

INTERNATIONAL AS MATHEMATICS

MA01

(9660/MA01) Unit P1 Pure Mathematics

Mark scheme

June 2026

Version: 1.0 Final

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Key to mark scheme abbreviations

M	Mark is for method
m	Mark is dependent on one or more M marks and is for method
A	Mark is dependent on M or m marks and is for accuracy
B	Mark is independent of M or m marks and is for method and accuracy
E	Mark is for explanation
✓ or ft	Follow through from previous incorrect result
CAO	Correct answer only
CSO	Correct solution only
AWFW	Anything which falls within
AWRT	Anything which rounds to
ACF	Any correct form
AG	Answer given
SC	Special case
oe	Or equivalent
A2, 1	2 or 1 (or 0) accuracy marks
–x EE	Deduct x marks for each error
NMS	No method shown
PI	Possibly implied
SCA	Substantially correct approach
sf	Significant figure(s)
dp	Decimal place(s)
ISW	Ignore subsequent working

Q	Answer	Marks	Comments
1(a)(i)	$[u_1 =]$ 166	B1	
		1	

Q	Answer	Marks	Comments
1(a)(ii)	$[n =]$ 11	B1	
		1	

Q	Answer	Marks	Comments
1(b)	$[p =]$ 175	B1ft	ft their $u_1 + 9$ for p
	$[q =]$ 9	B1	
		2	

Q	Answer	Marks	Comments
1(c)	Arithmetic [sequence]	E1	
		1	

	Question 1 Total	5	
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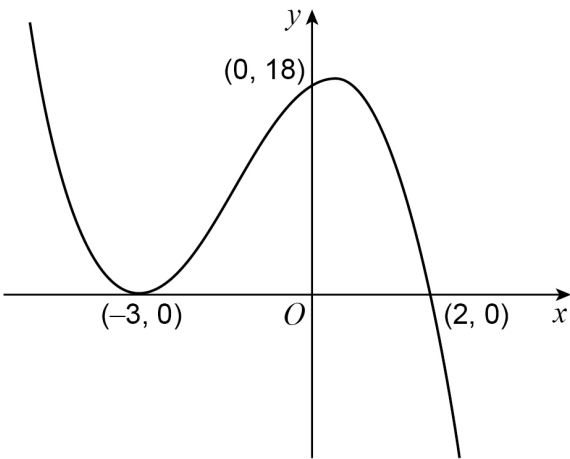
Q	Answer	Marks	Comments
2(a)	$\left[\left(3x^{\frac{5}{2}} + x^{\frac{1}{2}} \right) \left(5x^{\frac{3}{2}} - 4x^{-\frac{1}{2}} \right) \right]$ $3x^{\frac{5}{2}} \times 5x^{\frac{3}{2}} - 3x^{\frac{5}{2}} \times 4x^{-\frac{1}{2}}$ $+ x^{\frac{1}{2}} \times 5x^{\frac{3}{2}} - x^{\frac{1}{2}} \times 4x^{-\frac{1}{2}}$ $= 15x^4 - 12x^2 + 5x^2 - 4$ $= 15x^4 - 7x^2 - 4$	<p>M1</p> <p>A1</p>	<p>oe Brackets fully expanded partially simplified or unsimplified Allow one error PI by $15x^4 - 12x^2 + 5x^2 - 4$</p> <p>CAO oe Fully simplified three-term expression</p>
		2	

Q	Answer	Marks	Comments
2(b)	$\frac{9\sqrt{10} + 2\sqrt{3}}{\sqrt{10} + \sqrt{3}} \times \frac{\sqrt{10} - \sqrt{3}}{\sqrt{10} - \sqrt{3}}$ $(9\sqrt{10})(\sqrt{10}) - (9\sqrt{10})(\sqrt{3})$ $+ (2\sqrt{3})(\sqrt{10}) - (2\sqrt{3})(\sqrt{3})$ <p>or</p> $90 - 9\sqrt{30} + 2\sqrt{30} - 6$ <p>or</p> $84 - 7\sqrt{30}$ $(\sqrt{10})^2 - (\sqrt{3})^2$ <p>or</p> $10 - 3$ <p>or</p> 7 $\left[\frac{9\sqrt{10} + 2\sqrt{3}}{\sqrt{10} + \sqrt{3}} \right] 12 - \sqrt{30}$	<p>M1</p> <p>M1</p> <p>B1</p> <p>A1</p>	<p>Intention to multiply both numerator and denominator by the conjugate of the denominator</p> <p>oe Multiplies numerator by the conjugate of the denominator and correct expansion</p> <p>Multiplies the denominator by its conjugate Must be seen as a denominator</p> <p>CAO Must be in the correct form</p>
		4	

