



Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE Mathematics A
4WM2H/01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

November 2025

Question Paper Log Number P81645A

Publication Code 4WM2H_01_2511_MS

All the material in this publication is copyright

© Pearson Education Ltd

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 e . g . algebra.

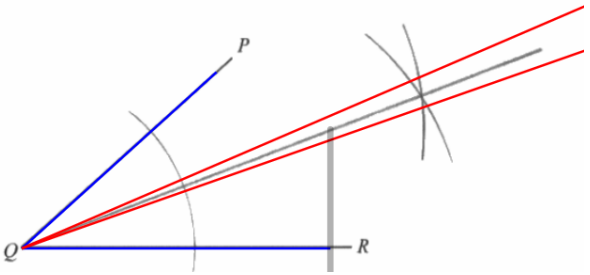
Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **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		Fully correct angle bisector with all relevant arcs	2	B2 for a fully correct angle bisector with all arcs shown (B1 for all arcs and no angle bisector drawn or for a correct angle bisector but no arcs or insufficient arcs) NB Overlay is available
				Total 2 marks

<p>2</p>	<p>$5 \times 17 + 15 \times 9 + 25 \times 16 + 35 \times 14 + 45 \times 4 (= 1290)$</p> <p>or</p> <p>$85 + 135 + 400 + 490 + 180 (= 1290)$</p> <p>[lower bound products are: 0, 90, 320, 420, 160] [Sum of lower bound products = 990]</p> <p>[upper bound products are: 170, 180, 480, 560, 200] [Sum of upper bound products = 1590]</p>		<p>4</p> <p>M2 for at least 4 correct products added (need not be evaluated) ie can be in the form $5 \times 17 + 15 \times 9 + \dots$)</p> <p>If not M2 then award:</p> <p>M1 for use of values within interval (including end points) for at least 4 products which must be added (need not be evaluated ie can be in the form $10 \times 17 + 20 \times 9 + \dots$)</p> <p>or</p> <p>correct midpoints used for at least 4 products and not added</p>
	<p>“1290” \div 60</p>		<p>M1 dep on M1</p> <p>Allow division by their Σf provided addition or total under column seen</p>
	<p><i>Correct answer scores full marks (unless from obvious incorrect working)</i></p>	<p>21.5</p>	<p>A1 oe eg $\frac{43}{2}$ or $21\frac{1}{2}$</p>
			<p style="text-align: right;">Total 4 marks</p>

3	eg $5x + y = 11$ $3x - y = 9$ Adding $(5x + 3x = 11 + 9$ or $8x = 20)$ or $3x - (11 - 5x) = 9$ or $5x + 3x - 9 = 11$	eg $15x + 3y = 33$ $15x - 5y = 45$ Subtracting $(3y - -5y = 33 - 45$ or $8y = -12)$ or $3\left(\frac{11-y}{5}\right) - y = 9$ oe or $5\left(\frac{9+y}{3}\right) + y = 11$ oe		3 M1 for a correct method to eliminate x or y : coefficients of x or y are the same and the correct operation to eliminate selected variable, if operator not written, the correct operation can be implied by 2 out of 3 terms correct. (condone any one arithmetic error in multiplication) or writing x or y in terms of the other variable and correctly substituting (condone missing brackets) NB The mark is for the method and not for the result of the method. However, if the correct result of the method is seen, the mark can be awarded.
	eg $5 \times "2.5" + y = 11$ or $3 \times "2.5" - y = 9$ or $11 - 5 \times "2.5"$ or $3 \times "2.5" - 9$	eg $5x - 1.5 = 11$ oe or $3x - -1.5 = 9$ or $\frac{11 - "-1.5"}{5}$ oe or $\frac{9 + "-1.5"}{3}$		M1 dep for correct substitution to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable.
	<i>Working required</i>		$x = 2.5$ $y = -1.5$	A1 oe dep on M1
				Total 3 marks

