GradeMax

Pearson

Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE In Mathematics A

4MA1/2H

GradeMax

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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, 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 additionalwork 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 egalgebra.
  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	$(x =)\frac{3+9}{2}\left(=\frac{12}{2}=6\right)$ oe or $(y =)\frac{4+16}{2}\left(=\frac{20}{2}=10\right)$ oe or (x =) 6 or (y =) 10 or (10, 6)		2	M1 for a **correct** method to work out the midpoint of x or the midpoint of y or one correct value or (10, 6)
	Correct answer scores full marks (unless from obvious incorrect working)	(6, 10)		A1
				Total 2 marks

2	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	M1for 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.
	Working required		$x = 2.5$ $y = -1.5$		A1 oe dep on M1
					Total 3 marks

3	eg $1-\frac{7}{20}\left(=\frac{13}{20}\right)$ or 1 – 0.35 (= 0.65) oe or 100% – 35% (= 65%) or (9 + 43) ÷ (20 – 7) or 52 ÷ 13 or (Y : R & B =) 7 : 13 or $\frac{x}{9+43+x}=\frac{7}{20}$ oe or $\frac{7}{20}\times(9+43+x)=x$ oe or $\frac{y-9-43}{y}=\frac{7}{20}$ oe or $\left(1-\frac{7}{20}\right)\times y=9+43$ oe or 9 × 35 + 43 × 35 (= 52 × 35)		4	M1 for a correct first step **seen** eg $\frac{13}{20}$ or for any correct equation that would lead to 28 or 80 (x = number of yellow bricks and y = total number of bricks)
	(x =) 28 or (y =) 80 or 1820 or 2800			A1 28 or 80 may be seen as a fraction 1820 is the weight of the red and blue bricks 2800 is the total weight of the bricks
	eg (“80” – 9 – 43) × 35 oe or (“80” – 52) × 35 oe or $80\times\frac{7}{20}\times35$ oe or “28” × 35 or “1820” ÷ 13 × 7 oe			M1 If the first step is to form a correct algebraic equation then ft their found value of x or y
	Correct answer scores full marks (unless from obvious incorrect working)	980		A1
				Total 4 marks

4	eg 28 ÷ 7 (= 4) or 7 ÷ 28 $\left(=\frac{1}{4}\right)$ oe or 28 : 7 oe or 7 : 28 oe or 18 ÷ 6 (= 3) or 6 ÷ 18 $\left(=\frac{1}{3}=0.33(333\ldots.)\right)$ oe 18 : 6 oe or 6 : 18 oe or 12 or $\frac{1}{12}\left(=0.083(33...)\right)$ 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 $(IJ=)\frac{7}{3}\left(=2.3(333...)\right)$ oe		3	M1 for a correct SF can be expressed as a fraction, decimal or ratio (may or may not be used) **NB** $\frac{6\times7}{18\times28}=\frac{42}{504}=\frac{1}{12}$ or for a correct equation (FG or IJ) Allow any letter for their side **NB** 15 may be written on the diagram for FG or 2.3(333…) oe may be written on the diagram for IJ
	eg 60 ÷ "4" ÷ "3" oe or 60 ÷ "12" oe or "15" ÷ "3" oe or $60\times"\frac{1}{4}"\times"\frac{1}{3}"$ oe or $60\times"\frac{1}{12}"$ oe or 60 ÷ "12" or $(JK=)"15"\times\frac{6}{18}$ oe or $(JK=)60\times\frac{"7/3"}{28}$ oe			M1 Allow $\frac{7}{3}=2.3(333...)$
	Correct answer scores full marks (unless from obvious incorrect working)	5		A1 **NB** JK = 5 may be written on the diagram if no answer on the answer line
				Total 3 marks

