







3.  $f(x) = 4 \operatorname{cosec} x - 4x + 1$ , where  $x$  is in radians.

(a) Show that there is a root  $\alpha$  of  $f(x) = 0$  in the interval  $[1.2, 1.3]$ . (2)

(b) Show that the equation  $f(x) = 0$  can be written in the form

$$x = \frac{1}{\sin x} + \frac{1}{4}$$
 (2)

(c) Use the iterative formula

$$x_{n+1} = \frac{1}{\sin x_n} + \frac{1}{4}, \quad x_0 = 1.25,$$

to calculate the values of  $x_1$ ,  $x_2$  and  $x_3$ , giving your answers to 4 decimal places. (3)

(d) By considering the change of sign of  $f(x)$  in a suitable interval, verify that  $\alpha = 1.291$  correct to 3 decimal places. (2)

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4. The function  $f$  is defined by

$$f : x \mapsto |2x - 5|, \quad x \in \mathbb{R}$$

(a) Sketch the graph with equation  $y = f(x)$ , showing the coordinates of the points where the graph cuts or meets the axes. (2)

(b) Solve  $f(x) = 15 + x$ . (3)

The function  $g$  is defined by

$$g : x \mapsto x^2 - 4x + 1, \quad x \in \mathbb{R}, \quad 0 \leq x \leq 5$$

(c) Find  $fg(2)$ . (2)

(d) Find the range of  $g$ . (3)





5.

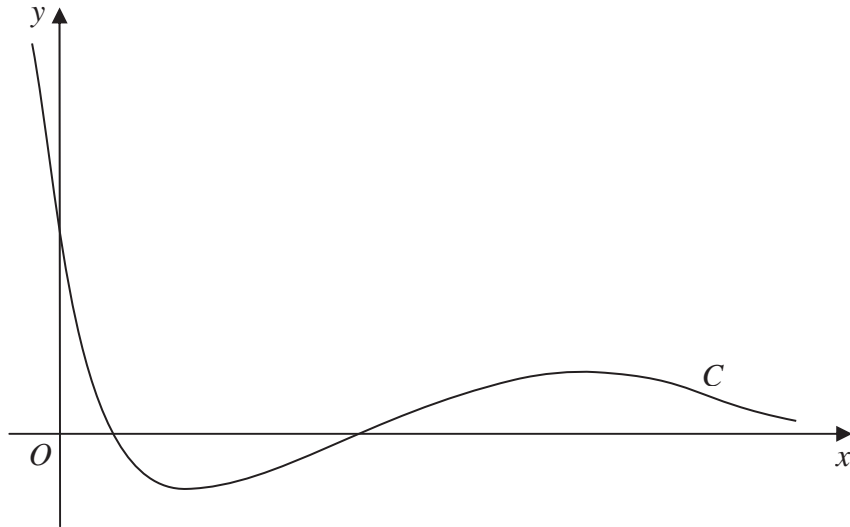


Figure 1

Figure 1 shows a sketch of the curve  $C$  with the equation  $y = (2x^2 - 5x + 2)e^{-x}$ .

- (a) Find the coordinates of the point where  $C$  crosses the  $y$ -axis. (1)
  
- (b) Show that  $C$  crosses the  $x$ -axis at  $x = 2$  and find the  $x$ -coordinate of the other point where  $C$  crosses the  $x$ -axis. (3)
  
- (c) Find  $\frac{dy}{dx}$ . (3)
  
- (d) Hence find the exact coordinates of the turning points of  $C$ . (5)

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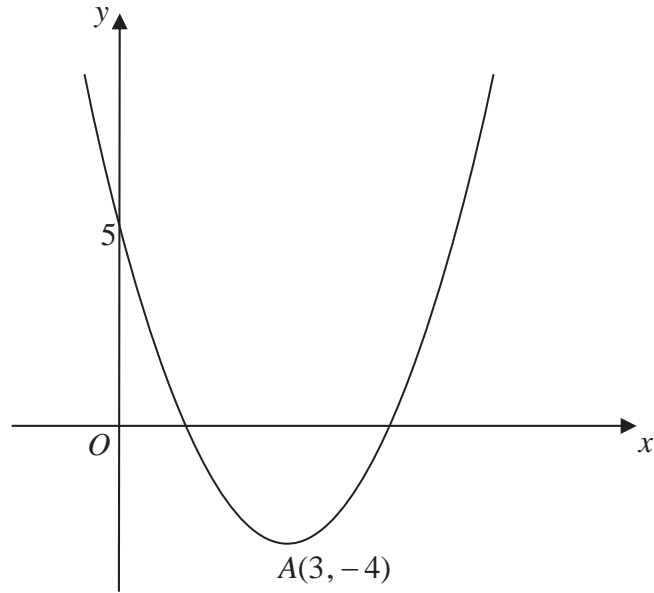


**Question 5 continued**

Ruled lines for writing the answer to Question 5.



6.



**Figure 2**

Figure 2 shows a sketch of the curve with the equation  $y = f(x)$ ,  $x \in \mathbb{R}$ .  
The curve has a turning point at  $A(3, -4)$  and also passes through the point  $(0, 5)$ .

(a) Write down the coordinates of the point to which  $A$  is transformed on the curve with equation

(i)  $y = |f(x)|$ ,

(ii)  $y = 2f(\frac{1}{2}x)$ .

**(4)**

(b) Sketch the curve with equation

$$y = f(|x|)$$

On your sketch show the coordinates of all turning points and the coordinates of the point at which the curve cuts the  $y$ -axis.

**(3)**

The curve with equation  $y = f(x)$  is a translation of the curve with equation  $y = x^2$ .

(c) Find  $f(x)$ .

**(2)**

(d) Explain why the function  $f$  does not have an inverse.

**(1)**







**Question 7 continued**

Lined area for writing the answer to Question 7.