4	$960 \div (6 + 7 + 3)$ (= 60)	$0.65 \times 7 (= 4.55)$	$0.65 \times 960 (= 624)$	4	M1 a correct start to the problem as far as one of these
	$7 \times \text{"60"} (= 420)$ or $(360 \div) 420 (: 180)$ oe	$\frac{\text{"4.55"}}{16} (= 0.284375)$ or $\text{"4.55"} \times 960 (= 4368)$	$\text{"624"} \div (6 + 7 + 3)$ (= 39)		M1
	$0.65 \times \text{"420"}$	$\frac{\text{"4.55"}}{16} \times 960$ oe	$\text{"39"} \times 7$		M1 a fully correct method to find how many cherry trees will grow morello cherries
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>			273	A1 cao SCB3 for answer of 234 or 117
					Total 4 marks

<p>5</p> <p>eg $28 \div 7 (= 4)$ or $7 \div 28 \left(= \frac{1}{4} \right)$ oe or $28 : 7$ oe or $7 : 28$ oe or $18 \div 6 (= 3)$ or $6 \div 18 \left(= \frac{1}{3} = 0.33(333\dots) \right)$ oe or $18 : 6$ oe or $6 : 18$ oe or 12 or $\frac{1}{12} (= 0.083(33\dots))$ oe or $1 : 12$ oe or $12 : 1$ oe or $\frac{(FG)}{60} = \frac{7}{28}$ oe or $(FG =) 15$ or $60 : 28 (=) FG : 7$ oe or $\frac{(IJ)}{6} = \frac{7}{18}$ oe or $(IJ =) \frac{7}{3} (= 2.3(333\dots))$ oe</p>		<p>3</p>	<p>M1 for a correct SF can be expressed as a fraction, decimal or ratio (may or may not be used) NB $\frac{6 \times 7}{18 \times 28} = \frac{42}{504} = \frac{1}{12}$ or for a correct equation (<i>FG</i> or <i>IJ</i>) Allow any letter for their side NB 15 may be written on the diagram for <i>FG</i> or 2.3(333...) oe may be written on the diagram for <i>IJ</i></p>
<p>eg $60 \div "4" \div "3"$ oe or $60 \div "12"$ oe or $"15" \div "3"$ oe or $60 \times \frac{1}{4} \times \frac{1}{3}$ oe or $60 \times \frac{1}{12}$ oe or $60 \div "12"$ or $(JK =) "15" \times \frac{6}{18}$ oe or $(JK =) 60 \times \frac{"7/3"}{28}$ oe</p>			<p>M1 Allow $\frac{7}{3} = 2.3(333\dots)$</p>
<p><i>Correct answer scores full marks (unless from obvious incorrect working)</i></p>		<p>5</p>	<p>A1 NB JK = 5 may be written on the diagram if no answer on the answer line</p>
			<p>Total 3 marks</p>

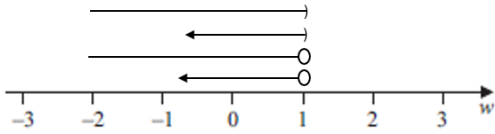
6	(a)	$87 - 75 (= 12)$ or $\frac{87}{75} (= 1.16)$ oe		3	M1
		$\frac{12}{75} (\times 100) (= 0.16 (\times 100))$ oe or $\frac{87}{75} \times 100 (= 116)$ oe or "1.16" $\times 100 (= 116)$ oe			M1
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	16		A1
	(b)	$0.2 \times 960 (= 192)$ oe or $0.8 \times 960 (= 768)$ oe or $0.8 \times 0.8 \times 960 (= 614.4)$ oe or $0.8^3 (= 0.512)$ oe		3	M1 NB Use of % sign to indicate the calculation, eg $80\% \times 960$, is not sufficient for this mark unless an answer of 768 is stated for this calculation
		$0.8^3 \times 960$ oe or $0.8 \times 0.8 \times "768"$ oe or $0.8 \times "614.4"$ oe or $0.2 \times "768" (= 153.6)$ and $0.2 \times ("768" - "153.6") (= 122.88)$ oe or "192" + "153.6" + "122.88" (= 468.48)			M1 NB Use of % sign to indicate the calculation, eg $(1 - 20\%)^3 \times 960$, is not sufficient for this mark unless an answer of 491.52 is stated for this calculation
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	491.52		A1 491 - 492 SC B2 for $0.8^4 \times 960 (= 393(.216))$ If no other mark awarded, SCB1 for $960 \times 0.2 \times 3 (= 576)$ oe or $960 \times 0.4 (= 384)$ oe or $960 + 960 \times 0.2 \times 3 (= 1536)$ oe or $960 \times 1.6 (= 1536)$ oe or $1.2 \times 960 (= 1152)$ oe or $1.2^2 \times 960 (= 1382(.4))$ oe or $1.2^3 \times 960 (= 1658(.88))$ oe
					Total 6 marks

