Pearson

Mark Scheme (Results)

January 2026

Pearson Edexcel International Advanced Level in
Pure Mathematics P2
WMA12/01

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January 2026
Question Paper Log Number P84523A
Publication Code WMA12_01_2601_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.

EDEXCEL IAL MATHEMATICS
General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

   - **M** marks: Method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
   - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - **B** marks are unconditional accuracy marks (independent of M marks)

   Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN:

   - bod – benefit of doubt
   - ft – follow through
     - the symbol $\sqrt{}$ will be used for correct ft
   - cao – correct answer only
   - cso – correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC – special case
   - oe – or equivalent (and appropriate)
   - d… or dep – dependent
   - indep – independent
   - dp – decimal places
   - sf – significant figures
   - ∗ – The answer is printed on the paper or ag- answer given

- ⎣ or d… – The second mark is dependent on gaining the first mark

4. All A marks are ‘correct answer only’ (cao), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.

5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected. If you are using the annotation facility on ePEN, indicate this action by ‘MR’ in the body of the script.

6. If a candidate makes more than one attempt at any question:
   a) If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   b) If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

7. Ignore wrong working or incorrect statements following a correct answer.

General Principles for Pure Mathematics Marking

(NB specific mark schemes may sometimes override these general principles)

Method mark for solving 3 term quadratic:

1. Factorisation

$(x^2 + bx + c) = (x + p)(x + q)$, where $|pq| = |c|$ leading to $x = \ldots$

$(ax^2 + bx + c) = (mx + p)(nx + q)$, where $|pq| = |c|$ and $|mn| = |a|$ leading to $x = \ldots$

2. Formula

Attempt to use correct formula (with values for a, b and c)

3. Completing the square

Solving $x^2 + bx + c = 0$: $(x \pm \frac{b}{2})^2 \pm q \pm c, \quad q \neq 0$ leading to $x = \ldots$

Method marks for differentiation and integration:

1. Differentiation

Power of at least one term decreased by 1 ($x^n \to x^{n-1}$)

2. Integration

Power of at least one term increased by 1 ($x^n \to x^{n+1}$)

Use of a formula

Where a method involves using a formula that has been learnt, the advice given in recent examiners' reports is that the formula should be quoted first.

Normal marking procedure is as follows:

Method mark for quoting a correct formula and attempting to use it, even if there are small mistakes in the substitution of values.

Where the formula is not quoted, the method mark can be gained by implication from correct working with values, but may be lost if there is any mistake in the working.

Exact answers

Examiners' reports have emphasised that where, for example, an exact answer is asked for, or working with surds is clearly required, marks will normally be lost if the candidate resorts to using rounded decimals.

Answers without working

The rubric says that these may not gain full credit. Individual mark schemes will give details of what happens in particular cases. General policy is that if it could be done "in your head", detailed working would not be required. Most candidates do show working, but there are occasional awkward cases and if the mark scheme does not cover this, please contact your team leader for advice.

Question Number	Scheme	Marks
1. (a)	$(3+kx)^7 = \underline{3^7} + {}^7C_1 3^6 (kx)^1 + {}^7C_2 3^5 (kx)^2 + {}^7C_3 3^4 (kx)^3 + \ldots$	<u>B1</u>, M1
	$= 2187 + 5103kx + 5103k^2x^2 + 2835k^3x^3 + \ldots$	A1, A1
		(4)
(b)	Sets $5103k^2 = 3\times 2835k^3 \Rightarrow k = \ldots$	M1
	$k = \dfrac{3}{5}$	A1
		(2)
		(6 marks)

(a)

B1: For a first term (constant term) of 3^7 or 2187 or even ${}^7C_0 \times 3^7$

M1: For an attempt at the binomial expansion. Score for a correct attempt at one of terms 2, 3 or 4

Accept sight of ${}^7C_1 3^6 (kx)^1$ or ${}^7C_2 3^5 (kx)^2$ or ${}^7C_3 3^4 (kx)^3$ condoning the Omission of brackets.

