x}{[4]} < \frac{13}{4}$ oe eg $0.75 + x < 3.25$ or $\frac{5}{2}$ oe		2	M1 correctly isolates term in x or for correctly dividing through by 4 or for $\frac{5}{2}$ oe with no inequality or an incorrect inequality or equals symbol
		cas	$x < \frac{5}{2}$		A1 oe eg $\frac{5}{2} > x$ $x < \frac{10}{4}$ Allow a correctly inequality, then incorrectly processed eg $x < \frac{5}{2}$ followed by eg $x < 0.5$ eg $x < 10$ will get A1 Allow this to be awarded in the body of working. do not isw when there is misunderstanding $x < \frac{5}{2}$ oe followed by $\frac{5}{2}$ oe is A0 $x = \frac{5}{2}$ oe is A0 $x > \frac{5}{2}$ oe is A0
	(b)			1	B1 cao Accept anything that has an open circle at 2, with an arrow pointing in the correct direction. Allow "(" to represent an open circle. Eg  as arrow indicates this continues beyond where the line stops.
					Total 3 marks

Question		Working	Answer	Mark	Notes
10			$x \,,,\, 4$ oe eg $x-4,,\ 0$	3	B3 All 3 correct B2 Any 2 correct B1 Any 1 correct Accept equivalents, condone strict inequalities
			$y \,,,\, x+3$ oe eg $y-x,,\ 3$		
		cas	$x+y \ldots 4$ oe eg $y \ldots 4-x$		SC1 – all three inequalities incorrect way round, strict or not
					Total 3 marks

Question		Working	Answer	Mark	Notes
11		$\frac{80}{360}\times 2\times\pi\times 5\left[=\frac{20}{9}\pi=6.981...\right]$ oe		3	M1 Correct method to find arc length Watch for this done in parts. If miscalculation during, **award marks for method** eg $2\times\pi\times 5\left[=8.281...\right.$ correct method, incorrect processing$\left.\right]$ $\frac{4}{9}\times$"8.281" gets this mark
		"6.981..."$+2\times 5$ [=16.981] oe			M1 Add on straight edges to their arc length. It should be clear they're adding the 2 straight edges onto something they think is the arc length (ie nothing to contradict this is the arc length).
		cas	17		A1 awrt 17 Watch out for incorrect method of finding the area which also leads to a value of 17 (to 2sf) 17.4532……
					Total 3 marks

Question		Working	Answer	Mark	Notes
12		Frequency density of $\frac{18}{20}$ oe eg 0.9 or $\frac{33}{40}$ oe eg 0.825 seen by the table or in working or on the graph or any correct missing frequency or frequency density indicated in table, on graph or in working (39 or 10) or any correct FD on the vertical axis where the height of 1 small square is 0.025 = $\frac{1}{40}$ oe eg 8 cm to 1 FD or eg 1 cm^2 to 2.5 frequency		3	M1 Method to find either a frequency for the table or height of a bar or correct frequency density. Any correct missing frequency or frequency density implies this mark
			39 **or** 10		A1 indicated on table, on graph or in working.
		cas Bar from 60-100 height 0.825 (33 small squares), and Bar from 100-200 height 0.1 (4 small squares)			A1
					Total 3 marks

Time (t minutes)	Number of students
$0 \leqslant t < 20$	18
$20 \leqslant t < 60$	39
$60 \leqslant t < 100$	33
$100 \leqslant t < 200$	10