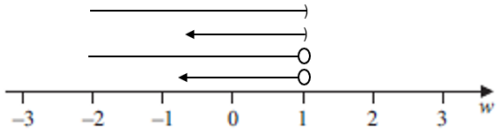
5	(a)	87 – 75 (= 12) or $\frac{87}{75}(=1.16)$ oe		3	M1
		$\frac{"12"}{75}(\times 100)(=0.16(\times 100))$ oe or $\frac{87}{75}\times 100(=116)$ oe or $"1.16"\times 100(=116)$ oe			M1
		Correct answer scores full marks (unless from obvious incorrect working)	16		A1
	(b)	0.2 × 960 (= 192) oe or 0.8 ×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

6	$160 = \pi \times$ [any variable] or $160 = 2 \times \pi \times$ [any variable] or $160 = \pi \times 3 \times$ [any variable] or $160 = 2 \times \pi \times$ [any variable]	$(C_2 =) 160 \div 3$ (= 53.3(333…)) or		5	M1 Do not accept $\pi "R"^2 = 160$ D = diameter of large circle (C_1) R = radius of large circle (C_1) d = diameter of small circle (C_2) r = radius of small circle (C_2) **NB** $C_1 = 3 \times C_2$ Allow 3.14… or $\frac{22}{7}$ for π
	$(D =) \frac{160}{\pi}$ (= 50.9(29…..)) or $(R =) \frac{160}{2\pi}$ (= 25.4(647…))	$(d =) 160 \div 3 \div \pi \left(= \frac{160}{3\pi} = 16.9(765...) \right)$ or $2\pi r = \frac{160}{3}$			M1 must come from a correct circumference formula Do not accept $"R"^2 = \frac{160}{\pi}$ This mark implies first M1
	$(r =)$ "50.9" ÷ 6 (= 8.48(826…)) or $(r =)$ "25.4" ÷ 3 (= 8.48(826…))	$(r =) 160 \div 3 \div \pi \div 2 \left(= \frac{160}{6\pi} = \frac{160}{6\pi} = 8.48(826...) \right)$			M1
	$\pi \times "8.48"^2$ (226(.353…))				M1
	Correct answer scores full marks (unless from obvious incorrect working)		226		A1 awrt 226 or awrt 227
					Total 5 marks

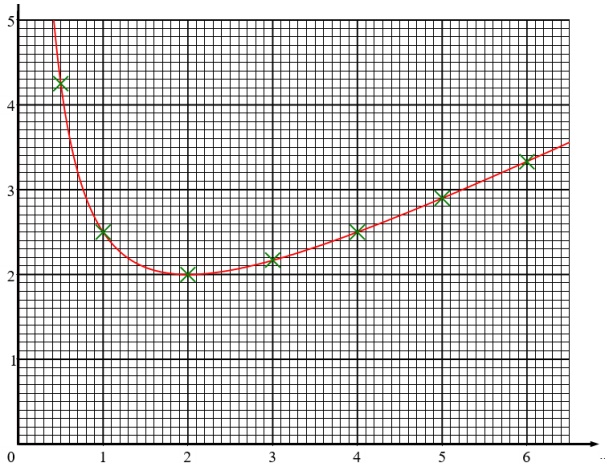
7	(i)	$(x \pm 6)(x \pm 8)$ or $(6 \pm x)\,(8 \pm x)$ or $x(x + 8) – 6(x + 8)$ or $x(x – 6) + 8(x – 6)$		2	M1 for $(x \pm 6)(x \pm 8)$ or for brackets in the form $(x+a)(x+b)$ where $ab = –48$ or $a + b = 2$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x − 6)(x + 8)$		A1 oe Allow any letter for x
	(ii)		6, –8	1	B1ft follow through from (i) and must be 2 answer values provided $(x + a)(x + b)$ seen in either parts (i) or (ii) seen
					Total 3 marks

8	(a)		57 600	1	B1
	(b)	$\frac{308\,000}{4\times10^{-2}}$ or $\frac{308\,000}{0.04}$ or $\frac{308\times10^{3}}{4\times10^{-2}}$ or $\frac{308\times10^{3}}{0.04}$ or $\frac{3.08\times10^{5}}{4\times10^{-2}}$ or $\frac{3.08\times10^{5}}{0.04}$ or $\frac{300\,000+8000}{4\times10^{-2}}$ 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
		Correct answer scores full marks (unless from obvious incorrect working)	7.7×10^6		A1
					Total 3 marks

