

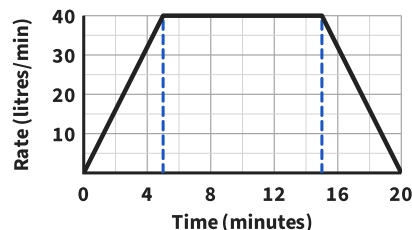
Area Under a Graph *extend*

ANSWERS

1



An empty 550 litre tank fills at this rate. Does it overflow? If so, by how much?



the area is the volume

$$100 + 400 + 100 = 600 \text{ litres}$$

Yes, by 50 litres

Answer

2



A train starts from rest and speeds up at 0.5 m/s^2 until it reaches 20 m/s . It travels at 20 m/s , then slows down at 0.4 m/s^2 until it stops. The journey is 3 km . How long does the journey take?

$$40 \text{ s and } 400 \text{ m, } 50 \text{ s and } 500 \text{ m}$$

$$2100 \div 20 = 105 \text{ s, } 40 + 105 + 50$$

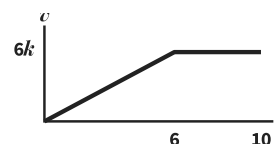
195 s

Answer

3



A car starts from rest and speeds up at $k \text{ m/s}^2$ for 6 seconds. Then it keeps the same speed for 4 seconds. It travels 210 m in the 10 seconds. Find k .



$$\text{top speed } 6k: 18k + 24k = 210$$

$$42k = 210$$

k = 5

Answer

4



A cyclist's velocity is measured at these times. Estimate how far she travels in the 30 seconds.

Time (s)	0	5	10	20	30
Velocity (m/s)	0	8	12	14	15

strips 5, 5, 10 and 10 wide

$$20 + 50 + 130 + 145 = 345$$

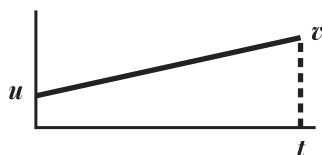
345 m

Answer

5



A car speeds up steadily from $u \text{ m/s}$ to $v \text{ m/s}$ in t seconds. Show that it travels $\frac{1}{2}(u+v)t$ metres, so its average speed is the mean of u and v .



the area is a trapezium

$$\frac{1}{2} \times (u + v) \times t$$

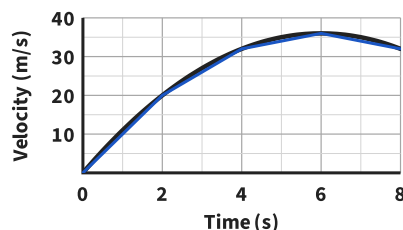
$$\frac{1}{2}(u+v)t \div t = \frac{u+v}{2}$$

Reason

6



Here $v = 12t - t^2 \text{ m/s}$. Use 4 equal strips to estimate the distance in 8 s. Is it an over or underestimate? Why?



$$20 + 52 + 68 + 68 = 208$$

the curve is above the strips

208 m, an underestimate

Answer

7



A cyclist's velocity after t seconds is $v = 4 + 2t \text{ m/s}$. How long does she take to travel 45 m ?

$$\frac{1}{2}(4 + 4 + 2T)T = 45 \Rightarrow 4T + T^2 = 90$$

$$(T+9)(T-5) = 0$$

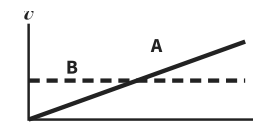
5 s

Answer

8



Car A starts from rest and speeds up steadily. Car B passes it at that moment at a steady $u \text{ m/s}$. Prove that when A catches B, A is going at twice B's speed.



$$\text{acceleration } a: \frac{1}{2}at^2 = ut, \text{ so } t = \frac{2u}{a}$$

$$\text{speed } a \times \frac{2u}{a} = 2u$$

A's speed is 2u

Reason