GradeMax

Pearson

Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE in Mathematics B

4MB1/01

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

- cas – correct answer scores full marks (unless from obvious incorrect working)
- wr – working required

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. e.g., 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 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.

Question		Working	Answer	Mark	Notes
1		$5\times4^2-2\times4[=72]$ **or** $5\times3^2-2\times3[=39]$		2	M1 A correct method to find the 3rd term **or** the 4th term This may be embedded within the difference (condone missing brackets around the terms), which could be the other way round eg 39 – 72 May be implied by 72 or 39
			33 or – 33		A1
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
2		$2k=8h+5j$ **or** $k=\frac{8h}{2}+\frac{5j}{2}$ oe **or** $\frac{2k-5j}{8}$		2	M1 for start by multiplying by 2 **or** separating the fraction **or** correct expression for h without h = …
			$h=\frac{2k-5j}{8}$		A1 oe eg $h=\frac{k}{4}-\frac{5j}{8}$ or $h=\frac{k-\frac{5j}{2}}{\frac{8}{2}}$ or $h=\frac{5j-2k}{-8}$ Allow the other way round eg $\frac{2k-5j}{8}=h$ Must see h = … Do not ISW except allow correct expression without $h=...$ on the answer line if given correctly with $h=...$ in the working
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
3		$\frac{11}{6}\times\frac{12}{5}$ oe or $1\times2+\frac{5}{6}\times2+1\times\frac{2}{5}+\frac{5}{6}\times\frac{2}{5}$ oe		2	M1 at least one correct improper fraction Or at least three correct terms from a method to expand $\left(1+\frac{5}{6}\right)\left(2+\frac{2}{5}\right)=1\times2+\frac{5}{6}\times2+1\times\frac{2}{5}+\frac{5}{6}\times\frac{2}{5}$
			$\frac{132}{30}=\left[4\frac{12}{30}=\right]4\frac{2}{5}$ $\frac{66}{15}=\left[4\frac{6}{15}=\right]4\frac{2}{5}$ $\frac{22}{5}=4\frac{2}{5}$		A1 dep on M1 We must see both working and the correct simplified mixed number. Do not accept decimals but ISW a decimal number if a correct mixed number is seen.
		wr			***Total 2 marks***

Question		Working	Answer	Mark	Notes
4	(a)		6	1	B1 Allow written in words eg six cao
	(b)		2	1	B1 Allow written in words eg two cao
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
5					**Use the overlay when marking this question**
			Accurate bisector	2	B2 for a line within the guidelines **and** 2 pairs of suitable intersecting arcs which intersect within the guidelines (if extended) (B1 for a line within the guidelines **or** 2 pairs of suitable intersecting arcs) NB The line can be any length - does not need to cross *AB* but must touch it and should remain within the guidelines if it were to be extended
					Total 2 marks

Question		Working	Answer	Mark	Notes
6		$304-180$ or $180-(360-304)$ or $90+(304-270)$		2	M1 for a complete correct method to find the bearing e.g. $360-(180+(360-304))$ Do not ISW e.g. $304-180=124$ and $180-124=56$ scores M0
			124		A1 cao May be seen in the diagram
					Total 2 marks

