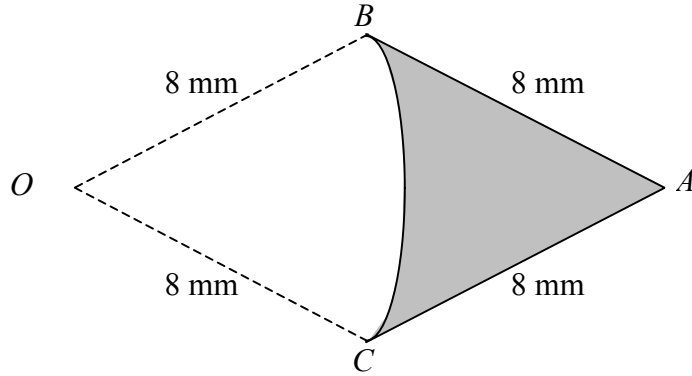


5.

Figure 1



The shaded area in Fig. 1 shows a badge ABC , where AB and AC are straight lines, with $AB = AC = 8$ mm. The curve BC is an arc of a circle, centre O , where $OB = OC = 8$ mm and O is in the same plane as ABC . The angle BAC is 0.9 radians.

- (a) Find the perimeter of the badge. (2)

- (b) Find the area of the badge. (5)

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A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.

6. At the beginning of the year 2000 a company bought a new machine for £15 000. Each year the value of the machine decreases by 20% of its value at the start of the year.

(a) Show that at the start of the year 2002, the value of the machine was £9600. (2)

When the value of the machine falls below £500, the company will replace it.

(b) Find the year in which the machine will be replaced. (4)

To plan for a replacement machine, the company pays £1000 at the start of each year into a savings account. The account pays interest at a fixed rate of 5% per annum. The first payment was made when the machine was first bought and the last payment will be made at the start of the year in which the machine is replaced.

(c) Using your answer to part (b), find how much the savings account will be worth immediately after the payment at the start of the year in which the machine is replaced. (4)

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7. (a) Use the factor theorem to show that $(x + 1)$ is a factor of

$$x^3 - x^2 - 10x - 8. \tag{2}$$

(b) Find all the solutions of the equation $x^3 - x^2 - 10x - 8 = 0$. (4)

(c) Prove that the value of x that satisfies

$$2 \log_2 x + \log_2 (x - 1) = 1 + \log_2 (5x + 4) \tag{I}$$

is a solution of the equation

$$x^3 - x^2 - 10x - 8 = 0. \tag{4}$$

(d) State, with a reason, the value of x that satisfies equation (I). (2)

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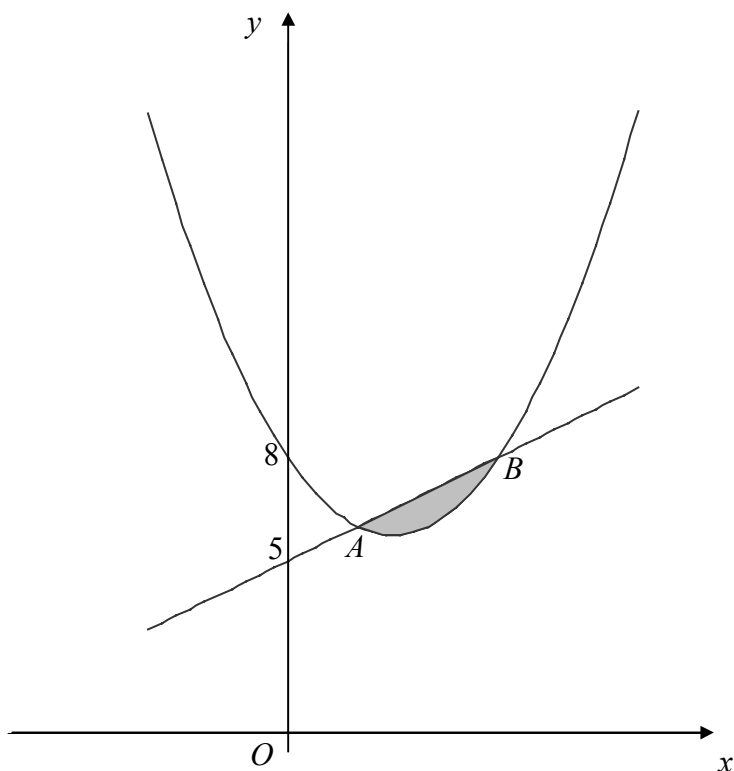
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Handwriting practice area with 25 horizontal dotted lines.

8.

Figure 2

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The line with equation $y = x + 5$ cuts the curve with equation $y = x^2 - 3x + 8$ at the points A and B , as shown in Fig. 2.

(a) Find the coordinates of the points A and B . (5)

(b) Find the area of the shaded region between the curve and the line, as shown in Fig. 2. (7)

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9.

Figure 3

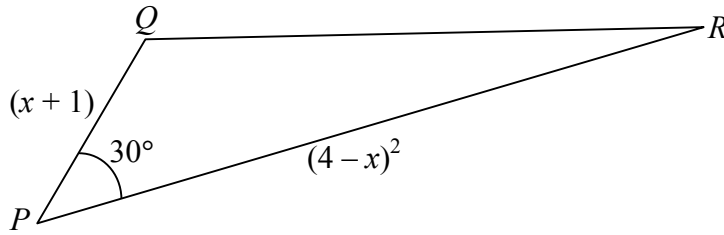


Figure 3 shows a triangle PQR . The size of angle QPR is 30° , the length of PQ is $(x + 1)$ and the length of PR is $(4 - x)^2$, where $x \in \mathbb{R}$.

- (a) Show that the area A of the triangle is given by

$$A = \frac{1}{4}(x^3 - 7x^2 + 8x + 16).$$

(3)

- (b) Use calculus to prove that the area of ΔPQR is a maximum when $x = \frac{2}{3}$. Explain clearly how you know that this value of x gives the maximum area.

(6)

- (c) Find the maximum area of ΔPQR .

(1)

- (d) Find the length of QR when the area of ΔPQR is a maximum.

(3)

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Handwriting practice area consisting of 25 horizontal dotted lines.

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