

SAMPLE PAPER 2014 (SET F): PAPER 1**QUESTION 9 (50 MARKS)****QUESTION 9 (a) (i)**

Replace N by 100 in the formula to work out the yield of wheat Y .

$$N = 100 \text{ kg per hectare}$$

$$Y = 7000 + 32N - 0.1N^2$$

$$= 7000 + 32(100) - 0.1(100)^2$$

$$= 7000 + 3200 - 1000$$

$$= 9200 \text{ kg per hectare}$$

QUESTION 9 (a) (ii)

To find the maximum yield differentiate Y with respect to N , put it equal to zero and solve for N .

$$Y = 7000 + 32N - 0.1N^2$$

$$\frac{dY}{dN} = 32 - 0.2N = 0$$

$$\therefore 32 = 0.2N$$

$$N = \frac{32}{0.2} = 160 \text{ kg per hectare}$$

FINDTURNINGPOINTS(LOCALMAXIMUM/MINIMUM)
Put $\frac{dy}{dx} = 0$ and solve for x

QUESTION 9 (a) (iii)

Replace N by 160 in the formula to work out the maximum yield of wheat Y .

$$N = 160 \text{ kg per hectare}$$

$$Y = 7000 + 32N - 0.1N^2$$

$$= 7000 + 32(160) - 0.1(160)^2$$

$$= 9560 \text{ kg per hectare}$$

QUESTION 9 (a) (iv)

$$\text{Cost of production} = \text{€}1300$$

$$\text{Maximum yield of wheat per hectare} = 9560 \text{ kg} = 9.56 \text{ tonne}$$

$$\text{Price of left-over straw} = \text{€}75$$

$$\text{Price of wheat} = \text{€}160 \text{ per tonne}$$

$$\text{Income} = 160 \times 9.56 + 75 = \text{€}1606.60$$

$$\text{Profit} = \text{Income} - \text{Cost} = \text{€}1606.60 - \text{€}1300 = \text{€}304.60$$

$$\begin{aligned} 1000 \text{ kg} &= 1 \text{ tonne} \\ 9560 \text{ kg} &= 9.56 \text{ tonne} \end{aligned}$$

QUESTION 9 (b) (i)

Firstly, find out how long it takes the marble to hit the ground by putting the height $h = 0$ and solving for the time t .

Hits the ground: $h = 0$

$$h = 44 \cdot 1 - 4 \cdot 9t^2$$

$$0 = 44 \cdot 1 - 4 \cdot 9t^2$$

$$4 \cdot 9t^2 = 44 \cdot 1$$

$$t^2 = \frac{44 \cdot 1}{4 \cdot 1} = 9$$

$$t = \sqrt{9} = 3 \text{ s}$$

Differentiate the height h with respect to time t to find the speed v . Then replace t in your answer by 3 s to find the speed when it hits the ground.

$$h = 44 \cdot 1 - 4 \cdot 9t^2$$

$$v = \frac{dh}{dt} = -2 \times 4 \cdot 9t = -9 \cdot 8t$$

$$v = \frac{dh}{dt}$$

$$\left(\frac{dh}{dt} \right)_{t=3} = -9 \cdot 8(3) = -29 \cdot 4 \text{ m/s}$$

ANSWER: Speed = 29·4 m/s

FORMULAE AND TABLES BOOK
Calculus: Derivatives [page 25]

$$y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$$

QUESTION 9 (b) (ii)

$$v = 29 \cdot 4 \text{ m/s} = \frac{29 \cdot 4 \text{ m}}{1 \text{ s}} = \frac{29 \cdot 4}{\frac{1}{3600} \text{ h}} \text{ km} = 105 \cdot 84 \text{ km/h}$$

$$\begin{array}{l} 1000 \text{ m} = 1 \text{ km} \\ 3600 \text{ s} = 1 \text{ hour} \end{array}$$

Or

$$\begin{aligned} & 29 \cdot 4 \text{ m/s} \\ &= 29 \cdot 4 \times 60 \text{ m/min} \\ &= 29 \cdot 4 \times 60 \times 60 \text{ m/h} \\ &= \frac{29 \cdot 4 \times 60 \times 60}{1000} \text{ km/h} \\ &= 105 \cdot 84 \text{ km/h} \end{aligned}$$
