Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE In Mathematics A
4WM1H/01

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Summer 2026
Question Paper Log Number P81651A
Publication Code 4WM1H_01_2606_MS

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, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

  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**

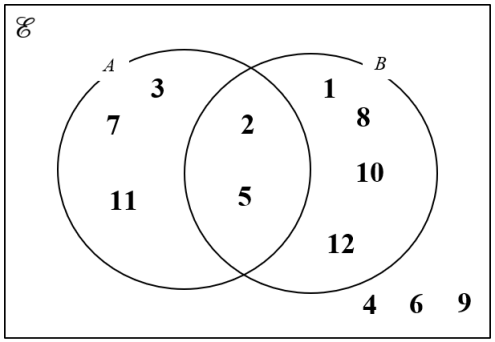
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

International GCSE Maths				
Values in quotation marks must come from a correct method previously seen unless clearly stated otherwise.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	$\frac{29}{7}(-)\frac{13}{5}$ or $(4)\frac{5}{35}(-)(2)\frac{21}{35}$ oe or $(4)\frac{5a}{35a}(-)(2)\frac{21a}{35a}$ oe		3	M1 for correct improper fractions or fractional part of numbers written correctly over a suitable common denominator
	eg $\frac{145}{35}-\frac{91}{35}$ **or** $\frac{29\times5}{7\times5}-\frac{13\times7}{5\times7}$ **or** $\frac{29\times5-13\times7}{5\times7}$ **or** $\frac{145a}{35a}-\frac{91a}{35a}$ **or** $4\frac{5}{35}-2\frac{21}{35}=2\frac{-16}{35}$ oe or $2+\frac{5}{35}-\frac{21}{35}=2-\frac{16}{35}$ oe or $3\frac{40}{35}-2\frac{21}{35}$			M1 for correct fractions with a common denominator with subtraction sign present or for working with mixed numbers to the stage shown implies the first M1
	eg $\frac{145}{35}-\frac{91}{35}=\frac{54}{35}=1\frac{19}{35}$ **or** $4\frac{5}{35}-2\frac{21}{35}=2\frac{-16}{35}=1\frac{19}{35}$ **or** $4\frac{5}{35}-2\frac{21}{35}=3\frac{40}{35}-2\frac{21}{35}=1\frac{19}{35}$ If common denominator is not 35 then cancelling must be shown eg $\frac{290}{70}-\frac{182}{70}=\frac{108}{70}=\frac{54}{35}=1\frac{19}{35}$ oe or $\frac{290}{70}-\frac{182}{70}=\frac{108}{70}=1\frac{38}{70}=1\frac{19}{35}$ oe or $4\frac{10}{70}-2\frac{42}{70}=2\frac{-32}{70}=2\frac{-16}{35}=1\frac{19}{35}$ oe	A fully correct solution shown		A1 dep on M2 for a correct answer from fully correct working If a student shows that $1\frac{19}{35}=\frac{54}{35}$ and has working that shows LHS = $\frac{54}{35}$ this can gain full marks **NB Use of decimals scores no marks unless as a check**
	Working required			**Total 3 marks**

2	eg $\cos 65 = \frac{x}{10}$ or $\tan 65 = \frac{10\sin 65}{x}$ or $\sin(90-65) = \frac{x}{10}$ or $\frac{x}{\sin(90-65)} = \frac{10}{\sin 90}$ or $(x^2 =) 10^2 - (10\sin 65)^2 \left(= 17.8(60...)\right)$ or $(x^2 =) 10^2 - (9.06(307...))^2 \left(= 17.8(60...)\right)$ or $(x^2 =) 10^2 + (10\sin 65)^2 - (2\times 10\times 10\sin 65\times\cos 25)\left(= 17.8(60...)\right)$ or $(x^2 =) 10^2 + 9.06^2 - (2\times 10\times 9.06\times\cos 25)\left(= 17.8(60...)\right)$		3	M1 for a correct trigonometrical statement for x or for a correct Pythagoras statement for x^2
	eg $(x =) 10\cos 65$ or $(x =) \frac{10\sin 65}{\tan 65}$ or $(x =) 10\sin(90-65)$ or $(x =) \frac{10}{\sin 90}\times\sin(90-65)$ or $(x =) \sqrt{10^2 - (10\sin 65)^2}\left(= \sqrt{17.8(60...)}\right)$ or $(x =) \sqrt{10^2 - (9.06(307...))^2}\left(= \sqrt{17.8(60...)}\right)$ or $(x =) \sqrt{10^2 + (10\sin 65)^2 - (2\times 10\times 10\sin 65\times\cos 25)}\left(= \sqrt{17.8(60...)}\right)$ or $(x =) \sqrt{10^2 + 9.06^2 - (2\times 10\times 9.06\times\cos 25)}\left(= \sqrt{17.8(60...)}\right)$			M1 for correct calculation to find x (implies the first M1)
	Correct answer scores full marks (unless from obvious incorrect working)	4.23		A1 accept an answer in the range 4.22 – 4.23
				Total 3 marks

3	(a)		78	1	B1 allow 20^{78}
	(b)		75	1	B1 allow 36^{75}
	(c)		64	1	B1 allow 52^{64}
	(d)		99.5	1	B1 cao
	(e)		16.35	1	B1 allow $16.34\dot{9}$ or $16.34\bar{9}$
					Total 5 marks