Question		Working	Answer	Mark	Notes
7		$\dfrac{2\times-5-3\times(-5)^2}{2\times2+1}$		2	M1 for correct substitution to evaluate the numerator Allow -85 or $-10-75$ or $2(-5)-3(-5)^2$ or $2(-5)-3(5)^2$ or $2\times-5-3\times-5^2$ or $2\times-5-3\times25$
			-17		A1 cao
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
8				2	M1 Attempt at differentiation such that $x^n \rightarrow x^{n-1}$ for at least one non-zero term Accept unsimplified power and unsimplified coefficients eg $2\times 2x^{2-1}$ or $15x^{1-1}$
			$3x^2+4x-15$		A1 oe eg $3x^2+4x^1-15x^0$ Do not ISW
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
9	(a)		23	1	B1 cao
	(b)	12, 15, 16, 18, 19, 23, 23, 30		2	M1 for ordered list. Allow the first 5 terms or last 5 terms correct or a list with only one error (either one value omitted, one value added or one value either incorrect or incorrectly placed). Ordered list may be seen within an (incorrect) attempt to sum the terms. Allow the ordered list to be seen anywhere in the question.
			18.5		A1 oe eg $\frac{37}{2}$ or $18\frac{1}{2}$ Do not ISW cao
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
10	(a)		0.65	1	B1 oe eg $\frac{13}{20}$ or $\frac{65}{100}$ or $\frac{0.65}{1}$ or 65%
	(b)	0.35×20		2	M1 for $p\times 20$ where $0<p<1$ Allow for $\frac{7}{20}$
			7		A1 cao Do not allow $\frac{7}{20}$ for A1
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
11			$\begin{pmatrix} 0 & 6-2m \\ 21m-5 & 18 \end{pmatrix}$	3	B3 a fully correct matrix (B2 for 3 correct entries in a matrix of correct order or a fully correct unsimplified matrix) (B1 for 1 or 2 correct entries in a matrix of correct order **or** for correct multiplication by a scalar eg $3\mathbf{A}=\begin{pmatrix} -3 & 6 \\ 21m & 12 \end{pmatrix}$) NB: If correct matrix is seen but followed by incorrect subsequent algebra then award a maximum of B2 eg $\begin{pmatrix} 0 & 6-2m \\ 21m-5 & 18 \end{pmatrix}$ followed by $\begin{pmatrix} 0 & 4m \\ 16m & 18 \end{pmatrix}$ scores B2 maximum
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
12		$\frac{-8-3}{6-4}[=-5.5]$ oe $\frac{3--8}{4-6}[=-5.5]$ **or** $3=4m+c$ **and** $-8=6m+c$ leading to $[m=]\frac{-8-3}{2}[=-5.5]$		3	M1 correct method to find the gradient using $\frac{\text{difference in } y}{\text{difference in } x}$ **or** setting up simultaneous equations and finding m May be implied by $-\frac{11}{2}$ oe May be implied by an equation with the correct gradient.
		$3="-5.5"\times 4+c$ or $-8="-5.5"\times 6+c$ or $y-3="-5.5"(x-4)$ oe or $y-(-8)="-5.5"(x-6)$ oe			M1 for a correct equation using one of the given points and their gradient to find the intercept, (commonly c but can be any letter) Their gradient must be clearly identified if incorrect or has come from correct working.
			$y=-5.5x+25$		A1 Allow any equivalent fraction for –5.5 eg $y=-\frac{11}{2}x+25$ Must see $y=\ldots$ Do not ISW except allow correct expression without $y=\ldots$ on the answer line if given correctly with $y=\ldots$ in the working Equivalent form implies M2 eg $y-25=-5.5x$ or $2y=-11x+50$
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
13		Major angle at $POR = 360 - 124 [= 236]$ or $\angle PXR = 124 \div 2 [= 62]$ (where X is a point on the circle)		3	M1 for method to find major angle at POR or angle PXR (where X is a point on the circle. May be seen on the diagram or X must be specified) Do not accept $\angle PQR = 124 \div 2 = 62$ Award for correct angles marked on the diagram
		Angle PQR = "236" ÷ 2 or Angle PQR = 180 – 62	118		A1 cao Do not award if angle comes from incorrect working eg $\angle PQR = 124 \div 2 = 62$
		Angle at the centre is 2 × (double) angle at circumference angle at circumference is ½ angle at centre			B1 (dep on M1) The reason must include at least the underlined words or an unambiguous abbreviation Eg Accept ∠ for angle, twice for double.
					Total 3 marks

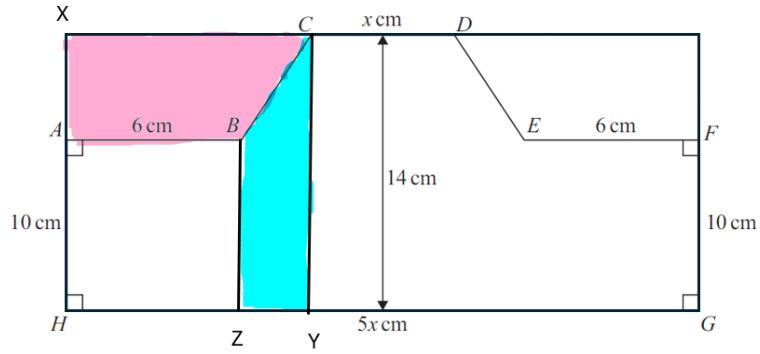
Question		Working	Answer	Mark	Notes
14		1. $AD=DC$ **square** 2. $AN = DM$ **midpoints** of AB and AD 3. $\angle DAN = \angle CDM = 90^0$ 4. $ND = \frac{\sqrt{5}}{2}AD = \frac{\sqrt{5}}{2}DC = MC$		3	M2 two correct statements with reasons (M1 one correct statement with reason or all 3 stated with no reasons) Allow $\angle DAB$ for $\angle DAN$ or $\angle CDA$ for $\angle CDM$ or $\angle A$ or $\angle D$ Allow right angle for 90° If statements 1 & 2 are given then "$ND = MC$ due to Pythagoras" is a sufficient alternative to statement 4
			SAS		A1 SAS or RHS or SSS stated with all 3 correct, including appropriate reasons For SAS must have reasons 1 2 3 For RHS must have reasons 1 3 4 or reasons 2 3 4 For SSS must have 1 2 4
		wr			***Total 3 marks***