Accept any **correct** coefficient appearing from Pascal's triangle.

A1: For any two simplified terms of $2187 + 5103kx + 5103k^2x^2 + 2835k^3x^3$

A1: For $2187 + 5103kx + 5103k^2x^2 + 2835k^3x^3$ ignoring terms with greater powers. Allow as a list and allow in descending order.

ALT For the first two marks

B1: Takes 3^7 out as a common factor to obtain $3^7\left(1+\dfrac{kx}{3}\right)^7$

M1: For an attempt at the binomial expansion Score for a correct attempt at one of terms 2, 3 or 4 inside the main bracket.

Accept $\ldots\left(1+(7\times)\left(\dfrac{kx}{3}\right),\ \left(\dfrac{7\times 6}{2!}\right)\times\left(\dfrac{kx}{3}\right)^2,\ \left(\dfrac{7\times 6\times 5}{3!}\right)\times\left(\dfrac{kx}{3}\right)^3\right)$ condoning the omission of brackets

(b)

M1: For setting $'5103'k^2 = 3\times '2835'k^3$ leading to $k = \ldots$following **correct** processing M0 if they include x's, but allow if recovered

A1: For $k = \dfrac{3}{5}$ or exact equivalent. No other values stated.

Question Number	Scheme	Marks
2 (a)	$h = 3$	B1
	Area $\approx \frac{3}{2}\{1.3195 + 0.4665 + 2\times(1.0718 + 0.8706 + 0.7071 + 0.5743)\}$	M1
	$= 12.35$	A1
		(3)
(b)	States either 'use more trapezia', or other such as 'make the strip widths narrower'	B1
		(1)
(c)	$\int_{-4}^{11} 2^{3-0.1x}\,\mathrm{d}x = 2^3 \times \int_{-4}^{11} 2^{-0.1x}\,\mathrm{d}x = 8\times'12.35' = 98.8$	M1, A1
		(2)
		(6 marks)

(a)

B1 For $h = 3$ seen anywhere even if it is not later used correctly.

This is implied by sight of $\frac{3}{2}$ in front of the bracket

M1 For a correct content of the bracket within Trapezium Rule, condoning slips.
E.g., missing end bracket(s) or MR on no more than two values

FYI: Area A $\approx \left(\frac{3}{2}\right)(1.786 + 2[3.2238]) \Rightarrow \left(\frac{3}{2}\right)(8.2336) = 12.3504$

A1 awrt 12.35 following the award of M1
Note that the calculator answer for this integral is 12.31

(b)

B1: States any valid method that states or implies thinner strips, more strips, more trapezia, reduce the size of h etc.,

We will also condone for the award of this mark;

Use more y values
Use more x values
Use more x and y values

(c)

M1: Attempts to use the rule $2^{3-0.1x} = 2^3 \times 2^{-0.1x}$ seen anywhere.

A1: awrt 99 following 8×12.35
Note that the calculator answer is 98.4

Question Number	Scheme	Marks
3.(i)	Sets $f(-2)=0 \Rightarrow 4(-2)^3+6(-2)+k=0 \Rightarrow k=44$	M1, A1
	Attempts $f(5)=4x^3+6x+'44'=4\times5^3+6\times5+'44'=574$	dM1, A1
		(4)
(ii)	Sets $6x^3-15x^2-21x+8=\left(Ax^2+Bx+C\right)(2x+3)+R$	
	And attempts to find values of A, B, C and R via inspection/ substitution etc	M1
	Two correct of A, B, C and R	A1
	$Q(x)=3x^2-12x+\dfrac{15}{2} \quad R=-\dfrac{29}{2}$	A1
		(3)
		(7 marks)

(i) M1: Sets $f(\pm2)=0 \rightarrow$ leading to a value for k

Uses Polynomial Division:

$$x+2\,\overline{\smash{\big)}\,4x^3+0x^2+6x+k}} \quad \text{quotient } 4x^2+8x+32 \qquad \text{Rem}=k-44=0 \Rightarrow k=44$$

Allow for $4x^2+\alpha x+\beta$ with a remainder $k\pm\phi=0$

A1: $k=44$ seen or implied

dM1: Attempts $f(\pm5)$ with their value for k leading to a value for the remainder.

