1 Fig. 10 shows the speed of a car, in metres per second, during one minute, measured at 10-second intervals.

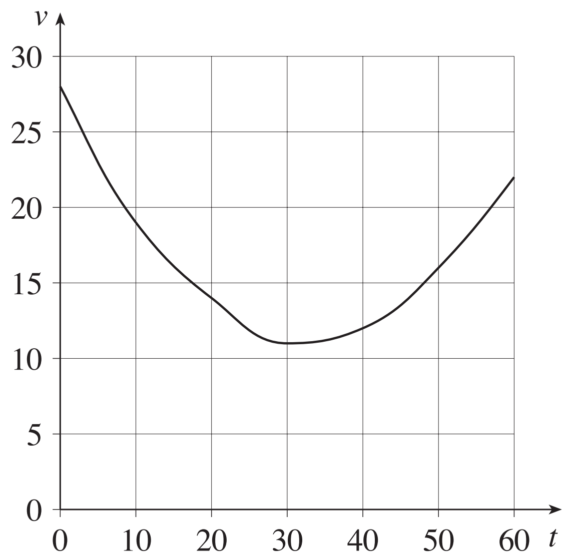

Fig. 10

The measured speeds are shown below.

Time (t seconds)	0	10	20	30	40	50	60
Speed (v m s^{-1})	28	19	14	11	12	16	22

(i) Use the trapezium rule with 6 strips to find an estimate of the area of the region bounded by the curve, the line $t = 60$ and the axes. [This area represents the distance travelled by the car.] [4]

(ii) Explain why your calculation in part **(i)** gives an overestimate for this area. Use appropriate rectangles to calculate an underestimate for this area. [3]

The speed of the car may be modelled by $v = 28 - t + 0.015t^2$.

(iii) Show that the difference between the value given by the model when $t = 10$ and the measured value is less than 3% of the measured value. [2]

(iv) According to this model, the distance travelled by the car is

$$\int_0^{60} (28 - t + 0.015t^2)\,dt.$$

Find this distance. [3]

2 At a place where a river is 7.5 m wide, its depth is measured every 1.5 m across the river. The table shows the results.

Distance across river (m)	0	1.5	3	4.5	6	7.5
Depth of river (m)	0.6	2.3	3.1	2.8	1.8	0.7

Use the trapezium rule with 5 strips to estimate the area of cross-section of the river. **[3]**

3 Fig. 11 shows the cross-section of a school hall, with measurements of the height in metres taken at 1.5 m intervals from O.

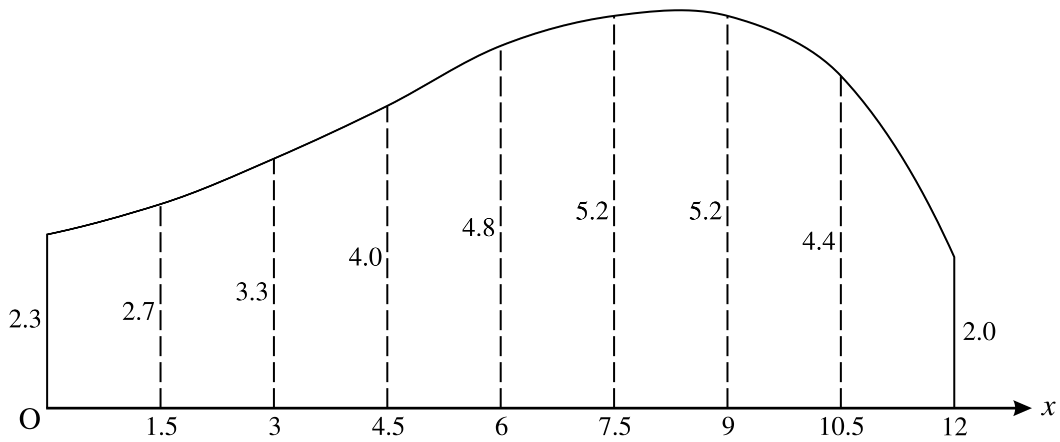

Fig. 11

(i) Use the trapezium rule with 8 strips to calculate an estimate of the area of the cross-section. **[4]**

(ii) Use 8 rectangles to calculate a lower bound for the area of the cross-section. **[2]**

The curve of the roof may be modelled by $y = -0.013x^3 + 0.16x^2 - 0.082x + 2.4$, where x metres is the horizontal distance from O across the hall, and y metres is the height.