Question		Working	Answer	Mark	Notes
15		$\frac{11+\sqrt{2}}{3\sqrt{2}-1}=\left(\frac{11+\sqrt{2}}{3\sqrt{2}-1}\right)\left(\frac{3\sqrt{2}+1}{3\sqrt{2}+1}\right)$		3	M1 for multiplying numerator and denominator by $3\sqrt{2}+1$ or $-3\sqrt{2}-1$ oe eg $\sqrt{18}+1$
		$\frac{33\sqrt{2}+11+6+\sqrt{2}}{(3\sqrt{2})^2-1^2}$ or $\frac{33\sqrt{2}+11+6+\sqrt{2}}{18-1}$ or $\frac{34\sqrt{2}+17}{17}$			M1 (dep) for expanding numerator (2, 3 or 4 terms) and denominator (1, 2 or 4 terms) – condone one error only when multiplying out both numerator and denominator eg $\frac{33\sqrt{2}+11+3\sqrt{2}\sqrt{2}+\sqrt{2}}{3\times3\sqrt{2}\sqrt{2}+3\sqrt{2}-3\sqrt{2}-1^2}$ or $\frac{33\sqrt{2}+11+3\sqrt{4}+\sqrt{2}}{9\sqrt{4}-1}$
			$1+2\sqrt{2}$		A1 final answer (dependent on both M marks) Accept $2\sqrt{2}+1$
		wr			***Total 3 marks***
					No marks for $\frac{11+\sqrt{2}}{3\sqrt{2}-1}=1+2\sqrt{2}$ M1 only for $\left(\frac{11+\sqrt{2}}{3\sqrt{2}-1}\right)\left(\frac{3\sqrt{2}+1}{3\sqrt{2}+1}\right)=1+2\sqrt{2}$

Question		Working	Answer	Mark	Notes
16		$3\left(x^2+8x\right)+1$ or $3\left(x^2+8x+\frac{1}{3}\right)$ oe		3	M1 Allow for $a=3$ or $b=4$ or $c=-47$ Allow these seen in an expression of the form $a\left(x+b\right)^2+c$ This may be implied by the second M1
		$\left(3(x+4)^2-48\right)+1$ or $3\left(\left(x+4\right)^2-16+\frac{1}{3}\right)$ oe			M1 Allow for any two of $a=3$ or $b=4$ or $c=-47$ Allow these seen in an expression of the form $a\left(x+b\right)^2+c$
			$3\left(x+4\right)^2-47$		A1 accept $a=3$, $b=4$, $c=-47$
Alternative mark scheme					
		$ax^2+2abx+ab^2+c$			M1 for multiplying out $a(x+b)^2+c$ to obtain $ax^2+2abx+ab^2+c$ oe
		2 of: $a=3$ $2ab=24$ oe $ab^2+c=1$ oe			M1 for equating coefficients and making 2 correct statements
			$3\left(x+4\right)^2-47$		A1 accept $a=3$, $b=4$, $c=-47$
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
17	(a)	$6c-15c^2-10c^2-2c$		2	M1 for 3 terms correct
			$-25c^2+4c$		A1 do not ISW Allow $c(4-25c)$ or $4c-25c^2$ or $-c(25c-4)$ or $c(-25c+4)$
	(b)		$de^2(2e^3-9)$	2	B2 for $de^2(2e^3-9)$ Do not ISW Condone a missing RH bracket (B1 for correct partial factorisation $d(2e^5-9e^2)$ or $e^2(2de^3-9d)$ or $de(2e^4-9e)$ Allow $m\times de^2(...\pm...)$ where m is a constant ISW for B1)
		cas			***Total 4 marks***

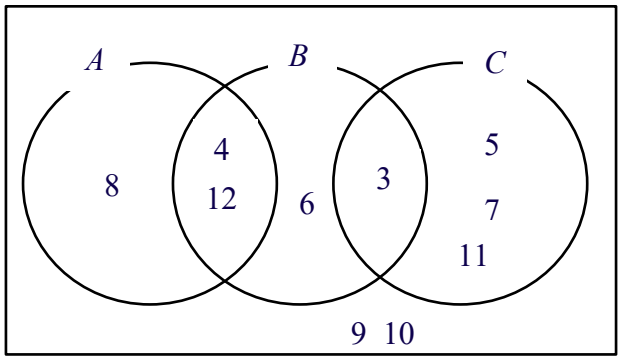
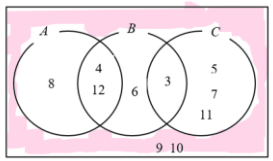
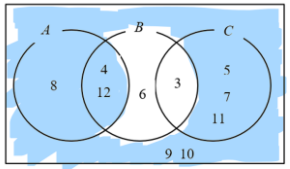
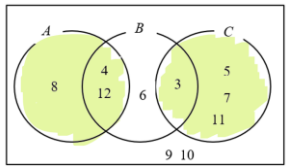
GradeMax