Uses Polynomial division

$$x-5\,\overline{\smash{\big)}\,4x^3+\left(0x^2\right)+6x+'44'}} \quad \text{quotient } 4x^2+20x+106 \qquad \text{Rem}=574 \text{ or Rem}=530+k$$

Allow for $4x^2+\mu x+\nu$ with a constant remainder

A1: 574

(ii) M1: Full attempt to find both the quotient and remainder.

See main scheme but valid via division. Look for a 3 term quadratic quotient and a constant remainder

Alt - uses polynomial division

Look for a 3-term quadratic quotient and a constant remainder

$$2x+3\,\overline{\smash{\big)}\,6x^3-15x^2-21x+8}} \quad \text{quotient } 3x^2-12x+\frac{15}{2} \qquad r=-\frac{29}{2}$$

A1: 2 correct terms of the 4 terms in $Q(x)=3x^2-12x+\dfrac{15}{2}$ and $R=-\dfrac{29}{2}$

A1: $Q(x)=3x^2-12x+\dfrac{15}{2}$ and $R=-\dfrac{29}{2}$ correctly labelled and identified. Allow Quotient (or even Q) in place of $Q(x)$

Question Number	Scheme	Marks
4.	$\int \left(\frac{12}{x^2}+4\right)\mathrm{d}x = -\frac{12}{x}+4x$	M1
	Sets $\int_k^{2k}\left(\frac{12}{x^2}+4\right)\mathrm{d}x = 14 \Rightarrow \left[-\frac{12}{x}+4x\right]_k^{2k} = 14$	
	$\left(-\frac{6}{k}+8k\right)-\left(-\frac{12}{k}+4k\right)=14 \Rightarrow 2k^2-7k+3=0$ o.e.	dM1, A1
	$(2k-1)(k-3)=0 \Rightarrow k=\frac{1}{2}, 3$	ddM1, A1
		(5 marks)

M1: Attempts to integrate with one index correct

dM1: Applies the limits either way around with a subtraction, **and** sets = 14

A1: Forms a correct 3TQ. Terms do not need to be on the same side of the = sign.

Look for $4k^2+6=14k$ o.e

ddM1: Uses any method of solving a 3TQ including a calculator.

A1: $k=\frac{1}{2}, 3$ following all previous marks.

Question Number	Scheme	Marks
5 (a)	$x^2+y^2-6x+5y-41=0$	
	Attempts $(x-3)^2+\left(y+\frac{5}{2}\right)^2=...$	M1
	Correct centre $\left(3,-\frac{5}{2}\right)$	A1
	Exact radius $\frac{15}{2}$	A1
		(3)
(b)	Sets up appropriate equation $(k+'3')^2+\left('\frac{5}{2}'\right)^2=\left(5+'\frac{15}{2}'\right)^2$	M1
	$(k+3)^2=150\Rightarrow k+3=\sqrt{150}$	dM1
	$\Rightarrow k=5\sqrt{6}-3$	A1
		(3)
		(6 marks)

(a)

M1: Attempts to complete the square for both variables. Look for $(x\pm3)^2,\left(y\pm\frac{5}{2}\right)^2=...$

This mark can be implied from the coordinates of the centre $\left[\left(3,-\frac{5}{2}\right)\right]$ just written down.

