6. Use the substitution $u = \sqrt{x^3 + 1}$ to show that

$$\int \frac{9x^5}{\sqrt{x^3 + 1}} \mathrm{d}x = 2\left(x^3 + 1\right)^k \left(x^3 - A\right) + c$$

where k and A are constants to be found and c is an arbitrary constant.

(5)

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Question 6 continued

(Total for Question 6 is 5 marks)

7.

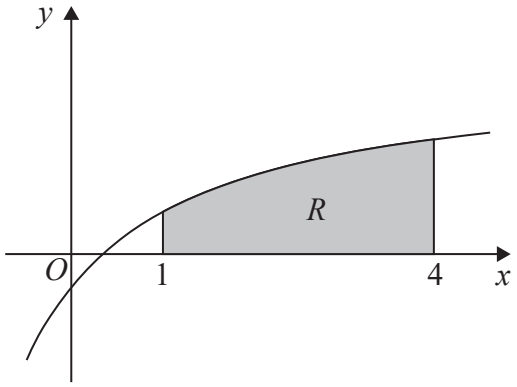

Figure 4

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

$$y = \frac{3x - 1}{x + 2} \qquad x > -2$$

(a) Show that

$$\frac{3x - 1}{x + 2} \equiv A + \frac{B}{x + 2}$$

where A and B are constants to be found.

(2)

The finite region R, shown shaded in Figure 4, is bounded by the curve, the line with equation $x = 4$, the x-axis and the line with equation $x = 1$

This region is rotated through 2π radians about the x-axis to form a solid of revolution.

(b) Use the answer to part (a) and algebraic integration to find the exact volume of the solid generated, giving your answer in the form

$$\pi(p + q \ln 2)$$

where p and q are rational constants.

(6)

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