





**Question 1 continued**

Handwriting practice area with horizontal lines.

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**Q1**

**(Total 6 marks)**





3.

Figure 1

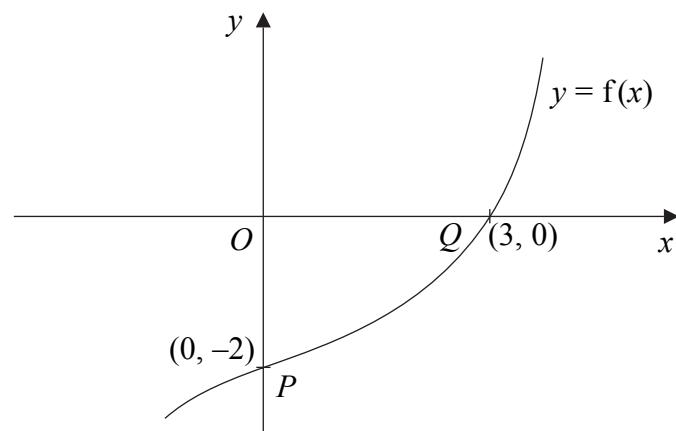


Figure 1 shows part of the curve with equation  $y = f(x)$ ,  $x \in \mathbb{R}$ , where  $f$  is an increasing function of  $x$ . The curve passes through the points  $P(0, -2)$  and  $Q(3, 0)$  as shown.

In separate diagrams, sketch the curve with equation

(a)  $y = |f(x)|$ , **(3)**

(b)  $y = f^{-1}(x)$ , **(3)**

(c)  $y = \frac{1}{2} f(3x)$ . **(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**



**Question 3 continued**

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**(Total 9 marks)**

**Q3**



4. A heated metal ball is dropped into a liquid. As the ball cools, its temperature,  $T^\circ\text{C}$ ,  $t$  minutes after it enters the liquid, is given by

$$T = 400 e^{-0.05t} + 25, \quad t \geq 0.$$

(a) Find the temperature of the ball as it enters the liquid. **(1)**

(b) Find the value of  $t$  for which  $T = 300$ , giving your answer to 3 significant figures. **(4)**

(c) Find the rate at which the temperature of the ball is decreasing at the instant when  $t = 50$ . Give your answer in  $^\circ\text{C}$  per minute to 3 significant figures. **(3)**

(d) From the equation for temperature  $T$  in terms of  $t$ , given above, explain why the temperature of the ball can never fall to  $20^\circ\text{C}$ . **(1)**

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5.

**Figure 2**

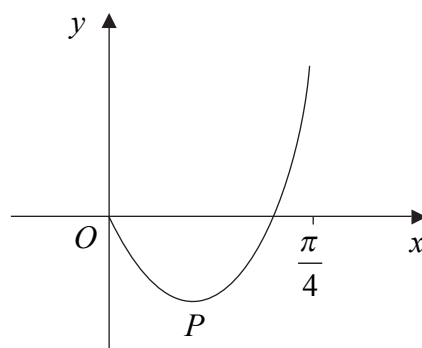


Figure 2 shows part of the curve with equation

$$y = (2x - 1) \tan 2x, \quad 0 \leq x < \frac{\pi}{4}.$$

The curve has a minimum at the point  $P$ . The  $x$ -coordinate of  $P$  is  $k$ .

(a) Show that  $k$  satisfies the equation

$$4k + \sin 4k - 2 = 0.$$

**(6)**

The iterative formula

$$x_{n+1} = \frac{1}{4}(2 - \sin 4x_n), \quad x_0 = 0.3,$$

is used to find an approximate value for  $k$ .

(b) Calculate the values of  $x_1, x_2, x_3$  and  $x_4$ , giving your answers to 4 decimal places.

**(3)**

(c) Show that  $k = 0.277$ , correct to 3 significant figures.

**(2)**

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**Question 6 continued**

Horizontal lines for writing.

**(Total 10 marks)**

**Q6**



7. For the constant  $k$ , where  $k > 1$ , the functions  $f$  and  $g$  are defined by

$$\begin{aligned} f: x &\mapsto \ln(x+k), & x > -k, \\ g: x &\mapsto |2x-k|, & x \in \mathbb{R}. \end{aligned}$$

- (a) On separate axes, sketch the graph of  $f$  and the graph of  $g$ .

On each sketch state, in terms of  $k$ , the coordinates of points where the graph meets the coordinate axes.

**(5)**

- (b) Write down the range of  $f$ .

**(1)**

- (c) Find  $fg\left(\frac{k}{4}\right)$  in terms of  $k$ , giving your answer in its simplest form.

**(2)**

The curve  $C$  has equation  $y = f(x)$ . The tangent to  $C$  at the point with  $x$ -coordinate 3 is parallel to the line with equation  $9y = 2x + 1$ .

- (d) Find the value of  $k$ .

**(4)**



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**Question 7 continued**

Lined area for writing the answer to Question 7 continued.



N 2 3 5 8 1 A 0 1 9 2 4