4	$10^2+(BD)^2=26^2$ oe or $(BD^2=)26^2-10^2\,(=576)$ oe or $(\text{angle } A=)\cos^{-1}\left(\frac{10}{26}\right)(=67.3(801...))$ **and** $\sin"67.3"=\frac{(BD)}{26}$ oe or $(\text{angle } B=)\sin^{-1}\left(\frac{10}{26}\right)(=22.6(198...))$ **and** $\tan"22.6"=\frac{10}{(BD)}$ oe		5	M1 Allow the use of different trigonometrical techniques to find *BD*
	$(BD=)\sqrt{26^2-10^2}\,(=\sqrt{576}=24)$ oe or $(BD=)26\sin"67.3"(=23.9(859...))$ oe or $(BD=)\frac{10}{\tan"22.6"}(=24.0(234...))$ oe			M1
	$\pi\times"24"(=24\pi=75.3(982...))$ oe or $\pi\times[\textit{their } BD]$ or $2\times\pi\times\frac{"24"}{2}(=24\pi=75.3(982...))$ oe or $2\times\pi\times\frac{[\textit{their } BD]}{2}$ or $\frac{1}{2}\times\pi\times"24"(=12\pi=37.6(991...))$ oe or $\frac{1}{2}\times\pi\times[\textit{their } BD]$ or $\frac{1}{2}\times2\times\pi\times\frac{"24"}{2}(=12\pi=37.6(991...))$ oe or $\frac{1}{2}\times2\times\pi\times\frac{[\textit{their } BD]}{2}$			M1 [their *BD*] **must** be seen on the diagram or clearly labelled in the working if the first 2 M marks are not awarded Allow 3.14… or $\frac{22}{7}$ for π
	$\frac{"75.3(982...)"}{2}+10+26$ oe or $\frac{"75.3(982...)"}{2}+10+26$ $37.6(991...)+10+26$ oe or $"\frac{1}{2}\times\pi\times[\textit{their } BD]"+10+26$ oe			M1 or for $36+12\pi$ **Allow this mark for the addition of 24 or the answer in the range 97.5 – 97.8** **May be seen as ….. + 60**
	Correct answer scores full marks (unless from obvious incorrect working)	73.7		A1 accept answers in the range 73.5 – 73.8 SC B1 for answers in the range 43.6 – 43.9 or 87.3 – 87.7 SC B2 for answers in the range 79.6 – 79.9 or 107.3 – 107.7
				Total 5 marks

5 (a)		Correct Venn diagram	3	B3 for all 4 regions of the Venn diagram correct. If not B3 then award (B2 for 2 or 3 regions correct) B1 for 1 region correct) Numbers must not be repeated in a region
(b)		$\frac{3}{12}$	1	B1ft provided the Venn diagram is not blank **or** for a correct answer oe eg $\frac{1}{4}$ or 0.25 or 25%
				Total 4 marks

6		$64x^{15}y^{18}$	2	B2 for $64x^{15}y^{18}$ (B1 a single product with 2 of 64, x^{15}, y^{18} correct eg $64x^{15}y^{n}$ where $n \neq 18$ **or** $64x^{m}y^{18}$ where $m \neq 15$ **or** $px^{15}y^{18}$ where $p \neq 64$. One term can be missing with 2 correct for B1 eg $64x^{15}$ **or** $64y^{18}$ **or** $(4)x^{15}y^{18}$ **or** $ax^{15}by^{18}$ where a and b are integers as long as not added to any other terms)
				Total 2 marks

7	1 – (0.12 + 0.16) (= 0.72) oe or 0.12 + x + 2x + 0.16 = 1 oe or 3x + 0.28 = 1 oe or 0.12 × 500 (= 60) oe or 0.16 × 500 (= 80) oe or (0.12 + 0.16) × 500 (= 140) oe		4	M1
	(x =) "0.72" ÷ 3 (= 0.24) oe or (2x =) "0.72" ÷ 3 × 2 (= 0.48) oe or (500 – "140") ÷ 3 (= 120) oe or (500 – "140") ÷ 3 × 2 (= 240) oe			M1
	("0.24" + 0.16) × 500 oe or [1 – (0.12 + "0.48")] × 500 oe or ("0.24" × 500) + "80" oe or 500 – ["60" + "0.48" × 500] oe or "120" + "80" oe or 500 – ["60" + "240"] oe			M1 or for $\frac{200}{500}$ or $\frac{300}{500}$ or 300
	Correct answer scores full marks (unless from obvious incorrect working)	200		A1 cao
				Total 4 marks

8	$640 = \frac{480}{(V)}$ oe		3	M1
	$(V =) \frac{480}{640}$ oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	0.75		A1 or $\frac{3}{4}$ Allow 750 000 cm^3 as long as m^3 is crossed out
				Total 3 marks