A1: $\left(3,-\frac{5}{2}\right)$

A1: $\frac{15}{2}$ condone $\sqrt{\frac{225}{4}}$ o.e which may be scored following $(x-3)^2+\left(y+\frac{5}{2}\right)^2=\frac{225}{4}$

(b)

M1: Uses Pythagoras' theorem to set up an equation in k

Look for $(k\pm'3')^2+\left('\frac{5}{2}'\right)^2=\left(5+'\frac{15}{2}'\right)^2$ following through on their $\left(3,-\frac{5}{2}\right)$ and $\frac{15}{2}$

Also look for $k^2+6k-141=0$ o.e.

dM1: Uses an appropriate method to proceed to a value for k

A1: $k=5\sqrt{6}-3$ o.e.

Question Number	Scheme	Marks
6 (i)	Can write p and/or q in an appropriate form. E.g $p=2n+1, q=2n+3$ $n\in\mathbb{N}$	B1
	$p^2-q^2=(2n+1)^2-(2n-1)^2$	M1
	$=4n^2+4n+1-(4n^2-4n+1)$	A1
	$=8n$ which is a multiple of 8, hence proven *	A1*
		(4)
(ii)	$y=x^3+12x^2+49x+2\Rightarrow\frac{dy}{dx}=3x^2+24x+49$	M1,
	$\Rightarrow\frac{dy}{dx}=3(x+4)^2+1$	dM1, A1
	Gradient is always $\geqslant 1$ so cannot ever be 0, so no stationary points on C *	A1*
		(4)
		(8 marks)

(i)

B1: Can write p and/or q in an appropriate form. Condone omission of $n\in\mathbb{N}$
Allow any letter to be used in place of n
Allow $(p=)\,2n+3, (q=)\,2n+1$ p and q to be implied

M1: Starts the proof by writing $[p^2-q^2=]\ (2n+1)^2-(2n-1)^2$ o.e
OR, such as $p^2-q^2=(2n+3)^2-(2n+1)^2$
NB Must be in one variable only and *p* and *q* must be consecutive.

A1: Correct multiplication to an intermediate or fully simplified answer,
Allow $4n^2+4n+1-(4n^2-4n+1)$

A1*: Reaches a correct answer, E.g. $8n$, gives a valid statement 'which is a multiple of 8' or a minimal conclusion. E.g., 'QED', 'Shown', □, #, etc.,
Note with $p^2-q^2=(2n+3)^2-(2n+1)^2$ you will get $8n+8$

SC Uses *p* < *q* Award marks as above, but score B1 M1 A1 A0 for an otherwise fully correct proof.

(ii)

M1: Attempts to differentiate and achieves a 3TQ

An attempt to differentiate is defined in General Guidance.

dM1: And then uses a valid method of showing that $\frac{\mathrm{d}y}{\mathrm{d}x} \neq 0$

Valid methods could be

1. Attempting to complete the square
2. Attempting the discriminant $(\text{Disc} = -12)$
3. Attempting to solve, with working, $'3x^2 + 24x + 49' = 0$
   Accept 'not real roots' following some working but not 'Math Error'
   $\left(\text{Roots are } \frac{-12 \pm \sqrt{3}\mathrm{i}}{3}\right)$

A1: Correct calculations [As above]

A1*: Valid conclusion. E.g.

1. $\frac{\mathrm{d}y}{\mathrm{d}x} \geqslant 1$ hence is never 0 **so no stationary points**

2. The Discriminant is negative **so no (real) roots** and **hence no stationary points**

3. The roots are complex so there are **no (real) solutions** and **hence no stationary points.**

Accept reference to turning points.