7	(int angle of pentagon = $(3 \times 180) \div 5 (= 108)$ oe or (ext angle of pentagon = $360 \div 5 (= 72)$ oe		4	M1 allow in working but not if labelled in wrong place on diagram (unless clearly started again)
	(angle $QED =$) "108" – 90 (= 18) (angle $CQP =$) $\frac{180 - "108"}{2}$ (= 36) or			M1 a fully correct method to find the size of acute angle QED or angle CQP , need not be labelled. Do not award if not labelled and given as the final answer M2 Use of straight line from C to midpoint of AE (call it M): (angle $MCD =$) "108" $\div 2 (= 54)$ Provided no further working is seen.
	(angle $EQD =$) $180 - 108 - "18"$ or $18 + 108 + EQD = 180$ oe (angle $EQD =$) $180 - "36" - 90$ or $36 + 90 + EQD = 180$ oe			M1 a fully correct method to find the size of angle EQD (allow other clearly defined variable for EQD)
	<i>Working required</i>	54		A1 dep on M1
				Total 4 marks

8	$75\% = 240$ or $0.75 = 240$ or $0.75 \times n = 240$ oe or $\frac{3}{4} \times n = 240$ oe $\frac{7}{9} = 245$ oe or $\frac{7}{9} \times m = 245$ oe		4	M1 Allow $\frac{7}{9} = 0.77(777\dots)$ oe or 77% or 78% or better
	$240 \div 0.75 (= 320)$ or $240 \times \frac{4}{3}$ oe			M1 NB Use of % sign to indicate the calculation, eg $240 \div 75\%$, is not sufficient for this mark unless an answer of 320 is stated for this calculation
	$\frac{245 \times 9}{7}$ oe (= 315)			M1 Allow $245 \div 0.77(777\dots) (\approx 314\dots \text{to } 318)$ oe NB Use of % sign to indicate the calculation, eg $245 \div 77\%$, is not sufficient for this mark unless an answer of 314... to 318 is stated for this calculation
	<i>working required</i>	5		A1 dep M3
				Total 4 marks

9	(a)		57 600	1	B1
	(b)	$\frac{308\,000}{4 \times 10^{-2}}$ or $\frac{308\,000}{0.04}$ or $\frac{308 \times 10^3}{4 \times 10^{-2}}$ or $\frac{308 \times 10^3}{0.04}$ or $\frac{3.08 \times 10^5}{4 \times 10^{-2}}$ or $\frac{3.08 \times 10^5}{0.04}$ or $\frac{300\,000 + 8000}{4 \times 10^{-2}}$ or $\frac{300\,000 + 8000}{0.04}$ oe or 7 700 000 or $75 \times 10^5 + 2 \times 10^5$ or 77×10^5 oe or 7.7×10^n where $n \neq 6$		2	M1
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	7.7×10^6		A1
					Total 3 marks