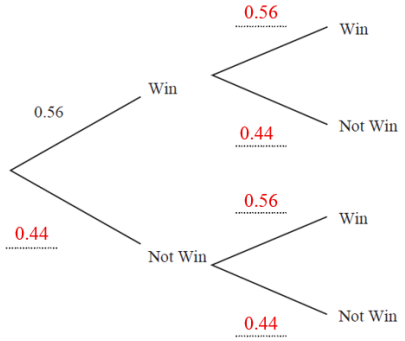
9 (a)		$5gh(3g^3 - 4h^2)$	2	B2 for $5gh(3g^3 - 4h^2)$ B1 for any **correct** partial factorisation with at least 2 different factors outside the bracket eg $gh(15g^3 - 20h^2)$ or $5g(3g^3h - 4h^3)$ or $5h(3g^4 - 4gh^2)$ **or** for $5gh$ as common factor with one error inside the bracket eg. $5gh(\ldots - 4h^2)$ or $5gh(3g^3 - \ldots)$
(b)(i)	$(x \pm 7)(x \pm 4)$ or $(7 \pm x)(4 \pm x)$ or $x(x + 7) - 4(x + 7)$ or $x(x - 4) + 7(x - 4)$		2	M1 for $(x \pm 7)(x \pm 4)$ or for brackets in the form $(x + a)(x + b)$ where $ab = -28$ or $a + b = 3$
	Correct answer scores full marks (unless from obvious incorrect working)	$(x+7)(x-4)$		A1 oe Allow any letter for x
(ii)		-7 (and) 4	1	B1ft answer must ft from their $(x+a)(x+b)$ in in b(i) Award B0 for -7, 4 if no marks scored in b(i).
				Total 5 marks

10		$y = 2x + 1$	3	B3 for $y = 2x + 1$ oe eg $y - 2x = 1$ or $y - 3 = 2(x - 1)$ or $y - 5 = 2(x - 2)$ oe B2 for $(L =) 2x + 1$ $y = 2x(+c)$ where c can be any letter or number or 0 $y = mx + 1$ where m can be any letter or number but $m \neq 0$ B1 for $(L =) 2x + c$ where c can be any letter or number or 0 $(L =) mx + 1$ where m can be any letter or number but $m \neq 0$ $(m =) 2$ (gradient =) 2 eg $\frac{5-3}{2-1}$ or $\frac{7-1}{3(-0)}$ oe
				Total 3 marks

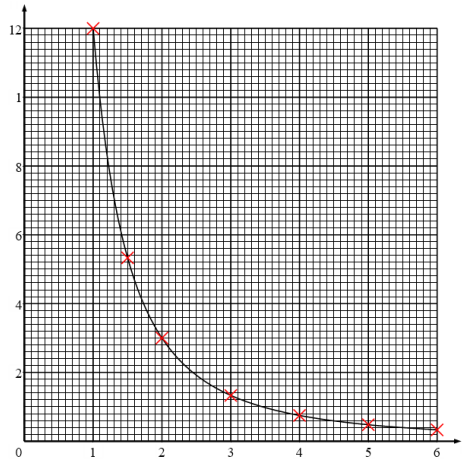
11	$\frac{25}{40+3x}=\frac{5}{11}$ oe or $\frac{25}{40+x+2x}=\frac{5}{11}$ oe or $\frac{25}{40+c}=\frac{5}{11}$ oe or $\frac{25}{y}=\frac{5}{11}$ or $\frac{5}{11}\times\frac{5}{5}$ or $40\times\frac{11}{8}$ oe or $25\div\frac{5}{11}$ oe or $\frac{7+2x+8+x}{40+3x}=\frac{6}{11}$		3	M1 Allow $\frac{5}{11}=0.45(4545...)$ $\frac{6}{11}=0.54(5454...)$
	$(3x=)15$ or $(x=)5$ or $(c=)15$ or $(y=)55$ or $\frac{25}{55}$			A1
	Correct answer scores full marks (unless from obvious incorrect working)	10		A1
				Total 3 marks

12 (a)	For $2^{\frac{x}{3}}$ eg $\left(4^{\frac{1}{2}}\right)^{\frac{x}{3}}$ **or** $4^{\frac{x}{6}}$ **or** $\left(8^{\frac{1}{3}}\right)^{\frac{x}{3}}$ **or** $8^{\frac{x}{9}}$ **or** $\left(64^{\frac{1}{6}}\right)^{\frac{x}{3}}$ **or** $64^{\frac{x}{18}}$	For 8^x eg $\left(2^3\right)^x$ **or** 2^{3x} **or** $\left(4^{\frac{3}{2}}\right)^x$ **or** $4^{\frac{3x}{2}}$ **or** 8^{x+2} or 8^{2+x} or $\left(64^{\frac{1}{2}}\right)^x$ **or** $64^{\frac{x}{2}}$		3	M1 for one correct application of an index rule involving $2^{\frac{x}{3}}$ or 8^x
	eg $\frac{x}{3}-3x=6$ oe **or** $\frac{x}{6}-\frac{3x}{2}=3$ oe **or** $\frac{x}{9}-x=2$ oe **or** $\frac{x}{18}-\frac{x}{2}=1$ oe **or** $x-9x=18$ oe				M1 for setting up a **correct** equation. This can be embedded in an index equation eg $2^{\frac{x}{3}-3x}=2^6$ (the base on the LHS and the RHS must be the same)
	Working required		–2.25		A1 dep on M1 oe eg $-\frac{18}{8}$ or $-\frac{9}{4}$ or $-2\frac{1}{4}$

(b)	$4t(t+5)=4t^2+20t$ or $4t(2t-3)=8t^2-12t$ or $(t+5)(2t-3)=2t^2-3t+10t-15$ or $\left(2t^2+7t-15\right)$		3	M1 for an expansion with **only one error**	M2 for 3 (out of a maximum of 4) of $8t^3-12t^2+40t^2-60t$ this can be implied by
	$\left(4t^2+20t\right)\left(2t-3\right)=8t^3-12t^2+40t^2-60t$ oe or $\left(8t^2-12t\right)\left(t+5\right)=8t^3+40t^2-12t^2-60t$ oe or $4t\left(2t^2-3t+10t-15\right)=8t^3-12t^2+40t^2-60t$ oe or $4t\left(2t^2+7t-15\right)=8t^3+28t^2-60t$ oe			M1 ft dep on M1 and a quadratic expression × linear expression **Allow one further error**	$8t^3+28t^2$ … or … $+28t^2-60t$ (M1 for 2 correct out of a maximum of 4)
	Correct answer scores full marks (unless from obvious incorrect working)	$8t^3+28t^2-60t$		A1 (terms may be in any order but must be simplified) ISW correct factorisation eg $2\left(4t^3+14t^2-30t\right)$ or $4\left(2t^3+7t^2-15t\right)$ Do not ISW incorrect simplification or subsequent division eg $4t^3+14t^2-30t$ or $2t^3+7t^2-15t$	
					Total 6 marks

