The Exponential Function e^x

Specification: AQA 7357: F1, F2, B9 · Edexcel 9MA0: 6.1, 6.2, 2.9

INDEPENDENT

You do

A · Differentiate No calculator.

1 Differentiate with respect to x:
(a) e^{8x}
(b) e^{-3x}
(c) $e^{x/4}$
(d) $e^{0.5x}$

2 Differentiate with respect to x:
(a) $6e^{2x}$
(b) $-e^{5x}$
(c) $10e^{-0.2x}$
(d) $\frac{1}{2}e^{4x}$

3 Differentiate with respect to x:
(a) $e^{2x} + x^3$
(b) $3e^x - 4e^{-x}$
(c) $(e^x + 1)^2$
(d) $e^x(e^{2x} + 3)$

4 Find the exact gradient of $y = e^{4x}$ when
(a) $x = 0$
(b) $x = \frac{1}{2}$
(c) $x = -\frac{1}{4}$

B · Sketch State the y-intercept and the equation of the asymptote, then sketch.

5 Sketch $y = e^x - 2$.

6 Sketch $y = 4e^{-x}$.

7 Sketch $y = e^{x+2}$.

8 Sketch $y = 5 - e^x$.

9 Sketch $y = 2e^{3x} + 1$.

C · Reasoning No calculator.

10 Explain why $y = e^{kx}$ is increasing for every $k > 0$.

11 The curve $y = Ae^{kx}$ passes through $(0, 5)$, and its gradient there is -15. Find A and k.

12 (a) Show that for $y = e^{2x}$, the gradient is always twice the y-value.
(b) A population grows at a rate proportional to its size. Explain why a model of the form $P = Ae^{kt}$ is suitable.

D · Algebra

13 Show that the tangent to $y = 3e^{x/2}$ at $x = 2$ passes through the origin.

14 Find the coordinates of the point on $y = e^{3x}$ where the gradient is $3e^6$.

15 (a) Show that $y = e^x - x$ has a stationary point at $(0, 1)$.
(b) Determine its nature.

E · Exam-style question AQA-style. Use the mark scheme to self-assess.

16 A curve has equation $y = 2e^{2x} - 8x$.
(a) Find $\frac{dy}{dx}$. [2 marks]
(b) Find the equation of the tangent to the curve at the point where $x = 0$. [3 marks]
(c) Find where this tangent crosses the x-axis. [1 mark]
(d) Show that $\frac{d^2y}{dx^2} > 0$ for all x. [2 marks]