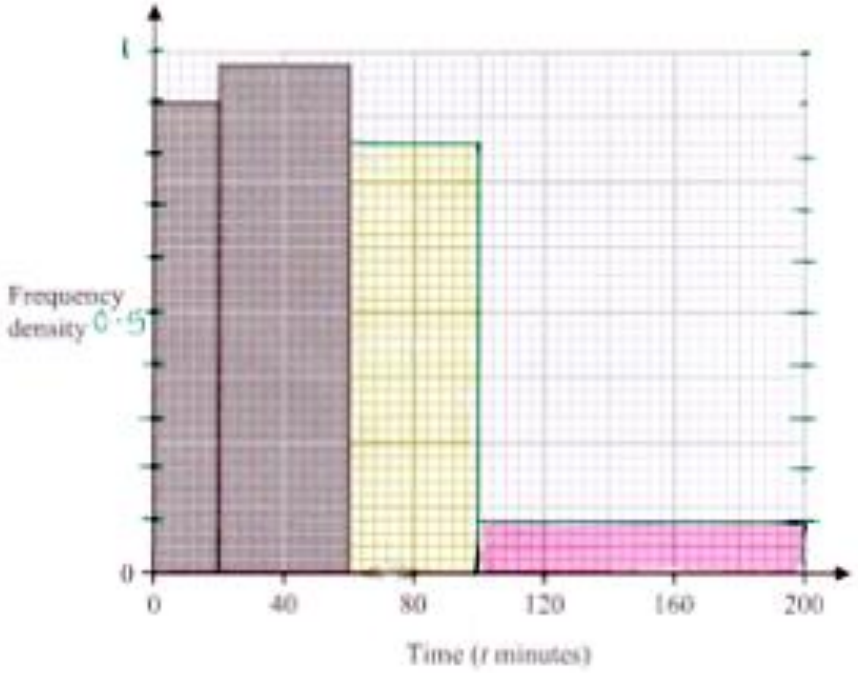
FD

$\frac{18}{20}$ $\frac{9}{10}$ $\frac{36}{40}$ 0.9

$\frac{39}{40}$

$\frac{33}{40}$ 0.825

$\frac{10}{40}$



Question	Working	Answer	Mark	Notes
13	$[x=]\dfrac{1+\sqrt{7}}{\frac{1}{2}\left(6-2\sqrt{7}\right)}\left[=\dfrac{1+\sqrt{7}}{3-\sqrt{7}}=\dfrac{2+2\sqrt{7}}{6-2\sqrt{7}}\right]$ or $\left[\frac{1}{2}x=\right]\dfrac{1+\sqrt{7}}{\left(6-2\sqrt{7}\right)}$ oe		3	M1 Any correct expression shown oe For this question, completely ignore labelling of x or $\frac{1}{2}x$
	Finding x $\dfrac{1+\sqrt{7}}{3-\sqrt{7}}\times\dfrac{3+\sqrt{7}}{3+\sqrt{7}}=\dfrac{3+3\sqrt{7}+\sqrt{7}+7}{9\left[+3\sqrt{7}-3\sqrt{7}\right]-7}$ or $\dfrac{10+4\sqrt{7}}{2}$ oe eg $\dfrac{1+\sqrt{7}}{3-\sqrt{7}}\times\dfrac{-3-\sqrt{7}}{-3-\sqrt{7}}=\dfrac{-3-3\sqrt{7}-\sqrt{7}-7}{-9\left[+3\sqrt{7}-3\sqrt{7}\right]+7}$ or $\dfrac{-10-4\sqrt{7}}{-2}$ or $\dfrac{10+4\sqrt{7}}{2}$ oe eg $\dfrac{2+2\sqrt{7}}{6-2\sqrt{7}}\times\dfrac{6+2\sqrt{7}}{6+2\sqrt{7}}=\dfrac{12+12\sqrt{7}+4\sqrt{7}+4\times7}{36\left[+12\sqrt{7}-12\sqrt{7}\right]-28}$ or $\dfrac{40+16\sqrt{7}}{8}$ or Finding $\dfrac{1}{2}x$ $\dfrac{1+\sqrt{7}}{6-2\sqrt{7}}\times\dfrac{6+2\sqrt{7}}{6+2\sqrt{7}}=\dfrac{6+6\sqrt{7}+2\sqrt{7}+14}{36\left[+12\sqrt{7}-12\sqrt{7}\right]-28}$ or $\dfrac{20+8\sqrt{7}}{8}$ oe eg $\dfrac{1+\sqrt{7}}{6+2\sqrt{7}}\times\dfrac{-6-2\sqrt{7}}{-6-2\sqrt{7}}=\dfrac{-6-6\sqrt{7}-2\sqrt{7}-14}{-36\left[+12\sqrt{7}-12\sqrt{7}\right]-28}$ or $\dfrac{-20-8\sqrt{7}}{-8}$ or $\dfrac{20+8\sqrt{7}}{8}$			M1 For rationalising any of $\dfrac{1+\sqrt{7}}{\frac{1}{2}\left(6-2\sqrt{7}\right)}$ $\dfrac{1+\sqrt{7}}{3-\sqrt{7}}$ $\dfrac{2+2\sqrt{7}}{6-2\sqrt{7}}$ oe or $\dfrac{1+\sqrt{7}}{\left(6-2\sqrt{7}\right)}$ oe a **correct** product stated to rationalise the denominator **and** processing with at least 2 out of 4 numerator terms correct and correct processing of denom allow any mix of processing – full evaluation doesn't need to be seen eg accept 4×7 for 28 $\left(\sqrt{7}\right)^2$ for 7 eg $\dfrac{10+3\sqrt{7}+\sqrt{7}}{9-7}$ eg $\dfrac{10-7\sqrt{7}+\sqrt{7}}{9-\left(\sqrt{7}\right)^2}$ would imply 2 out of 4 terms correct.
	wr	$5+2\sqrt{7}$		A1 accept $a=5$, $b=2$, $c=7$
				Total 3 marks

Question		Working	Answer	Mark	Notes
14	(a)	$\frac{1926}{1.2}$ or $\frac{1926}{120}\times 100$ oe eg $\frac{1926}{6}\times 5$ $1.2x = 1926$		2	M1 Complete method to reverse percentage increase or a correct equation in x Condone eg $\frac{1926}{120\%}$ eg $\frac{1926}{(1+20\%)}$ Do not condone this, without the % sign
		cas	1605		A1 cao
	(b)	$\frac{1926}{1.07}$ oe		2	M1 Correct method to change \$1926 into euros
		cas	1800		A1 cao
					Total 4 marks

15	(a)	10.8×10^{201} or 1.08×10^{n} or $k\times10^{202}$		2	M1 n must be an integer and 1,, $k<10$
		cas	1.08×10^{202}		A1 cao
	(b)	0.9×10^{101} or 12×10^{100} or 21×10^{100} or 2.1×10^{m} or $q\times10^{101}$			M1 Express both numbers with same exponent where m is an integer and 1,, $q<10$.
		cas	2.1×10^{101}	2	A1 cao
					Total 4 marks

Question		Working	Answer	Mark	Notes
16	(a)		$\pi \times 6^2 \times 12 [= 432\pi]$ or $\pi \times \left(\frac{12}{2}\right)^2 \times 12 [= 432\pi]$ or $\pi \times 36 \times 12 [= 432\pi]$	1	B1 one of the correct expressions only
	(b)	$\pi r^2 \times 2r = (432 - 416)\pi [= 16\pi]$ oe or $\pi \left(\frac{d}{2}\right)^2 \times d = (432 - 416)\pi [= 16\pi]$ oe or $\left[(432 - 416)\pi = \pi r^2 h \Rightarrow h = \frac{16}{r^2}\right]$ $\left[\frac{h}{12} = \frac{r}{6}\right] \Rightarrow \frac{\frac{16}{r^2}}{12} = \frac{r}{6}$ oe eg $\frac{\frac{16\pi}{\pi r^2}}{12} = \frac{r}{6}$ where r and h are radius and height of small cylinder		3	M1 correct equation involving r or d only (r is radius d is diameter of small cylinder) Allow any letters for r or d
		[r =] 2			M1 Dep on 1st M solves for r or d (allow 1 processing error)
		cas	4		A1

