Differentiation – 2022 A2 June

1. March/2022/Paper_9709/22/No.2

A curve has equation $y = 7 + 4\ln(2x + 5)$.

Find the equation of the tangent to the curve at the point $(-2, 7)$, giving your answer in the form $y = mx + c$. [5

(b) Hence find the value of x when $y = 36$. Give your answer correct to 3 significant figures. [2]

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2. March/2022/Paper_9709/22/No.5(a)

(a) Given that $y = \tan^2 x$, show that $\frac{dy}{dx} = 2\tan x + 2\tan^3 x$. [2]

3. March/2022/Paper_9709/22/No.7

A curve has equation $e^{2x}y - e^{y} = 100$.

(a) Show that $\frac{dy}{dx} = \frac{2e^{2x}y}{e^{y} - e^{2x}}$. [3]

(b) Show that the curve has no stationary points. [2]

It is required to find the x-coordinate of P, the point on the curve at which the tangent is parallel to the y-axis.

(c) Show that the x-coordinate of P satisfies the equation

$$x = \ln 10 - \tfrac{1}{2}\ln(2x - 1).$$ [4]

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(d) Use an iterative formula, based on the equation in part **(c)**, to find the x-coordinate of P correct to 3 significant figures. Use an initial value of 2 and give the result of each iteration to 5 significant figures. [3]

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4. June/2022/Paper_9709/21/No.4

A curve has equation $x^2y + 2y^3 = 48$.

Find the equation of the normal to the curve at the point (4, 2), giving your answer in the form $ax + by + c = 0$ where a, b and c are integers. [7]

5. June/2022/Paper_9709/21/No.6

A curve has equation $y = \dfrac{9e^{2x} + 16}{e^x - 1}$.

(a) Show that the x-coordinate of any stationary point on the curve satisfies the equation

$$e^x(3e^x - 8)(3e^x + 2) = 0.$$ [4]

(b) Hence show that the curve has only one stationary point and find its exact coordinates. [4]

6. Given that $y = \frac{\ln x}{x^2}$, find the exact value of $\frac{dy}{dx}$ when $x = e$. [3]

7. June/2022/Paper_9709/22/No.3

A curve has equation $e^{2x} \cos 2y + \sin y = 1$.

Find the exact gradient of the curve at the point $(0, \frac{1}{6}\pi)$. [5]