13	(a)		0.44 0.56, 0.44 0.56, 0.44	2	B2 for all correct (B1 for 0.44 in any of the 3 possible positions) NB all values may be given as fractions $0.56 = \frac{56}{100} = \frac{28}{50} = \frac{14}{25}$ $0.44 = \frac{44}{100} = \frac{22}{50} = \frac{11}{25}$
	(b)	0.56 × "0.56" oe or 1 – (0.56 × "0.44" + "0.44" × "0.56" + "0.44" × "0.44") oe or 1 – 0.6864 oe or $1-\frac{429}{625}$ oe		2	M1ft (probabilities < 1) for a complete method
		Correct answer scores full marks (unless from obvious incorrect working)	0.3136		A1ft oe eg $\frac{196}{625}$ or 0.31(36) or 31(.36)%
					Total 4 marks

<table>
<tr><td>14 (a) (i)</td><td></td><td>D</td><td>1</td><td>B1 allow d</td></tr>
<tr><td>(ii)</td><td></td><td>E</td><td>1</td><td>B1 allow e</td></tr>
<tr><td>(b)</td><td>
<table>
<tr><td>x</td><td>1</td><td>1.5</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>y</td><td>12</td><td>5.33</td><td>3</td><td>1.33</td><td>0.75</td><td>0.48</td><td>0.33</td></tr>
</table>
</td><td>12
3
0.75
0.48</td><td>2</td><td>B2 for all correct

(B1 for 2 or 3 correct)
NB Allow equivalent fractions for 0.75 and 0.48</td></tr>
<tr><td>(c)</td><td> 
Use overlay</td><td></td><td>2</td><td>M1 ft their table for at least 6 points plotted correctly (tolerance within or on the circles on the overlay)</td></tr>
<tr><td></td><td>Correct answer scores full marks (unless from obvious incorrect working)</td><td>Correct graph</td><td></td><td>A1 for a fully correct graph – points plotted correctly (within or on the circles on the overlay) and intention to join with a smooth curve (be generous if intention is clearly a smooth curve through all points)

Ignore curve drawn for $x < 1$ and $x > 6$</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Total 6 marks</td></tr>
</table>

15 (a)	$(BC^2 =)25^2 + 73^2 - 2\times25\times73\times\cos65$ oe **or** $(BC =)\sqrt{25^2 + 73^2 - 2\times25\times73\times\cos65}$ **OR** $(BN =)25\sin65(= 22.6(576...))$ **and** $(NC = AC - AN =)73 - 25\cos65(= 62.4(345...))$		3	M1 for values correctly substituted into the cosine rule **OR** finding the perpendicular height of the triangle and *NC* where *N* is the foot of the perpendicular on *AC* Allow truncated or rounded values for *AN* = 25cos65 = 10.5(654…)
	eg $25^2 + 73^2 - 1542(.556)$ **or** 625 + 5329 – 1542(.556) **or** $5954 - 1542(.556...)$ **or** 4411(.4433…) **OR** $"22.6..."^2 + "62.4..."^2$ **or** 513.(37…) + 3898.(07…)			M1 clear evidence of correct order of operations used for the cosine rule (these calculations may be square rooted) **OR** a correct statement for BC^2 using Pythagoras from finding *BN* and *NC*
	Correct answer scores full marks (unless from obvious incorrect working)	66.4		A1 Accept answer in the range 66.3 – 66.5
(b)	$\frac{1}{2}\times25\times73\times\sin65$ oe or $\frac{1}{2}\times"22.6"\times73$ oe or $\frac{1}{2}(25\cos65\times25\sin65) + \frac{1}{2}((73 - 25\cos65)\times25\sin65)$ oe or 119(.694…) + 707(.311…) oe		2	M1
	Correct answer scores full marks (unless from obvious incorrect working)	827		A1 Accept answer in the range 824 – 829
				Total 5 marks