ALT1	(b)	$\frac{(432-416)\pi}{432\pi}\left[=\frac{16\pi}{432\pi}=\frac{1}{27}\right]$ oe **and** $\sqrt[3]{\frac{(432-416)\pi}{432\pi}}\left[=\frac{1}{3}\right]$ oe or $\frac{432\pi}{(432-416)\pi}\left[=\frac{432\pi}{16\pi}=27\right]$ oe **and** $\sqrt[3]{\frac{432\pi}{(432-416)\pi}}[=3]$ oe			find ratio of volumes of smaller cylinder to original **and** find a linear ratio For 16π allow awrt 50.3 For 416π allow awrt 1310 For 432π allow awrt 1360
		$12\times"\frac{1}{3}"$ or $6\times"\frac{1}{3}"$ oe			M1 Dep on 1st M use linear ratio to find diameter or radius
		cas	4		A1 awrt 4
ALT2	(b)	$\frac{(432-416)\pi}{432\pi}=\left(\frac{d}{12}\right)^3$ oe			M1 correct equation involving d only (d is diameter of small cylinder) For $16\pi, 416\pi, 432\pi$ allow values as per ALT1 Allow any letter for d (including r)
		[d =] 4			M1 Dep on 1st M solves for d (allow 1 processing error)
		cas	4		A1 awrt 4
					Total 4 marks

Question		Working	Answer	Mark	Notes
17	(a)	Examples for B1: $2^3x^6y^9$ $x^5\times2^3\times y^9$ $x^6\times y^9\times2^3$ $4.5x^6y^9$	$8x^6y^9$	2	B2 For the correct term. Allow in any order eg $x^6 8y^9$ 8 must not be 2^3 (B1 any 2 terms correct as part of a product of the form $bx^ny^m \quad b,m,n\neq0$. Allow 8 to be 2^3 Condone terms with or without of multiplication signs for B1 only eg $x^6\times y^9 2^3$ Only allow transcription errors of the powers or the constant onto the answer line) Do not isw (B1 only)
	(b)	Examples for B1: $3^2p^8q^4$ $p^8\times3^2\times q^{-2}$ $p^6\times q^4\times3^2$ $p^8q^4\times6$	$9p^8q^4$	2	B2 Allow in any order eg $p^8q^4 9$ Condone $a = 9$, $m = 8$, $n = 4$ 9 must not be 3^2 B1 any 2 terms correct as part of a product of the form $ap^nq^m \quad a,n,m\neq0$. Allow 9 to be 3^2 Condone terms with or without of multiplication signs for B1 only eg $p^6\times q^4 3^2$ Only allow transcription errors of the powers or the constant onto the answer line Do not isw (B1 only)
					Total 4 marks

Question		Working	Answer	Mark	Notes
18		$\frac{x}{x+1} = \sin 20 [= 0.342]$ oe eg $x = (x+1)\sin 20$ eg $\frac{x}{\sin 20} = \frac{x+1}{\sin 90}$		4	M1 Form correct equation in x using sin 20 Allow also BC or a mix of BC and x **Allow sin 20 to be awrt 0.34 throughout.** Allow a processing error for sin 20 if clearly seen written first (general marking principle, if not precluded by the MS) A common error seen will be where a candidate's calculator is in radians and they evaluate sin20 as 0.912945….. Must be using a number with minimum 2dp. Allow a misevaluation of sin20, if sin20 is seen, throughout, with continued correct working.
		$x = x\sin 20 + \sin 20$ oe eg $x - \sin 20 = x\sin 20$ eg $0.34(2\ldots)x + 0.34(2\ldots) = x$			Dep on 1st M1 Correctly removes fraction from equation and expands bracket Can imply the previous method mark.
		$x(1-\sin 20) = \sin 20$ oe eg $x(1-\sin 20) - \sin 20 = 0$ eg $[x =] \frac{\sin 20}{1-\sin 20} = \frac{0.34(2...)}{1-0.34(2...)}$			Dep on 2nd M1 Correctly separates terms in x (or collects if using awrt 0.34) Can imply previous 2 method marks.
		cas	0.52		A1 awrt 0.52

ALT1		$\left[(AB)=\sqrt{(x+1)^2-x^2}=\sqrt{2x+1}\right]$ $\cos 20=\frac{\sqrt{2x+1}}{x+1}$ oe eg $(\cos 20)^2=\left(\frac{\sqrt{2x+1}}{x+1}\right)^2$ oe or $\frac{\sqrt{2x+1}}{\sin 70}=\frac{x}{\sin 20}$ oe eg $\frac{2x+1}{(\sin 70)^2}=\frac{x^2}{(\sin 20)^2}$ eg $\frac{\sqrt{2x+1}}{\sin 70}=\frac{x+1}{[\sin 90]}$ or $\tan 20=\frac{x}{\sqrt{2x+1}}$ oe eg $(\tan 20)^2=\left(\frac{x}{\sqrt{2x+1}}\right)^2$ oe		4	M1 For a correct equation in x and sin20 or cos20 or tan20 sin20 = 0.34202….. cos20 = 0.93969…. tan20 = 0.36397…. $(\sin 20)^2$ = 0.11697….. $(\cos 20)^2$ = 0.88302…. $(\tan 20)^2$ = 0.13247…. Allow awrt 2dp
		$(\cos 20)^2 x^2+\left(2(\cos 20)^2-2\right)x+(\cos 20)^2-1[=0]$ oe or $(\sin 70)^2 x^2-2(\sin 20)^2 x-(\sin 20)^2[=0]$ oe or $(0.88302...)x^2-(0.23395...)x-0.11697...[=0]$ oe or $x^2-2(\tan 20)^2-(\tan 20)^2[=0]$ oe or $x^2-(0.26494...)x-0.13247...[=0]$ oe			M1 dep on 1st M1 For correct 3 term quadratic in cos20 or tan 20 Award if 2 out of 3 terms are correct Don't need to see = 0 May imply previous M mark with 2 coefficients correct Allow evaluated coefficients awrt 0.88, 0.23. 0.12, 0.26, 0.13
		eg $[x=]\frac{-\left(2(\cos 20)^2-2\right)\pm\sqrt{\left(\left(2(\cos 20)^2-2\right)\right)^2-4(\cos 20)^2\left((\cos 20)^2-1\right)}}{2(\cos 20)^2}$			M1 dep on 2nd M1 (ie using a 3TQ with 2 out of 3 terms correct) Correct substitution into the quadratic formula
		cas	0.52		A1 awrt 0.52

