1. Nov/2020/Paper_9709/21/No.7

A curve is defined by the parametric equations

$$x = 3t - 2\sin t, \qquad y = 5t + 4\cos t,$$

where $0 \leqslant t \leqslant 2\pi$. At each of the points P and Q on the curve, the gradient of the curve is $\frac{5}{2}$.

(a) Show that the values of t at P and Q satisfy the equation $10\cos t - 8\sin t = 5$. [3]

(b) Express $10\cos t - 8\sin t$ in the form $R\cos(t + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. Give the exact value of R and the value of α correct to 3 significant figures. [3]

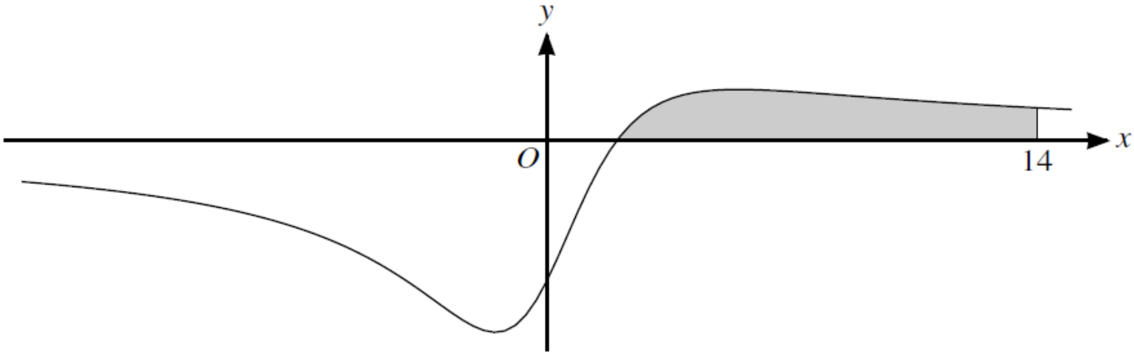
(c) Hence find the values of t at the points P and Q. [4]

2. Nov/2020/Paper_9709/21/No.8a

A curve has equation $y = \mathrm{f}(x)$ where $\mathrm{f}(x) = \dfrac{4x^3 + 8x - 4}{2x - 1}$.

(a) Find an expression for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and hence find the coordinates of each of the stationary points of the curve $y = \mathrm{f}(x)$. [5]

3. Nov/2020/Paper_9709/22/No.4



The diagram shows the curve with equation $y = \dfrac{x-2}{x^2+8}$. The shaded region is bounded by the curve and the lines $x = 14$ and $y = 0$.

(a) Find $\dfrac{dy}{dx}$ and hence determine the exact x-coordinates of the stationary points. [4]

(b) Use the trapezium rule with three intervals to find an approximation to the area of the shaded region. Give the answer correct to 2 significant figures. [3]

4. Nov/2020/Paper_9709/22/No.5

The equation of a curve is $2e^{2x}y - y^3 + 4 = 0$.

(a) Show that $\frac{dy}{dx} = \frac{4e^{2x}y}{3y^2 - 2e^{2x}}$. [4]

(b) The curve passes through the point $(0, 2)$.

Find the equation of the tangent to the curve at this point, giving your answer in the form $ax + by + c = 0$. [3]

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

5. June/2020/Paper_9709/21/No.3

A curve has parametric equations

$$x = e^t - 2e^{-t}, \qquad y = 3e^{2t} + 1.$$

Find the equation of the tangent to the curve at the point for which $t = 0$. [5]

6. June/2020/Paper_9709/22/No.2

Find the exact coordinates of the stationary point on the curve with equation $y = 5xe^{\frac{1}{2}x}$. [5]

7. June/2020/Paper_9709/22/No.3

The equation of a curve is $\cos 3x + 5\sin y = 3$.

Find the gradient of the curve at the point $(\frac{1}{9}\pi, \frac{1}{6}\pi)$. [5]

8. March/2020/Paper_9709/22/No.4

A curve has equation

$$3x^2 - y^2 - 4\ln(2y + 3) = 26.$$

Find the equation of the tangent to the curve at the point $(3, -1)$. [6]