10		$5 \times 217 (= 1085)$ or $\frac{T_5}{5} = 217$ oe		3	M1 for the correct product to find total over 5 days or correct equation written for the calculation of the mean, allow candidate's own choice of label.
		"1085" + 175 (= 1260)			M1 for correct method to find the total number for the 6 days
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	210		A1
					Total 3 marks

11 (a)		Open circle at $w = 1$ and a line with an arrow to the left	1	B1 for an open circle at $w = 1$ and a line with an arrow of any length to the left Allow) for an open circle Allow a line without an arrow if it reaches to at least -2
(b)		$y \geq x$	3	B1 oe allow $>$ in place of \geq
		$y \leq 4$		B1 oe allow $<$ in place of \leq
		$x \geq -3$		B1 oe allow $>$ in place of \geq
				If no marks have been awarded then SCB2 for identifying the outside region eg $y \leq x$, $y \geq 4$ and $x \leq -3$ oe SCB1 for identifying ALL 3 lines eg $y = x$, $y = 4$ and $x \leq -3$ oe Allow $<$ in place of \leq or vice versa
				Total 4 marks

12	For one of 0.95 oe or 1.2 oe or 1.065 oe		3	M1 NB: do not allow 95% as an equivalent answer to 0.95 etc
	For $0.95 \times 1.2 \times 1.065 (=1.2141)$ oe			M1 correct product of all three multipliers
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	21.41		A1 allow 21.4
				Total 3 marks

13	729×10^{240} or $9^3 \times (10^{80})^3$ oe or 7.29×10^n where n is any positive integer		2	M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	7.29×10^{242}		A1
				Total 2 marks

14	(a)	27	1	B1 Allow 27 – 27.5
	(b) Readings are [18.5, 19.5] and [35, 36]		2	M1 for a correct method to allow 2 readings to be taken on the x -axis from CF 10 (or 10.25) and from CF 30 (or 30.75) oe
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	16		A1 Allow 15.5 – 17.5
	(c) $40 - 34 (= 6)$		2	M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	180		A1 cao
				Total 5 marks

15	(a)(i)		96	1	B1
	(ii)	<p>accept \sphericalangle for 'angle' and $2 \times$ or double for twice)</p> <p>For <u>centre</u> allow <u>midpoint/origin (or O)/middle/central</u></p> <p>For <u>circumference</u> allow <u>side/edge/arc/perimeter</u></p>	Correct reason	1	<p>B1 dep on correct answer in a(i) for <u>angle at the centre</u> is $2 \times$ (double) angle at <u>circumference</u> oe or <u>angle at the circumference</u> is <u>half</u> angle at <u>centre</u> oe or <u>angle at the centre</u> is <u>double</u> the angle at the <u>circumference subtended</u> by the same <u>chord</u> oe or <u>central angle</u> is <u>twice</u> the <u>inscribed</u> angle oe or <u>inscribed angle</u> is <u>half</u> the <u>central</u> angle</p>
	(b)(i)		132	1	B1
	(ii)	<p>accept \sphericalangle for 'angle' and $2 \times$ or double for twice)</p> <p>For <u>centre</u> allow <u>midpoint/origin (or O)/middle/central</u></p> <p>For <u>circumference</u> allow <u>side/edge/arc/perimeter</u></p>	Correct reason	1	<p>B1 dep on correct answer in b(i) for <u>opposite angles</u> of a <u>cyclic quadrilateral</u> sum to 180° (or are supplementary)</p> <p>Awarding of reason mark for use of 264 as a reflex angle for <i>DOB</i></p> <p>B1 for <u>angle at the centre</u> is $2 \times$ (double) angle at <u>circumference</u> oe or <u>angle at the circumference</u> is <u>half</u> angle at <u>centre</u> oe or <u>angle at the centre</u> is <u>double</u> the angle at the <u>circumference subtended</u> by the same <u>chord</u> oe or <u>central angle</u> is <u>twice</u> the <u>inscribed</u> angle oe or <u>inscribed angle</u> is <u>half</u> the <u>central</u> angle</p>
					Total 4 marks

