

A Level Maths Pure 3: Calculus Practice Exam

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

Name _____

Date _____

Score / 59

- Answer every question. Show your working: most marks are for method.
- Calculator allowed.
- Topics: Differentiation from first principles; Differentiating powers of x ; Increasing and decreasing functions; Stationary points and the second derivative; Differentiating trig functions; Implicit differentiation; Parametric differentiation; Connected rates of change; Integrating powers of x ; Definite integrals and area under a curve; Integrating e^x , $1/x$ and trig functions; Integration by parts; Forming differential equations; Differentiating e^x and $\ln x$; Area between a curve and a line; Integration by substitution; Integration using partial fractions; Solving differential equations and modelling.
- The mark scheme is a separate free PDF: [alevelmathrevision.com/alevel-frontend/downloads/practice-exams/9ma0/a-level-maths-pure-3-calculus-practice-exam-mark-scheme.pdf](https://www.alevelmathrevision.com/alevel-frontend/downloads/practice-exams/9ma0/a-level-maths-pure-3-calculus-practice-exam-mark-scheme.pdf)

1. For a constant k , the chord joining the points on the curve $y = kx^2$ with x -coordinates 3 and $3 + h$ has gradient $30 + 5h$ for every non-zero h . Find the value of k and the gradient of the curve at the point where $x = 3$. [3]

2. A curve has equation $y = 3x^{4/3}$. Find $\frac{dy}{dx}$, and find the value of x at which the gradient of the curve is 32. [3]

3. Find the interval on which the function $f(x) = x^3 - 3x^2 - 9x + 2$ is decreasing. [3]

4. The function f is given by $f(x) = x^4 - 6x^2 + 2$. Find the set of values of x for which the curve $y = f(x)$ is convex. [3]

5. For the curve $y = 5 \sin\left(3x + \frac{\pi}{4}\right)$, find $\frac{dy}{dx}$ and state the greatest value of the gradient of the curve. [3]



6. The curve $x^2 + e^y = 5$ passes through the point $(2, 0)$. Find the gradient of the curve at this point. [3] [3]
7. The path of a drone is given by $x = t^2$, $y = t^3$, $t \geq 0$. Find the coordinates of the point on the path at which $\frac{dy}{dx} = 6$. [3]
8. A point moves along the curve $y = x^3 - 2x$ so that its x -coordinate increases at 0.2 units per second. Find the rate at which its y -coordinate is changing when $x = 3$. [3]
9. Expand $(2x + 1)^2$ and hence find $\int (2x + 1)^2 dx$ term by term. [3] [3]
10. Find the exact value of $\int_1^8 x^{1/3} dx$. [3] [3]
11. Evaluate $\int_0^{\ln 2} e^{2x} dx$, giving an exact answer. [3] [3]
12. Find $\int x e^{-2x} dx$. [3] [3]



- 13.** A rumour spreads through a school of 600 students. At time t hours, N students have heard it. The rate at which N increases is proportional to the product of the number of students who have heard the rumour and the number who have not. When $N = 100$, the rumour is spreading at 25 students per hour. Form a differential equation connecting N and t , giving the constant of proportionality as an exact decimal. [3]

- 14.** Show that the curve $y = xe^{-2x}$ has exactly one turning point, and find its exact coordinates. [4]

- 15.** Find the area of the region that lies above the line $y = 2$ and below the curve $y = 6 - x^2$. [4]

- 16.** Use the substitution $u = \cos x$ to show that $\int_0^{\pi/2} \sin x \cos^3 x \, dx = \frac{1}{4}$. [4]

- 17.** By factorising the denominator and using partial fractions, find $\int \frac{4}{x^2 - 4} \, dx, x > 2$. [4]

- 18.** A curve lies above the x -axis and passes through the point $(0, 3)$. At every point on the curve, $y \frac{dy}{dx} = x^2$. By solving this differential equation, find y in terms of x . [4]