	Question 2 Total	6	
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Q	Answer	Marks	Comments
3(a)	$[f(3)=] 3^3 - 4(3)^2 - 3(3) + 18$	M1	$x = 3$ correctly substituted
	$[f(3)=] 27 - 36 - 9 + 18 = 0$	A1	All powers and products evaluated before setting equal to zero
		2	

Q	Answer	Marks	Comments
3(b)	$[f(x)=]$ $[(x-3)](x^2 - x - 6)$	M1 A1	M1: At least two terms correct in the quadratic factor A1: Correct quadratic factor
	$[f(x)=] (x+2)(x-3)^2$	A1	CAO Must be in the correct form
		3	

Q	Answer	Marks	Comments
3(c)		<p>M1</p> <p>Correctly orientated cubic curve intersecting the x-axis in the first quadrant and touches the x-axis in the second quadrant</p> <p>A1ft</p> <p>ft their a and b from part (b) Correct coordinates of the points where the curve touches and intersects the x-axis Condone given as x-values only</p> <p>B1</p> <p>$(0, 18)$ labelled on the y-axis. Condone given as y-value only. Must have attempted to draw a curve.</p>	
		3	

	Question 3 Total	8	
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Q	Answer	Marks	Comments
4(a)	$4t^2 - 25t - 70 - (t^2 - 4t - 12)$ $= t^2 - 4t - 12 - (t + 6)$ or $3t^2 - 21t - 58 = t^2 - 5t - 18$ $2t^2 - 16t - 40 = 0$ and $t^2 - 8t - 20 = 0$	M1 A1	oe Correct equation equating the difference between the 1st and 2nd terms to the difference between the 2nd and the 3rd terms Could see $u_1 + u_3 = 2u_2$ Further line of working set equal to zero before AG Must be convincingly shown
		2	

Q	Answer	Marks	Comments
4(a) ALT	$4t^2 - 25t - 70 - (t + 6)$ $= 2(t^2 - 4t - 12 - (t + 6))$ or $4t^2 - 26t - 76 = 2t^2 - 10t - 36$ $2t^2 - 16t - 40 = 0$ and $t^2 - 8t - 20 = 0$	M1 A1	oe Correct equation equating the difference between the 1st and the 3rd terms to twice the difference between the 1st and 2nd terms Further line of working set equal to zero before AG Must be convincingly shown
		2	

Q	Answer	Marks	Comments
4(b)(i)	$[t^2 - 8t - 20 = 0 \Rightarrow]$ $[t =] 10 \text{ or } -2$	B1	Finds the correct possible values of t Condone $t = -2$ omitted
	When $t = 10$ the sequence only contains positive terms Or When $t = -2$ the sequence does not always have positive terms	B1	Indicates that the sequence has only positive terms when $t = 10$, or not only positive terms when $t = -2$ PI in later working
	$[a =] 16 \text{ and } [d =] 32$	B1	Correct first term and common difference for when the sequence is formed only by positive terms PI in later working
	$16 + (k - 1) \times 32 = 3(16 + (8 - 1) \times 32)$ or $32k - 16 = 720$	M1	oe Correct equation equating the k th term to 3 times the 8th term ft their a and d
	$[k =] 23$	A1	CAO
		5	

Q	Answer	Marks	Comments
4(b)(ii)	$[S_n =] \frac{n}{2}(2 \times 16 + (n - 1) \times 32)$	M1	oe Correct expression for S_n ft their a and d from part (b)(i)
	$[S_n =] 16n^2$	A1	Accept $2^4 n^2$
	Hence as $[S_n = 16n^2 =] (4n)^2$ is a square number then S_n is a square number for all values of n	E1	Writes $16n^2$ as $(4n)^2$ and states conclusion. Allow a convincing argument for $16n^2$ being a square number if $(4n)^2$ is not seen.
		3	