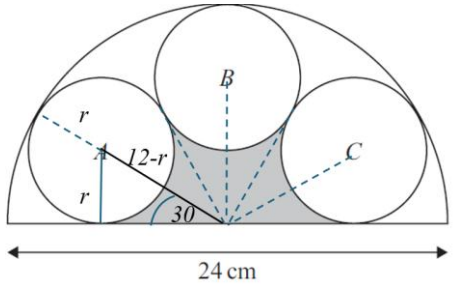
Question		Working	Answer	Mark	Notes
18		$10\times 5x\,[=50x]$ oe **or** $14\times 5x\,[=70x]$ oe **or** $10\times(5x-12)\,[=50x-120]$ oe		4	M1 for correct method to find the area of the rectangle *AFHG* (may be seen as part of a calculation), may not be simplified eg $60+10(5x-12)+60$ **or** the area of the extended rectangle **or** the area of the central rectangle
		$\frac{x+(5x-12)}{2}\times 4\,[=12x-24]$ oe **or** $\frac{6+2x}{2}\times 4\,[=12+4x]$ oe **or** $\frac{10+14}{2}\times(2x-6)\,[=24x-72]$ oe			M1 a correct method for the area of the trapezium *BCDE* or *ABCX* or *BCYZ (see diagram)* with numbers and expressions substituted 
		$12x-24+50x=534$ **or** $70x-(24+8x)=534$ **or** $60+2(24x-72)+14x+60=534$			M1 for a correct equation does not need to be simplified eg $60+10(5x-12)+60+\frac{1}{2}(x+5x-12)\times 4=534$ or $70x-2\left(\frac{6+2x}{2}\times 4\right)=534$
			9		A1
		cas			***Total 4 marks***

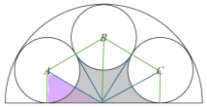
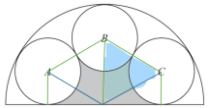
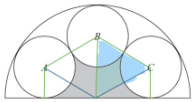
Question		Working		Answer	Mark	Notes
19		For 2 of: $81^x = (3)^{4x}$ oe $6^{4x} = (2 \times 3)^{4x}$ oe $\frac{1}{\sqrt{8^x}} = 2^{-1.5x}$ oe	For 2 of: $(81^x)^2 = (3)^{8x}$ oe $(6^{4x})^2 = (2 \times 3)^{8x}$ oe $\frac{1}{8^x} = 2^{-3x}$ oe		4	M1 for writing at least 2 of the terms with the bases of 2 and/or 3. This can be done in two ways. The first working column shows the terms as they are given. The second column squares the equation to remove the square root before manipulating the terms.
		$\frac{2^1 \times 3^{4x} \times 2^{x^2}}{2^{4x} \times 3^{4x}} = 2^{-1.5x}$	$\frac{2^2 \times 3^{8x} \times 2^{2x^2}}{2^{8x} \times 3^{8x}} = 2^{-3x}$			M1 dep on previous M mark for correct equation in which all bases are 2 or 3 allow the denominator to be seen as $(2\times3)^{4x}$ this can be implied by $2^1 \times 3^{4x} \times 2^{x^2} \times 2^{-4x} \times 3^{-4x} = 2^{-1.5x}$ or $2^{1+x^2-4x} \times 3^{4x-4x} = 2^{-1.5x}$ or $x^2 - 4x + 1 = -1.5x$ or $2x^2 - 8x + 2 = -3x$
		$x^2 - 4x + 1 = -1.5x$	$2x^2 - 8x + 2 = -3x$			M1 dep on previous M mark A correct quadratic equation oe Implied by $x^2 - 2.5x + 1 = 0$
				$\frac{1}{2}$ **and** 2		A1 oe both values must be seen
		wr				***Total 4 marks***

