

1. Filters at a water treatment plant become less effective over time and hence the amount of pollution passing through the filters increases over time. The rate that pollution passes through the filters is given by the table.

Day	0	7	14	21	28	35
rate (kg/day)	3	5	8	15	25	45

- (a) Estimate the amount of pollution passing through the filters during the 35 days using the following methods.

i. left sum

$$7(3) + 7(5) + 7(8) + 7(15) + 7(25) \\ \approx 392 \text{ Kg.}$$

All Rectangles below so lower estimate.

ii. right sum

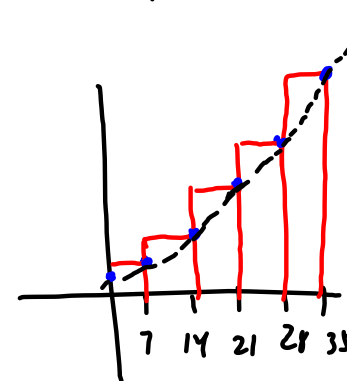
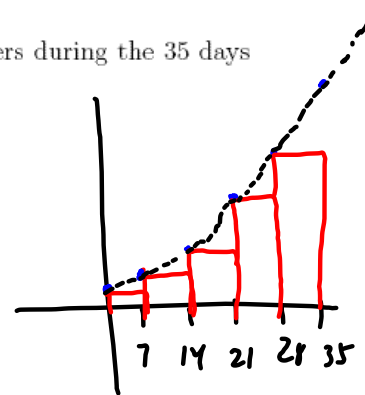
$$7(5) + 7(8) + 7(15) + 7(25) + 7(45) \\ = 686 \text{ Kg.}$$

All Rectangles go over so upper estimate.

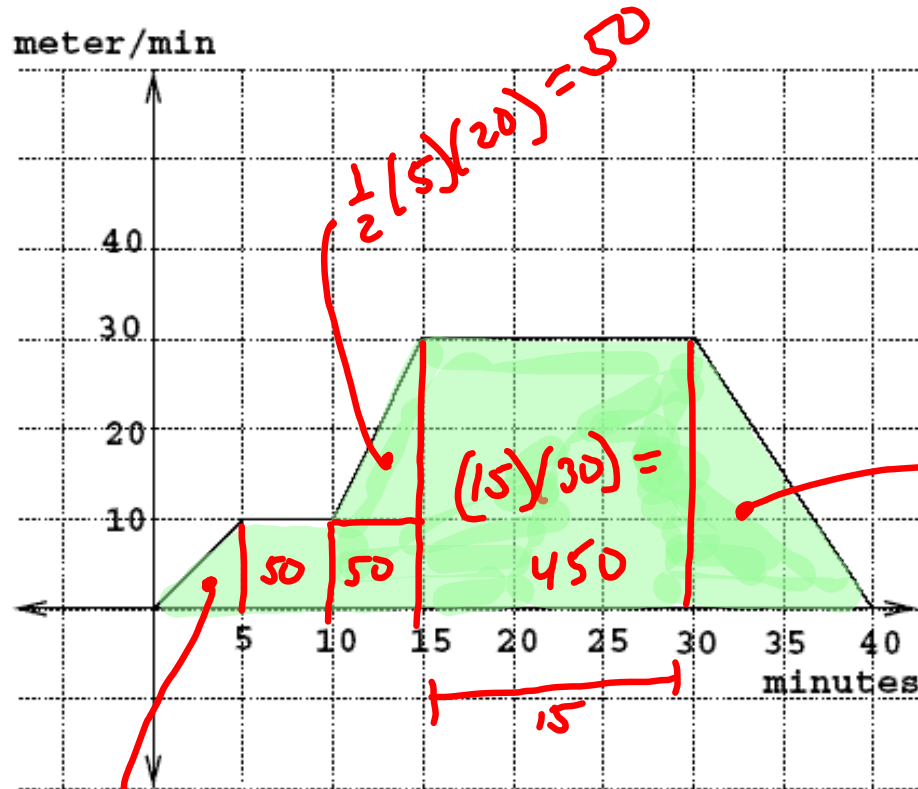
iii. average of the two previous results.

$$\frac{392 + 686}{2} = 539 \text{ Kg}$$

- (b) Which of the estimates is a lower estimate? upper estimate?



