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6. The line with equation  $y = 4x + c$ , where  $c$  is a constant, meets the curve with equation  $y = x(x - 3)$  at only one point.

(a) Find the value of  $c$ .

(4)

(b) Hence find the coordinates of the point of intersection.

(3)

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1. Find

$$\int \left( 10x^5 + 6x^3 - \frac{3}{x^2} \right) dx$$

giving your answer in simplest form.

(4)

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7. The curve  $C$  has equation  $y = f(x)$  where  $x > 0$

Given that

- $f'(x) = \frac{4x^2 + 10 - 7x^{\frac{1}{2}}}{4x^{\frac{1}{2}}}$

- the point  $P(4, -1)$  lies on  $C$

(a) (i) find the value of the gradient of  $C$  at  $P$

(ii) Hence find the equation of the normal to  $C$  at  $P$ , giving your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers to be found.

(4)

(b) Find  $f(x)$ .

(6)

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11.

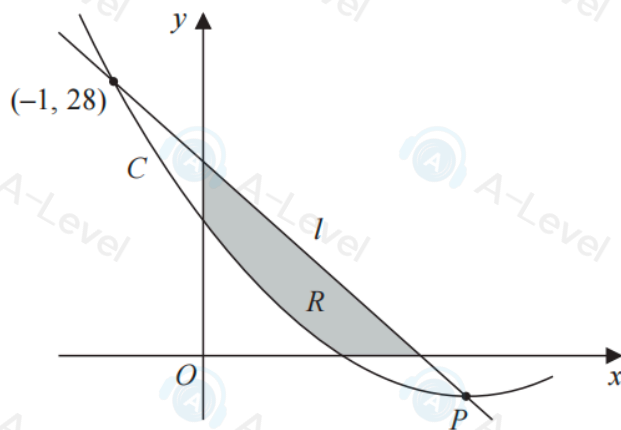


Figure 5

Figure 5 shows part of the curve  $C$  with equation  $y = f(x)$  where

$$f(x) = 2x^2 - 12x + 14$$

(a) Write  $2x^2 - 12x + 14$  in the form

$$a(x + b)^2 + c$$

where  $a$ ,  $b$  and  $c$  are constants to be found.

(3)

Given that  $C$  has a minimum at the point  $P$

(b) state the coordinates of  $P$

(1)

The line  $l$  intersects  $C$  at  $(-1, 28)$  and at  $P$  as shown in Figure 5.

(c) Find the equation of  $l$  giving your answer in the form  $y = mx + c$  where  $m$  and  $c$  are constants to be found.

(3)

The finite region  $R$ , shown shaded in Figure 5, is bounded by the  $x$ -axis,  $l$ , the  $y$ -axis, and  $C$ .

(d) Use inequalities to define the region  $R$ .

(3)

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6. (a) Given that  $k$  is a positive constant such that  $0 < k < 4$  sketch, on **separate axes**, the graphs of

(i)  $y = (2x - k)(x + 4)^2$

(ii)  $y = \frac{k}{x^2}$

showing the coordinates of any points where the graphs cross or meet the coordinate axes, leaving coordinates in terms of  $k$ , where appropriate.

(5)

- (b) State, with a reason, the number of roots of the equation

$$(2x - k)(x + 4)^2 = \frac{k}{x^2}$$

(1)

5.

**In this question you must show all stages of your working.**

**Solutions relying on calculator technology are not acceptable.**

- (a) Fully factorise

$$9x^3 - 10x^2 + x$$

(2)

- (b) Hence solve

$$9 \times 27^y - 10 \times 9^y + 3^y = 0$$

(3)

2. Given that

$$(x - 5)(2x + 1)(x + 3) \equiv ax^3 + bx^2 - 32x - 15$$

where  $a$  and  $b$  are constants,

- (a) find the value of  $a$  and the value of  $b$ .

(2)

- (b) Hence find

$$\int \frac{(x - 5)(2x + 1)(x + 3)}{5\sqrt{x}} dx$$

writing each term in simplest form.

(5)