9	120 × 0.45 (= 54) oe or 80 × 0.3 (= 24) oe or 78 or 120 × (1 – 0.45) (= 66) oe or 80 × (1 – 0.3) (= 56) oe or 122		3	M1 for a correct first step **seen** eg 120 × 0.45 or 54
	$\frac{"54"+"24"}{120+80}$ oe or $1-\left(\frac{"66"+"56"}{120+80}\right)$ oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{39}{100}$		A1 oe eg. 0.39 or $\frac{78}{200}$ oe or 39% M2 A0 for 78 : 200 or 39 : 100
				Total 3 marks

10	(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 ≥
			$y \leq 4$		B1 oe allow < in place of ≤
			$x \geq -3$		B1 oe allow > in place of ≥
					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 ≤ or vice versa
					Total 4 marks

11	$240 = \frac{1}{2} \times 30 \times (AC)$ or $240 = \frac{1}{2} \times 30 \times (AC) \times \sin 90$ or $(AC =) \frac{240 \times 2}{30} (= 16)$ or $(AC =) \frac{240 \times 2}{30 \times \sin 90} (= 16)$		4	M1
	$(BC^2 =) 30^2 + \text{“16”}^2 (= 1156)$ or $(BC^2 =) 30^2 + \text{"16"}^2 - 2 \times 30 \times 16 \times \cos 90 (= 1156)$ or $(ABC =) \tan^{-1}\left(\frac{\text{"16"}}{30}\right) (= 28.0(724...))$ or $(ACB =) \tan^{-1}\left(\frac{30}{\text{"16"}}\right) (= 61.9(275...))$			M1 dep on M1 ft their AC value provided the first M1 has been awarded
	$(BC =) \sqrt{30^2 + \text{"16"}^2} \left(= \sqrt{1156} = 34\right)$ or $(BC =) \sqrt{30^2 + \text{"16"}^2 - 2 \times 30 \times 16 \times \cos 90} \left(\sqrt{1156} = 34\right)$ or $(BC =) \frac{\text{"16"}}{\sin(\text{"28.0"})} (= 34)$ or $(BC =) \frac{30}{\cos(\text{"28.0"})} (= 34)$ or $(BC =) \frac{\text{"16"}}{\cos(\text{"61.9"})} (= 34)$			M1
	Correct answer scores full marks (unless from obvious incorrect working)	80		A1 Allow 79.9 – 80.1 SCB2 for 69(.048…) SCB1 for 31(.048…) – 31.1 or $\sqrt{964}$ or $2\sqrt{241}$
				Total 4 marks

12	(a)	<table><tr><td>1</td><td>2</td></tr><tr><td>**2.5**</td><td>**2**</td></tr></table>	2.5 and 2	1	B1 oe eg $\frac{5}{2}$
	(b)			2	M1 ft their table for at least 6 points plotted correctly (tolerance within or on the circles on the overlay)
		 *Correct answer scores full marks (unless from obvious incorrect working)*	Correct graph		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 $x < 0.5$ and $x > 6$ Note: If a fully correct graph is shown, but an incomplete table is shown in (a), then award the mark for (a)
	(c)			2	M1 ft for a line drawn at $y = 3$ **or** an indication on the curve at $y = 3$ eg dot or cross etc **or** $\frac{1}{2}\left(x+\frac{4}{x}\right)=3$ stated **or** $y = 3$ stated
		Working required	0.8 and 5.2		A1ft dep on previous M1 for 0.7 – 0.8 **and** 5.1 – 5.3 **or** ft graph with 2 points of intersection with $y = 3$
					Total 5 marks

