

7. (a) Sketch the graph of the curve  $C$  with equation

$$y = \frac{4}{x - k}$$

where  $k$  is a positive constant.

Show on your sketch

- the coordinates of any points where  $C$  cuts the coordinate axes
- the equation of the vertical asymptote to  $C$

(4)

Given that the straight line with equation  $y = 9 - x$  does not cross or touch  $C$

(b) find the range of values of  $k$ .

(5)

11.

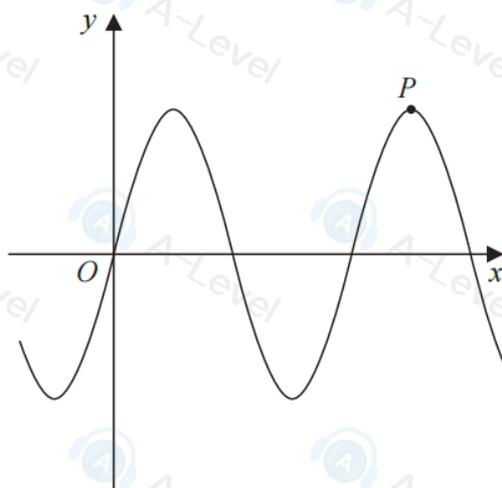


Figure 4

Figure 4 shows a sketch of part of the curve  $C_1$  with equation

$$y = 12 \sin x$$

where  $x$  is measured in radians.

The point  $P$  shown in Figure 4 is a maximum point on  $C_1$

(a) Find the coordinates of  $P$ .

(2)

The curve  $C_2$  has equation

$$y = 12 \sin x + k$$

where  $k$  is a constant.

Given that the **maximum** value of  $y$  on  $C_2$  is 3

- (b) find the coordinates of the **minimum** point on  $C_2$  which has the **smallest** positive  $x$  coordinate. (2)

The curve  $C_3$  has equation

$$y = 12 \sin(x + B)$$

where  $B$  is a positive constant.

Given that  $\left(\frac{\pi}{4}, A\right)$ , where  $A$  is a constant, is the **minimum** point on  $C_3$  which has the **smallest** positive  $x$  coordinate,

- (c) find
- the value of  $A$ ,
  - the smallest possible value of  $B$ .
- (2)

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5. **In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable.**

The curve  $C$  has equation  $y = f(x)$ ,  $x > 0$

Given that

- $f'(x) = \frac{12}{\sqrt{x}} + \frac{x}{3} - 4$
- the point  $P(9, 8)$  lies on  $C$

- (a) find, in simplest form,  $f(x)$  (5)

The line  $l$  is the normal to  $C$  at  $P$

- (b) Find the coordinates of the point at which  $l$  crosses the  $y$ -axis. (4)

3. The curve  $C$  has equation

$$y = \frac{5x^3 - 8}{2x^2} \quad x > 0$$

- (a) Find  $\frac{dy}{dx}$  writing your answer in simplest form. (4)

The point  $P(2, 4)$  lies on  $C$ .

- (b) Find an equation for the tangent to  $C$  at  $P$  writing your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (3)

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