

1. A curve has equation

$$y = 2x^3 - 5x^2 - \frac{3}{2x} + 7 \quad x > 0$$

(a) Find, in simplest form, $\frac{dy}{dx}$ (3)

The point P lies on the curve and has x coordinate $\frac{1}{2}$

(b) Find an equation of the normal to the curve at P , writing your answer in the form $ax + by + c = 0$, where a , b and c are integers to be found. (5)

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5. A plot of land OAB is in the shape of a sector of a circle with centre O .

Given

- $OA = OB = 5$ km
- angle $AOB = 1.2$ radians

(a) find the perimeter of the plot of land. (2)

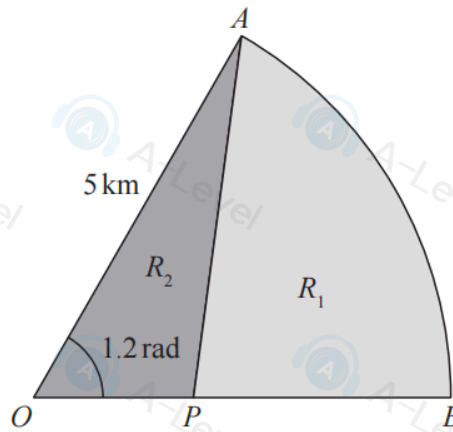


Diagram NOT accurately drawn

Figure 2

A point P lies on OB such that the line AP divides the plot of land into two regions R_1 and R_2 as shown in Figure 2.

Given that

$$\text{area of } R_1 = 3 \times \text{area of } R_2$$

(b) show that the area of $R_2 = 3.75 \text{ km}^2$ (3)

(c) Find the length of AP , giving your answer to the nearest 100 m. (4)

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3.

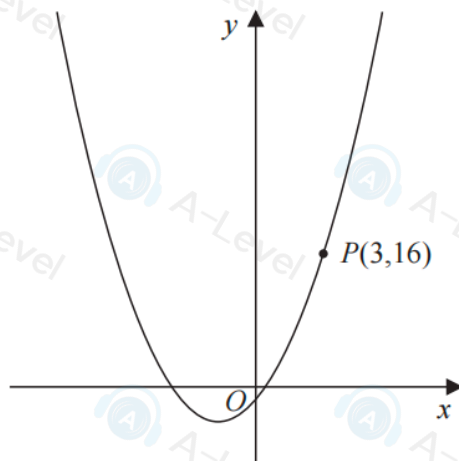
**Figure 1**

Figure 1 shows part of the curve with equation $y = x^2 + 3x - 2$

The point $P(3, 16)$ lies on the curve.

(a) Find the gradient of the tangent to the curve at P .

(2)

The point Q with x coordinate $3 + h$ also lies on the curve.

(b) Find, in terms of h , the gradient of the line PQ . Write your answer in simplest form.

(3)

(c) Explain briefly the relationship between the answer to (b) and the answer to (a).

(1)

8.

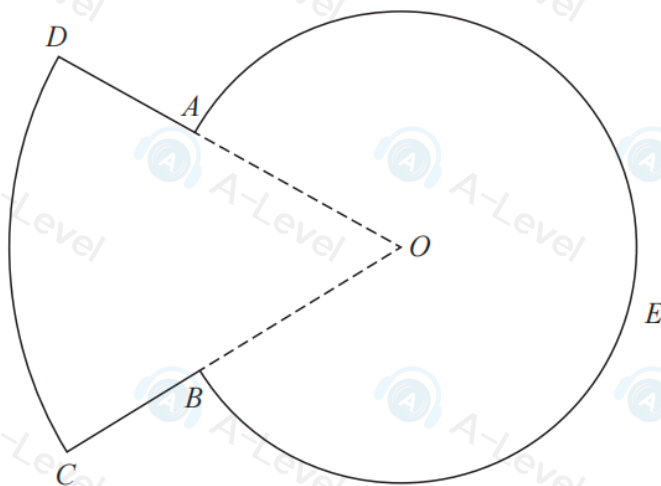


Figure 3

Figure 3 shows a sketch of the plan view of a platform.

The plan view of the platform consists of a sector DOC of a circle centre O joined to a sector $AOBEA$ of a different circle, also with centre O .

Given that

- angle $AOB = 0.8$ radians
- arc length $CD = 9$ m
- $DA:AO = 3:5$

(a) show that $AO = 7.03$ m to 3 significant figures.

(3)

(b) Find the perimeter of the platform, in m, to 3 significant figures.

(3)

(c) Find the total area of the platform, giving your answer in m^2 to the nearest whole number.

(3)