5. The table below gives some x and y values for a function, $y = f(x)$.

The y values are given to 4 significant figures.

x	3	3.25	3.5	3.75	4	4.25	4.5
y	5.389	6.231	6.815	7.028	6.901	6.732	6.469

(a) Use the trapezium rule with all the y values in the table to find an estimate for

$$\int_3^{4.5} f(x)\,dx$$

giving the answer to 3 significant figures.

(3)

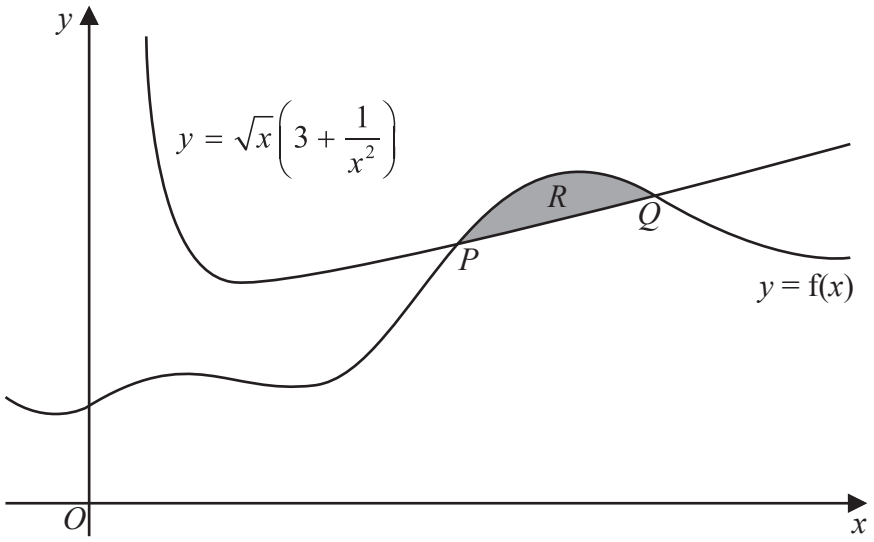

Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$ and the curve with equation $y = \sqrt{x}\left(3 + \frac{1}{x^2}\right)$

The finite region R, shown shaded in Figure 1, is bounded by both curves.

(b) Find

$$\int \sqrt{x}\left(3 + \frac{1}{x^2}\right) dx$$

(3)

The curves intersect at the points P and Q with x coordinates 3 and 4.5 respectively, as shown in Figure 1.

(c) Use the answer to part (a) and the answer to part (b) to find an estimate for the area of R. Give the answer to 2 significant figures.

(2)

(Total for Question 5 is 8 marks)

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

(i) Solve, using logarithms,

$$7^{x+3} = 5$$

giving the answer to 3 significant figures.

(2)

(ii) (a) Show that the equation

$$18(\log_8 y)^2 + 5\log_8(64y^3) = 73$$

can be written as

$$6(\log_8 y)^2 + 5\log_8 y - 21 = 0$$

(3)

(b) Hence find the exact values of y for which

$$18(\log_8 y)^2 + 5\log_8(64y^3) = 73$$

(3)

(Total for Question 6 is 8 marks)

---

7. The circle C has equation

$$(x-3)^2 + (y-6)^2 = k$$

where k is a positive constant.

(a) Write down the coordinates of the centre of C.

(1)

The line l passes through the origin, O, and the centre of C.

(b) Find an equation for the line l, giving the answer in the form $y = mx$, where m is a constant.

(2)

Given that

- the point A is the point on C closest to O
- the distance OA is $\sqrt{5}$

(c) find the two possible values of k.

(4)

(Total for Question 7 is 7 marks)