Question Number	Scheme	Marks
7 (i)	$8^{2x-5} = 20$	
	Take $\log_2$ of <u>both</u> sides and uses power rule $(2x-5)\log_2 8 = \log_2 20$	M1
	Uses $\log_2 8 = 3$ or $\log_2 20 = \log_2 4 + \log_2 5$	dM1
	$3(2x-5) = 2 + \log_2 5$	A1
	$x = \frac{17}{6} + \frac{1}{6}\log_2 5$	A1
		(4)
(ii)	$\log_3(13+2y) + 3 = 2\log_3(4-y)$	
	One correct log law $2\log_3(4-y) \to \log_3(4-y)^2$ or $3 \to \log_3 27$	B1
	Correct attempt to combine two terms	M1
	Correct equation (not involving logs) E.g. $(4-y)^2 = 27(13+2y)$	A1
	$y^2 - 62y - 335 = 0$	
	$(y+5)(y-67) = 0$	dM1
	$y = -5$ only	A1
		(5)
		(9 marks)

(i)

M1: Take $\log_2$ of <u>both</u> sides and uses power rule $(2x-5)\log_2 8 = \log_2 20$

Allow this mark for log work with any or no base: E.g. $(2x-5)\log 8 = \log 20$

dM1: Uses $\log_2 8 = 3$ or $\log_2 20 = \log_2 4 + \log_2 5$ **correctly** to obtain an equation in x involving just $\log_2 5$

A1: A **correct** intermediate equation in x involving just $\log_2 5$

A1: $x = \frac{17}{6} + \frac{1}{6}\log_2 5$

There are several ways of solving part (i). These are the General Principles for marking this. Allow numerical slips only, index and log work must be correct.

M1: Deal with the index and take logs of both sides

dM1: Simplify logs/use the addition law **correctly** to obtain an equation involving x, $\log_2 5$ and constant(s) only. If candidates change from base 8 to base 2 it must be correct throughout.

A1: For a **correct** equation involving x and $\log_2 5$ (no other logs) and constant(s)

A1: For $x = \frac{17}{6} + \frac{1}{6}\log_2 5$

(ii)

B1: One correct log law $2\log_3(4-y) \to \log_3(4-y)^2$ or $3 \to \log_3 27$

M1: Correct attempt to **combine** two terms

$\log_3(13+2y)+3 = \log_3 27(13+2y)$ or

$$2\log_3(4-y) - \log_3(13+2y) = \log_3 \frac{(4-y)^2}{(13+2y)}$$

Do not award this mark for an equation from incorrect log work when **combining** the terms, for example:

$$2\log_3(4-y) - \log_3(13+2y) = \frac{\log_3(4-y)^2}{\log_3(13+2y)} \Rightarrow \log_3 \frac{(4-y)^2}{(13+2y)}$$

A1: Correct equation (not involving logs) E.g. $(4-y)^2 = 27(13+2y)$

dM1: Correct method of solving 3TQ in y. Allow for either 67 or – 5 seen.

Dependent upon previous M

A1: A1: $y=-5$ **only** If $y = 67$ is not rejected then award A0

Question Number	Scheme	Marks
8 (i)	$4\tan^2(2\theta-30)°+1=49$	
	$\tan(2\theta-30)°=(\pm)\sqrt{12}$	M1
	$(2\theta-30)=$ any of awrt 74, 106, 254, 286	A1
	Correct method to find θ E.g. $\theta=$ awrt $\frac{74+30}{2}$	dM1
	Two of $\theta=$ awrt 51.9, 68.1, 141.9, 158.1	A1
	All four of $\theta=$ awrt 51.9, 68.1, 141.9, 158.1	A1
		(5)
(ii)	Uses $\tan x=\frac{\sin x}{\cos x}\Rightarrow 2\times\frac{\sin x}{\cos x}\sin x+3=0$	M1
	$2\sin^2 x+3\cos x=0\Rightarrow 2\left(1-\cos^2 x\right)+3\cos x=0$	dM1
	$\Rightarrow 2\cos^2 x-3\cos x-2=0$	A1
	$\Rightarrow(2\cos x+1)(\cos x-2)=0\Rightarrow\cos x=-\frac{1}{2}$	ddM1
	$\Rightarrow x=\frac{2}{3}\pi,\frac{4}{3}\pi$	A1
		(5) **(10 marks)**