	Question 4 Total	10	
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Q	Answer	Marks	Comments
5(a)	$4x + 4w + 4(x - 1) = 24$ or $4(x + w + (x - 1)) = 24$ or $x + w + (x - 1) = 6$ [$w = $] $7 - 2x$ [$V = x(x - 1)(7 - 2x)$] [$\Rightarrow V = $] $7x^2 - 2x^3 - 7x + 2x^2$ or [$V = $] $x(-2x^2 + 9x - 7)$ and $V = -2x^3 + 9x^2 - 7x$	<p align="center">M1</p> <p align="center">A1</p> <p align="center">A1</p>	<p>oe Uses the dimensions of the frame and the total lengths of the rods to form an equation in x and w. Allow one error.</p> <p>Correct simplified expression for w in terms of x.</p> <p>oe Correct attempt to expand brackets giving an unsimplified expression for V before AG. Must be convincingly shown.</p>
		3	

Q	Answer	Marks	Comments
5(b)(i)	$\left[\frac{dV}{dx} = \right] -6x^2 + 18x - 7$ $-6x^2 + 18x - 7 = 0$ $[x =] \frac{-18 \pm \sqrt{18^2 - 4(-6)(-7)}}{2(-6)}$ or $[x =] \frac{-(-18) \pm \sqrt{(-18)^2 - 4(6)(7)}}{2(6)}$ $[x =] 2.54[083...]$ $[V_{\max} = (-2)(2.54)^3 + 9(2.54)^2 - 7(2.54) =]$ 7.51	B1 M1 M1 A1 A1	Correct first derivative, simplified or unsimplified Sets their derivative equal to zero. PI by attempt to solve the quadratic equation. Attempt to solve their quadratic equation Must be a correct substitution into the quadratic formula PI by AWRT 2.54 and 0.46 AWRT 2.54 Ignore $x = 0.45[916...]$ if seen. Exact value $\frac{9 + \sqrt{39}}{6}$ CAO AWRT 7.51 Exact value $\frac{54 + 13\sqrt{39}}{18}$
		5	

Q	Answer	Marks	Comments
5(b)(ii)	$\left[\frac{d^2V}{dx^2} = \right] -12x + 18$ $\left[\frac{d^2V}{dx^2} = \right] -12(2.54) + 18$ $[= -12.48 \text{ or } -2\sqrt{39}]$ and Since $\frac{d^2V}{dx^2} < 0$ [then it is a] maximum [value of V]	B1ft E1ft	ft their first derivative from part (b)(i) Substitutes their $x = 2.54$ into their second derivative provided its value would be negative and gives statement linking negative value of the second derivative to V being a maximum. Correct value of the second derivative implies the correct substitution. For the value of the second derivative AWRT -12.5
		2	

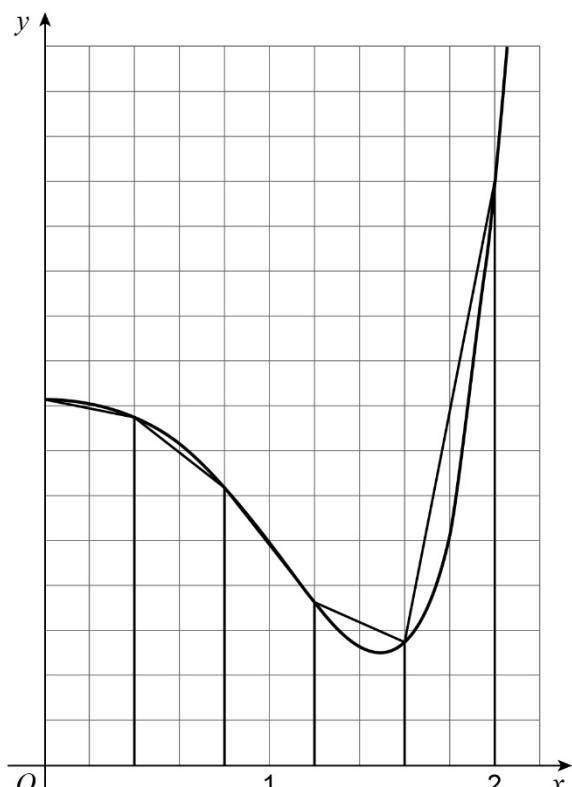
	Question 5 Total	10	
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Q	Answer	Marks	Comments
6(a)	$\left[\left(\frac{13+3}{2}, \frac{5+(-9)}{2} \right) \right] = (8, -2)$ $\frac{5-(-9)}{13-3} \left[= \frac{7}{5} \right]$ $-\frac{5}{7}$ $y - (-2) = -\frac{5}{7}(x - 8)$ or $y = -\frac{5}{7}x + \frac{26}{7}$ $5x + 7y - 26 = 0$	<p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Correct mid-point of AC</p> <p>Correct method to find gradient of AC PI by correct gradient of AC or BD</p> <p>Correct gradient of BD</p> <p>oe ft their midpoint of AC and their gradient of BD provided previous M1 scored Correct equation of BD but not in the required form</p> <p>CAO In correct form. Any integer multiple</p>
		5	

