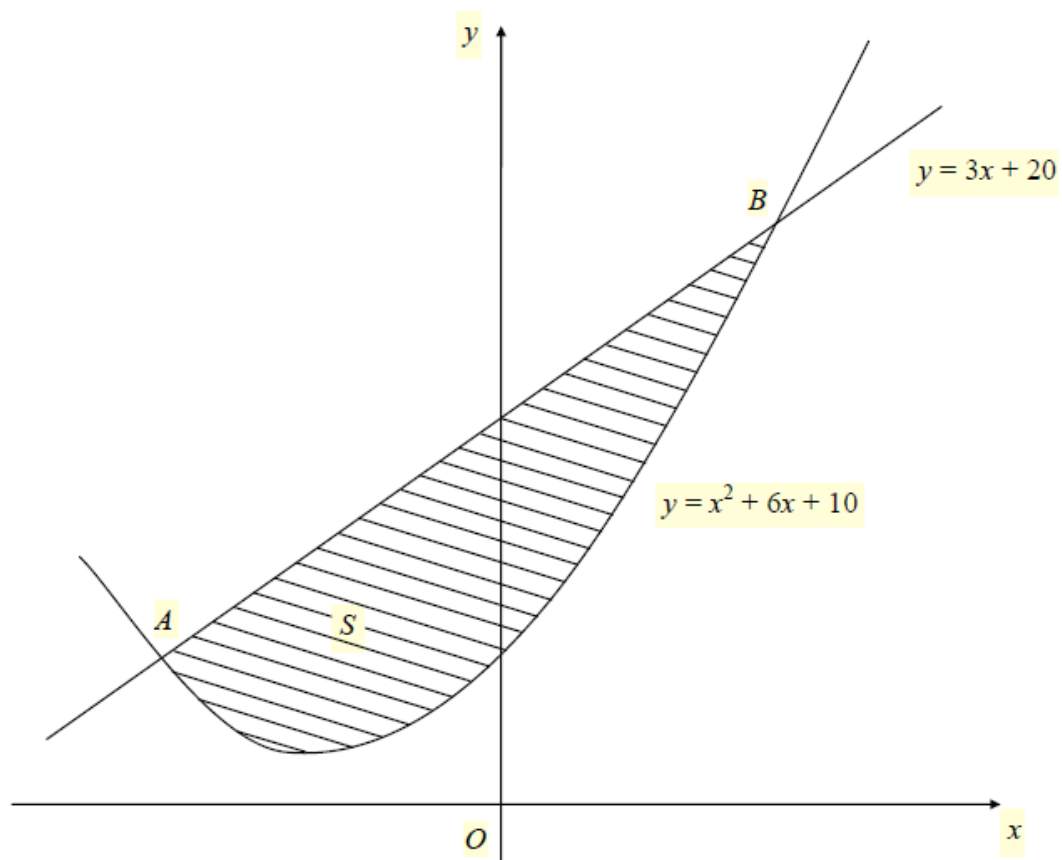


## Past Paper Questions – Set 3

1.

Figure 2



The line with equation  $y = 3x + 20$  cuts the curve with equation  $y = x^2 + 6x + 10$  at the points  $A$  and  $B$ , as shown in Figure 2.

(a) Use algebra to find the coordinates of  $A$  and the coordinates of  $B$ .

(5)

The shaded region  $S$  is bounded by the line and the curve, as shown in Figure 2.

(b) Use calculus to find the exact area of  $S$ .

(7)

2.

