

A Level Maths Pure 3: Calculus Practice Exam: Mark Scheme

Pearson Edexcel A Level Mathematics (9MA0) · 18 questions · 59 marks

- M marks are for a correct method; A marks for an accurate answer that follows a correct method; B marks are independent of method.
- Accept any correct method that reaches a correct answer, unless the question says which method to use.
- Practise these topics online with instant feedback: alevelmathrevision.com/alevel-frontend/alevel-unit.html?course=uk&unit=3

Question 1

3 marks

M1 Chord gradient $\frac{k(3+h)^2 - 9k}{h} = 6k + kh$

A1 Compares with $30 + 5h$: $k = 5$

A1 Gradient at $x = 3$ is the limit as $h \rightarrow 0$: 30

Final answer: $k = 5$; gradient 30

Question 2

3 marks

B1 $\frac{dy}{dx} = 4x^{1/3}$

M1 $4x^{1/3} = 32 \Rightarrow x^{1/3} = 8$

A1 $x = 512$

Final answer: $\frac{dy}{dx} = 4x^{1/3}$; $x = 512$

Question 3

3 marks

M1 $f'(x) = 3x^2 - 6x - 9$

M1 $3(x-3)(x+1) < 0$

A1 $-1 < x < 3$

Final answer: $-1 < x < 3$

Question 4

3 marks

M1 $f''(x) = 12x^2 - 12$

M1 Convex where $f''(x) > 0$: $x^2 > 1$

A1 $x < -1$ or $x > 1$

Final answer: $x < -1$ or $x > 1$



Question 5**3 marks**

M1 $k \cos\left(3x + \frac{\pi}{4}\right)$

A1 $15 \cos\left(3x + \frac{\pi}{4}\right)$

A1 Greatest gradient 15

Final answer: $15 \cos\left(3x + \frac{\pi}{4}\right)$; greatest gradient 15

Question 6**3 marks**

M1 $2x + e^y \frac{dy}{dx} = 0$

A1 $\frac{dy}{dx} = -\frac{2x}{e^y}$

A1 -4

Final answer: -4

Question 7**3 marks**

M1 $\frac{dy}{dx} = \frac{3t^2}{2t} = \frac{3}{2}t$

M1 $\frac{3}{2}t = 6, t = 4$

A1 $(16, 64)$

Final answer: $(16, 64)$

Question 8**3 marks**

M1 $\frac{dy}{dx} = 3x^2 - 2 = 25$

M1 $\frac{dy}{dt} = 25 \times 0.2$

A1 5 units per second

Final answer: 5 units per second

Question 9**3 marks**

B1 $4x^2 + 4x + 1$

M1 Integrates term by term

A1 $\frac{4}{3}x^3 + 2x^2 + x + c$

Final answer: $\frac{4}{3}x^3 + 2x^2 + x + c$

Question 10**3 marks**

M1 $\frac{3}{4}x^{4/3}$

M1 $\frac{3}{4}(16 - 1)$

A1 $\frac{45}{4}$

Final answer: $\frac{45}{4}$



Question 11**3 marks**

M1 $\frac{1}{2}e^{2x}$

M1 $\frac{1}{2}e^{2\ln 2} - \frac{1}{2} = \frac{1}{2} \times 4 - \frac{1}{2}$

A1 $\frac{3}{2}$

Final answer: $\frac{3}{2}$ **Question 12****3 marks**

M1 $-\frac{1}{2}xe^{-2x} + \int \frac{1}{2}e^{-2x} dx$

A1 Correct first step

A1 $-\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + c$

Final answer: $-\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + c$ **Question 13****3 marks**

M1 $\frac{dN}{dt} = kN(600 - N)$

M1 $25 = k \times 100 \times 500$

A1 $k = 0.0005; \frac{dN}{dt} = 0.0005N(600 - N)$

Final answer: $\frac{dN}{dt} = 0.0005N(600 - N)$ **Question 14****4 marks**

M1 Product rule: $\frac{dy}{dx} = e^{-2x} - 2xe^{-2x}$

A1 Correct derivative, e.g. $e^{-2x}(1 - 2x)$ **M1** $e^{-2x} > 0$ for all x , so $\frac{dy}{dx} = 0$ only when $x = \frac{1}{2}$: exactly one turning point

A1 $\left(\frac{1}{2}, \frac{1}{2e}\right)$

Final answer: $\left(\frac{1}{2}, \frac{1}{2e}\right)$ **Question 15****4 marks**

M1 $6 - x^2 = 2: x = \pm 2$

M1 $\int_{-2}^2 (4 - x^2) dx$

A1 $\left[4x - \frac{1}{3}x^3\right]_{-2}^2$

A1 $\frac{32}{3}$

Final answer: $\frac{32}{3}$ 

Question 16**4 marks**

M1 $du = -\sin x \, dx$

M1 Limits $u = 1$ and $u = 0$: $\int_0^1 u^3 \, du$

A1 $\left[\frac{1}{4}u^4\right]_0^1$

A1* $= \frac{1}{4}$

Final answer: $\frac{1}{4}$

Question 17**4 marks**

M1 $\frac{4}{(x-2)(x+2)} = \frac{A}{x-2} + \frac{B}{x+2}$

A1 $\frac{1}{x-2} - \frac{1}{x+2}$

M1 Integrates to logarithms

A1 $\ln(x-2) - \ln(x+2) + c$

Final answer: $\ln(x-2) - \ln(x+2) + c$

Question 18**4 marks**

M1 Separates: $\int y \, dy = \int x^2 \, dx$

A1 $\frac{1}{2}y^2 = \frac{1}{3}x^3 + c$

M1 Uses $x = 0, y = 3$: $c = \frac{9}{2}$

A1 $y = \sqrt{\frac{2}{3}x^3 + 9}$

Final answer: $y = \sqrt{\frac{2}{3}x^3 + 9}$

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