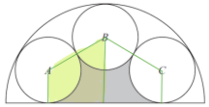
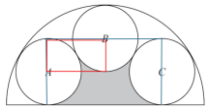
Question		Working	Answer	Mark	Notes
20		$\frac{5}{100}\times 420[=21]$ **or** $\frac{3}{5}\times 420[=252]$ **or** eg $\frac{1}{20}+\frac{3}{5}\left[=\frac{13}{20}\right]$ or 0.05 + 0.6 [=0.65] or 5% + 60% [=65%]		5	M1 for finding 5% of 420 **or** $\frac{3}{5}$ of 420 **or** for combining 5% and $\frac{3}{5}$
		420 – "21" – "252" [=147] or $\left(1-"\frac{13}{20}"\right)\times 420$ [=147]			M1 for finding the number of students who prefer comedy ft their 21 and their 252
		$\frac{"147"}{1+6}\times 6[=126]$			M2 for a complete method to use the ratio to find the number in group B ft their total number for comedy which comes from a correct method (M1 for dividing into the ratio eg $\frac{"147"}{1+6}[=21]$)
			126		A1 cao Accept if seen in a ratio as $21:126$ Do not accept $126:21$ unless 126 is clearly labelled as *B*
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
21	(a)	$(12 \times 27) + (14 \times 59) + (16 \times x) + (18 \times 40) + (20 \times 15)$ or $324+826+16x+720+300$ $[=2170+16x]$		4	M1 for at least **3** correct products (need not be evaluated but must be added)
		$\frac{"2170+16x"}{"141+x"}=15.6$			M1 dep on previous M1 awarded ft with their sum of products Allow division by their total frequency ("141+x") provided addition or total under column seen
		$"2170+16x"=15.6("141+x")$			M1 for method to remove the fraction ft with their sum of products and total frequency as long as both include an x May be implied by $2170+16x=2199.6+15.6x$ or $0.4x=29.6$
			74		A1
	(b)	$\frac{40+15}{141+"74"}$	$\frac{55}{215}$	1	B1oe eg $\frac{11}{43}$, 0.2558… ft their x Allow 2 decimal places or better
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
22	(a)			3	B3 All 6 regions correct (B2 for 4 or 5 correct regions B1 for 3 correct regions)
	(b)		2	1	B1 ft as long as the highlighted region is not empty
	(c)		8	1	B1 ft their Venn diagram
	(d)			2	M1 for **either** $\frac{7}{n}$ where $n > 7$ **or** $\frac{m}{10}$ where $0 < m < 10$ **or** follow through 7 or 10 from their Venn diagram
			$\frac{7}{10}$		A1 oe eg 0.7 or 70%
		cas			***Total 7 marks***

Question		Working	Answer	Mark	Notes
23	(a)	$\sin 30 = \frac{r}{12-r}$ or $12-r=2r$ or $12=3r$ or $24=6r$  	$12=3r$ $[\Rightarrow r=4]$	1	B1 for a correct relationship for r Allow correct trig statement or $12-r=2r$ or $12=3r$ or $24=6r$

	(b)	Triangle and rectangle 	$\sqrt{8^2-4^2}\times 4+2\sqrt{8^2-4^2}\times 4$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ or $4\times\sqrt{8^2+8^2-2\times 8\times 8\cos(120)}+\frac{1}{2}\times 4\times\sqrt{8^2+8^2-2\times 8\times 8\cos(120}$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$		4	M2 for area of the irregular pentagon or a combination of rectangles This may be implied by $12\sqrt{48}=48\sqrt{3}=83.138...$ **Allow use of *r* instead of 4** (Award M1 for the area of a right-angled triangle $\frac{1}{2}\times 4\times 8\sin(60)\left[=8\sqrt{3}=13.85...\right]$ or area of equilateral triangle $\frac{1}{2}\times 8^2\times\sin(60)\left[=16\sqrt{3}=27.71...\right]$ or correct use of Pythagoras to find the length of half the base of the pentagon $\sqrt{(2\times 4)^2-4^2}\left[=\sqrt{48}=4\sqrt{3}=6.92...\right]$. or cosine rule to find the length of the base $\sqrt{8^2+8^2-2\times 8\times 8\cos(120)}\left[=8\sqrt{3}=13.85...\right]$)
		6 right-angled triangles 	$6\times\left(\frac{1}{2}\times 4\times 8\sin(60)\right)\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ or $6\times\left(\frac{1}{2}\times 4\times\sqrt{8^2-4^2}\right)\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ oe			
		3 equilateral triangles 	$3\times\left(\frac{1}{2}\times 8\times 8\sin(60)\right)\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ or $3\times\left(\frac{1}{2}\times 8\times\sqrt{8^2-4^2}\right)\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ oe			
		2 equilateral triangles and 2 right-angled triangles 	$2\times\left(\frac{1}{2}\times 8\times 8\sin(60)\right)+2\times\left(\frac{1}{2}\times 4\times 8\sin(60)\right)$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$ or $2\times\left(\frac{1}{2}\times 8\times\sqrt{8^2-4^2}\right)+2\times\left(\frac{1}{2}\times 4\times\sqrt{8^2-4^2}\right)$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$			