2. The function graphed is the speed (meters/minute) of somebody riding a bike. Give the total distance traveled during that 40 minutes.



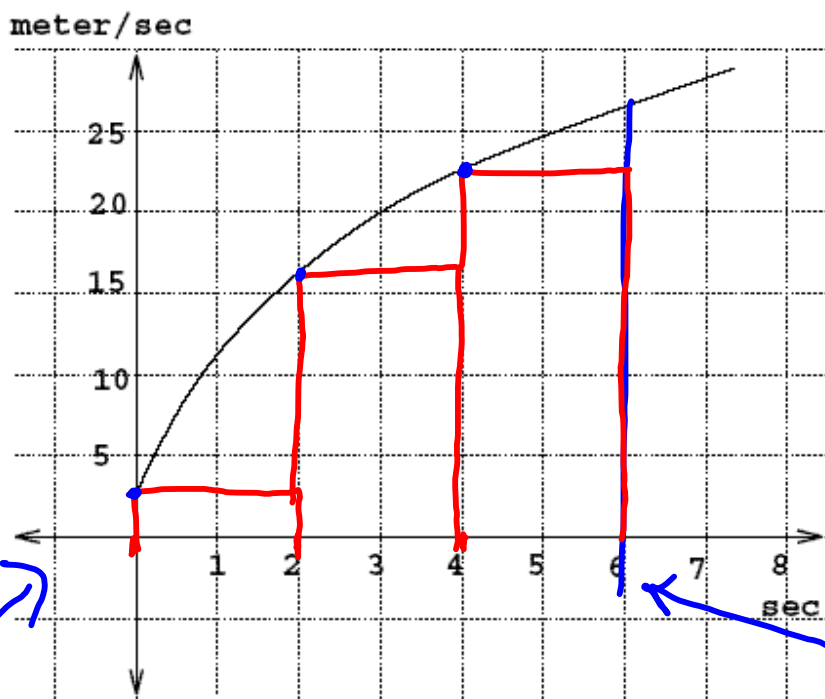
find Area
of shaded
region.

$$\frac{1}{2}(10)(30) = 150$$

$$\frac{1}{2}(5)(10) = 25$$

$$\begin{array}{r}
 25 \\
 50 \\
 50 \\
 50 \\
 50 \\
 450 \\
 150 \\
 \hline
 775 \text{ meters}
 \end{array}$$

3. The graph shows the velocity of an object in meters/sec. Estimate the distance traveled between $t = 0$ and $t = 6$ using the methods listed below.



