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A LEVEL MATHS

(68) Differentiation (Gradients, Tangents and Normals)

WORKING AT D/E

(1) A curve has equation $y = 4x^3 + 2x + 1$

(a) Find the value of y when $x = 1$

(b) Find an expression for $\frac{dy}{dx}$

(c) Find the gradient of the curve at the point where $x = 1$

(d) Hence, show that the equation of the tangent to the curve at the point $(1,7)$ is $y = 14x - 7$

(e) Write down the gradient of the normal at the point $(1,7)$.

(f) Hence, show that an equation of the normal at $(1,7)$ is $x + 14y = 99$

(2) $y = 4x^3 - 5x^2 + 2$

(a) Find the equation of the tangent to the curve at the point with x coordinate 2. Give your answer in the form $y = mx + c$

(b) Find an equation of the normal to the curve at the point with x coordinate 3.

(3) $y = x^2 + 6x$

Find the equation of the tangent to the curve when the gradient is 3 in the form $y = mx + c$.

WORKING AT B/C

(1) (a) Find the equation of the tangent to the curve with equation $y = \frac{1}{x}$ at the point where $x = 2$ giving your answer in the form $ax + by = c$.

(b) Show that the normal to the curve at the point $(4, \frac{1}{4})$ can be written as $y = 16x + c$ where c is an exact fraction to be found.

(2) The curve with equation $y = 2x^5 + x$ has a tangent at the point (p, q) where p and q are positive constants.

Given that the tangent is parallel to the line with equation $y = 11x - 3$, find the values of p and q.

(3) The normal to the curve with equation $y = x^2$ at the point with x coordinate -3 crosses the x axis at A and y axis at B.

Show that $AB = \frac{19\sqrt{37}}{2}$

WORKING AT A*/A

(1) The normal to the curve with equation $y = 2x\sqrt{x}$ is parallel to the line with equation $36y + 2x - 3 = 0$.
Find where the normal crosses the x axis.

(2) The normal to the curve with equation $y = -x(x - 3)$ at the point $P\ (2, y)$ intersects the curve at the point P and the point Q.
Find the coordinates of the point Q.

(3) (a) Find the coordinates of the point P on the curve with equation $y = 2x^{0.5} + 2x - 8,\ \ x > 0$ where the tangent at P is parallel to the line with equation $12x - 2y = 7$

(b) The tangent to the curve at P crosses the x axis at A and y axis at B. Find the area of ΔAOB where O is the origin.