		2 trapeziums 	$2\times\left(\frac{1}{2}(4+8)\sqrt{8^2-4^2}\right)$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$			
		Combination of rectangles 	$4\times2\times\sqrt{8^2-4^2}+4\times\sqrt{8^2-4^2}$ $\left[=12\sqrt{48}=48\sqrt{3}=83.13...\right]$			
		$3\times\frac{120}{360}\times4^2\times\pi\left[=3\times\frac{16}{3}\pi=3\times16.75...\right]$ or $6\times\frac{60}{360}\times4^2\times\pi\left[=6\times\frac{8}{3}\pi=6\times8.37...\right]$ or $2\times\frac{60}{360}\times4^2\times\pi+2\times\frac{120}{360}\times4^2\times\pi\left[=2\times\frac{8}{3}\pi+2\times\frac{16}{3}\pi=16.75...+33.51...\right]$ $2\times\frac{90}{360}\times4^2\times\pi+2\times\frac{30}{360}\times4^2\times\pi+\frac{120}{360}\times4^2\times\pi$ $\left[=2\times4\pi+2\times\frac{4}{3}\pi+\frac{16}{3}\pi=2\times12.56...+2\times4.18...+16.75...\right]$ $2\times\frac{90}{360}\times4^2\times\pi+2\times\frac{90}{360}\times4^2\times\pi$ $\left[=2\times4\pi+2\times4\pi=2\times12.56...+2\times12.56...\right]$			M1 for sector areas that need to be subtracted from the pentagon or combination of rectangles Allow a sector of angle θ where θ is 30, 45, 60, 90, 120, 180 or 360. eg $\left[\frac{\theta}{360}\times\right]4^2\pi=\left[\frac{\theta}{360}\times\right]16\pi=\left[\frac{\theta}{360}\times\right]\times50.26...$
			32.9			A1 awrt 32.9
		Note that Area of the semi-circle $-n\times$ area of the small circle $\left[=72\pi-n\times16\pi\right]$ where $n=1,\ 2$ *or* 3 is **not** a correct method and is awarded M0M0M0A0 If 16π is seen it **must** be referring to the area that is being subtracted from the pentagon (or combination of rectangles)				
		(a) wr (b) cas				***Total 5 marks***

Question		Working	Answer	Mark	Notes
24		$\left[2x^2-x-1=\right](2x+1)(x-1)$ $\left[4-x^2=\right](2+x)(2-x)$ $\left[x^2-3x+2=\right](x-2)(x-1)$		5	M2 Attempt to **factorise** all three quadratics. Must multiply to give 2 correct terms eg $\frac{(2+x)(2-x)}{(x-2)(x-1)}\div\left(\frac{1}{x-1}-\frac{x+2}{(2x+1)(x-1)}\right)$ For the attempted expansion of $\left(4-x^2\right)$ allow $(x+2)(x-2)$ (If not M2 then M1 for attempt to factorise 1 or 2 quadratics. Must multiply to give 2 correct terms eg $\frac{4-x^2}{(x-2)(x-1)}\div\left(\frac{1}{x-1}-\frac{x+2}{2x^2-x-1}\right)$ or $\frac{4-x^2}{x^2-3x+2}\div\left(\frac{1}{x-1}-\frac{x+2}{(2x+1)(x-1)}\right)$ or $\frac{(2+x)(2-x)}{x^2-3x+2}\div\left(\frac{1}{x-1}-\frac{x+2}{2x^2-x-1}\right)$)

		$\frac{2x+1-(x+2)}{(x-1)(2x+1)}$ or $\frac{x-1}{(x-1)(2x+1)}$ or $\frac{1}{2x+1}$ or $\frac{(2x+1)(x-1)-(x+2)(x-1)}{(x-1)(2x+1)(x-1)}$			M1 Correct method used to **subtract** fractions by finding a common denominator. Must be done before the division. May be done before factorising the quadratics (and candidate may have expanded the brackets). Eg $\frac{2x^2-x-1}{(x-1)(2x^2-x-1)}-\frac{(x+2)(x-1)}{(2x^2-x-1)(x-1)}$ or $\frac{2x^2-x-1}{2x^3-3x^2+1}-\frac{x^2+x-2}{2x^3-3x^2+1}$ or $\frac{2x^2-x-1}{(x-1)(2x^2-x-1)}-\frac{x^2+x-2}{(x-1)(2x^2-x-1)}$
		$\frac{(2+x)(2-x)}{(x-2)(x-1)}\times\frac{(x-1)(2x+1)}{(x-1)}$			M1 for **division** by multiplying the first fraction by the reciprocal of the second. May be done before factorising the quadratics (and candidate may have expanded the brackets). Must be done after the subtraction. Accept $\frac{4-x^2}{x^2-3x+2}\times\frac{x^2-2x-3}{2x^3-3x^2+1}$
			$\frac{(x+2)(2x+1)}{1-x}$		A1oe eg $-\frac{2x^2+5x+2}{x-1}$ dep on all 4 method marks
		wr			***Total 5 marks***