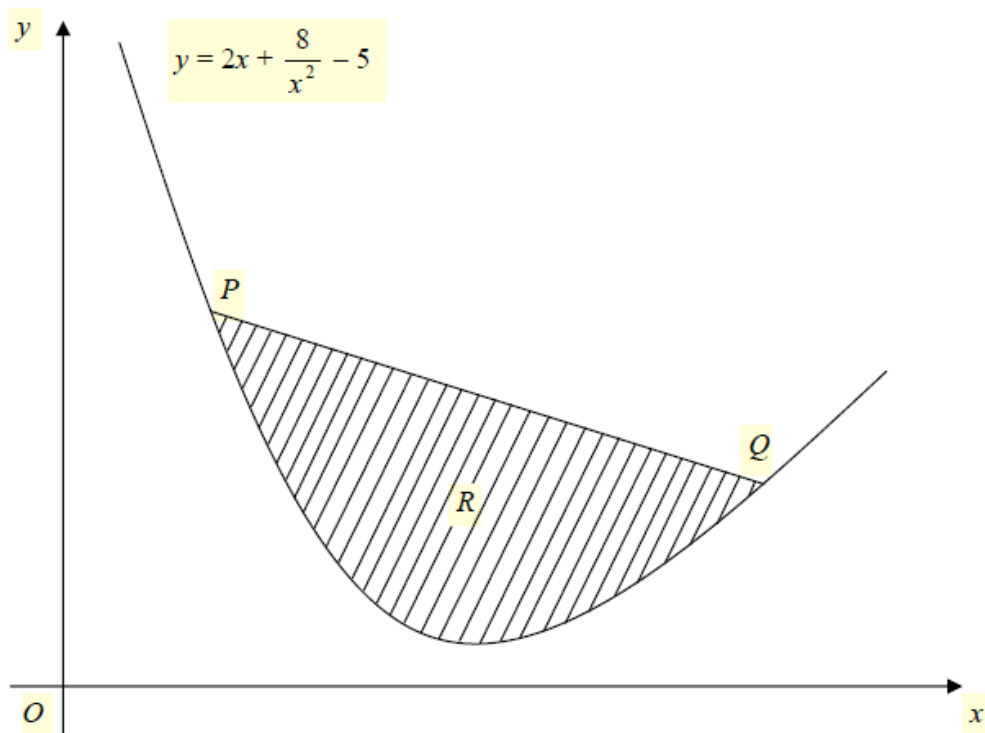


Figure 1 shows part of a curve  $C$  with equation  $y = 2x + \frac{8}{x^2} - 5$ ,  $x > 0$ .

The points  $P$  and  $Q$  lie on  $C$  and have  $x$ -coordinates 1 and 4 respectively. The region  $R$ , shaded in Figure 1, is bounded by  $C$  and the straight line joining  $P$  and  $Q$ .

(a) Find the exact area of  $R$ .

(8)

(b) Use calculus to show that  $y$  is increasing for  $x > 2$ .

(4)

3.

Figure 3

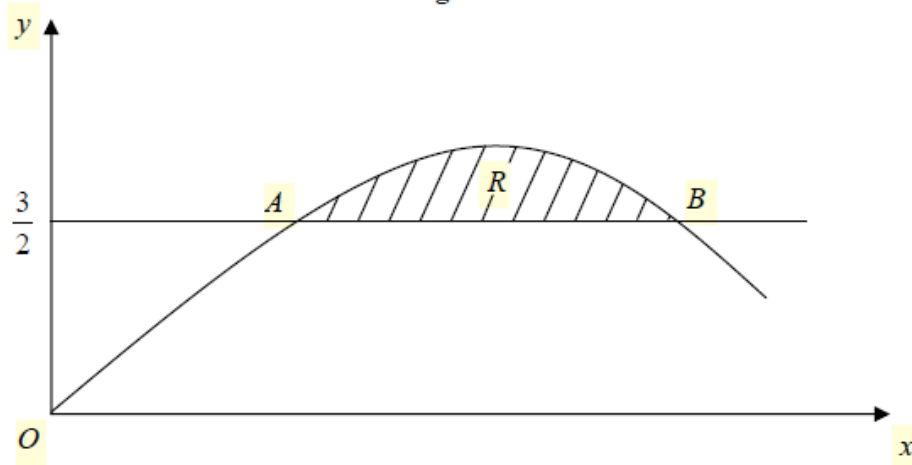


Figure 3 shows the shaded region  $R$  which is bounded by the curve  $y = -2x^2 + 4x$  and the line  $y = \frac{3}{2}$ . The points  $A$  and  $B$  are the points of intersection of the line and the curve.

Find

(a) the  $x$ -coordinates of the points  $A$  and  $B$ ,

(4)

(b) the exact area of  $R$ .

(6)

4.

Figure 3

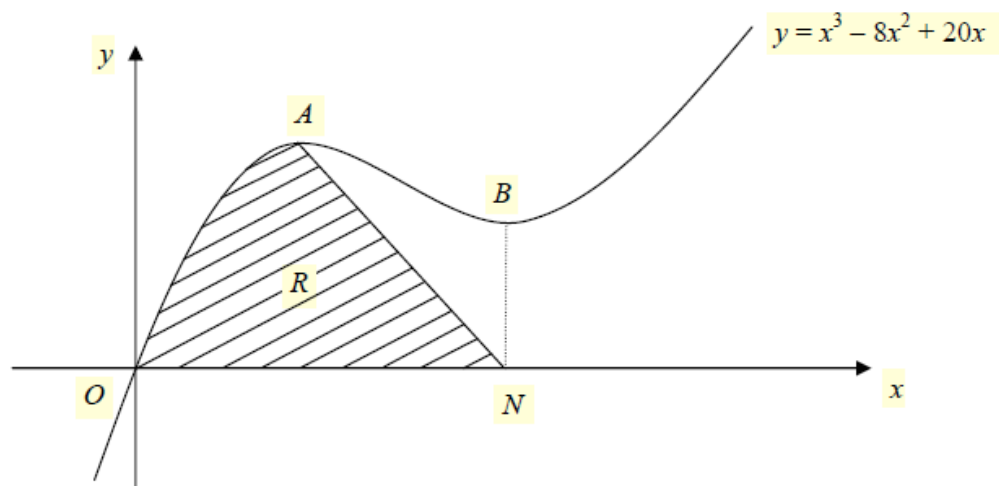


Figure 3 shows a sketch of part of the curve with equation  $y = x^3 - 8x^2 + 20x$ . The curve has stationary points  $A$  and  $B$ .