16 (a)	$(x=)\dfrac{--2\sqrt{3}\pm\sqrt{\left(-2\sqrt{3}\right)^2-4\times1\times-13}}{2(\times1)}$ or $(x=)\dfrac{--2\sqrt{3}\pm\sqrt{\left(2\sqrt{3}\right)^2-4\times1\times-13}}{2(\times1)}$ or $(x=)\dfrac{2\sqrt{3}\pm\sqrt{12+52}}{2}$ or $\left(x-\sqrt{3}\right)^2-\left(\sqrt{3}\right)^2-13(=0)$ oe or $\left(x-\sqrt{3}\right)^2-3-13(=0)$ oe or $\left(x-\sqrt{3}\right)^2-16(=0)$ oe or $\left(x-\sqrt{3}\right)^2=16$ oe or $\left(x+\dfrac{-2\sqrt{3}}{2\times1}\right)^2-\left(\dfrac{-2\sqrt{3}}{2\times1}\right)^2-\dfrac{13}{1}(=0)$		3	M1 for correctly substituting into the quadratic formula (don't need a bracket around b^2 or $4ac$) (condone **one** sign error) Treat a + sign or a – sign instead of ± as **one** sign error Allow $\left(2\sqrt{3}\right)^2$ instead of $\left(-2\sqrt{3}\right)^2$ in quadratic formula or completing the square or for correctly substituting into $\left(x+\dfrac{b}{2a}\right)^2-\left(\dfrac{b}{2a}\right)^2-\dfrac{c}{a}(=0)$ Allow partial correct evaluation Allow $2\sqrt{3}=\sqrt{12}$ Allow $2\sqrt{3}=3.4(641\ldots)$ for this mark only
	$(x=)\dfrac{2\sqrt{3}\pm\sqrt{64}}{2}$ or $x-\sqrt{3}=(\pm)\sqrt{16}$ or $x-\sqrt{3}=(\pm)4$			M1 dep on M1 for a simplification of their b^2-4ac in a complete expression
	Working required	$\sqrt{3}\pm4$		A1 dep on a fully correct substitution with no sign errors in M1 **OR** clear recovery in second M1 oe eg $\pm4+\sqrt{3}$ or $\sqrt{3}+4$ **and** $\sqrt{3}-4$ oe Allow $a=3$ and $b=4$

(b)	$\frac{\sqrt{20}}{\sqrt{5}+2}\times\frac{\sqrt{5}-2}{\sqrt{5}-2}$ or $\frac{\sqrt{20}}{\sqrt{5}+2}\times\frac{-\sqrt{5}+2}{-\sqrt{5}+2}$ or $\frac{\sqrt{20}\left(\sqrt{5}-2\right)}{1}$ or $\frac{\sqrt{20}\left(\sqrt{5}-2\right)}{5-4}$		3	M1 for rationalising the denominator by multiplying numerator and denominator by $\sqrt{5}-2$ or $-\sqrt{5}+2$ NB $\sqrt{20}$ may be written as $2\sqrt{5}$ and denominator may be 4 terms which need to be all correct
	eg $\frac{\sqrt{20}\sqrt{5}-2\sqrt{20}}{\sqrt{5}\sqrt{5}+2\sqrt{5}-2\sqrt{5}-4}$ or $\frac{2\sqrt{5}\sqrt{5}-2\times2\sqrt{5}}{\sqrt{5}\sqrt{5}+2\sqrt{5}-2\sqrt{5}-2\times2}$ or $\frac{\sqrt{100}-2\sqrt{20}}{\sqrt{5}\sqrt{5}-4}$ or $\frac{10-2\sqrt{20}}{5-4}$ or $\frac{10-2\sqrt{20}}{1}$ or $\frac{10-4\sqrt{5}}{5-4}$ or $\frac{10-4\sqrt{5}}{1}$ or $10-2\sqrt{20}$			M1 for expanding numerator and denominator (may be 4 terms which need to be all correct) Accept 1 in the denominator without working This M1 implies the first M1 NB $\frac{\sqrt{20}}{\sqrt{5}+2}\times\frac{\sqrt{5}-2}{\sqrt{5}-2}=10-4\sqrt{5}$ scores M1M1
	Working required	$10-\sqrt{80}$		A1dep on M2 Allow $c = 10$ and $d = 80$ SCB1 for $10-\sqrt{80}$ gained with no method marks awarded SCB2 for $10-\sqrt{80}$ gained if you would award 1st M1 but not 2nd M1 (total 2 marks)
				Total 6 marks

17	$4\times(m)=-1$ oe or $(m=)-\frac{1}{4}$ oe		4	M1 for finding the gradient of **L** May be embedded in an equation
	$y="-\frac{1}{4}"x+\frac{19}{2}$ oe or $0="-\frac{1}{4}"x+\frac{19}{2}$ oe or $"\frac{1}{4}"x=\frac{19}{2}$ oe or $\left(y-\frac{19}{2}\right)="-\frac{1}{4}"(x-0)$ oe or $\left(y-\frac{19}{2}\right)="-\frac{1}{4}"x$ oe or $\left(0-\frac{19}{2}\right)="-\frac{1}{4}"(x-0)$ oe or (x =) 38 or (38, 0) or $y="-\frac{1}{4}"x+c$ **and** $c=\frac{19}{2}$ oe			M1 for finding the equation of **L** or for finding the x value of point B
	$\frac{1}{2}\times\frac{19}{2}\times"38"$ oe			M1
	Working required	180.5		A1 dep on M1 oe eg $\frac{361}{2}$ Accept 181 (dep on M1)
	NB Some students might get the correct answer for the area of 180.5 by getting m= +0.25 and from B = (–38,0). **These cases score ZERO marks.**			
				Total 4 marks