Question		Working	Answer	Mark	Notes
25		[Volume of hemisphere is] $\frac{2}{3}\pi(5)^3\left[=\frac{250}{3}\pi=261.79...\right]$		6	B1 may be seen in an equation
		[Volume of cone is] $\frac{1}{3}\pi(5)^2 h=\left[\frac{25}{3}\pi h=26.179...h\right]$			B1 may be seen in an equation
		$\frac{250}{3}\pi+\frac{25}{3}\pi\times h=\frac{550}{3}\pi$ oe			M1 for setting up an equation for the total volume of the shape (dep on the sum of 2 **volumes** and at least B1 previously awarded) ft their **volumes** with at least one correct May be implied by $h=12$
		$l=\sqrt{5^2+("12")^2}\,[=13]$			M1 for finding the slant height of the cone ft their value of h if from correct working or clearly labelled May be implied by $l=13$
		[surface area of the hemisphere & cone is] $2\pi 5^2+\pi\times 5\times "13"$			M1 for the surface area of the hemisphere and cone ft their value of l if from correct working or clearly labelled
			361		A1 awrt 361 allow 115π
		cas			***Total 6 marks***

Question		Working	Answer	Mark	Notes
26	(a)		$3\mathbf{b}-2\mathbf{a}$	1	B1 oe
	(b)	$3\mathbf{b}+\frac{4}{5}\left(-"\left(-2\mathbf{a}+3\mathbf{b}\right)"+\mathbf{a}+2\mathbf{b}\right)$ oe or $2\mathbf{a}+\mathbf{a}+2\mathbf{b}+\frac{1}{5}\left(-\mathbf{a}-2\mathbf{b}+"-2\mathbf{a}+3\mathbf{b}"\right)$ oe		2	M1 use of correct ratio on their BC ft their AC May be seen as $3\mathbf{b}+\frac{4}{5}(-\mathbf{b}+3\mathbf{a})$ or $\mathbf{3a}+2\mathbf{b}+\frac{1}{5}(-3\mathbf{a}+\mathbf{b})$
			$\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}$		A1 oe *cas*
	(c)	$\left[\overrightarrow{OD}=\right]\lambda\left("\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}"\right)$ or $\left[\overrightarrow{PD}=\right]\alpha\left("\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}"\right)$ $\overrightarrow{OD}="\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}"+\alpha\left("\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}"\right)$ or $\overrightarrow{PD}=\frac{\gamma}{1-\gamma}\left("\frac{12}{5}\mathbf{a}+\frac{11}{5}\mathbf{b}"\right)$		5	M1 finds $\overrightarrow{OD}$ or $\overrightarrow{PD}$ in terms of their $\overrightarrow{OP}$ must include an unknown parameter. This may be seen as $\overrightarrow{OD}=\lambda\overrightarrow{OP}$ $\overrightarrow{PD}=\alpha\overrightarrow{OP}$ $\overrightarrow{OD}=\overrightarrow{OP}+\overrightarrow{PD}=\overrightarrow{OP}+\alpha\overrightarrow{OP}$ $\overrightarrow{PD}=\lambda\overrightarrow{OD}$ To award marks, the vectors must be in terms of **a** and **b** Alternative routes may be seen
		$\overrightarrow{OD}=2\mathbf{a}+\mu(\mathbf{a}+2\mathbf{b})$ or $\overrightarrow{OD}=2\mathbf{a}+(\mathbf{a}+2\mathbf{b})+\beta(\mathbf{a}+2\mathbf{b})$ or $\overrightarrow{PD}=\frac{1}{5}(3\mathbf{a}-\mathbf{b})+\beta(\mathbf{a}+2\mathbf{b})$ or $\overrightarrow{PD}=\frac{1}{5}(3\mathbf{a}-\mathbf{b})+\frac{\delta}{1-\delta}(\mathbf{a}+2\mathbf{b})$			M1 finds $\overrightarrow{OD}$ or $\overrightarrow{PD}$ in terms of a multiple of $\overrightarrow{AB}$ or a multiple of $\overrightarrow{BD}$ must include an unknown parameter. This may be seen as $\overrightarrow{OD}=\overrightarrow{OA}+\mu\overrightarrow{AB}$ $\overrightarrow{OD}=\overrightarrow{OA}+\overrightarrow{AB}+\overrightarrow{BD}=\overrightarrow{OA}+\overrightarrow{AB}+\beta\overrightarrow{AB}$ $\overrightarrow{PD}=\overrightarrow{PB}+\overrightarrow{BD}=\overrightarrow{PB}+\beta\overrightarrow{AB}$ To award marks, the vectors must be in terms of **a** and **b** Alternative routes may be seen

