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1. A curve  $C$  has the equation  $y^2 - 3y = x^3 + 8$ .

(a) Find  $\frac{dy}{dx}$  in terms of  $x$  and  $y$ .

(4)

(b) Hence find the gradient of  $C$  at the point where  $y = 3$ .

(3)

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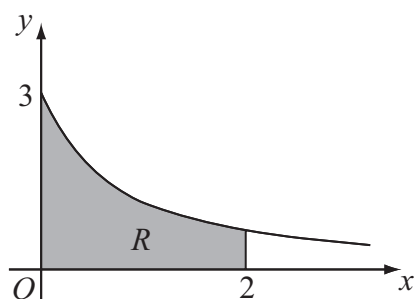
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2.



**Figure 1**

Figure 1 shows part of the curve  $y = \frac{3}{\sqrt{1+4x}}$ . The region  $R$  is bounded by the curve, the  $x$ -axis, and the lines  $x = 0$  and  $x = 2$ , as shown shaded in Figure 1.

(a) Use integration to find the area of  $R$ . **(4)**

The region  $R$  is rotated  $360^\circ$  about the  $x$ -axis.

(b) Use integration to find the exact value of the volume of the solid formed. **(5)**

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Question 2 continued

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**Question 2 continued**

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**(Total 9 marks)**

**Q2**



3.

$$f(x) = \frac{27x^2 + 32x + 16}{(3x+2)^2(1-x)}, \quad |x| < \frac{2}{3}$$

Given that  $f(x)$  can be expressed in the form

$$f(x) = \frac{A}{3x+2} + \frac{B}{(3x+2)^2} + \frac{C}{1-x},$$

- (a) find the values of  $B$  and  $C$  and show that  $A = 0$ . (4)
- (b) Hence, or otherwise, find the series expansion of  $f(x)$ , in ascending powers of  $x$ , up to and including the term in  $x^2$ . Simplify each term. (6)
- (c) Find the percentage error made in using the series expansion in part (b) to estimate the value of  $f(0.2)$ . Give your answer to 2 significant figures. (4)

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Question 6 continued

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Question 6 continued

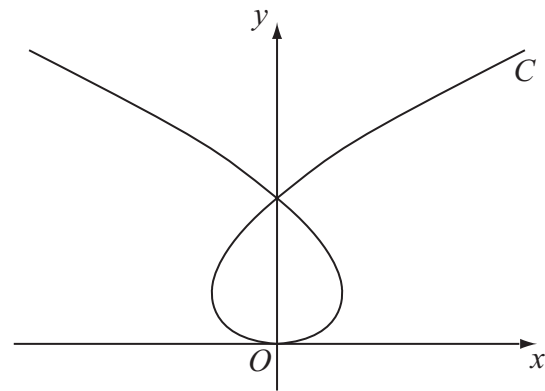
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7.



**Figure 3**

The curve  $C$  shown in Figure 3 has parametric equations

$$x = t^3 - 8t, \quad y = t^2$$

where  $t$  is a parameter. Given that the point  $A$  has parameter  $t = -1$ ,

- (a) find the coordinates of  $A$ . (1)

The line  $l$  is the tangent to  $C$  at  $A$ .

- (b) Show that an equation for  $l$  is  $2x - 5y - 9 = 0$ . (5)

The line  $l$  also intersects the curve at the point  $B$ .

- (c) Find the coordinates of  $B$ . (6)

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