13	(a)		$\frac{25x^4}{y^{10}}$	2	B2 oe for all 3 correct eg $25x^4y^{-10}$ (B1 for a quotient in the form of $\frac{px^q}{y^r}$ eg $\frac{25x^4}{y^6}$ or $\frac{5^2x^4}{y^{10}}$ or $\frac{ax^4}{y^{10}}$ where a ($\neq 25$) is a constant or a product in the form px^qy^{-r} eg $25x^4y^{10}$ or ax^4y^{-10} where a ($\neq 25$) is a constant where 2 from p or q or r are correct Allow $25x^4$ or $\frac{x^4}{y^{10}}$ or x^4y^{-10} or $\frac{25}{y^{10}}$ or $25y^{-10}$ etc so long as not added to any other terms)
	(b)	4^{3p} or $4^n = 4^{m-3p}$ or $n + 3p = m$ oe or $2^{2n} = \frac{2^{2m}}{2^{6p}}$ or $2^{2n} = 2^{2m-6p}$ or $2n = 2m - 6p$ oe		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	$m - 3p$		A1 oe eg $\frac{2m-6p}{2}$ SC B1 for an answer of $\frac{m}{3p}$
					Total 4 marks

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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
		Correct answer scores full marks (unless from obvious incorrect working)	16		A1 Allow 15.5 – 17.5
	(c)	40 – 34 (= 6)		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	180		A1 cao
					Total 5 marks

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

16	eg $(100x =)\ 37.878\ldots$ $\underline{\quad (x =)\ 0.378\ldots}$ **or** $(1000x =)\ 378.78\ldots$ $\underline{\quad (10x =)\ \ 3.78\ldots}$ **or** $(100000x =)\ 37878.78\ldots$ $\underline{\quad (1000x =)\ \ 378.78\ldots}$		2	M1 for 2 **correct** recurring decimals that when subtracted should give a whole number or terminating decimal with intention to subtract. (ie may give 37.5 or 375 or 37500 or 78 etc) eg $(1000x =)\ 37.878\ldots$ and $(x =)\ 0.378\ldots$ **or** $(1000x =)\ 378.78\ldots$ and $(10x =)\ 3.78\ldots$ **or** $(100000x =)\ 37878.78\ldots$ and $(1000x =)\ 378.78\ldots$ **or** $0.3+0.0\dot{7}\dot{8}$ **and** $(1000y =)\ 78.787...$ and $(10y =)\ 0.78....$ with intention to subtract. x is not required to award this mark (if recurring dots not shown in both numbers then showing at least **one** of the numbers to at least **5sf**) **NB** Accept bar notation for dot notation to indicate recurring decimals
	eg $100x - x = 37.878\ldots - 0.378\ldots = 37.5$ **and** $\frac{37.5}{99} = \frac{25}{66}$ **or** $1000x - 10x = 378.78... - 3.78... = 375$ **and** $\frac{375}{990} = \frac{25}{66}$ **or** $100000x - 1000x = 37878.78... - 378.78... = 37500$ **and** $\frac{37500}{99000} = \frac{25}{66}$ **or** $1000y - 10y = 78.787... - 0.7878... = 78$ **and** $0.3+\frac{78}{990} = \frac{0.3\times990+78}{990} = \frac{375}{990} = \frac{25}{66}$ oe	Shown		A1 for completion to $\frac{25}{66}$ dep on M1and must use algebra for this final mark to be awarded **No algebra used gets a maximum of 1 mark**
	Working required			**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	
	Correct answer scores full marks (unless from obvious incorrect working)		$T = \frac{90}{\sqrt{m}}$		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	$5 + x + 7 + 2x + 4x + 14 = 40$ oe or $7x + 26 = 40$ oe or $5 + x + 7 + 2x + 4x = 26$ oe or $x = 2$		3	M1	M2 for $40 - 7 - 14$ (= 19)
	$\frac{5+"2"}{40}\left(=\frac{7}{40}=0.175\right)$ oe **or** $\frac{2("2")+4("2")}{40}\left(=\frac{12}{40}=0.3\right)$ oe **or** $\frac{5+"2"+2("2")+4("2")}{40}$ oe **or** $5+"2"+2("2")+4("2")(=19)$			M1 dep on M1 Allow substitution of **their** value of $0 < x < 5$ provided previous M1 has been gained Allow $\frac{19}{y}$ where $19 < y \leq 40$	
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{19}{40}$		A1 oe eg. 0.475 or 0.48 or 47.5% or 48% SC B1 for $\frac{5+x+2x+4x}{40}$ oe or $\frac{5+7x}{40}$ oe SC B1 for $\frac{33}{40}$ or 0.825 or 82.5%	
					Total 3 marks