16	16 and 28 identified		2	M1 NB: the median of 20 may also be identified
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	12		A1
				Total 2 marks

17	$T = \frac{k}{\sqrt{m}}$ oe eg $k = T\sqrt{m}$	$hT = \frac{1}{\sqrt{m}}$ oe eg $h = \frac{1}{T\sqrt{m}}$		3	M1 NB $T = \frac{1}{\sqrt{m}}$ or $T \propto \frac{1}{\sqrt{m}}$ on its own is not enough to score M1 Constant of proportionality must be a symbol such as k	M2 for $15 = \frac{k}{\sqrt{36}}$ oe or $h \times 15 = \frac{1}{\sqrt{36}}$ oe
	$15 = \frac{k}{\sqrt{36}}$ oe or $k = 90$	$h \times 15 = \frac{1}{\sqrt{36}}$ oe or $h = \frac{1}{90}$			M1 for substitution of T and m into a correct formula Allow use of \propto sign in place of $=$ for the M marks	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>		$T = \frac{90}{\sqrt{m}}$		A1 oe e.g $T = 90 \times \frac{1}{\sqrt{m}}$ or $T = \frac{90}{m^{\frac{1}{2}}}$ or $T = 90m^{-\frac{1}{2}}$ Award 3 marks if answer is $T = \frac{k}{\sqrt{m}}$ on the answer line and $k = 90$ clearly given in the body of working of the script	
Total 3 marks						

18	$p^2 = \frac{7w+y}{cw+k}$ oe		4	M1 for squaring both sides of the equation Expression need not be simplified ie $p^2 = \left(\sqrt{\frac{7w+y}{cw+k}} \right)^2$
	eg $cwp^2 + kp^2 = 7w + y$			M1 dep on first M mark for multiplying both sides by denominator and expanding the brackets
	eg $cwp^2 - 7w = y - kp^2$ oe eg $w(cp^2 - 7) = y - kp^2$			M1ft dep on 2 terms in w and 2 other terms for collecting w terms on one side and other terms on the other side from their expansion (with no other incorrect work)
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	$w = \frac{y - kp^2}{cp^2 - 7}$		A1 oe eg $w = \frac{kp^2 - y}{7 - cp^2}$ Must see $w =$ in working or on answer line
				Total 4 marks

19	$4 \times \pi \times 12^2$		2	M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	1810		A1 1808 – 1810.3
				Total 2 marks

20	eg $x^2 + (x+2)^2 = 3x(x+2) - 11$	eg $(y-2)^2 + y^2 = 3y(y-2) - 11$		5	M1 for substitution of $y = x + 2$ (or $x = \pm y \pm 2$) into $x^2 + y^2 = 3xy - 11$ to obtain an equation in x only (or y only)
	eg $x^2 + 2x - 15 (= 0)$ $x^2 + 2x = 15$	eg $y^2 - 2y - 15 (= 0)$ $y^2 - 2y = 15$			M1 dep on previous M1 for forming a 3-term quadratic where at least 2 coefficients
	eg $(x+5)(x-3) [= 0]$ Or $\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -15}}{2 \times 1}$ or $(x+1)^2 - 1 - 15 (= 0)$ oe or $(x = -5 \text{ and } 3)$ (allow y used for x here)	eg $(y-5)(y+3) [= 0]$ or $\frac{-(-2) \pm \sqrt{(-2)^2 - 4 \times 1 \times -15}}{2 \times 1}$ or $(y-1)^2 - 1 - 15 = 0$ oe or $(y = 5 \text{ and } -3)$ (allow x used for y here)			M1ft dep on first M1 method to solve their 3 term quadratic equation using any correct method (if using formula allow one sign error and some simplification – allow as far as $\frac{-2 \pm \sqrt{4+60}}{2}$ or if factorising, allow brackets which expanded give 2 out of 3 terms correct or if completing the square then as far as shown on LHS or the correct values for x or the correct values for y
	$(y =) - 5 + 2$ oe, $"3" + 2$ oe	$(x =) - 5 - 2$ oe eg $"-3" - 2$ oe			M1 dep on previous M1 for substituting their 2 found values of x or y into one of the two given equations or fully correct values for the other variable (correct labels for x/y) or for one correct pair of values
	<i>Working required</i>		$x = -5, y = -3$ $x = 3, y = 5$		A1 oe dep on M2 (allow coordinates)
					Total 5 marks

