





2.

$$f(x) = x^3 + 3x^2 + 4x - 12$$

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

$$x = \sqrt{\left(\frac{4(3-x)}{(3+x)}\right)}, \quad x \neq -3 \quad (3)$$

The equation  $x^3 + 3x^2 + 4x - 12 = 0$  has a single root which is between 1 and 2

(b) Use the iteration formula

$$x_{n+1} = \sqrt{\left(\frac{4(3-x_n)}{(3+x_n)}\right)}, n \geq 0$$

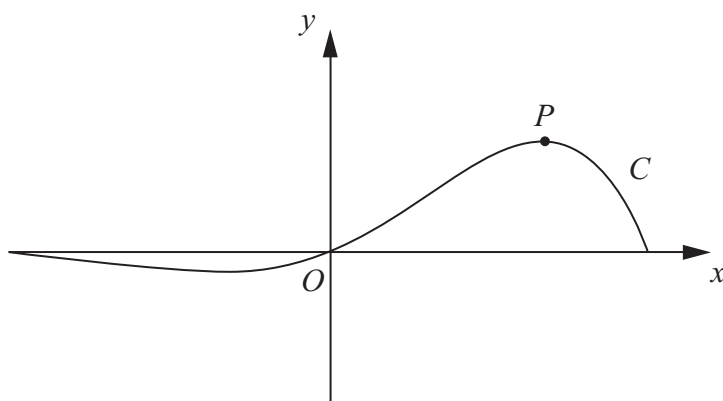
with  $x_0 = 1$  to find, to 2 decimal places, the value of  $x_1$ ,  $x_2$  and  $x_3$ .

The root of  $f(x) = 0$  is  $\alpha$ .

(c) By choosing a suitable interval, prove that  $\alpha = 1.272$  to 3 decimal places. (3)



3.



### Figure 1

Figure 1 shows a sketch of the curve  $C$  which has equation

$$y = e^{x\sqrt{3}} \sin 3x, \quad -\frac{\pi}{3} \leq x \leq \frac{\pi}{3}$$

- (a) Find the  $x$  coordinate of the turning point  $P$  on  $C$ , for which  $x > 0$ .  
Give your answer as a multiple of  $\pi$ .

(6)

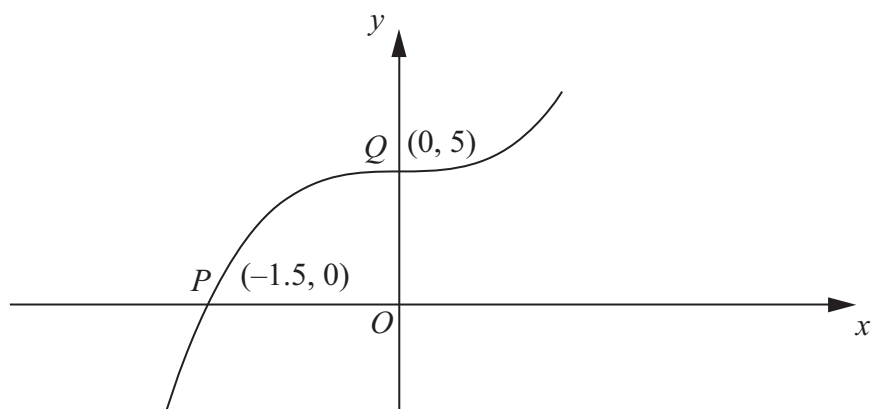
- (b) Find an equation of the normal to  $C$  at the point where  $x = 0$

(3)





4.



**Figure 2**

Figure 2 shows part of the curve with equation  $y = f(x)$   
The curve passes through the points  $P(-1.5, 0)$  and  $Q(0, 5)$  as shown.

On separate diagrams, sketch the curve with equation

(a)  $y = |f(x)|$  (2)

(b)  $y = f(|x|)$  (2)

(c)  $y = 2f(3x)$  (3)

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



**Question 4 continued**











7. (a) Differentiate with respect to  $x$ ,

(i)  $x^{\frac{1}{2}} \ln(3x)$

(ii)  $\frac{1-10x}{(2x-1)^5}$ , giving your answer in its simplest form.

(6)

(b) Given that  $x = 3 \tan 2y$  find  $\frac{dy}{dx}$  in terms of  $x$ .

(5)



8.

$$f(x) = 7 \cos 2x - 24 \sin 2x$$

Given that  $f(x) = R \cos(2x + \alpha)$ , where  $R > 0$  and  $0 < \alpha < 90^\circ$ ,

- (a) find the value of  $R$  and the value of  $\alpha$ .

(3)

- (b) Hence solve the equation

$$7 \cos 2x - 24 \sin 2x = 12.5$$

for  $0 \leq x < 180^\circ$ , giving your answers to 1 decimal place.

(5)

- (c) Express  $14\cos^2 x - 48\sin x \cos x$  in the form  $a \cos 2x + b \sin 2x + c$ , where  $a$ ,  $b$ , and  $c$  are constants to be found.

(2)

- (d) Hence, using your answers to parts (a) and (c), deduce the maximum value of

$$14 \cos^2 x - 48 \sin x \cos x$$

(2)



**Question 8 continued**

**(Total 12 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**

**Q8**