(i)

M1: **Either:** Attempts to make $\tan(2\theta-30)°$ the subject. Allow $\tan\alpha°=3.46$

An attempt is defined as a numerical slip in finding '12'

Allow the use of a substitution here e.g., let $2\theta-30=x\Rightarrow\tan x°=(\pm)\sqrt{12}$

OR: Uses the sin/cos and Pythagorean identities as follows:

$$\tan^2\alpha=12\Rightarrow\frac{\sin^2\alpha}{\cos^2\alpha}=12\Rightarrow 1-\cos^2\alpha=12\cos^2\alpha$$

$$\cos^2\alpha=\frac{1}{13}\Rightarrow\cos\alpha=(\pm)\sqrt{\frac{1}{13}}\quad\text{o.e.}$$

OR $$\sin\alpha=(\pm)\sqrt{\frac{12}{13}}\quad\text{o.e.}$$

Award this mark for obtaining a value for either sin or cos allowing for numerical slips only.

A1: Achieves $(2\theta-30)=$ any of one of awrt 74, 106, 254, 286

Allow a substitution, so achieves any one of $x=$ awrt 74, 106………..

dM1: Dependent upon the previous M mark. It is for attempting to find θ. Score for $\dfrac{\arctan k \pm 30}{2}$

A1: For two of $\theta =$ awrt 51.9, 68.1, 141.9, 158.1

A1: All four of $\theta =$ awrt 51.9, 68.1, 141.9, 158.1 and no other values in the range
Ignore values outside of range.

(ii)

M1: Uses $\tan x = \dfrac{\sin x}{\cos x} \Rightarrow 2 \times \dfrac{\sin x}{\cos x} \sin x + 3 = 0$

dM1: Uses $\sin^2 x = 1 - \cos^2 x$ and multiplies by $\cos x$ and attempts to form a 3TQ in $\cos x$

A1: Correct simplified 3 term quadratic $2\cos^2 x - 3\cos x - 2 = 0$ in any form.

ddM1: Solves a 3TQ using any valid method [including calculators] in $\cos x$ leading to at least one value for $\cos x$

A1: $x = \dfrac{2}{3}\pi, \dfrac{4}{3}\pi$ and no other values in the range Ignore values outside of range

Question Number	Scheme	Marks
9.(a)	Attempts to use $7\,500 = 12\,400 + 14d$ to find 'd'	M1
	Finds $d = (-350)$ and uses this in $12\,400 + 4d$	M1
	Lithium mined in Year 5 is 11 000	A1
		(3)
(b)	Attempts $\frac{15}{2}(12400+7500)$ or $\frac{15}{2}\{2\times12400+14\times-350\} = 149\,250$	M1, A1
		(2)
(c)	Attempts to use $7\,500 = 12\,400r^{14}$ to find 'r'	M1
	Finds $r = (0.9647)$ and uses this in $12\,400 \times r^{9}$	M1
	Lithium mined in Year 10 $8580 \leqslant \mathbb{L} \leqslant 9000$	A1
		(3)
(d)	Limit $= \dfrac{12400}{1-'0.9647'} = 351\,300$ Accept $310\,000 \leqslant S_\infty \leqslant 351\,600$	M1, A1
		(2)
		(10 marks)

]

(a)

M1: Attempts to use the AP formula in an attempt to find 'd'

Accept an attempt at $7\,500 = 12\,400 + 14d$ resulting in a value for d.

Accept the calculation $\dfrac{7500-12400}{14}$ condoning slips on the 7500 and 12400

M1: A correct attempt, using $12\,400 + 4d$, to find the mass of lithium mined in year 5.

You may award this following an "incorrect" AP formula with $15d$ being used instead of $14d$

Eg $7\,500 = 12\,400 + 15d$ or more likely $\dfrac{7500-12400}{15}$ usually leading to an answer of awrt 11093

A1: Lithium mined in Year 5 is 11 000

(b)

M1: Any correct method to find the sum of the AP .