21	(a)		-21	1	B1
	(b)	$5(4x^2 + 16x - 9) - 3$ oe		2	M1
			$20x^2 + 80x - 48$		A1 oe eg $4(5x^2 + 20x - 12)$ but terms must be simplified
	(c)	$(y =) 4(x^2 + 4x) - 9$ or $(y =) 4\left(x^2 + 4x - \frac{9}{4}\right)$ or $\frac{y+9}{4} = x^2 + 4x$ or $\pm 4\left(x + \frac{16}{2 \times 4}\right)^2 - \frac{\left(\frac{16}{2}\right)^2}{4} \pm \dots$ or $(y =)(2x + 4)^2 + \dots$	$(x =) 4(y^2 + 4y) - 9$ or $(x =) 4\left(y^2 + 4y - \frac{9}{4}\right)$ or $\frac{x+9}{4} = y^2 + 4y$ or $4\left(y + \frac{16}{2 \times 4}\right)^2 - \frac{\left(\frac{16}{2}\right)^2}{4} \pm \dots$ or $(x =)(2y + 4)^2 + \dots$	4	M1 for a correct equation from a first step in order to complete the square or a correct perfect square factorisation of the first two terms $4x^2$ and $16x$ (or $4y^2$ and $16y$)
		eg $(y =) 4((x+2)^2 - 2^2) - 9$ or $(y =) 4\left((x+2)^2 - 2^2 - \frac{9}{4}\right)$ or $(y =) 4(x+2)^2 - 25$ oe or $\frac{y+9}{4} = (x+2)^2 - 2^2$ or $4\left(x + \frac{16}{2 \times 4}\right)^2 - \frac{\left(\frac{16}{2}\right)^2}{4} - 9$ or $(y =)(2x + 4)^2 - 25$	eg $(x =) 4((y+2)^2 - 2^2) - 9$ or $(x =) 4\left((y+2)^2 - 2^2 - \frac{9}{4}\right)$ or $(x =) 2(y+2)^2 - 25$ oe or $\frac{x+9}{4} = (y+2)^2 - 2^2$ or $4\left(y + \frac{16}{2 \times 4}\right)^2 - \frac{\left(\frac{16}{2}\right)^2}{4} - 9$ or $(x =)(2y + 4)^2 - 25$		M1 dep on M1 for a correct equation from a second step in order to complete the square or a fully correct perfect square factorisation of the first two terms $4x^2$ and $16x$ (or $4y^2$ and $16y$) with subtraction of 16

	$(x+2)^2 = \frac{y+25}{4}$ oe or $(x+2)^2 = \frac{y+9}{4} + 2$ oe	$(y+2)^2 = \frac{x+25}{4}$ oe or $(y+2)^2 = \frac{x+9}{4} + 2$ oe		M1 dep on previous M1 for isolating x on one side of the equation and y onto the other side
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>		$-2 + \sqrt{\frac{x+25}{4}}$	A1 oe Must be in terms of x M3A0 for $-2 \pm \sqrt{\frac{x+25}{4}}$ and $-2 \pm \sqrt{\frac{y+25}{4}}$
	See next page for alternative for (c)			
				Total 7 marks