$$n = 3 \quad \begin{array}{l} a = 0 \\ b = 6 \end{array}$$

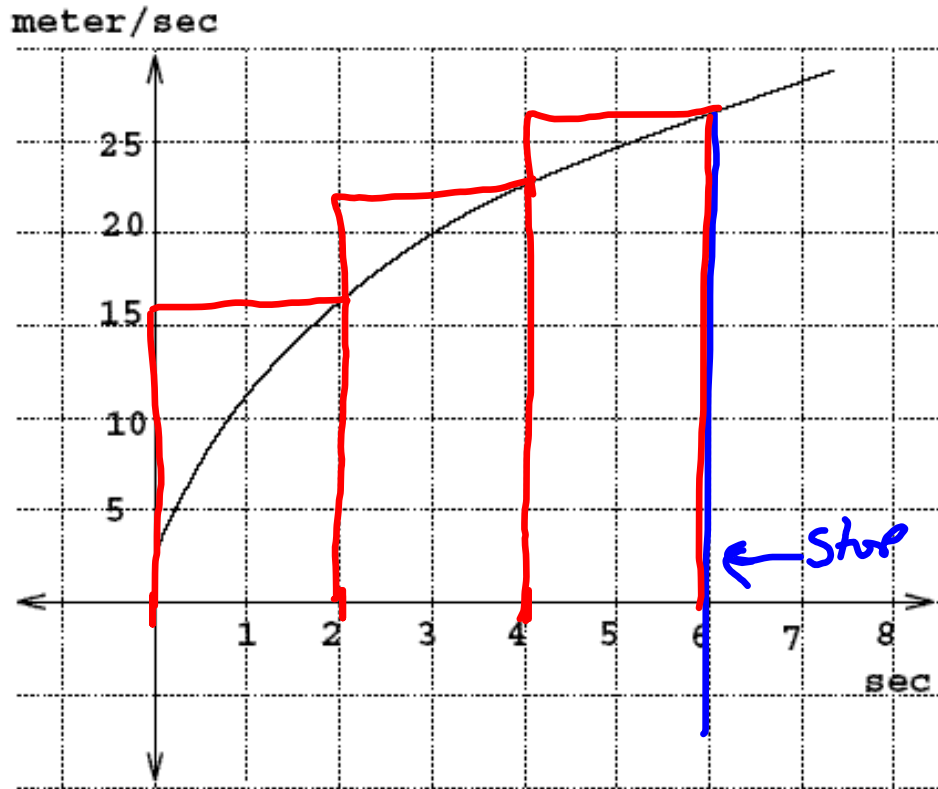
$$\text{base} = \Delta t = \frac{b-a}{n}$$