ALT2		$\left[(AB)=\sqrt{(x+1)^2-x^2}=\sqrt{2x+1}\right]$ $x^2=(x+1)^2+\left(\sqrt{2x+1}\right)^2-2(x+1)\left(\sqrt{2x+1}\right)\cos 20$ oe oe eg $\cos 20=\dfrac{(x+1)^2+2x+1-x^2}{2(x+1)\sqrt{2x+1}}$ or $\left(\sqrt{2x+1}\right)^2=(x+1)^2+x^2-2x(x+1)\cos 70$		4	M1 correct equation in x using cosine rule cos70 = 0.34202….. cos20 = 0.93969…. Allow awrt 2dp
		$2(\cos 20)^2x^3+\left(5(\cos 20)^2-4\right)x^2+4\left((\cos 20)^2-4\right)x+(\cos 20)^2-1[=0]$ or $(1.76604...)x^3+(0.41511...)x^2-(0.46791...)x-0.11697...[=0]$ oe or $(2-2\cos 70)x^2-(2\cos 70)x[=0]$ or $(1.31595....)x^2-(0.68404....)x[=0]$			M1 dep on 1st M1 For correct 4 term cubic in cos20 or quadratic in cos70 Award if 2 out of 4 terms are correct for the cubic or 2 out of 3 terms correct for the quadratic. Don't need to see = 0 May imply previous M mark with 2 coefficients correct Allow evaluated coefficients awrt 1.77, 0.42, - 0.47, - 0.12, 1.32, 0.68 in the relevant cubic or quadratic
		eg $x\left((2-2\cos 70)x-2\cos 70\right)[=0]$ oe oe eg $[x=]\dfrac{2\cos 70}{2-2\cos 70}$ oe			M1 for correct factorisation or use of correct substitution into the quadratic formula to solve the 2TQ (with at least one term correct) May be implied by awrt 0.52
		cas	0.52		A1 awrt 0.52

Question		Working	Answer	Mark	Notes
19		$3x^2+9x=3x(x+3)$ or $2x^2+9x+9=(2x+3)(x+3)$		4	M1 Correctly factorises $3x^2+9x$ or factorises $2x^2+9x+9$ correctly May be awarded for factorising after the fractions are added, in which case expect to see $3x(x+3)(x-2)$ in the denom
		$\frac{2x^2+9x+9}{3x^2+9x}=\frac{2x+3}{3x}$ or $\frac{(2x^2+9x+9)(x-2)}{(3x^2+9x)(x-2)}=\frac{2x+3}{3x}$			M1 Correct simplification of the second fraction. May be awarded for simplification after the fractions are added
		$\frac{3x(x-5)+(x-2)(2x+3)}{3x(x-2)}$ oe eg $\frac{3x^2-15x}{3x^2-6x}+\frac{2x^2-x-6}{3x^2-6x}$ or eg $\frac{(3x^2+9x)(x-5)}{(3x^2+9x)(x-2)}+\frac{(x-2)(2x^2+9x+9)}{(3x^2+9x)(x-2)}$ or eg $\frac{3x(x+3)(x-5)+(x-2)(2x+3)(x+3)}{3x(x+3)(x-2)}$ or eg $\frac{5x^3-x^2-54x-18}{3x^3+3x^2-18x}$ or eg $\frac{3x^3-15x^2+9x^2-45x}{3x^3+9x^2-6x^2-18x}+\frac{2x^3+9x^2+9x-4x^2-18x-18}{3x^3+9x^2-6x^2-18x}$			M1 For the correct addition of the 2 correct fractions. Must reach a common denominator. This may be as separate fractions. Missing brackets must be recovered. May be implied by A1
		cas	$\frac{5x^2-16x-6}{3x(x-2)}$		A1 oe must be simplified eg $\frac{5x^2-16x-6}{3x^2-6x}$
					Total 4 marks

Question		Working	Answer	Mark	Notes
20	(a)	$[f(-2)=]$ eg $(-2)^3+7\times([-]2)^2+17\times-2+14$		2	M1 **If a full substitution is not seen, the minimum we will accept is** $-8+28-34+14$ Condone $-2^3+7\times-2^2+17\times-2+14=0$ **or** $-2^3+7\times(-2)^2+17\times-2+14=0$ Must see = 0 for either of these Ignore any reference to long division for part (a)
		wr	$=0$		A1
	(b)	x^2+Ax+7 or x^2+5x+B $A,B>0$		2	M1 Any 2 terms of the quadratic factor obtained – **this may be seen awarded for the correct quadratic factor seen in part (a)**
		cas	x^2+5x+7		A1 Do not isw eg if they go on to solve, after seeing the correct quadratic, award A0 **This must be seen in part (b) to be awarded**
					Total 4 marks

Question		Working	Answer	Mark	Notes
21		$[\mathbf{NM} =]\begin{pmatrix}15 & 19\\19 & 24\end{pmatrix}$		4	M1 Attempt to find **NM** (at least 2 values in the matrix correct)
		$\left[\left\|\begin{pmatrix}15 & 19\\19 & 24\end{pmatrix}\right| = \right]15\times24-19\times19[=-1]$ For reference $\left[\mathbf{MN} = \begin{pmatrix}7 & -9\\-25 & 32\end{pmatrix}\right]$ $7\times32-(-9\times-25)[=-1]$			M1 Correct **method** to find determinant of their **NM** (allow their **MN)** Eg for **MN** $\left[\begin{pmatrix}7 & -9\\-25 & 32\end{pmatrix} = \right]7\times32-(-9)\times(-25)[=-1]$ For an incorrect **NM** or **MN**, correct working must be shown for their matrix product
		$\left[(\mathbf{NM})^{-1} = \frac{1}{-1}\right]\begin{pmatrix}24 & -19\\-19 & 15\end{pmatrix}$			M1 ft their **NM** (allow their **MN**) This mark is for (ignore the determinant) $\begin{pmatrix}a & b\\c & d\end{pmatrix}\rightarrow\begin{pmatrix}d & -b\\-c & a\end{pmatrix}$ with their **NM** or their **MN**
		cas	$\begin{pmatrix}-24 & 19\\19 & -15\end{pmatrix}$ or $-\begin{pmatrix}24 & -19\\-19 & 15\end{pmatrix}$		A1 Allow eg $-\frac{1}{1}\begin{pmatrix}24 & -19\\-19 & 15\end{pmatrix}$ or eg $\frac{1}{-1}\begin{pmatrix}24 & -19\\-19 & 15\end{pmatrix}$
					Total 4 marks