(c) ALT	$4x^2 + 16x - 9 - y (= 0)$			4	M1 for a correct first step
	$(x =) \frac{-16 \pm \sqrt{16^2 + 16(9+y)}}{8}$ oe	$4((x+2)^2 - 4) - 9 - y (= 0)$ oe			M1 dep on M1 for a correct first step at solving the equation using the quadratic formula or completing the square.
	$(x =) -2 \pm \sqrt{\frac{y+25}{4}}$ oe	$(x+2)^2 = \frac{y+25}{4}$			M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>		$-2 + \sqrt{\frac{x+25}{4}}$		A1 oe Must be in terms of x M3A0 for $-2 \pm \sqrt{\frac{x+25}{4}}$ and $-2 \pm \sqrt{\frac{y+25}{4}}$
Note: Allow candidates to swap x and y when finding the inverse					

22	$\left(\frac{dy}{dx} = \right) 3 \times x^2 - 16 (= 3x^2 - 16)$		6 B2 for $3 \times x^2 - 16$ or $3x^2 - 16$ (with no other terms) (B1 for one term, ie $3 \times x^2$ or $3x^2$ or -16)
	$3x^2 - 16 = 11$ oe eg $3x^2 - 27 = 0$ (allow one of $x = 3$ or $x = -3$)		M1 for equating their initial derivative to 11 Derivative must be a two term quadratic (dep on B1) in the form $3x^2 - a = 11$ oe where $a \neq 0$ or $bx^2 - 16 = 11$ oe where $b \neq 0$ (a and b are constants) Allow $3x^2 - 16 + 7 = 11$ oe NB $3x^2 - 16x = 11$ is M0
	$(y =) ("3")^3 - 16("3") + 7 (= -14)$ or $(y =) (" - 3")^3 - 16(" - 3") + 7 (= 28)$		M1 dep on previous M1
	$" - 14" = 11("3") + b$ or $y - " - 14" = 11(x - "3")$ or $\frac{y - " - 14"}{x - "3"} = 11$ oe or $"28" = 11(" - 3") + b$ or $y - "28" = 11(x - " - 3")$ or $\frac{y - "28"}{x - " - 3"} = 11$ oe		M1 dep on previous M1
	<i>Working required</i>	-47 and 61	A1 dep on B2M1 Answer of -47 or 61 award 5 marks dep on B2M1
			Total 6 marks

23	$\sqrt{\frac{450}{200}} \text{ or } \sqrt{\frac{9}{4}} \text{ or } \frac{3}{2} \text{ or } 3 : 2 \text{ oe eg } 15\sqrt{2} : 10\sqrt{2} \text{ or } \left(\frac{3}{2}\right)^3 \text{ oe}$ <p>or</p> $\sqrt{\frac{200}{450}} \text{ or } \sqrt{\frac{4}{9}} \text{ or } \frac{2}{3} \text{ or } 2 : 3 \text{ oe eg } 10\sqrt{2} : 15\sqrt{2} \text{ or } \left(\frac{2}{3}\right)^3 \text{ oe}$ <p>or</p> $\left(\frac{450}{200}\right)^3 = \left(\frac{V_Q}{672}\right)^2 \text{ oe}$ <p>or</p> $\sqrt{\frac{450}{200}} = \sqrt[3]{\frac{V_Q}{672}} \text{ oe}$		3	<p>M1 for a correct length SF or a correct length ratio or a correct equation involving V_Q</p> <p>$\frac{2}{3} = 0.66(666\dots)$ rounded or truncated</p>
	$672 \times \left(\frac{3}{2}\right)^3 \text{ oe}$ <p>or</p> $672 \div \left(\frac{2}{3}\right)^3 \text{ oe}$ <p>or</p> $(V_Q =) \sqrt{672^2 \times \left(\frac{450}{200}\right)^3} \text{ oe}$ <p>or</p> $(V_Q =) \left(\sqrt{\frac{450}{200}} \times \sqrt[3]{672}\right)^3 \text{ oe}$			M1 for a complete method
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	2268		A1 cao
				Total 3 marks

