1. Below is the graph of a journey **[6 marks]**
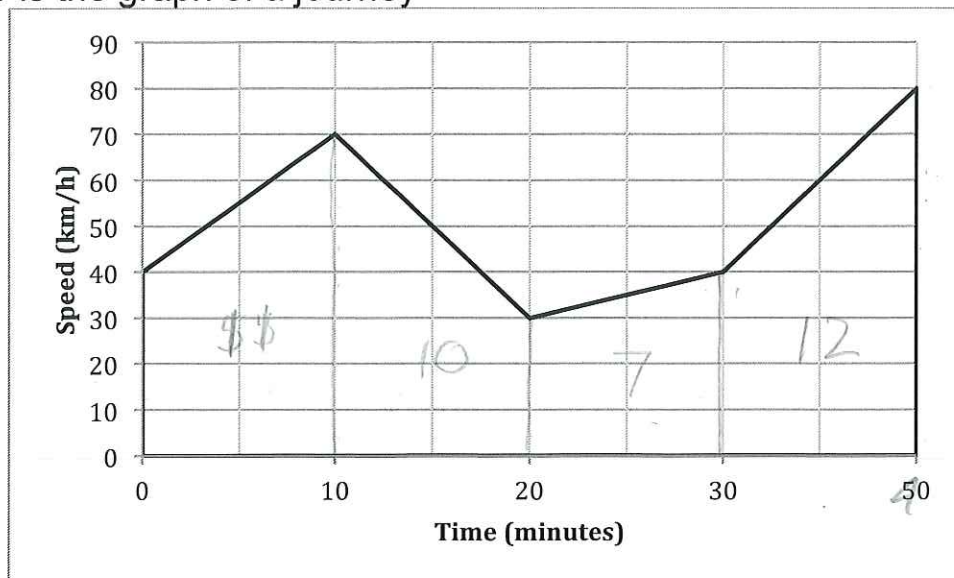
a) What is the area of each square in the grid and what does it represent?

$10 \times 5 = 50$ Km/h $\times$ min

$= 5000$m/h min

$= 833.3$m ✓✓

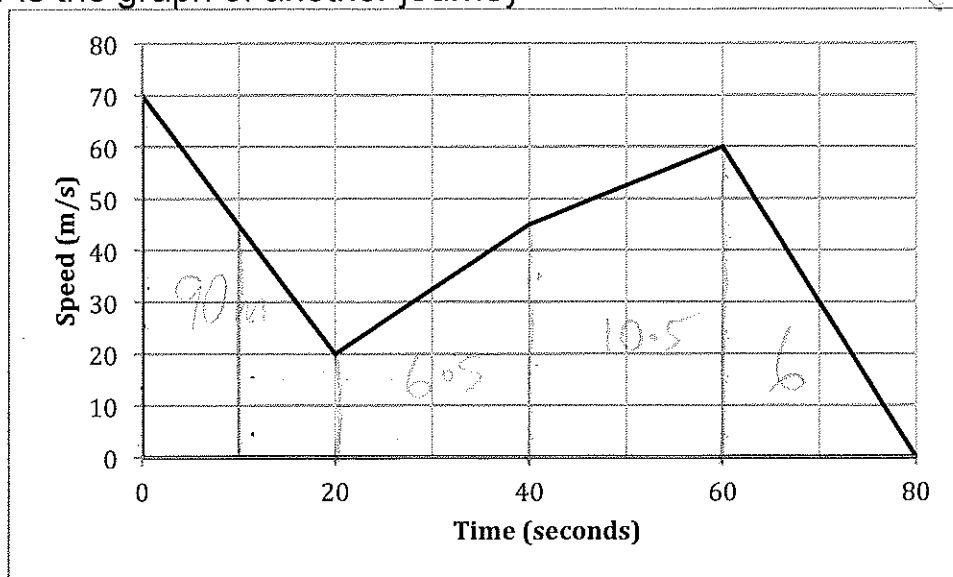b) What is the area under the curve?

or 2000

400 square ✓✓

c) What is the significance of your answer above to the journey?

33 333m travelled ✓✓

$33\frac{1}{3}$ km.