21 Alt1		$\left[\left\|\begin{pmatrix}1 & 1\\ -3 & -4\end{pmatrix}\right| = \right]1\times(-4)-1\times(-3)[=-1]$ or $\left[\left\|\begin{pmatrix}3 & -4\\ 4 & -5\end{pmatrix}\right| = \right]3\times(-5)-4\times(-4)[=1]$		4	M1 correct method to find determinant of **M** or **N**
		$\begin{pmatrix}1 & 1\\ -3 & -4\end{pmatrix}\rightarrow\begin{pmatrix}-4 & -1\\ 3 & 1\end{pmatrix}$ or $\begin{pmatrix}3 & -4\\ 4 & -5\end{pmatrix}\rightarrow\begin{pmatrix}-5 & 4\\ -4 & 3\end{pmatrix}$			M1 correct method to find inverse (ignore determinant) of **M** or **N**
		$\begin{pmatrix}-24 & 19\\ 19 & -15\end{pmatrix}$			M1 Find $\mathbf{M}^{-1}\mathbf{N}^{-1}$ Awarded if at least 2 out of 4 numbers in the final matrix are correct.
		cas	$\begin{pmatrix}-24 & 19\\ 19 & -15\end{pmatrix}$ or $-\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$		A1 Allow eg $-\frac{1}{1}\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$ or eg $\frac{1}{-1}\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$

21 Alt2		$[\mathbf{NM}=]\begin{pmatrix}15 & 19\\ 19 & 24\end{pmatrix}$		4	M1 Attempt to find **NM** (at least 2 numbers in the matrix correct)
		$"\begin{pmatrix}15 & 19\\ 19 & 24\end{pmatrix}"\begin{pmatrix}x_1 & x_2 & x_3.....\\ y_1 & y_2 & y_3.....\end{pmatrix}$ $=\begin{pmatrix}x_1' & x_2' & x_3'...\\ y_1' & y_2' & y_3'...\end{pmatrix}$			M1 Correct attempt to multiply any 2 by 2 matrix representing their **NM** by a 2 by *n* matrix with entries that form coordinates that could make any shape with *n* sides. **Entries in the resulting matrix will need to be checked. Allow for 2 correct columns using their NM and their set of coordinates.** Note it is also possible to just work with a 2 by 2 rather than 2 by *n* matrix and transform 2 points.
		$\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}x_1' & x_2' & x_3'....\\ y_1' & y_2' & y_3'....\end{pmatrix}$ $=\begin{pmatrix}x_1 & x_2 & x_3.....\\ y_1 & y_2 & y_3.....\end{pmatrix}\Rightarrow$ $ax_1'+by_1'=x_1$ $ax_2'+by_2'=x_2$ $ax_3'+by_3'=x_3$ and $cx_1'+dy_1'=y_1$ $cx_2'+dy_2'=y_2$ $cx_3'+dy_3'=y_3$			M1 for $\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}x_1' & x_2' & x_3'....\\ y_1' & y_2' & y_3'....\end{pmatrix}=\begin{pmatrix}x_1 & x_2 & x_3.....\\ y_1 & y_2 & y_3.....\end{pmatrix}$ **and** correctly forming 2 pairs of simultaneous equations. These equations must be correct for their **NM** and their image and original coordinates. Note it is also possible to just work with a 2 by 2 rather than 2 by *n* matrix and transform 2 points.
			$\begin{pmatrix}-24 & 19\\ 19 & -15\end{pmatrix}$ or $-\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$		A1 Allow eg $-\frac{1}{1}\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$ or eg $\frac{1}{-1}\begin{pmatrix}24 & -19\\ -19 & 15\end{pmatrix}$

Question		Working	Answer	Mark	Notes
22	(a)	$0.3+0.1+2x+x=1$ or $\frac{1-0.3-0.1}{3}$		2	M1 Correct equivalent equation or Correct equivalent full method (look for this to be in parts and carry through any processing errors, e.g 0.3 + 0.1 [= 0.31 incorrect processing, correct method] 1 – 0.31 [= 0.79 correct method again, with now 2 processing errors] $\frac{0.79}{3}$ will be awarded this mark if all of the method is explicitly shown.
		cas	0.2		A1
	(b)	0.3×340 oe		2	M1 award for 0.1×340 or 0.2×340 or 0.3×340 or 0.4×340 or for any **full** equivalent calculation to these
		cas	102		A1
	(c)	$\frac{0.3}{1-0.1}\left[=\frac{1}{3}\right]$ oe or $\frac{"102"}{340-0.1\times 340}\left[=\frac{"102"}{306}\right]$ oe		3	M1 Correct probability of red for first counter, given not green. Ft their 102 from part b, if used.
		$\frac{0.3}{1-0.1}$ or $\frac{102}{306}\left[=\frac{1}{3}\right]\times\frac{"102"-1}{340-1}$ or $\frac{\frac{"102"}{340}\times\frac{"102"-1}{339}}{1-\frac{"102"/3}{340}}=\left[\frac{0.3\times\frac{101}{339}}{0.9}\right]$ oe			M1 dep on 1st M Correct method to find probability of red for second counter and multiplication by probability of red for first counter. Ft their 102 from part b, if used.
		cas	$\frac{101}{1017}$		A1 accept awrt 0.099 Allow 0.1 from any correct working
					Total 7 marks