18	100 – 0.5 or 99.5 or 100 + 0.5 or 100.5 or 1.68 – 0.005 or 1.675 or 1.68 + 0.005 or 1.685 or 0.5 – 0.05 or 0.45 or 0.5 + 0.05 or 0.55		5	B2 for all 6 correct (B1 for 3 or 4 or 5 correct) Allow $100.4\dot{9}$ or $100.4\bar{9}$ for 100.5 Allow $1.684\dot{9}$ or $1.684\bar{9}$ for 1.685 Allow $0.54\dot{9}$ or $0.54\bar{9}$ for 0.55 The value of each bound may be embedded in $v = 2\left(\frac{s}{t}\right) - u$
	$(v_{UB} =) 2\left(\frac{100.5}{1.675}\right) - 0.45$ or $(v_{UB} =) 2\left(\frac{100+0.5}{1.68-0.005}\right) - (0.5-0.05)$			M1 for correct substitution into the *UB* (=119.55) $v_{UB} = 2\left(\frac{s}{t}\right) - u$ where $100 < s \leq 100.5$ $1.675 \leq t < 1.68$ $0.45 \leq u < 0.5$
	$(v_{LB} =) 2\left(\frac{99.5}{1.685}\right) - 0.55$ or $(v_{LB} =) 2\left(\frac{100-0.5}{1.68+0.005}\right) - (0.5+0.05)$			M1 for correct substitution into the *LB* (=117.55…) $v_{LB} = 2\left(\frac{s}{t}\right) - u$ where $99.5 \leq s < 100$ $1.68 < t \leq 1.685$ $0.5 < u \leq 0.55$
	Working required	120		A1 dep on M2 120 **and** correct upper bound (119.55) **and** correct lower bound (117.55…) seen
				Total 5 marks

19	$\left(PN^2=\right)12^2+5^2\left(=169\right)$ oe or $\left(PN=\right)\sqrt{12^2+5^2}\left(=\sqrt{169}=13\right)$ oe or $\left(PM^2=\right)12^2+5^2+9^2\left(=250\right)$ oe or $\left(PM=\right)\sqrt{12^2+5^2+9^2}\left(=\sqrt{250}=5\sqrt{10}=15.8\left(113...\right)\right)$ oe (where *N* is the midpoint of *QR*)			M1
	$\tan\left(MPN\right)=\frac{9}{"13"}$ oe or $\sin\left(MPN\right)=\frac{9}{"15.8"}$ oe or $\cos\left(MPN\right)=\frac{"13"}{"15.8"}$ oe or $\sin\left(MPN\right)=\frac{\sin 90}{"15.8"}\times 9$ oe or $\cos\left(MPN\right)=\frac{"13"^2+"15.8"^2-9^2}{2\times"13"\times"15.8"}$ oe			M1 for a correct trigonometrical statement for angle *MPN* with sin or cos or tan as the subject Allow any letter in place of *MPN*
	Correct answer scores full marks (unless from obvious incorrect working)	34.7		A1 allow 34.4 – 34.8
				Total 3 marks

20	$\frac{5(3x-5)-3(4x-7)}{(4x-7)(3x-5)}$ oe or $\frac{5(3x-5)-3(4x-7)}{12x^2-21x-20x+35}$ oe or $\frac{5(3x-5)-3(4x-7)}{(4x-7)(3x-5)}$ oe or $\frac{5(3x-5)}{(4x-7)(3x-5)}-\frac{3(4x-7)}{(4x-7)(3x-5)}$ oe or $\frac{15x-25-12x+21}{(4x-7)(3x-5)}$ oe or $\frac{3x-4}{(4x-7)(3x-5)}$ oe		4	M1 for expression written correctly over a suitable common denominator NB Brackets in the denominator may be expanded
	$(3x-5)(2x+1)$ oe **and** $(3x-4)(3x+4)$ oe			M1 indep for correct factorisation of **both** quadratics NB factors must be in the form $(ax + b)$ where a and b are integers
	$\frac{3x-4}{(4x-7)(3x-5)}\times\frac{(3x-5)(2x+1)}{(3x-4)(3x+4)}$ oe or $\frac{3x-4}{(4x-7)}\times\frac{(2x+1)}{(3x-4)(3x+4)}$ oe or $\frac{1}{(4x-7)(3x-5)}\times\frac{(3x-5)(2x+1)}{(3x+4)}$ oe			M1 for a **correct** expression where the second fraction has been inverted NB may be partially simplified
	Working required	$\frac{2x+1}{(4x-7)(3x+4)}$		A1 dep M2 oe $\frac{2x+1}{12x^2-5x-28}$ ISW for incorrect denominator expansion
				Total 4 marks

21	eg For frequency density method (0.8 × 5) (= 4), (1.8 × 10) (= 18), (2.8 × 5) (= 14), (1 × 6) (= 6) or 42 **OR** For number of squares method to find the number of rows (8 × 5) (= 40), (18 × 10) (= 180), (28 × 5) (= 140), (10 × 6) (= 60) or 420 **OR** For number of rows in an interval eg 5 (1 × 8) (= 8), (2 × 18) (= 36), (1 × 28) (= 28), (12 × 1) (= 12) or 84		3	M1 for finding the area of **at least** 3 given bars or number of squares for **at least** 3 given bars or number of rows for **at least** 3 given bars NB These 3 methods are not exhaustive
	eg (FD =) "42" ÷ 12 (= 3.5) **OR** (rows =) "420" ÷ 12 (= 35) **OR** (FD =) "420" ÷ 120 (= 3.5) **OR** (rows =) "84" ÷ 2.4 (= 35) **OR** (FD =) "84" ÷ (12 × 2) (= 3.5)			M1 for a correct method to find the correct FD (= 3.5) or the correct number of rows (= 35) for the interval 22 – 34 NB can be implied by correct height of bar 42 or 420 or 84 must come from a correct method to find the sum of 4 correct products
	Correct answer scores full marks (unless from obvious incorrect working)	Correct bar		A1 for a correct bar drawn at 3.5 Allow ±half square tolerance
				Total 3 marks