24	(a)		$10\mathbf{b} - 5\mathbf{a}$	1	B1oe
	(b)		$7\mathbf{a} + 4\mathbf{b}$	1	B1
	(c)	$\overline{OP} = \lambda(7\mathbf{a} + 4\mathbf{b})$ or $\overline{OP} = 5\mathbf{a} + \gamma(10\mathbf{b} - 5\mathbf{a})$ or $\overline{OP} = 10\mathbf{b} + \mu(5\mathbf{a} - 10\mathbf{b})$		4	M1 \overline{OP} written as a vector in one way Allow ft their \overline{AC} or \overline{OB}
		$\overline{OP} = \lambda(7\mathbf{a} + 4\mathbf{b})$ and $\overline{OP} = 5\mathbf{a} + \gamma(10\mathbf{b} - 5\mathbf{a})$ or $\overline{OP} = 10\mathbf{b} + \mu(5\mathbf{a} - 10\mathbf{b})$			M2 for eg $2\mathbf{a} + 4\mathbf{b} = x(-5\mathbf{a} + 10\mathbf{b}) + y(7\mathbf{a} + 4\mathbf{b})$ (for $\overline{AB} = x\overline{AC} + y\overline{OB}$) Allow ft their \overline{AC} or \overline{OB}
		Using $\overline{OP} = \lambda(7\mathbf{a} + 4\mathbf{b})$ and $\overline{OP} = 5\mathbf{a} + \gamma(10\mathbf{b} - 5\mathbf{a})$ And achieving $\lambda = \frac{5}{9}$ or $\gamma = \frac{2}{9}$	Using $\overline{OP} = \lambda(7\mathbf{a} + 4\mathbf{b})$ and $\overline{OP} = 10\mathbf{b} + \mu(5\mathbf{a} - 10\mathbf{b})$ And achieving $\lambda = \frac{5}{9}$ or $\mu = \frac{7}{9}$	eg $\lambda = \frac{5}{9}$ or $\mu = \frac{7}{9}$ or $\gamma = \frac{2}{9}$ or eg $y = \frac{4}{9}$ $x = \frac{2}{9}$	A1 a correct value for λ or μ or the variables they have chosen, eg x or y etc
		<i>Working required</i>		$\frac{35}{9}\mathbf{a} + \frac{20}{9}\mathbf{b}$	A1 oe dep M2
					Total 6 marks

25	(a)		(2, 1)	1	B1
	(b)(i)		3	1	B1
	(ii)		2	1	B1
					Total 3 marks

26	$86 = 10 + (20 - 1)d$ or $(d =) \frac{86 - 10}{19}$ oe or $4n + 6$ or $d = 4$		5	M1 for correct substitution into $U_n = a + (n - 1)d$
	$5194 = \frac{N}{2} [2(10) + (N - 1) \cdot 4]$ oe or $5194 = \frac{N}{2} [20 + 4N - 4]$ oe or $5194 = \frac{N}{2} [16 + 4N]$ oe			M1 dep on M1 for correct substitution into $S_n = \frac{n}{2} [2a + (n - 1)d]$ Allow any letter for N
	eg $N^2 + 4N - 2597 (= 0)$ oe eg $N^2 + 4N = 2597$ or $2N^2 + 8N - 5194 (= 0)$ oe or $4N^2 + 16N - 10388 (= 0)$ oe			M1ft dep on previous M1 for forming a 3-term quadratic where at least 2 coefficients are correct
	eg $(N - 49)(N + 53) (= 0)$ eg $(N =) \frac{-4 \pm \sqrt{4^2 - (4 \times 1 \times -2597)}}{2 \times 1}$ eg $(N + 2)^2 - 4 = 2597$			M1ft dep on previous M1 for a method to solve their 3-term quadratic using any correct method Allow one sign error and some simplification – allow as far as eg $\frac{-4 \pm \sqrt{16 + 10388}}{2}$ or $\frac{-4 + \sqrt{16 + 10388}}{2}$
	<i>Working required</i>	49		A1 dep on M2 M4A0 for 49 and -53 given as their answers
Total 5 marks				