(a) Use calculus to find the  $x$ -coordinates of  $A$  and  $B$ . (4)

(b) Find the value of  $\frac{d^2y}{dx^2}$  at  $A$ , and hence verify that  $A$  is a maximum. (2)

The line through  $B$  parallel to the  $y$ -axis meets the  $x$ -axis at the point  $N$ . The region  $R$ , shown shaded in Figure 3, is bounded by the curve, the  $x$ -axis and the line from  $A$  to  $N$ .

(c) Find  $\int (x^3 - 8x^2 + 20x) \, dx$ . (3)

(d) Hence calculate the exact area of  $R$ . (5)

---

5.

Find, giving your answer to 3 significant figures where appropriate, the value of  $x$  for which

(a)  $3^x = 5$ , (3)

(b)  $\log_2 (2x + 1) - \log_2 x = 2$ . (4)

---

6.

Solve

(a)  $5^x = 8$ , giving your answer to 3 significant figures, (3)

(b)  $\log_2 (x + 1) - \log_2 x = \log_2 7$ . (3)

---

7.

(i) Write down the value of  $\log_6 36$ . (1)

(ii) Express  $2 \log_a 3 + \log_a 11$  as a single logarithm to base  $a$ . (3)

---

8.

- (a) Find, to 3 significant figures, the value of  $x$  for which  $8^x = 0.8$ .

(2)

- (b) Solve the equation

$$2\log_3 x - \log_3 7x = 1.$$

(4)

9.

Figure 1

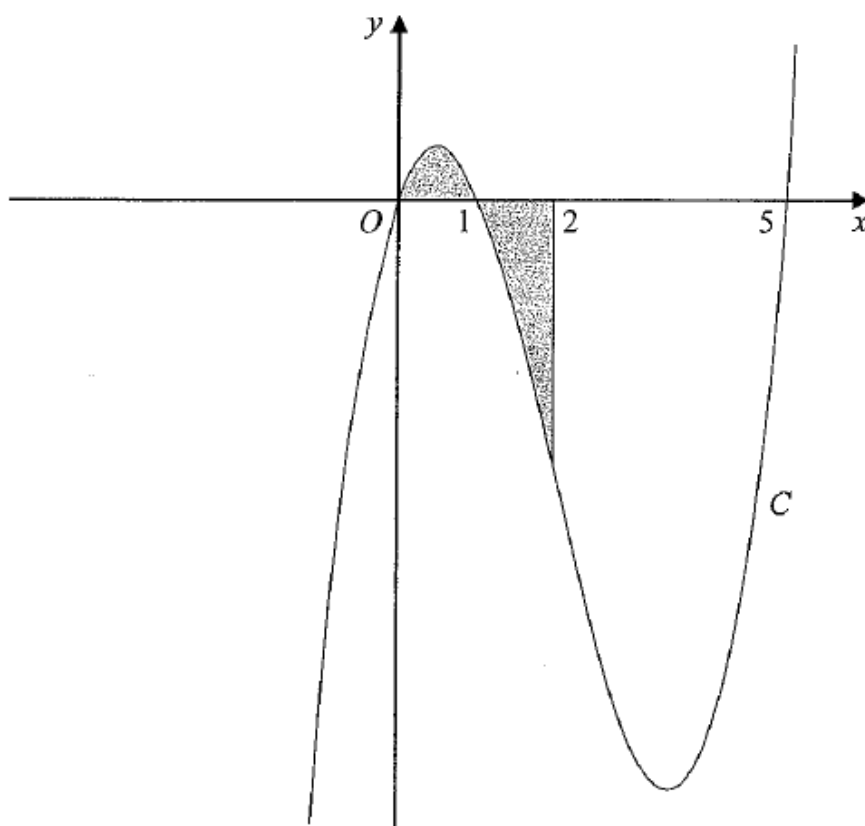


Figure 1 shows a sketch of part of the curve  $C$  with equation

$$y = x(x-1)(x-5).$$

Use calculus to find the total area of the finite region, shown shaded in Figure 1, that is between  $x = 0$  and  $x = 2$  and is bounded by  $C$ , the  $x$ -axis and the line  $x = 2$ .

(9)