19	(a)		$\frac{3}{5}$	1	B1 oe eg 0.6
	(b)	$\frac{3x-2}{2(3x-2)-1}$ oe		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{3x-2}{6x-5}$		A1 must be a simplified single fraction eg $\frac{-2+3x}{-5+6x}$
					Total 3 marks

20	$2a = 10$ oe or $a = 5$		3	M1
	$4^2 - 4 \times$ "5" $\times c = 4 \times 39$ oe or $16 - 20c = 156$ oe or $4 -$ "5" $\times c = 39$ oe			M1 for using the discriminant and removing the surd correctly
	Working required	$a = 5$ and $c = -7$		A1 dep on M1 SC B1 for $a = 2.5$ and $c = -3.5$
				Total 3 marks

20 **ALT**	$(5x+2)^2 - 39(=0)$ or $(5x+2)^2 = 39$ or $\left(x+\frac{2}{5}\right)^2 - \frac{39}{25}(=0)$ or $\left(x+\frac{2}{5}\right)^2 = \frac{39}{25}$		3	M1
	$25x^2+20x-35=0$ or $25x^2+20x=35$ or $x^2+\frac{20}{25}x-\frac{35}{25}(=0)$ oe or $x^2+\frac{20}{25}x=\frac{35}{25}$ oe			M1
	Working required	$a = 5$ and $c = -7$		A1 dep on M1 SC B1 for $a = 2.5$ and $c = -3.5$
				Total 3 marks

21	20 ÷ 5 (= 4) or a correct value on the FD scale and no errors or 2.5 oe seen		3	M1 for use of area to represent frequency **or** for **two** correct frequencies from bars of different widths (not including 20) eg 25 (for 0 – 10) **and** 14 (for 40 – 50) (frequencies to be seen on diagram or identified in working)
	$\left(\frac{1}{3}\times 45\right)+(1\times 10)+(0.7\times 20)$ or $(3\times 5)+(1\times 10)+(0.7\times 20)$ or or 15 + 10 + 14 or (6 + 4 + 5.6) × 2.5 or (150 + 100 + 140) × 0.1 or $(2.5\times 10)+20+\left(\frac{2}{3}\times 45\right)(=75)$ or $(2.5\times 10)+20+(3\times 10)(=75)$ or 25 + 20 + 30 (= 75) or (10 + 8 + 12) × 2.5 (= 75) or (250 + 200 + 300) × 0.1 (= 75)			M1
	Correct answer scores full marks (unless from obvious incorrect working)	39		A1 SC B2 for 54 $\frac{39}{114}$ scores M2A0
				Total 3 marks

22	$\left(\frac{dy}{dx} =\right) 3\times x^2 - 16 \left(= 3x^2 - 16\right)$		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 ft dep on B1 Derivative must be a two term **quadratic** 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
	$\left(y =\right)\left("3"\right)^3 - 16\left("3"\right) + 7 \left(= -14\right)$ **or** $\left(y =\right)\left("-3"\right)^3 - 16\left("-3"\right) + 7 \left(= 28\right)$			M1 dep on previous M1 **and** for a correct rearrangement for x
	$"-14" = 11\left("3"\right) + b$ or $y - "-14" = 11\left(x - "3"\right)$ or $\frac{y - "-14"}{x - "3"} = 11$ oe **or** $"28" = 11\left("-3"\right) + b$ or $y - "28" = 11\left(x - "-3"\right)$ or $\frac{y - "28"}{x - "-3"} = 11$ oe			M1 dep on previous M1
	Working required	–47 and 61		A1 dep on B2M1 Answer of –47 or 61 award 5 marks dep on B2M1
				Total 6 marks