Look for $\frac{15}{2}\{2\times12400+14\times-350\} = ...$ following through on their 'd'

OR $\frac{15}{2}(12400+7500) = ...$ using first + last formula

A1: 149 250

(c)

M1: Attempts to use the GP nth term formula in an attempt to find 'r'

Accept an attempt at $7\,500 = 12\,400r^{14} \Rightarrow r^{14} = \frac{7500}{12400} \Rightarrow r = \ldots$ condoning numerical slips on the values.

Accept the calculation $\sqrt[14]{\frac{7500}{12400}}$

M1: A correct attempt, using $12\,400 \times r^{9}$, to find the 10th term ft their positive r

You may award this following an "incorrect" GP formula with 15 being used instead of 14

Eg following $7\,500 = 12\,400r^{15}$.   or $r = \sqrt[15]{\frac{7500}{12400}}$.

A1: Accept awrt in the range $8580 \leqslant \mathbb{L} \leqslant 9000$

(d)

M1: A correct method for the sum to infinity of a GP.

Look for an attempt at $\frac{12400}{1-'0.9647'}$ following through on their 0.9647

Allow this mark only if their $|r|<1$

A1: Accept awrt in the range $310\,000 \leqslant S_\infty \leqslant 351\,600$

Question Number	Scheme	Marks
10.(a)	$y=\dfrac{\sqrt{x}\left(100-x^2\right)}{40}=\dfrac{5}{2}x^{\frac{1}{2}}-\dfrac{1}{40}x^{\frac{5}{2}}$	
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{5}{4}x^{-\frac{1}{2}}-\dfrac{1}{16}x^{\frac{3}{2}}$	M1, A1
	Stationary point $\dfrac{5}{4}x^{-\frac{1}{2}}-\dfrac{1}{16}x^{\frac{3}{2}}=0\Rightarrow x^2=20$	dM1
	$x=2\sqrt{5}$	A1
		(4)
(b)	$\displaystyle\int \frac{5}{2}x^{\frac{1}{2}}-\frac{1}{40}x^{\frac{5}{2}}\,\mathrm{d}x=\frac{5}{3}x^{\frac{3}{2}}-\frac{1}{140}x^{\frac{7}{2}}$	M1, A1
	$\dfrac{5}{3}k^{\frac{3}{2}}-\dfrac{1}{140}k^{\frac{7}{2}}=0\Rightarrow k^2=\dfrac{140\times 5}{3}=\dfrac{700}{3}$	dM1
	$\Rightarrow k=\sqrt{\dfrac{700}{3}}$ or $\dfrac{10}{3}\sqrt{21}$	A1
		(4)
		(8 marks)

(a)

M1: An attempt to differentiate.
Writes as a sum of two terms and reduces the power of at least one term by 1

A1: $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{5}{4}x^{-\frac{1}{2}}-\dfrac{1}{16}x^{\frac{3}{2}}$ which may be left unsimplified

dM1: Sets $\dfrac{\mathrm{d}y}{\mathrm{d}x}=0$ **and** proceeds to find a value for x^2 or kx^2

A1: $x=2\sqrt{5}$ or exact equivalent

(b)

M1: An attempt to integrate.
Writes as a sum of two terms and increases the power of at least one term by 1

A1: $\dfrac{5}{3}x^{\frac{3}{2}}-\dfrac{1}{140}x^{\frac{7}{2}}$ which may be left unsimplified. Ignore $+C$

dM1: Substitutes $x=k$ in their $\dfrac{5}{3}x^{\frac{3}{2}}-\dfrac{1}{140}x^{\frac{7}{2}}=0$ with only two terms in k [and any constant terms eliminated by cancelling] **and** solves for k^2

A1: $k=\dfrac{10}{3}\sqrt{21}$ or exact equivalent