9. A company mines lithium.

- in year 1, the company mined 12 400 tonnes of lithium
- in year 15, the company is predicted to mine 7 500 tonnes of lithium

Model *A* assumes that the mass of lithium the company mines will decrease by the same amount each year.

According to model *A*,

(a) find the mass of lithium the company will mine in year 5

(3)

(b) calculate the **total** mass of lithium the company will mine from year 1 to year 15 inclusive.

(2)

Model *B* assumes that the mass of lithium the company mines will decrease by the same percentage each year.

(c) Find, according to model *B*, the mass of lithium the company will mine in year 10. Give the answer to the nearest 10 tonnes.

(3)

According to model *B*, there is a limit to the **total** mass of lithium that can be mined.

(d) Calculate the value of this limit. Give the answer to the nearest 100 tonnes.

(2)

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Question 9 continued

(Total for Question 9 is 10 marks)

10.

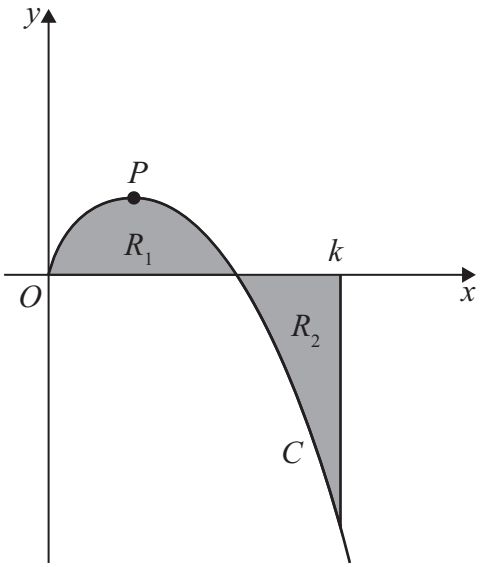


Figure 2

In this question you must show all stages of your working.
Solutions relying entirely on calculator technology are not acceptable.

Figure 2 shows a sketch of the curve C with equation

$$y = \frac{\sqrt{x}\left(100 - x^2\right)}{40} \qquad x \geqslant 0$$

The point P is a stationary point on C.

(a) Use algebraic differentiation to find the exact x coordinate of P.

(4)

The region R_1, shown shaded in Figure 2, is bounded by C and the x-axis.

The region R_2, also shown shaded in Figure 2, is bounded by C, the x-axis and the line with equation $x = k$, where k is a constant.

Given that the area of R_1 is equal to the area of R_2

(b) use algebraic integration to find the exact value of k.

(4)

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