7. (a) Find, in ascending powers of x, up to and including the term in x^2, the binomial expansion of

$$\left(1+\frac{5}{16}x\right)^{10}$$

fully simplifying each coefficient.

(4)

(b) Use $x=\frac{1}{10}$ and the answer to part (a) to show that an estimate for $\left(\frac{33}{32}\right)^{10}$ is

$$\frac{1389}{k}$$

where k is an integer to be found.

(3)

(c) Hence find a rational estimate for $\sqrt[10]{1389}$

(2)

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Question 7 continued

(Total for Question 7 is 9 marks)

8.

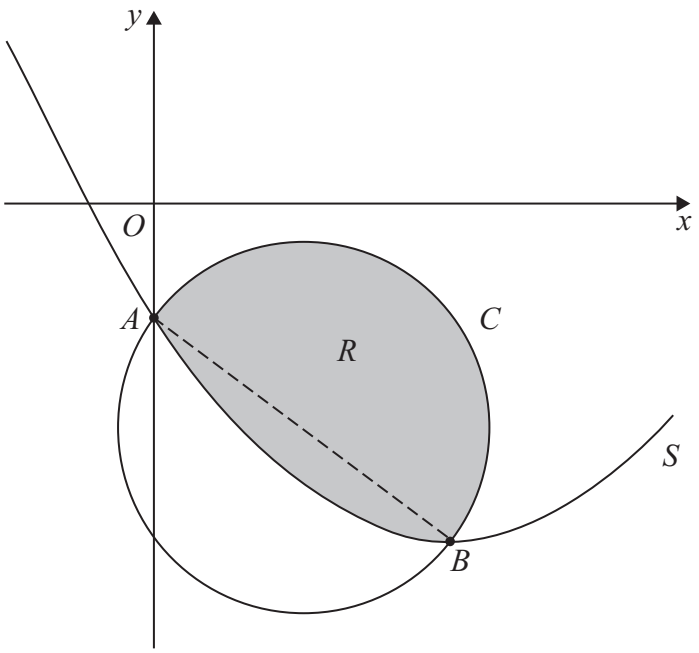


Figure 3

Figure 3 shows a sketch of a circle C and a parabola S.

The circle C has equation $x^2 + y^2 - 8x + 12y + 27 = 0$

(a) Find

(i) the coordinates of the centre of C

(ii) the radius of C

(3)

The parabola S

- has equation $y = ax^2 - \frac{3}{2}x - 3$
- intersects C on the y-axis at the point $A(0, -3)$
- intersects C again at the point B where AB is a diameter of C

Given that B is the minimum point of S,

(b) show that $a = \frac{3}{32}$

(3)

The finite region R is bounded by S and C and is shown shaded in Figure 3.

(c) Use algebraic integration to find the exact area of R.

(7)

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