Q	Answer	Marks	Comments
6(b)	$[AC =] \sqrt{(13-3)^2 + (5-(-9))^2}$ or $[AM =] \sqrt{(13-8)^2 + (5-(-2))^2}$ or $[CM =] \sqrt{(3-8)^2 + (-9-(-2))^2}$	M1	oe Correct method to find $ AC $, $ AM $ or $ CM $ using any two of the coordinates for A, C or the mid-point $M(8, -2)$ of AC ft their M from part (a)
	$[AC =] 2\sqrt{74}$ or $\sqrt{296}$ or $[AM = CM =] \sqrt{74}$	A1	Correct length of $ AC $, $ AM $ or $ CM $
	$[Area =] 2\left(\frac{1}{2} \times 2\sqrt{74} \times \sqrt{74}\right)$ or $\frac{1}{2} \times 296$	M1	oe Correct method to find the area of the square ft their length of $ AC $ or $ AM $ or $ CM $
	$[Area =] 148$ [square units]	A1	CAO
		4	
	Question 6 Total	9	

Q	Answer	Marks	Comments
7(a)(i)	[1.625,] [1.5534,] 1.2427,	B1	AWRT 1.2427
	[0.7375,] 0.5459, [2.5]	B1	AWRT 0.5459
		2	

Q	Answer	Marks	Comments
7(a)(ii)	[h =] 0.4	B1	PI
	$\left[\text{Integral} \approx \frac{h}{2} \{ \dots \} \right]$ $[\{ \dots \} =]$ $1.625 + 2.5 + 2 \left(\begin{array}{l} 1.5534 + 1.2427 \\ + 0.7375 + 0.5459 \end{array} \right)$	M1	oe ft their values from part (a)(i) PI by 12.284
	[Integral $\approx 0.2 \times 12.284 =$] 2.457	A1	CAO
		3	

Q	Answer	Marks	Comments
7(b)	 <p>Area above [the curve included in the estimate] is greater than the area below [the curve not included in the estimate]</p>	<p>B1</p> <p>E1ft</p>	<p>Draws correct trapezia on graph Condone chords instead of trapezia</p> <p>ft their trapezia provided their vertices lie on the curve and the area above is greater than the area below. oe</p>
		2	
	Question 7 Total	7	

Q	Answer	Marks	Comments
8(a)	$\left[y = \frac{81}{x^2} + 4\sqrt{x} - 5 = \right] 81x^{-2} + 4x^{\frac{1}{2}} - 5$ $\left[\frac{dy}{dx} = \right] -162x^{-3} + 2x^{-\frac{1}{2}}$ $\left[x = 9 \Rightarrow \frac{dy}{dx} = \right]$ $-162(9^{-3}) + 2\left(9^{-\frac{1}{2}}\right) \left[= \frac{4}{9} \right]$ <p>or</p> $-\frac{2}{9} + \frac{2}{3}$ $y - 8 = \frac{4}{9}(x - 9)$ <p>and</p> $y = \frac{4}{9}x + 4$	<p>B1</p> <p>M1 A1</p> <p>M1</p> <p>A1</p>	<p>Writes equation of G in index form PI by correct first derivative</p> <p>oe Simplified or unsimplified M1: At least one correct term A1: Correct first derivative</p> <p>oe Clear substitution of $x = 9$ into their first derivative</p> <p>oe Uses gradient and coordinates of Q to form an equation leading to the required result AG Must be convincingly shown May see $y = \frac{4}{9}x + c$ and substitution of the coordinates of Q to find c but must be a complete method</p>
		5	

