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1. The curve C has equation

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

The point P lies on C and has coordinates $(w, -32)$.

Find

(a) the value of w , **(2)**

(b) the equation of the tangent to C at the point P in the form $y = mx + c$, where m and c are constants. **(5)**



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2. $g(x) = e^{x-1} + x - 6$

(a) Show that the equation $g(x) = 0$ can be written as

$$x = \ln(6 - x) + 1, \quad x < 6 \tag{2}$$

The root of $g(x) = 0$ is α .

The iterative formula

$$x_{n+1} = \ln(6 - x_n) + 1, \quad x_0 = 2$$

is used to find an approximate value for α .

(b) Calculate the values of x_1 , x_2 and x_3 to 4 decimal places. (3)

(c) By choosing a suitable interval, show that $\alpha = 2.307$ correct to 3 decimal places. (3)



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3.

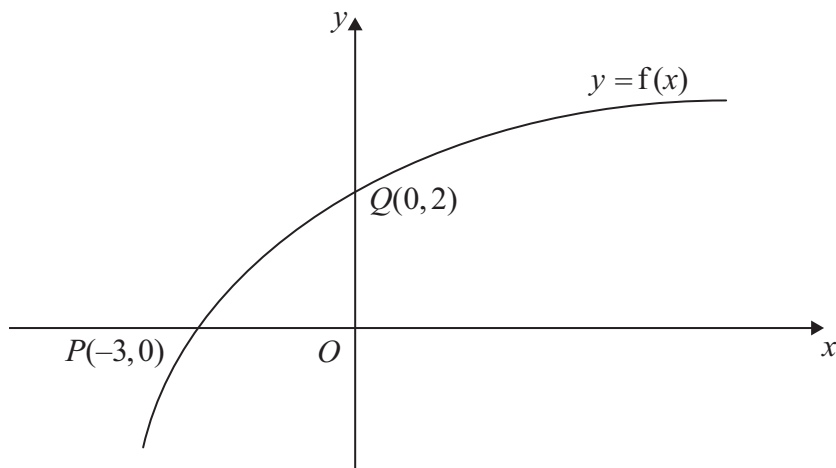


Figure 1

Figure 1 shows part of the curve with equation $y = f(x)$, $x \in \mathbb{R}$.

The curve passes through the points $Q(0, 2)$ and $P(-3, 0)$ as shown.

(a) Find the value of $ff(-3)$. (2)

On separate diagrams, sketch the curve with equation

(b) $y = f^{-1}(x)$, (2)

(c) $y = f(|x|) - 2$, (2)

(d) $y = 2f\left(\frac{1}{2}x\right)$. (3)

Indicate clearly on each sketch the coordinates of the points at which the curve crosses or meets the axes.



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Question 3 continued



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4. (a) Express $6 \cos \theta + 8 \sin \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$.

Give the value of α to 3 decimal places.

(4)

(b)
$$p(\theta) = \frac{4}{12 + 6 \cos \theta + 8 \sin \theta}, \quad 0 \leq \theta \leq 2\pi$$

Calculate

(i) the maximum value of $p(\theta)$,

(ii) the value of θ at which the maximum occurs.

(4)

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5. (i) Differentiate with respect to x

(a) $y = x^3 \ln 2x$

(b) $y = (x + \sin 2x)^3$

(6)

Given that $x = \cot y$,

(ii) show that $\frac{dy}{dx} = \frac{-1}{1+x^2}$

(5)



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6. (i) Without using a calculator, find the exact value of

$$(\sin 22.5^\circ + \cos 22.5^\circ)^2$$

You must show each stage of your working.

(5)

(ii) (a) Show that $\cos 2\theta + \sin \theta = 1$ may be written in the form

$$k \sin^2 \theta - \sin \theta = 0, \text{ stating the value of } k.$$

(2)

(b) Hence solve, for $0 \leq \theta < 360^\circ$, the equation

$$\cos 2\theta + \sin \theta = 1$$

(4)



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Question 6 continued

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7.
$$h(x) = \frac{2}{x+2} + \frac{4}{x^2+5} - \frac{18}{(x^2+5)(x+2)}, \quad x \geq 0$$

(a) Show that $h(x) = \frac{2x}{x^2+5}$ (4)

(b) Hence, or otherwise, find $h'(x)$ in its simplest form. (3)

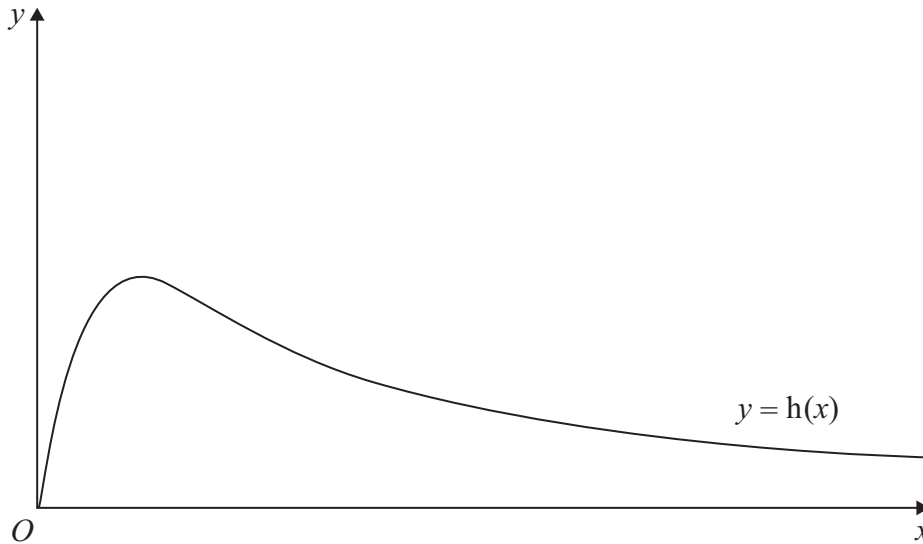


Figure 2

Figure 2 shows a graph of the curve with equation $y = h(x)$.

(c) Calculate the range of $h(x)$. (5)