(iii) Use integration to find the area of the cross-section according to this model. **[4]**

(iv) Comment on the accuracy of this model for the height of the hall when $x = 7.5$. **[2]**

4 Fig. 2 shows the coordinates at certain points on a curve.

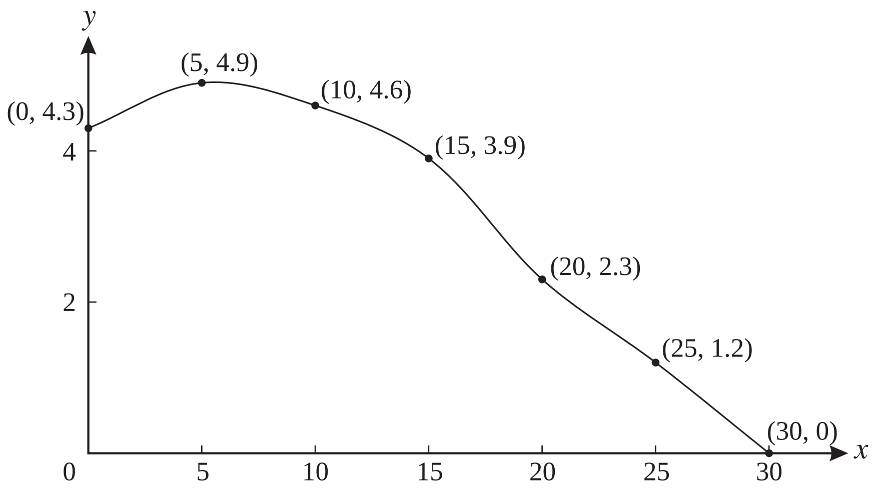

Fig. 2

Use the trapezium rule with 6 strips to calculate an estimate of the area of the region bounded by this curve and the axes. **[4]**

5 Fig. 10 shows a sketch of the graph of $y = 7x - x^2 - 6$.

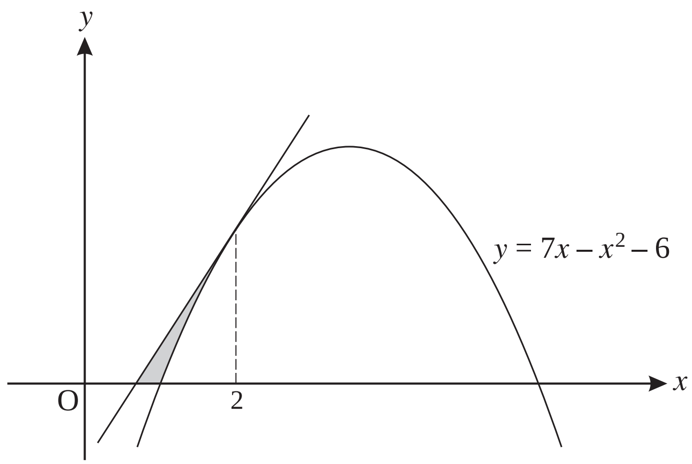

Fig. 10

(i) Find $\frac{dy}{dx}$ and hence find the equation of the tangent to the curve at the point on the curve where $x = 2$.

Show that this tangent crosses the x-axis where $x = \frac{2}{3}$. **[6]**

(ii) Show that the curve crosses the x-axis where $x = 1$ and find the x-coordinate of the other point of intersection of the curve with the x-axis. **[2]**

(iii) Find $\int_1^2 (7x - x^2 - 6)\,dx$.

Hence find the area of the region bounded by the curve, the tangent and the x-axis, shown shaded on Fig. 10. **[5]**