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

24	10.3 – 0.05 or 10.25 or 10.3 + 0.05 or 10.35 or 7.24 – 0.005 or 7.235 or 7.24 + 0.005 or 7.245 or 4.39 – 0.005 or 4.385 or 4.39 + 0.005 or 4.395		5	B2 for all 6 correct (B1 for 3 or 4 or 5 correct) Allow $10.34\dot{9}$ for 10.35 Allow $7.234\dot{9}$ for 7.245 Allow $4.394\dot{9}$ for 4.395 The value of each bound may be embedded in $D = \frac{n}{p-q}$
	$\frac{10.35}{7.235-4.395}$ or $\frac{10.3+0.05}{(7.24-0.005)-(4.39+0.005)}$			M1 for correct substitution into the *UB* (= 3.64(4366…)) $D = \frac{n}{p-q}$ where $10.3 < n_{(UB)} \leq 10.35$ $7.235 \leq p_{(LB)} < 7.24$ $4.39 < q_{(UB)} \leq 4.395$
	$\frac{10.25}{7.245-4.385}$ or $\frac{10.3-0.05}{(7.24+0.005)-(4.39-0.005)}$			M1 for correct substitution into the *LB* (= 3.58(3916…)) $D = \frac{n}{p-q}$ where $10.25 \leq n_{(LB)} < 10.3$ $7.24 < p_{(UB)} \leq 7.245$ $4.385 \leq q_{(LB)} < 4.39$
	Working required	3.6		A1 cao dep on M2 and all 6 correct bounds
				Total 5 marks

25	$86 = 10 + (20 - 1)d$ or $(d =)\dfrac{86-10}{19}$ oe or $4n + 6$ or $d = 4$		5	M1 for correct substitution into $U_n = a + (n-1)d$
	$5194 = \dfrac{N}{2}\left[2(10) + (N-1)4\right]$ oe or $5194 = \dfrac{N}{2}\left[20 + 4N - 4\right]$ oe or $5194 = \dfrac{N}{2}\left[16 + 4N\right]$ oe			M1 dep on M1 for correct substitution into $S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$ 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 $4N^2 + 16N - 10\,388\ (= 0)$ 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 $(N=)\ \dfrac{-4 \pm \sqrt{4^2 - (4 \times 1 \times -2597)}}{2 \times 1}$ 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 $\dfrac{-4 \pm \sqrt{16 + 10388}}{2}$ or $\dfrac{-4 + \sqrt{16 + 10388}}{2}$
	Working required	49		A1 dep on M2 M4A0 for 49 and –53 given as their answers
				Total 5 marks

26	$\left(\frac{1}{3}\times\pi\times x^2\times 5x\right)+\left(\frac{1}{2}\times\frac{4}{3}\times\pi\times x^3\right)=504\pi$ oe or $\frac{7}{3}\times\pi\times x^3=504\pi$ oe		6	M1 for an equation for the volume of the cone and hemisphere Allow 3.14… or $\frac{22}{7}$ for π
	$(x^3=)$ 216 or $(x=)$ 6			A1 dep on M1 for a correct value of x^3 or x
	$\frac{1}{2}\times\frac{4}{3}\times\pi\times 6^3\left(=144\pi=452...\right)$ oe or $\frac{1}{3}\times\pi\times 6^2\times(5\times 6)\left(=360\pi=1130...\right)$ oe			M1 dep on M1 and correct figures for a **correct** method to find the volume of the hemisphere (awrt 452 or awrt 453) or for a **correct** method to find the volume of the cone (awrt 1130 or awrt 1131)
	$9\times(504\pi-144\pi)\left(=3240\pi=10\,178...\right)$ oe or $9\times 360\pi\left(=3240\pi=10\,178...\right)$ oe			M1 dep on previous M1 and correct figures for a **correct** method to find the mass of the cone Allow in the range 10 173 – 10 183
	$\frac{4752\pi-3240\pi}{144\pi}$ oe or $\frac{1512\pi}{144\pi}$ oe or $\frac{4750....}{452.....}$			M1 dep on previous M1 and correct figures for a **correct** method to find the density of the hemisphere
	Working required	10.5		A1 oe dep on M4 Allow in the range 10.47 – 10.54
				Total 6 marks