Question		Working	Answer	Mark	Notes
23		$3x^2$ or -15		5	M1 one correct algebraic term correctly differentiated
		$"3x^2-15"=0$ or $[x=]\sqrt{5}$ or $[x=]-\sqrt{5}$			M1 dep on previous method mark, their derivative = 0 dependent also on a derivative in the form $3x^2+b$ or ax^2-15 $a,b\neq 0$ May be implied by $[x=]\sqrt{5}$ or $[x=]-\sqrt{5}$
		$("\pm\sqrt{5}")^3-15\times("\pm\sqrt{5}")+5$			M1 dep on previous method mark for substituting ***any*** value of x (from previous working) into $x^3-15x+5$ Condone use of a decimal here. This mark can be implied by a correct coordinate, decimal or exact.
			$(\sqrt{5},\ 5-10\sqrt{5})$ oe exact eg $(-\sqrt{5},\ 5-\sqrt{500})$ $(-\sqrt{5},\ 5+10\sqrt{5})$ oe exact eg $(-\sqrt{5},\ 5+\sqrt{500})$		A2 for both coordinates correct A1 only for one correct coordinate or all values correct given as decimals awrt 1dp or a mix of surds and decimals $\sqrt{5}=2.2(36067....)$ $5+10\sqrt{5}=27.4$ (27.36067977) $5+10\sqrt{5}=-17.4$ (−17.36067977) Allow answers to be given as $x=$ and $y=$, so long as correctly paired. If seen we can isw
		cas - discuss			***Total 5 marks***

Question		Working	Answer	Mark	Notes
24	(a)	$(18-2r)\times 18=12^2$ oe or $(18-r)^2=12^2+r^2$ oe eg $\left(18-\frac{d}{2}\right)^2=12^2+\left(\frac{d}{2}\right)^2$		3	M1 correctly form equation using intersecting chord theorem or correct equation using Pythagoras' theorem
		$36r=18^2-12^2\,[=180]$ oe			M1 dep on previous M Correctly isolate terms in r and eliminate r^2 if using Pythagoras
		cas	5		A1 cao
ALT	(a)	$18\times PA=12^2$ oe $(18-d)\times 18=12^2$ oe [$PA = 8$ or $d = 10$]			M1 Correct equation to find PA or d
		$\frac{18-"8"}{2}$ or $\frac{"10"}{2}$			M1 dep on previous M Correct method to find the radius, using their PA
		cas	5		A1 cao
	(b)	$"5"\times\frac{18}{12}$ oe or $(12+x)^2=18^2+x^2$ oe		2	M1 Correct use of similar triangles, ft their 5 from (a) or correctly forms equation using Pythagoras Allow seen in part (a) if used in part (b) $BQ = CQ$ (equal tangents) so a correct equation also is $\left(12+CQ^2\right)^2=18^2+CQ^2$
		cas	7.5		A1 oe

ALT		$[\angle OPC =]\tan^{-1}\frac{"5"}{12}[=22.61986....]$ $\tan"22.61986.."=\frac{BQ}{18}$ oe or $\left[\frac{\sin 90}{12}=\frac{\sin(POC)}{13}\right]$ $[POC =]\sin^{-1}\left(\frac{13}{12}\right)=67.3801.....$ $OPC = 90-"67.3801....."[=22.61986....]$ $\frac{\sin"22.61986...."}{BQ}=\frac{\sin"67.3801....."}{18}$		2	Full correct method to find angle *OPT* (= angle *BPQ*) awrt 23 **and** correct equation with *BQ* and this angle.
		cas	7.5		A1 oe
					Total 5 marks

Question		Working	Answer	Mark	Notes
25		$\left[\overrightarrow{OB}=\right]\begin{pmatrix}-8-5\lambda\\7+3\lambda\end{pmatrix}$ oe eg $\begin{pmatrix}-8\\7\end{pmatrix}+\begin{pmatrix}-5\lambda\\3\lambda\end{pmatrix}$ eg $\begin{pmatrix}-8\\7\end{pmatrix}+\begin{pmatrix}5\lambda\\-3\lambda\end{pmatrix}$ oe eg $\begin{pmatrix}x+8\\y-7\end{pmatrix}=\begin{pmatrix}-5\lambda\\3\lambda\end{pmatrix}$ eg $\begin{pmatrix}x+8\\y-7\end{pmatrix}=\begin{pmatrix}5\lambda\\-3\lambda\end{pmatrix}$ eg $\begin{pmatrix}8\\-7\end{pmatrix}+\begin{pmatrix}\sqrt{169-y^2}\\y\end{pmatrix}=\begin{pmatrix}-5\lambda\\3\lambda\end{pmatrix}$ or $\begin{pmatrix}5\lambda\\-3\lambda\end{pmatrix}$ eg $\begin{pmatrix}8\\-7\end{pmatrix}+\begin{pmatrix}x\\\sqrt{169-x^2}\end{pmatrix}=\begin{pmatrix}-5\lambda\\3\lambda\end{pmatrix}$ or $\begin{pmatrix}5\lambda\\-3\lambda\end{pmatrix}$		5	M1 Find $\overrightarrow{OB}$ by adding $\overrightarrow{OA}$ and a multiple of $\overrightarrow{AB}$ or place $\overrightarrow{OB}$ written with 2 variables equal to a multiple of $\overrightarrow{AB}$ Condone missing brackets from column vectors.
		$\sqrt{"(-8-5\lambda)"^2+"(7+3\lambda)"^2}=13$ oe eg $"(-8-5\lambda)"^2+"(7+3\lambda)"^2=13^2$ eg if using 5λ and -3λ $"(-8+5\lambda)"^2+"(7-3\lambda)"^2=169$ eg $-7+\sqrt{169-"(-5\lambda-8)"^2}=3\lambda$ oe including for $5\lambda/-3\lambda$ eg $\sqrt{169-"(3\lambda+7)"^2}+8=-5\lambda$ oe including for $5\lambda/-3\lambda$			M1 Use their $\left\lvert\overrightarrow{OB}\right\rvert=13$ to correctly form an equation in their parameter using $x^2+y^2=169$ and their $\overrightarrow{OB}$
		$34\lambda^2+122\lambda-56[=0]\left[\Rightarrow\lambda=\frac{7}{17}\right]$ oe or if using 5λ and -3λ $34\lambda^2-122\lambda-56[=0]\left[\Rightarrow\lambda=-\frac{7}{17}\right]$			A1 oe Correct three term quadratic gained. Do not need to see = 0 Implied by correct λ
		$-8-5\times"\frac{7}{17}"$ **and** $7+3\times"\frac{7}{17}"$ must use $\lambda>-\frac{8}{5}$ or if using 5λ and -3λ $-8+5\times"-\frac{7}{17}"$ **and** $7-3\times"-\frac{7}{17}"$ must use $\lambda<\frac{8}{5}$			M1 dep on previous 2 M marks or dep on correct λ seen for substituting their λ into a correct $\overrightarrow{OB}$ to find **both** coordinates (working must be seen for an incorrect λ, allow λ to be any other letter throughout) Both correct coordinates can imply this mark.
		cas	$\left(-\frac{171}{17},\frac{140}{17}\right)$		A1 oe fractions

