

SAMPLE PAPER 3: PAPER 1

QUESTION 9 (50 MARKS)

Question 9 (a) (i)

$$A = 12t^2 - \frac{2}{3}t^3$$

$$\frac{dA}{dt} = 24t - 2t^2$$

$$\left(\frac{dA}{dt}\right)_{t=1} = 24(1) - 2(1)^2$$

$$= 24 - 2 = 22 \text{ m}^2/\text{month}$$

After one month, the area of the algae is increasing.

Question 9 (b)

$$\frac{dA}{dt} = 0 \Rightarrow 24t - 2t^2 = 0$$

$$12t - t^2 = 0$$

$$t(12 - t) = 0$$

$$\therefore t = 12 \text{ months}$$

Question 9 (a) (ii)

$$\left(\frac{dA}{dt}\right)_{t=14} = 24(14) - 2(14)^2$$

$$= 24 - 2 = -56 \text{ m}^2/\text{month}$$

After 14 months, the area of the algae is decreasing.

Question 9 (c)

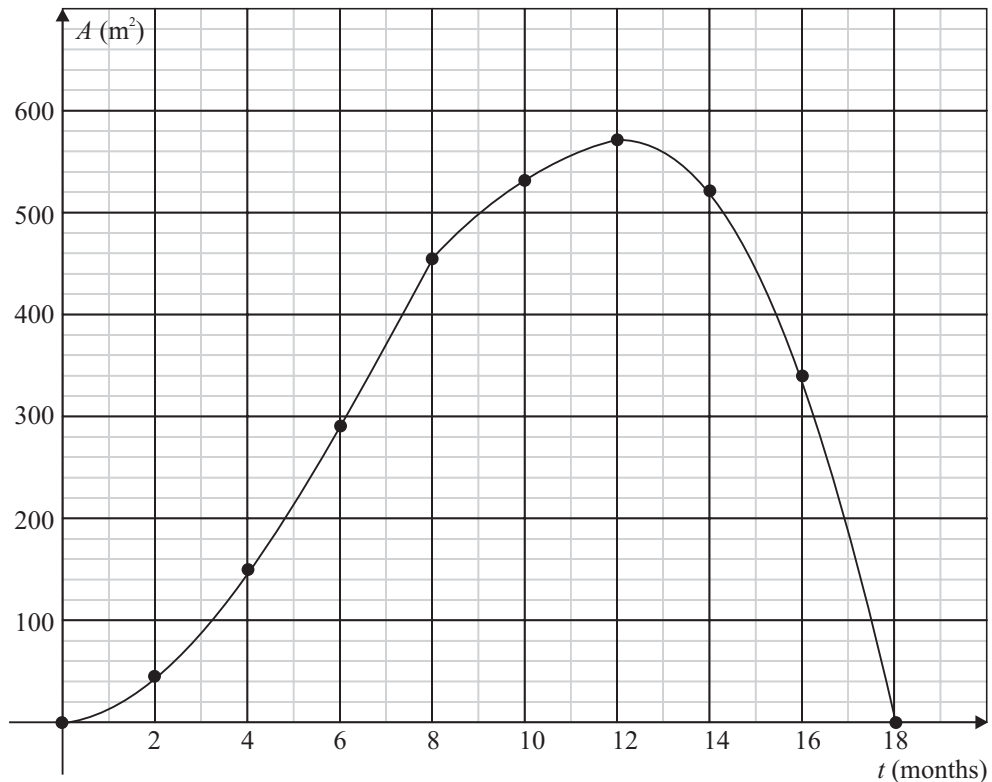
$$A = 12t^2 - \frac{2}{3}t^3$$

$$t = 12 \text{ months: } A_{\text{Max.}} = 12(12)^2 - \frac{2}{3}(12)^3 = 576 \text{ m}^2$$

Question 9 (d)

t (Months)	0	2	4	6	8	10	12	14	16	18
A (m ²)	0	43	149	288	427	533	576	523	341	0

Question 9 (e)



Question 9 (f)

The algae grows slowly to a maximum area of 576 m² over the first 12 months, and then rapidly decreases to zero over the last six months.

Question 9 (g)

$$A = 12t^2 - \frac{2}{3}t^3$$

$$t = 15 \text{ months: } A = 12(15)^2 - \frac{2}{3}(15)^3 = 450 \text{ m}^2$$

$$A = \pi r^2 \Rightarrow r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{450}{\pi}} \approx 12 \text{ m}$$