		‘$\frac{12}{5}\lambda = 2+\mu$ and $\frac{11}{5}\lambda = 2\mu$’ or ‘$\frac{12}{5}\lambda = 3+\beta$ and $\frac{11}{5}\lambda = 2+2\beta$’ or ‘$\frac{12}{5}\alpha + \frac{12}{5} = 2+\mu$ and $\frac{11}{5}\alpha + \frac{11}{5} = 2\mu$’ or ‘$\frac{12}{5}\alpha + \frac{12}{5} = 3+\beta$ and $\frac{11}{5}\alpha + \frac{11}{5} = 2+2\beta$’ or ‘ $\frac{12}{5}\alpha = \frac{3}{5}+\beta$ and $\frac{11}{5}\alpha = 2\beta - \frac{1}{5}$’ or ‘$\frac{12}{5}\frac{\gamma}{(1-\gamma)} = \frac{3}{5}+\beta$ and $\frac{11}{5}\frac{\gamma}{(1-\gamma)} = -\frac{1}{5}+2\beta$’ or ‘$\frac{12}{5}\alpha = \frac{3}{5}+\frac{\delta}{1-\delta}$ and $\frac{11}{5}\alpha = -\frac{1}{5}+\frac{2\delta}{1-\delta}$’ or ‘$\frac{12\gamma}{5(1-\gamma)} = \frac{3}{5}+\frac{\delta}{1-\delta}$ and $\frac{11\gamma}{5(1-\gamma)} = -\frac{1}{5}+\frac{2\delta}{1-\delta}$’,			M1 dep both previous M marks, for correctly setting expressions equal (to each other) and forming two equations in their parameters. Each equation must involve 2 parameters
		$\lambda = \frac{20}{13}$ or $\mu = \frac{22}{13}$ or $\alpha = \frac{7}{13}$ or $\beta = \frac{9}{13}$ or $\gamma = \frac{7}{20}$ or $\delta = \frac{9}{22}$			A1 for either parameter correct, is implied by a correct final ratio. These will depend on the path chosen.
			13 : 7		A1 oe
		cas			***Total 8 marks***

GradeMax

Question		Working	Answer	Mark	Notes
27	(a)	$6\times\left(\pm\frac{1}{2}\right)^3+17\times\left(\pm\frac{1}{2}\right)^2+6\times\left(\pm\frac{1}{2}\right)-8=...$ **or** $6\times\left(\pm\frac{1}{2}\right)^3+17\times\left(\pm\frac{1}{2}\right)^2+a\times\left(\pm\frac{1}{2}\right)-8=0$		2	M1 substitution of $x=\pm\frac{1}{2}$ and $a=6$ into expression and attempt to evaluate **or** substitution of $x=\pm\frac{1}{2}$ into expression and equating to 0 to form an equation in a For both methods allow with terms evaluated eg: $\pm\frac{3}{4}+\frac{17}{4}\pm3-8=...$ or $\pm\frac{3}{4}+\frac{17}{4}\pm\frac{1}{2}a-8=0$
		$\frac{3}{4}+\frac{17}{4}+3-8=\frac{20}{4}-5=0$ and shown **or** $\frac{a}{2}-3=0$ or $\frac{a}{2}=3$ and $a=6$			A1 Showing expression with $x=\frac{1}{2}$ and $a=6$ leads to 0 and a conclusion (eg shown or #) **or** Solving correct equation to gain $a=6$ with no errors seen (must see at least one line of working after the first line)
	(b)	$3x^2+10x+8$		3	M1 for two out of three terms correct in the quadratic factor. This may be seen in part (a)
		$\left[(2x-1)\right]\left(3x^2+10x+8\right)$			M1 fully correct quadratic factor This may be seen in part (a)
		$(x+2)(2x-1)(3x+4)$			A1 fully correct factorisation dep on previous M1 Condone =0 but do not ISW if gone on to solve NB: $(x+2)\left(x-\frac{1}{2}\right)\left(x+\frac{4}{3}\right)$ scores A0
	(c)	$3y+1=-2$ or $3y+1=\frac{1}{2}$ or $3y+1=-\frac{4}{3}$		2	M1 for recognising that $x=3y+1$ (can be implied by one correct value for y) ft values from their factorisation
			$-1,-\frac{1}{6},-\frac{7}{9}$		A1 all three values, with no extras dep on M1
					Total 7 marks