ALT1		$\left[\overrightarrow{OB}=\overrightarrow{OA}+\overrightarrow{AB}\right]$ $\left[\overrightarrow{OB}=\overrightarrow{OA}+k\overrightarrow{OC}\right]$ $\left[\begin{pmatrix}x\\y\end{pmatrix}=\right]\begin{pmatrix}-8-5k\\7+3k\end{pmatrix}$ oe eg $\begin{pmatrix}x+8\\y-7\end{pmatrix}=\begin{pmatrix}-5k\\3k\end{pmatrix}$		5	M1 Find $\overrightarrow{OB}$ by adding $\overrightarrow{OA}$ and a multiple of $\overrightarrow{AB}$ or place $\overrightarrow{OB}$ written with 2 variables equal to a multiple of $\overrightarrow{AB}$ Condone missing brackets from column vectors.
		$\frac{"x+8"}{-5}=k=\frac{"y-7"}{3}\Rightarrow x=$ or $y=$ **and** $x^2+y^2=13^2$ or $\left["\text{slope}" \text{ of } \overrightarrow{OC}=\right]-\frac{3}{5}=\frac{"y-7"}{\mathbf{"8+x"}}\left["\text{slope}" \text{ of } \overrightarrow{AB}=\right]$ oe eg $-3(x+8)=5(y-7)$ eg $y=-\frac{3}{5}x+\frac{11}{5}\Rightarrow x=$ or $y=$ $\left[x=\frac{-5y+11}{3}\quad y=\frac{3x-11}{-5}\right]$			M1 using their $\overrightarrow{OB}$ allow any letters for x and y Correctly rearrange each component for k and write x in terms of y or y in terms of x or correctly use "slope" of $\overrightarrow{OC}=$ "slope" of $\overrightarrow{AB}$ and write x in terms of y or y in terms of x **(this approach can imply first M mark)** **and** state $x^2+y^2=13^2$ The rearrangement for k or use of gradient must be correct and checked for their $\overrightarrow{OB}$ the expression for x in terms of y or y in terms of x needs to be present, but doesn't need to be checked.
		$34y^2-110y-1400\left[=0\right]$ or $34x^2-66x-4104\left[=0\right]$ oe $\left[\Rightarrow y=\frac{140}{17}=8.2(35294.....)\right.$ $\left.x=\frac{-171}{17}=-10.0(58823....)\right]$			A1 oe Correct three term quadratic gained. Do not need to see = 0 Look for equivalent coefficients eg $17x^2-33x-2052\left[=0\right]$ oe **Implied by correct x or y allow awrt 1dp**
		$x=\frac{-5\left(\frac{140}{17}\right)+11}{3}$ or $y=\frac{3\left(-\frac{171}{17}\right)-11}{-5}$ oe or $x=\sqrt{169-\left(\frac{140}{17}\right)^2}$ or $y=\sqrt{169-\left(-\frac{171}{17}\right)^2}$			M1 dep on both previous method marks or dep on correct x or y for substituting their x into a correct expression for y or their y into a correct expression for x (working must be seen for an incorrect x or y, allow to be any other letters throughout) Both correct coordinates can imply this mark.
		cas	$\left(-\frac{171}{17},\frac{140}{17}\right)$		A1 oe fractions
					Total 5 marks

ALT2		$\left[\overrightarrow{OB}=\overrightarrow{OA}+\overrightarrow{AB}\right]$ $\left[\overrightarrow{OB}=\overrightarrow{OA}+k\overrightarrow{OC}\right]$ $\left[\begin{pmatrix}x\\y\end{pmatrix}=\right]\begin{pmatrix}-8-5k\\7+3k\end{pmatrix}$ oe eg $\begin{pmatrix}x+8\\y-7\end{pmatrix}=\begin{pmatrix}-5k\\3k\end{pmatrix}$		5	M1 Find $\overrightarrow{OB}$ by adding $\overrightarrow{OA}$ and a multiple of $\overrightarrow{AB}$ or place $\overrightarrow{OB}$ written with 2 variables equal to a multiple of $\overrightarrow{AB}$ Condone missing brackets from column vectors.
		$\left[8+x=-5k \quad y-7=3k\right]$ $8+\sqrt{169-y^2}=-5\left(\frac{-7+y}{3}\right)$ oe or $3\left(\frac{8+x}{-5}\right)=-7+\sqrt{169-x^2}$ oe			M1 using their $\overrightarrow{OB}$ allow any letters for x and y Correctly rearranges one component for k and correctly substitutes into the other component **using** $x^2+y^2=13^2$ – this may be implied by a correct quadratic in x or y, usually with a square root sign. Allow any letters for x and y
		$34y^2-110y-1400\left[=0\right]$ or $34x^2-66x-4104\left[=0\right]$ oe $\left[\Rightarrow y=\frac{140}{17}=8.2(35294.....)\right.$ $\left.x=\frac{-171}{17}=-10.0(58823....)\right]$			A1 oe Correct three term quadratic gained. Do not need to see = 0 Look for equivalent coefficients eg $17x^2-33x-2052\left[=0\right]$ oe **Implied by correct *x* or *y* allow awrt 1dp**
		$x=\frac{-5\left(\frac{140}{17}\right)+11}{3}$ or $y=\frac{3\left(-\frac{171}{17}\right)-11}{-5}$ Or $x=\sqrt{169-\left(\frac{140}{17}\right)^2}$ or $y=\sqrt{169-\left(-\frac{171}{17}\right)^2}$			M1 dep on both previous method marks or dep on correct x or y for substituting their x into a correct expression for y or their y into a correct expression for x (working must be seen for an incorrect x or y, allow to be any other letters throughout) Both correct coordinates can imply this mark.
		cas	$\left(-\frac{171}{17},\frac{140}{17}\right)$		A1 oe fractions
					Total 5 marks

