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A LEVEL MATHS

(47) Differentiating Exponentials & Logs

WORKING AT D/E

(1) Find $\frac{dy}{dx}$ for each of the following:

(a) $y = e^x$ (b) $y = \ln x$ (c) $y = e^{3x}$

(d) $y = 2e^{-x}$ (e) $y = \ln 4x$ (f) $y = -4e^{0.5x}$

(2) Show that the equation of the tangent to the curve $y = e^{2x}$ at the point where the $x = 0$ is $y = 2x + 1$

(3) A curve has equation $y = x - 2\ln x$. Show that the coordinates of the stationary point on the curve are $(2,\ 2 - \ln 4)$

WORKING AT B/C

(1) Find $\frac{dy}{dx}$ for each of the following:

(a) $y = \frac{2}{e^x}$ (b) $y = \ln x^2$ (c) $y = e^{6x} - 2\ln x$

(d) $y = \frac{7 - e^{8x}}{e^{5x}}$ (e) $y = \ln\frac{1}{x}$ (f) $y = 4e^{\frac{x}{8}}$

(2) Show that the normal to the curve with equation $y = \ln 4x$ at the point with x coordinate 2 is $y = -2x + 3\ln 2 + 4$

(3) Find the coordinates of the stationary point on the curve with equation $y = e^{2x} - 8x$. Give your answer in exact form.

WORKING AT A*/A

(1) The tangent to the curve with equation $y = 2^x$ at the point $(0, p)$ crosses the x axis at Q.
(a) Write down the value of p.
(b) Find the coordinates of the point Q in exact form.

(2) The population of rats can be modelled by the equation $P = 300 \times 0.4^t$ where P is the number of rats after t days.
(a) Find the value of $\frac{dP}{dt}$ when $t = 8$.
(b) Interpret your answer in the context of the question
(c) State any limitations to the model.
(d) Cyril suggests a suitable domain for the function is $0 \le t \le 6$. Comment on his suggestion.

(3) (a) Find the coordinates of the stationary point on the curve with equation $y = \ln\left(\frac{1}{x^4}\right) + x^2,\ x > 0$ giving your answer in exact form.

(b) The normal to the curve at the point with x coordinate 1 crosses the x axis at A and the y axis at B.

Show that $AB = \frac{\sqrt{2}}{2}$