22	$\frac{12}{x}\times\frac{x-12}{x-1}$ oe or $\frac{x-12}{x}\times\frac{12}{x-1}$ oe		5	M1 for a correct expression for P(P,Y) or P(Y,P)
	$2\left(\frac{12}{x}\times\frac{x-12}{x-1}\right)=\frac{18}{47}$ oe or $\frac{12}{x}\times\frac{x-12}{x-1}+\frac{x-12}{x}\times\frac{12}{x-1}=\frac{18}{47}$ oe			M1 for a correct equation for P(P,Y) + P(Y,P) = $\frac{18}{47}$ This M mark implies first M mark
	$18x^2-1146x+13536(=0)$ oe or $9x^2-573x+6768(=0)$ oe or $3x^2-191x+2256(=0)$ oe			M1 dep on M2 simplified to a 3 term quadratic ($ax^2 + bx + c$ (= 0) in any form) with at least 2 coefficients (a or b or c) are correct
	$(3x-47)(x-48)(=0)$ oe or $(x=)\frac{--191\pm\sqrt{(-191)^2-(4\times3\times2256)}}{2\times3}$ or $3\left[\left(x-\frac{191}{6}\right)^2-\left(\frac{191}{6}\right)^2\right]+2256(=0)$ oe or $\left(x+\frac{-191}{2\times3}\right)^2-\left(\frac{-191}{2\times3}\right)^2+\frac{2256}{3}(=0)$			M1ft dep on first M1 for solving *their* 3-term quadratic equation using any method – if factorising, allow brackets which expand to give 2 out of the 3 terms correct. If using the formula or completing the square allow one sign error and some simplification as far as $(x=)\frac{191\pm\sqrt{36\,481-27\,072}}{6}$ or $3\left(x-\frac{191}{6}\right)^2-\frac{9409}{12}(=0)$ Award this mark for answers of 48 and $\frac{47}{3}$ dep on M3
	Working required	48		A1 cao dep on first 3 M marks Do not award if non-integer solution also given.
				Total 5 marks

WITH REPLACEMENT				
22	$\frac{12}{x}\times\frac{x-12}{x}$ oe or $\frac{x-12}{x}\times\frac{12}{x}$ oe			M0
	$2\left(\frac{12}{x}\times\frac{x-12}{x}\right)=\frac{18}{47}$ oe or $\frac{12}{x}\times\frac{x-12}{x}+\frac{x-12}{x}\times\frac{12}{x}=\frac{18}{47}$ oe			M1 for a correct equation for P(P,Y) + P(Y,P) = $\frac{18}{47}$ **This M mark DOES NOT imply the first M mark**
	$18x^2-1128x+13536(=0)$ oe or $9x^2-564x+6768(=0)$ oe or $3x^2-188x+2256(=0)$ oe			M1 dep on previous M1 simplified to a 3 term quadratic ($ax^2 + bx + c$ (= 0) in any form) with at least 2 coefficients (a or b or c) are correct
	$(x=)\frac{--188\pm\sqrt{(-188)^2-(4\times3\times2256)}}{2\times3}$ or $3\left[\left(x-\frac{188}{6}\right)^2-\left(\frac{188}{6}\right)^2\right]+2256(=0)$ oe or $(x=)\frac{188\pm4\sqrt{517}}{6}$ or $\left(x+\frac{-188}{2\times3}\right)^2-\left(\frac{-188}{2\times3}\right)^2+\frac{2256}{3}(=0)$ or (x =) 46(.491756) and 16(.174910)			M1ft dep on second M1 for solving *their* 3-term quadratic equation using any method – if factorising, allow brackets which expand to give 2 out of the 3 terms correct. If using the formula or completing the square allow one sign error and some simplification as far as $(x=)\frac{188\pm\sqrt{35\,344-27\,072}}{6}$ or $3\left(x-\frac{188}{6}\right)^2-\frac{2068}{3}(=0)$ Award this mark for both values of x dep on M2
	Working required			A0

23	$\pi\times(4r)^2\times\frac{50}{360}$ oe or $\pi\times16r^2\times\frac{50}{360}$ oe or $\pi\times r^2\times\frac{50}{360}$ oe or $\pi\times R^2\times\frac{50}{360}$ oe or $\frac{\pi\times r^2}{7.2}$ oe or $\frac{\pi\times R^2}{7.2}$ oe or $\pi\times\left(\frac{R}{4}\right)^2\times\frac{50}{360}$ oe or $\pi\times\frac{R^2}{16}\times\frac{50}{360}$ oe		6	M1 for finding an expression for the area of the sector *OAB* or *OPQ* Allow any letter for the radius eg *OA* or *OP* Condone missing brackets for this mark only *OA* = *OB* = *r* and *OP* = *OQ* = *R* Allow $\frac{50}{360}=0.138(888\ldots)$
	$\pi\times(4r)^2\times\frac{50}{360}-\pi\times r^2\times\frac{50}{360}=\frac{243}{16}\pi$ oe or $\pi\times R^2\times\frac{50}{360}-\pi\times\left(\frac{R}{4}\right)^2\times\frac{50}{360}=\frac{243}{16}\pi$			M1 for setting up a **correct** equation in one variable Allow $\frac{243}{16}\pi=47.7(129\ldots)$
	$(r=)\frac{27}{10}(=2.7)$ oe or $(R=)\frac{54}{5}(=10.8)$ oe			A1 for finding *r* or *R*
	$(AB=)2\times\pi\times"2.7"\times\frac{50}{360}\left(=\frac{3}{4}\pi=2.35(619...)\right)$ oe or $(PQ=)2\times\pi\times4\times"2.7"\times\frac{50}{360}(=3\pi=9.42(477...))$ oe or $(AB=)2\times\pi\times\frac{"10.8"}{4}\times\frac{50}{360}\left(=\frac{3}{4}\pi=2.35(619...)\right)$ oe or $(PQ=)2\times\pi\times"10.8"\times\frac{50}{360}(=3\pi=9.42(477...))$ oe			M1ft dep on M2 for finding arc length of *AB* or *PQ* Accept $2\times\pi\times5\times"2.7"\times\frac{50}{360}\left(=\frac{15}{4}\pi=11.7(809...)\right)$ $2\times\pi\times5\times\frac{"10.8"}{4}\times\frac{50}{360}\left(=\frac{15}{4}\pi=11.7(809...)\right)$
	$\frac{3}{4}\pi+3\pi+(3\times2.7)+(3\times2.7)$ oe or $\frac{3}{4}\pi+3\pi+\left(\frac{10.8}{4}\times3\right)+(10.8-2.7)$ oe			M1 dep on **correct** *r* or **correct** *R* and for a complete **correct** method to find the perimeter or an answer of 27.9(809…) Perimeter = 8.1 + 8.1 + 9.4(2..) + 2.35.. = 27.9 Perimeter = 8.1 + 8.1 + 11.7… = 27.9
	Working required	$\frac{15}{4}\pi+\frac{81}{5}$		A1 dep on M2 oe eg $3.75\pi+16.2$
				Total 6 marks