2. Below is the graph of another journey

How far did the person travel:

a) in the first 10 seconds 6.75×100

$575\,m$

b) between 10 and 35 seconds

9.75×100

$= 975\ m$

c) during the first 50 seconds 32×100

$= 3200\ m$

d) During what time period did the person have the greatest acceleration (positive or negative - explain your answer)
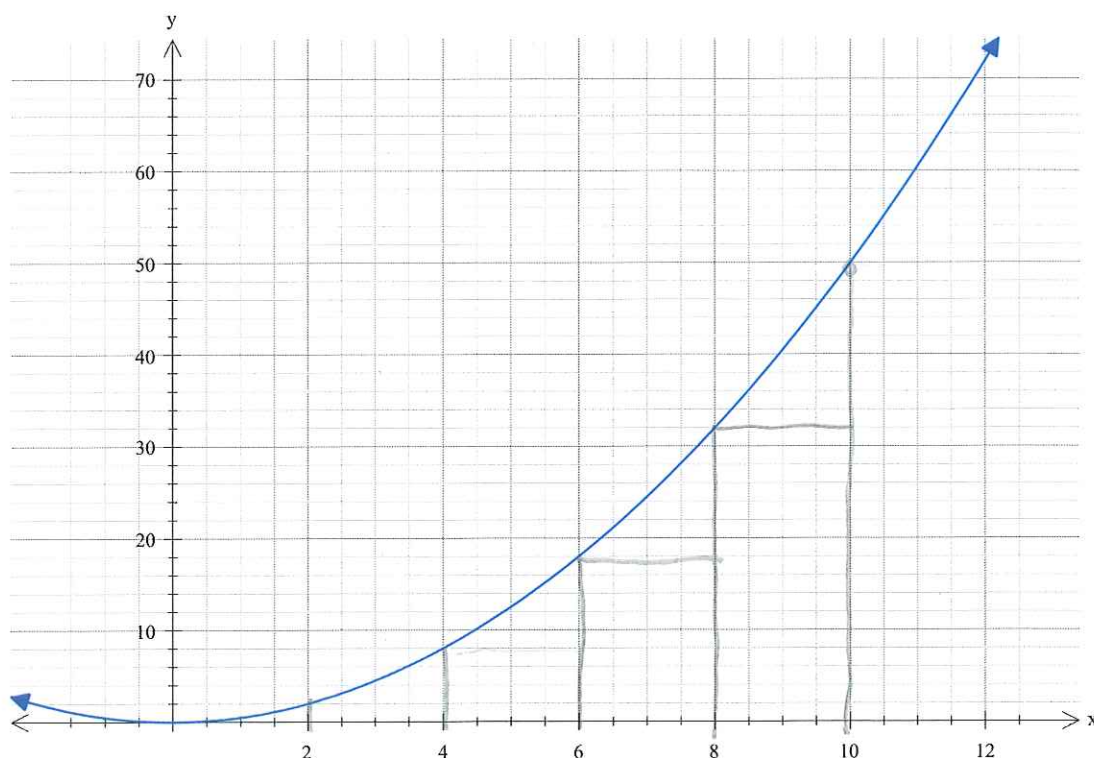
$60 \to 80$ seconds

e) When did the person have the greatest velocity?

0 secs

3. Below is a graph of $y = \dfrac{x^2}{2}$

Approximate the area between the curve and the x-axis from 0 to 10, using intervals of 2, and then:

a) find the sum of the left hand rectangles.

$120\ sq$

✓✓✓

		Area
0 - 2	0	0
2 - 4	2	4
4 - 6	8	16
6 - 8	18	36
8 - 10	32	64

b) find the sum of the right hand rectangles

$220\ sq$

✓✓

2	4
8	16
18	36
32	64
50	100

c) Find the approximate area between the curve and the x-axis from 0 to 10.

✓

$$\frac{220 + 120}{2} = 170\ sq$$

d) What would be the approximate area between the curve and the x-axis from 2 to 10?

✓

$$\frac{120 + 216}{2} = 168\ sq$$

[7 marks]

4. As part of this investigation we went on a bus trip and discovered (were reminded) that the area under a speed graph gave us the distance travelled.