$$\text{base} = \Delta t = \frac{6-0}{3} = 2$$

(a) left sum with 3 rectangles

$$\text{estimate} = 2(2.5) + 2(16) + 2(22.5) = 82 \text{ meters}$$

t	0	2	4
speed	2.5	16	22.5



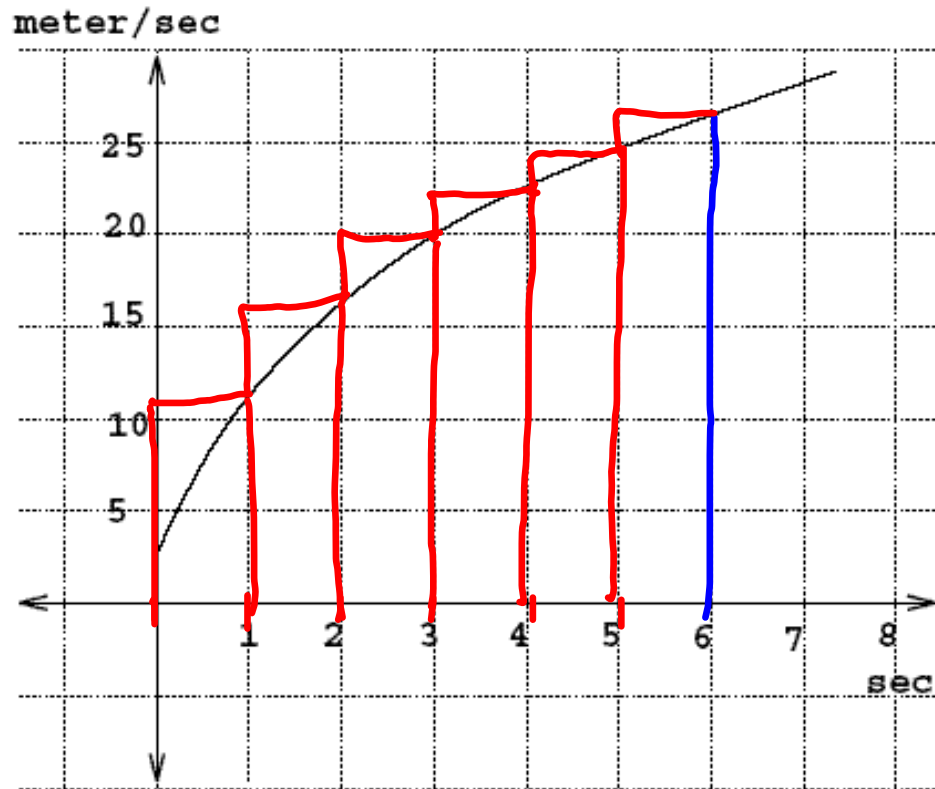
t	2	4	6
Speed	16	22.5	26.5

(b) right sum with 3 rectangles

estimate

$$2(16) + 2(22.5) + 2(26.5) = 130 \text{ meters}$$

(c) right sum with 6 rectangles



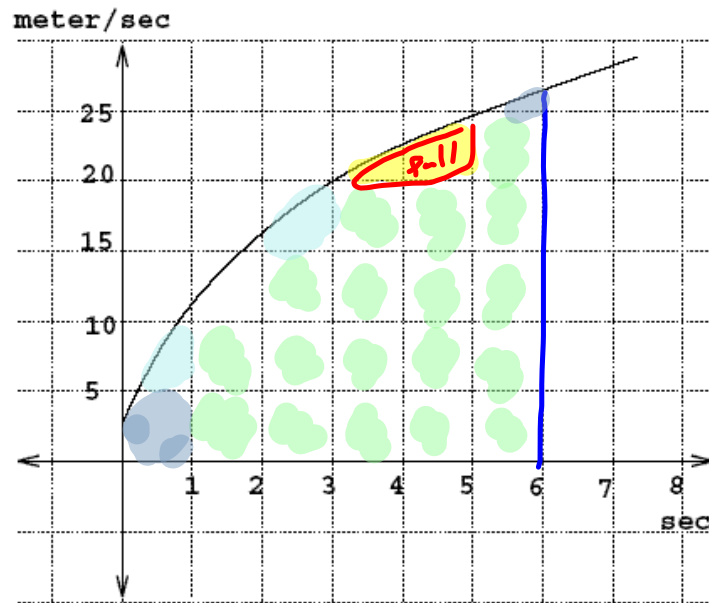
t	2	4	6
Speed	16	22.5	26.5

t	1	3	5
Speed	12	20	24.5

estimate

$$1(12) + 1(16) + 1(20) + 1(22.5) + 1(24.5) + 1(26.5) = 121.5 \text{ meters}$$

(d) by counting rectangles.



Each box on the grid has an area of $(1)(5) = 5$ or distance of 5 meters

full boxes = 18

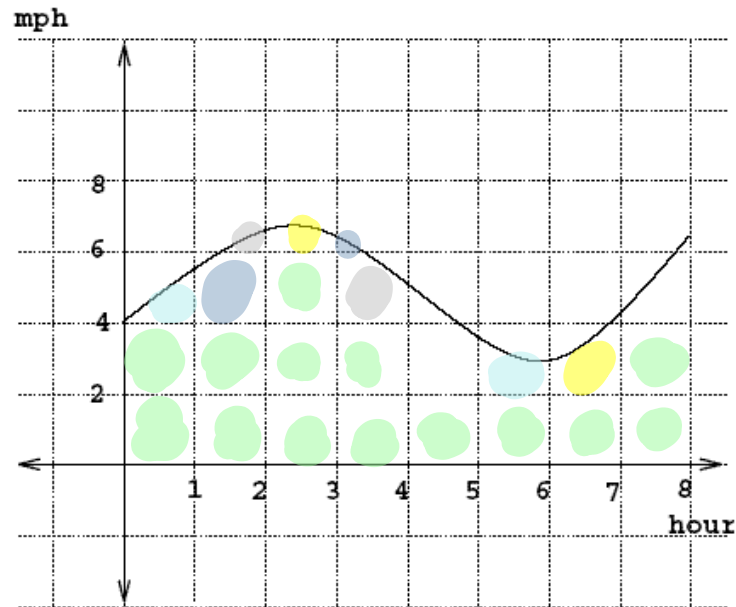
all partial boxes add up to approx 3.7 full boxes.

$$\text{Total boxes} = 18 + 3.7 = 21.5$$

* 5 (meters)

estimator 107.5 meters

4. The graph shows the velocity of an object in mph. Estimate the distance traveled between $t = 0$ and $t = 8$ by counting rectangles



each box
represents 2 miles
 $2(1) = 2$

full boxes = 14
all partial boxes add up to approx 5.8 full boxes.

$$14 + 5.8 = 19.8$$

$$\times 2$$

39.6 miles