Differentiation – 2022 A2 Nov Math

1.

   A curve has equation $4e^{2x}y + y^2 = 21$.

   Find the gradient of the curve at the point $(0, -7)$. [5]
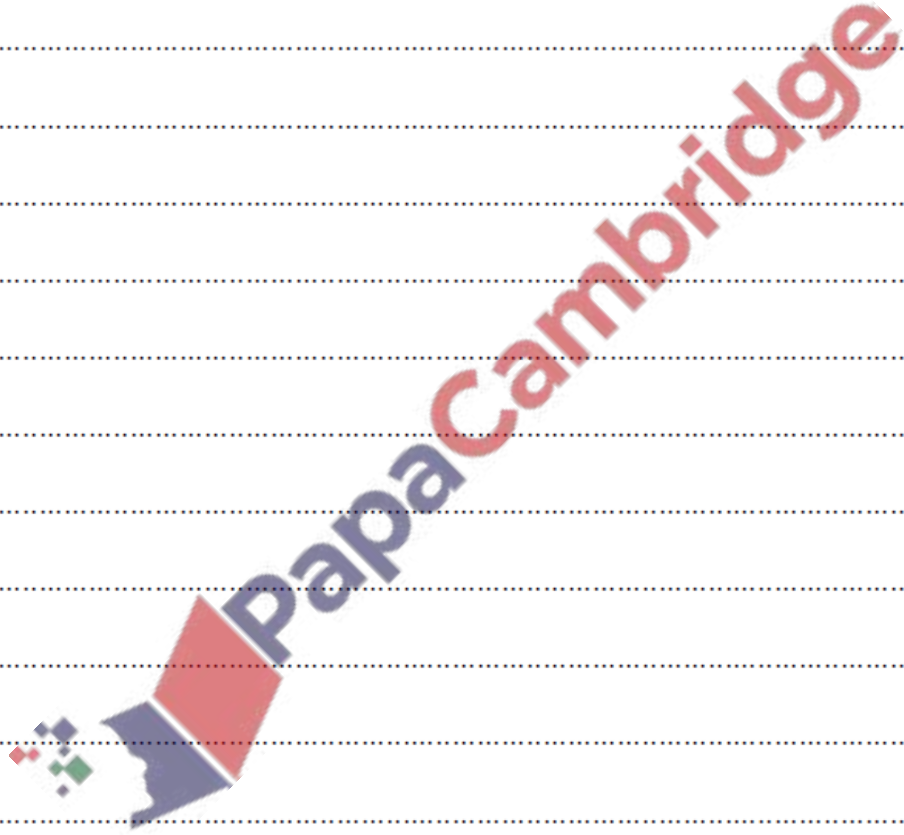
The curve with equation $y = x \ln(4x + 1) - 3x$ has one stationary point P.

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

$$x = \frac{2x + 0.75}{\ln(4x + 1)} - 0.25.$$

[4]

(b) Show by calculation that the *x*-coordinate of *P* lies between 1.8 and 1.9. [2]

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

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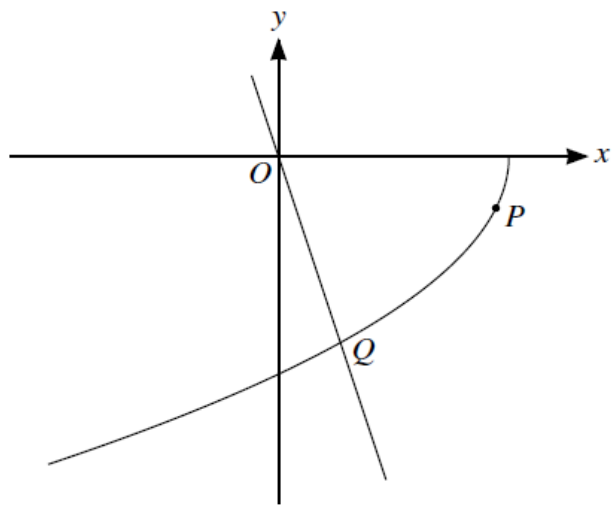..

The diagram shows the curve with parametric equations

$$x = 3\cos 2\theta, \qquad y = 4\sin\theta,$$

for $\pi \leqslant \theta \leqslant \frac{3}{2}\pi$. Points P and Q lie on the curve. The gradient of the curve at P is 2. The straight line $3x + y = 0$ meets the curve at Q.

(a) Find the value of θ at P, giving your answer correct to 3 significant figures. [5]

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(b) Find the gradient of the curve at Q, giving your answer correct to 3 significant figures. [6]