Thinking about the relationship between speed and distance, answer the following questions.

A bus is travelling with a speed given by $s = 4t^3 + 6t^2 + 10$ m/s $0s \leq t \leq 100s$

a) Does the bus ever travel with a negative speed?   Justify your answer.

No   since   whole   graph   above   zero   ✓

b) How far would the bus travel during the 100s trip?   ✓✓

$S = t^4 + 2t^3 + 10t + C$

$S(0) = 0$ $10^2 \, 001 \, Kms$

$s(100) = 10\,200\,1\,000$

c) How far would bus travel between t = 40 and t = 100s

$S(40) = 2688 \quad 400$

Distance $993\,1206$,   kms   ✓✓

$993\,12\,600$ ms.

5. Without counting squares, find the area under the curve $y = \dfrac{x^2}{2}$;

a) between the interval $0 \leq x \leq 10$?

$\int y = \dfrac{x^3}{6}$

$A(0) = 0$ ✓✓

$A(10) = 1000/6$

$166.7 u^2$

b) between the interval $4 \leq x \leq 10$?

$1000/6 - \dfrac{64}{6} = \dfrac{936}{6}$

$= 156\,.\,29$ ✓✓

6. A similar approach to the left hand rectangles and right hand rectangles can be used to find the approximate area of a circle.

a) If we consider a circle of radius 10cm. We could break it up into 6 internal triangles and 6 external triangles. Find the area of each triangle and hence find an approximation for internal area of the circle.
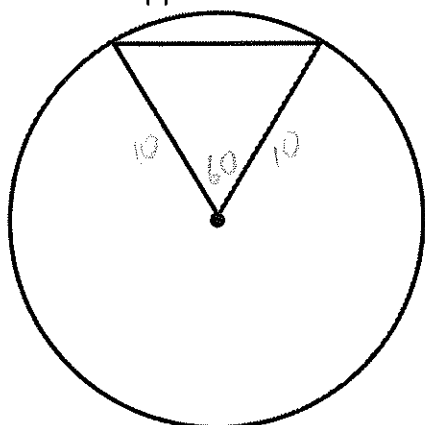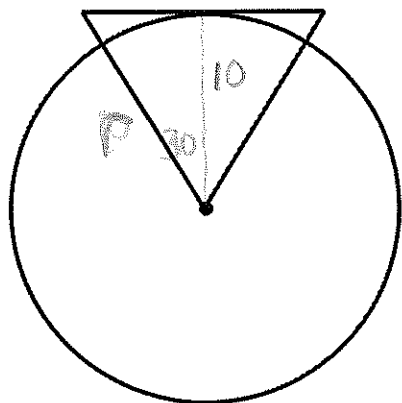

$$\text{Area} = 6 \times \tfrac{1}{2} \cdot 10^2 \, \text{Sin} \, 60$$
$$= 259.8 \, cm^2 \quad \checkmark$$

b) Now break it up into 6 external triangles. Find the area of each triangle and hence find an approximation for external area of the circle.

$$\cos 30 = \frac{10}{r}$$
$$r = 11.54$$

$$\text{Area} = 6 \times \tfrac{1}{2} \times 11.54^2 \cdot \text{Sin} \, 60$$
$$= 346.4 \, cm^2 \quad \checkmark$$

c) By averaging these results, find a good approximation to the area of the circle, radius 10cm.

$$303.1 \, cm^2 \quad \checkmark$$

d) How does this compare to the exact area of the circle?

$$a_1 = \pi \times 10^2$$
$$= 314 \, cm^2$$

It is close but smaller by 11 cm². ✓✓

7. Repeat question 6 only this time use 12 triangles instead of 6. [6 marks]

$$\text{Internal area} = 12 \times \tfrac{1}{2} \times 10^2 \times \sin 30$$
$$= 300 \text{ cm}^2$$

$$\text{External Area} = 12 \times \tfrac{1}{2} \times \left(\frac{10}{\cos 15}\right)^2 \times \sin 30$$
$$= 321.54$$

$$\therefore \text{Average} = 310.8 \text{ cm}^2$$

this is much closer