23 **MISREAD** **Using** $\frac{243}{16}$	$\pi\times(4r)^2\times\frac{50}{360}$ oe or $\pi\times16r^2\times\frac{50}{360}$ oe or $\pi\times r^2\times\frac{50}{360}$ oe or $\pi\times R^2\times\frac{50}{360}$ oe or $\pi\times\left(\frac{R}{4}\right)^2\times\frac{50}{360}$ oe or $\pi\times\frac{R^2}{16}\times\frac{50}{360}$ oe			M1 for finding an expression for the area of the sector *OAB* or *OPQ* Allow any letter for the radius eg *OA* or *OP* Condone missing brackets for this mark only *OA* = *OB* = *r* and *OP* = *OQ* = *R* Allow $\frac{50}{360}=0.138(888\ldots)$
	$\pi\times(4r)^2\times\frac{50}{360}-\pi\times r^2\times\frac{50}{360}=\frac{243}{16}$ oe or $\pi\times R^2\times\frac{50}{360}-\pi\times\left(\frac{R}{4}\right)^2\times\frac{50}{360}=\frac{243}{16}$			M1 for setting up a **correct** equation in one variable Allow $\frac{243}{16}\pi=47.7(129\ldots)$
	$(r=)1.52(331...)$ oe or $(R=)6.09(324...)$ oe			A0
	$(AB=)2\times\pi\times"1.52"\times\frac{50}{360}$ $(=1.32(645...))$ oe or $(PQ=)2\times\pi\times4\times"1.52"\times\frac{50}{360}(=5.30(580...))$ oe or $(AB=)2\times\pi\times\frac{"6.09"}{4}\times\frac{50}{360}$ $(=1.32(863...))$ oe or $(PQ=)2\times\pi\times"6.09"\times\frac{50}{360}(=5.31(452...))$ oe			M1ft dep on M2 for finding arc length of *AB* or *PQ* Accept $2\times\pi\times5\times"1.52"\times\frac{50}{360}$ $(6.64(669...))$ $2\times\pi\times5\times\frac{"6.09"}{4}\times\frac{50}{360}(=6.64(669...))$
	$1.32+5.31+(3\times1.52)+(3\times1.52)$ oe or $1.32+5.31+\left(\frac{6.09}{4}\times3\right)+(6.09-1.52)$ oe			M1 dep on use of **1.52.. or 6.09..** and for a complete **correct** method to find the perimeter or an answer of awrt 15.8 Perimeter = 4.57 + 4.57 + 1.32.. + 5.31.. = 15.8 Perimeter = 4.57 + 4.57 + 6.64.. = 15.8
	Working required			A0

24	$-3(x-5)^2$ ..... **or** $-3\left[(x-5)^2 .....\right]$ **or** $-3\left(x+\frac{30}{2\times-3}\right)^2+....$		3	M1 for a start to completing the square **or** correct substitution into $a\left(x+\frac{b}{2a}\right)+....$ from the formula $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}+c$
	$-3\left[(x-5)^2-5^2\right]$..... or or $-3\left[(x-5)^2-5^2.....\right]$ or $-3\left[(x-5)^2-25.....\right]$ or $-3\left(x+\frac{30}{2\times-3}\right)^2-\frac{(30)^2}{4\times-3}...$ or $-3(x-5)^2+75.....$			M1 for correctly completing the square but terms do not need to be simplified and 22 may or may not be present or correct simplification of the first two parts of $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}(+c)$
	Correct answer scores full marks (unless from obvious incorrect working)	$97-3(x-5)^2$		A1 oe eg $-3(x-5)^2+97$
				Total 3 marks
ALT	Two of $2bc=30$ or $a-bc^2=22$ or $b=3$			M1
	$2\times3\times c=30$ or $c=5$			M1
	Correct answer scores full marks (unless from obvious incorrect working)	$97-3(x-5)^2$		A1 oe eg $-3(x-5)^2+97$
				Total 3 marks