Question		Working	Answer	Mark	Notes
26		$\left[MC^2\right] = 24^2 + 64^2 \left[= 4672\right]$ $\left[MC =\right] \sqrt{24^2 + 64^2} \left[= 8\sqrt{73} = 68.3520....\right]$		6	M1 correct full method to find MC^2 or MC For MC accept awrt 68 – will imply correct method unless from obviously incorrect method.
		$\left[ME^2\right] = 32^2 + 9^2 \left[= 1105\right]$ $\left[ME\right] = \sqrt{32^2 + 9^2} \left[\sqrt{1105} = 33.24154....\right]$			M1 correct full method to find ME^2 or ME For ME accept awrt 33 – will imply correct method unless from obviously incorrect method.
		$\left[CE^2\right] = 24^2 + "33.2"^2$ oe eg $\left[CE^2\right] = 24^2 + "1105"\left[= 1681\right]$ $\left[CE\right] = \sqrt{24^2 + "33.2"^2}\ \left[CE\right] = \sqrt{24^2 + "1105"}\left[= 41\right]$ $\left[AC^2 =\right] 48^2 + 64^2 \left[= 6400\right]$ or $AC = \sqrt{48^2 + 64^2}\ \left[= 80\right]$ or $\left[OC^2 =\right] 24^2 + 32^2 \left[= 1600\right]$ or $AC = \sqrt{24^2 + 32^2}\ \left[= 40\right] \Rightarrow$ $\left[AE^2 =\right] "40"^2 + 9^2 \left[= 1609\right]$ or $AE = \sqrt{"40"^2 + 9^2}\ \left[= 41 = CE\right]$			M1 **correct full method** to find CE^2 or CE or any of the slant edges eg AE. ft their ME – allow anything they believe is their ME, not contradicted by other working. Allow awrt 41 – will imply correct method unless from obviously incorrect method. **For the first 3 marks, if students don't follow the quickest route, it must be a full method and they may find any equivalent length.**
		$"4672" = ("41")^2 + ("33.2")^2 - 2 \times "41" \times "33.2" \cos CEM$			M1 for full, correct use of cosine rule to find an **equation** involving CEM ft their lengths Implied by the next method mark. Follow through their MC, ME and CE if clearly they are using these sides and not contradicted.
		$\left[\cos CEM =\right] \dfrac{("41")^2 + ("33.2")^2 - "68.4^2"}{2 \times "41" \times "33.2"} \left[= -0.6919...\right]$ oe eg $\left[\cos CEM =\right] \dfrac{"1681" + "1105" - "4672"}{2 \times "41" \times "33.2"} \left[= -0.6919...\right]$ oe eg $\left[\cos CEM =\right] \dfrac{-"1681" - "1105" + "4672"}{-2 \times "41" \times "33.2"} \left[= -0.6919...\right]$			M1 Correctly rearranges cosine rule to find an expression for CEM ft their lengths, order of operations must be dealt with correctly. Implies the previous method mark Follow through their MC, ME and CE if clearly they are using these sides and not contradicted.
		Remember to look on the diagram for lengths or methods. If there is a contradiction between these, the working space takes precedence. cas	134		A1 awrt 134 A correct final answer may imply previous method marks (unless from obviously incorrect working).
					Total 6 marks

Question		Working	Answer	Mark	Notes
27	(a)		$\frac{360}{x+2}$ oe	1	B1 oe eg $180-\frac{180x}{x+2}$
	(b)	$\frac{360}{x}-9="\frac{360}{x+2}"$ oe eg $"180-\frac{180x}{x+2}"+9=180-\frac{180(x-2)}{x}$ oe eg $"189-\frac{180x}{x+2}"=180-\frac{180(x-2)}{x}$		3	M1 Form correct equation but ft their answer for part (a) Note from a correct expression in part (a) an equivalent equation is $[-]\frac{180x}{x+2}+9=[-]\frac{180(x-2)}{x}$
		Eg $360(x+2)-9x(x+2)=360x$ oe eg $360x+720=9x^2+18x+360x$ $[9x^2+18x-720=0]$			M1 for correct method to remove the denominators from the correct equation but **Condone** correct method to remove denominators from $\frac{360}{x}+9="\frac{360}{x+2}"$ $\frac{360}{x}="\frac{360}{x+2}"-9$ $\frac{360}{x}="\frac{360}{x+2}"$ $180-"\frac{180x}{x+2}"-9=180-\frac{180(x-2)}{x}$ oe $[-]\frac{180x}{x+2}=[-]\frac{180(x-2)}{x}+9$ $171-"\frac{180x}{x+2}"=180-\frac{180(x-2)}{x}$
		wr	Correctly shown		A1 for fully correct working **Allow = 0 to be missing on the final answer only**

	(c)	$(x + 10)(x – 8)$		2	M1 correct method to solve quadratic. If factorising, allow brackets which when expanded give 2 out of 3 terms correct If using formula must use a fully correct formula, but allow one sign error when substituting $\frac{-2 \pm \sqrt{(2)^2 - 4[\times 1] \times (-80)}}{2[\times 1]}$ oe If completing the square need to see $(x+1)^2 + c[=0]$ $c \neq 0, -80$ oe This mark is for the method shown $x = -10$ or 8 without working scores M0 (as students are told to show clear algebraic working).
		wr	8		A1 do not accept –10 unless rejected Dep on M1
					Total 6 marks