[illegible]

Q	Answer	Marks	Comments
9(a)	$\left[48x^{\frac{1}{2}} \right]_k^9 = 48\left(9^{\frac{1}{2}}\right) - 48\left(k^{\frac{1}{2}}\right)$ $48\left(9^{\frac{1}{2}}\right) - 48\left(k^{\frac{1}{2}}\right) = 48$ <p>or</p> $144 - 48\left(k^{\frac{1}{2}}\right) = 48 \text{ or } 3 - k^{\frac{1}{2}} = 1$ <p>and</p> $k^{\frac{1}{2}} = 2 \text{ and } k = 4$	<p>M1</p> <p>A1</p>	<p>oe Correct integration seen and correct substitution forming $F(9) - F(k)$</p> <p>oe Sets equal to 48 leading to $k^{\frac{1}{2}} = 2$ and AG Must be convincingly shown</p>
		2	

Q	Answer	Marks	Comments
9(d)	[Area =] $\frac{91}{10} + 15$	M1	ft their $\frac{91}{10}$ from part (c)
	[Area =] $\frac{241}{10}$ or 24.1	A1	oe CAO
		2	

Q	Answer	Marks	Comments
10(a)	$a + ar = 200$ or $a(1+r) = 200$ or $\frac{a(1-r^2)}{1-r} = 200$ or $\frac{a(1-r^4)}{1-r} = 272$ or $a + ar + ar^2 + ar^3 = 272$ $\left[\frac{a(1-r^4)}{1-r} = 272 \Rightarrow \right]$ $\frac{a(1+r^2)(1-r^2)}{1-r} = 272$ or $\left[a + ar + ar^2 + ar^3 = 272 \Rightarrow \right]$ $(a + ar) + (a + ar)r^2 = 272$ or $a(1+r) + a(1+r)r^2 = 272$ $\left[\begin{aligned} &\frac{a(1+r^2)(1-r^2)}{1-r} = 272 \\ &\Rightarrow \frac{a(1+r)(1-r)(1+r^2)}{1-r} = 272 \\ &\Rightarrow a(1+r)(1+r^2) = 272 \Rightarrow \end{aligned} \right]$ $200(1+r^2) = 272$ or $r^2 = \frac{72}{200}$ $r^2 = \frac{72}{200} \quad \text{or} \quad r^2 = \frac{9}{25} \quad \text{and} \quad r = \pm \frac{3}{5}$	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>oe A correct equation in terms of the first term and the common ratio for the sum of the first two or four terms PI by later working</p> <p>oe Factorising $(1-r^4)$ using the difference of two squares in a correct equation or If given as the sum of the first four terms factorises to give term(s) in $a(1+r)$ or $(a+ar)$ in a correct equation. Could be seen as $a(1+r)r^2 = 72$ PI by a quadratic equation in r^2 with a eliminated</p> <p>oe Factorising and clearing the denominator to obtain a correct equation with a eliminated</p> <p>Correct value for r^2 and AG Must be convincingly shown</p>
		4	

Q	Answer	Marks	Comments
10(b)	$\left[r = \frac{3}{5} \text{ and } a(1+r) = 200 \Rightarrow \right]$ $\left[\frac{8}{5}a = 200 \Rightarrow \right]$ $[a =] \ 125$ $[S_{\infty} =] \ \frac{125}{1 - \frac{3}{5}}$ $[S_{\infty} =] \ \frac{625}{2} \text{ or } 312.5$	 B1 M1 A1	 Correct value for the first term of the series oe Correct use of the formula for S_{∞} with their value for a substituted CAO
		3	

	Question 10 Total	7	
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