1. March/2022/Paper_9709/32/No.4

The parametric equations of a curve are

$$x = 1 - \cos\theta, \qquad y = \cos\theta - \tfrac{1}{4}\cos 2\theta.$$

Show that $\dfrac{dy}{dx} = -2\sin^2(\tfrac{1}{2}\theta)$. [5]

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2. June/2022/Paper_9709/31/No.8

The equation of a curve is $x^3 + y^3 + 2xy + 8 = 0$.

(a) Express $\frac{dy}{dx}$ in terms of x and y. [4]

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The tangent to the curve at the point where $x = 0$ and the tangent at the point where $y = 0$ intersect at the acute angle α.

(b) Find the exact value of $\tan \alpha$. [5]

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3. June/2022/Paper_9709/32/No.4

The equation of a curve is $y = \cos^3 x\sqrt{\sin x}$. It is given that the curve has one stationary point in the interval $0 < x < \frac{1}{2}\pi$.

Find the x-coordinate of this stationary point, giving your answer correct to 3 significant figures. [6]

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4. June/2022/Paper_9709/32/No.7

The equation of a curve is $x^3 + 3x^2y - y^3 = 3$.

(a) Show that $\dfrac{dy}{dx} = \dfrac{x^2 + 2xy}{y^2 - x^2}$. [4]

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(b) Find the coordinates of the points on the curve where the tangent is parallel to the x-axis. [5]

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5. June/2022/Paper_9709/33/No.4

The curve $y = e^{-4x} \tan x$ has two stationary points in the interval $0 \leqslant x < \frac{1}{2}\pi$.

(a) Obtain an expression for $\frac{dy}{dx}$ and show it can be written in the form $\sec^2 x(a + b \sin 2x)e^{-4x}$, where a and b are constants. [4]

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(b) Hence find the exact x-coordinates of the two stationary points. [3]

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6. June/2022/Paper_9709/33/No.6

The parametric equations of a curve are $x = \dfrac{1}{\cos t}$, $y = \ln \tan t$, where $0 < t < \frac{1}{2}\pi$.

(a) Show that $\dfrac{dy}{dx} = \dfrac{\cos t}{\sin^2 t}$. [5]

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(b) Find the equation of the tangent to the curve at the point where $y = 0$. [3]

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