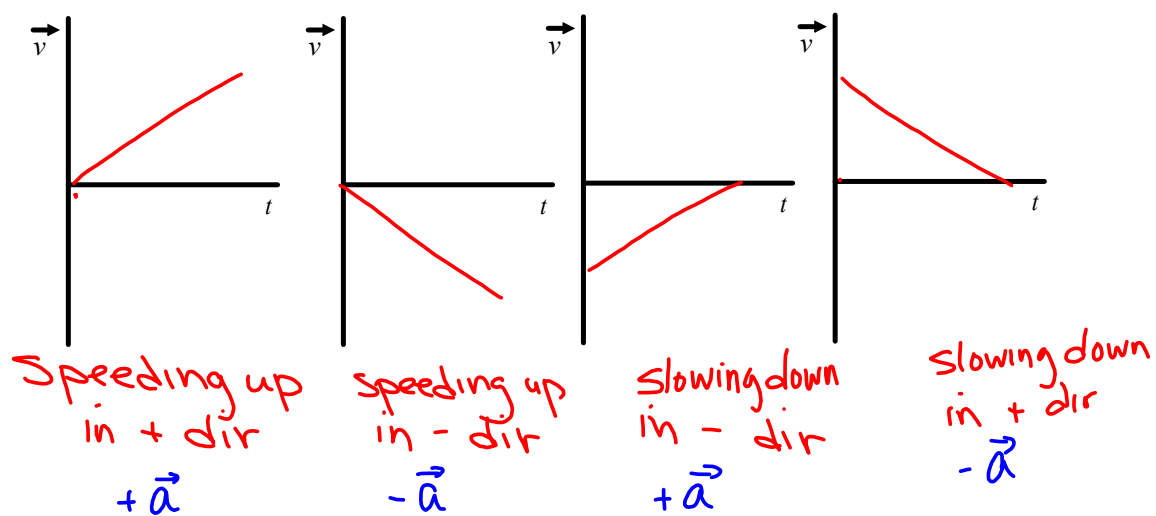
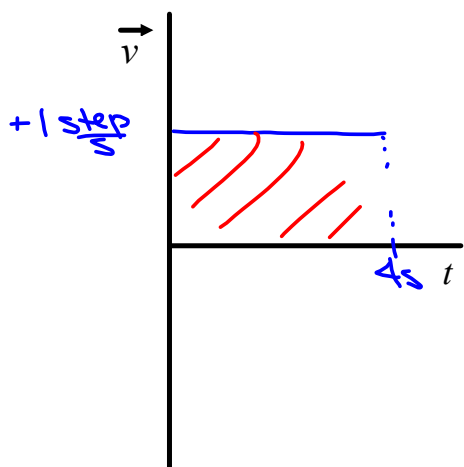


A Little More About Acceleration



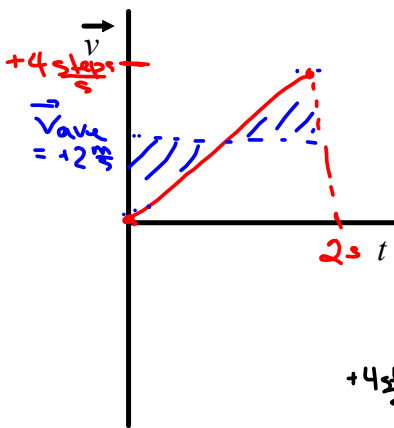
Displacement on a velocity-time graph



$$\begin{aligned}\vec{d} &= \vec{v}_{\text{ave}} t \\ &= (+1 \text{ step/s})(4 \text{ s}) \\ &= +4 \text{ steps}\end{aligned}$$

$$\begin{aligned}A_{\square} &= bh \\ &= (4 \text{ s})(+1 \text{ step/s}) \\ &= +4 \text{ steps} = \vec{d}\end{aligned}$$

What if the line isn't horizontal?

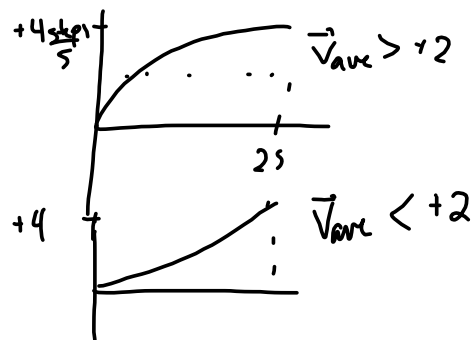


$$\vec{d} = \vec{V}_{ave} t$$

$$= A_{\Delta} = \frac{bh}{2}$$

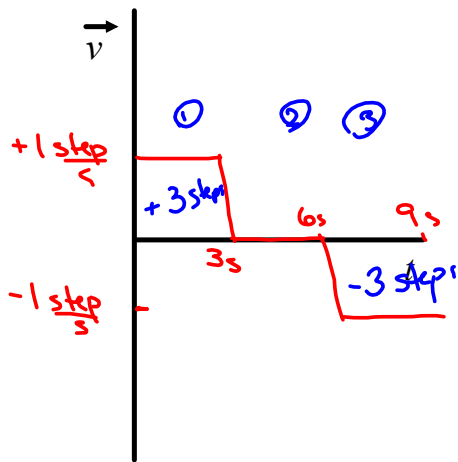
$$= \frac{(2s)(+4 \text{ steps/s})}{2}$$

$$= \underline{\underline{+4 \text{ steps}}}$$



\vec{d} = Area between line and x-axis.

What if there's both + and - velocity?



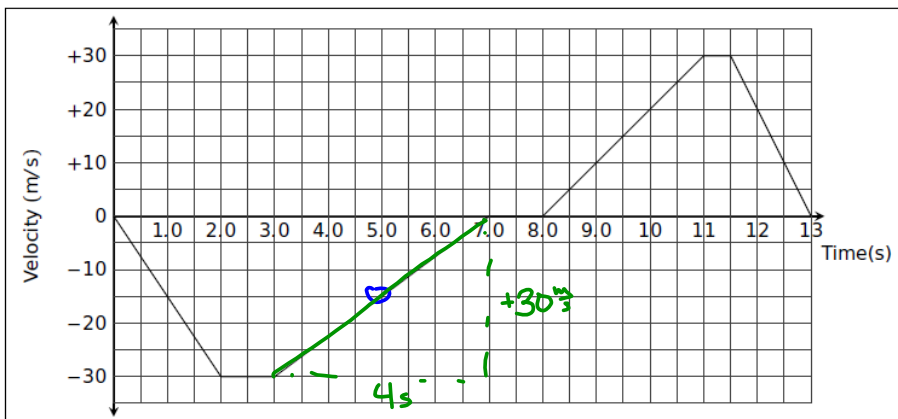
Displacement

$$\begin{aligned}\vec{d} &= A_1 + A_2 + A_3 \\ &= (3s)(+1 \frac{\text{step}}{s}) + \text{☺ steps} + (3s)(-1 \frac{\text{step}}{s}) \\ &= +3 + \text{☺} + (-3) \text{ steps} \\ &= \text{☺ steps}\end{aligned}$$

Distance

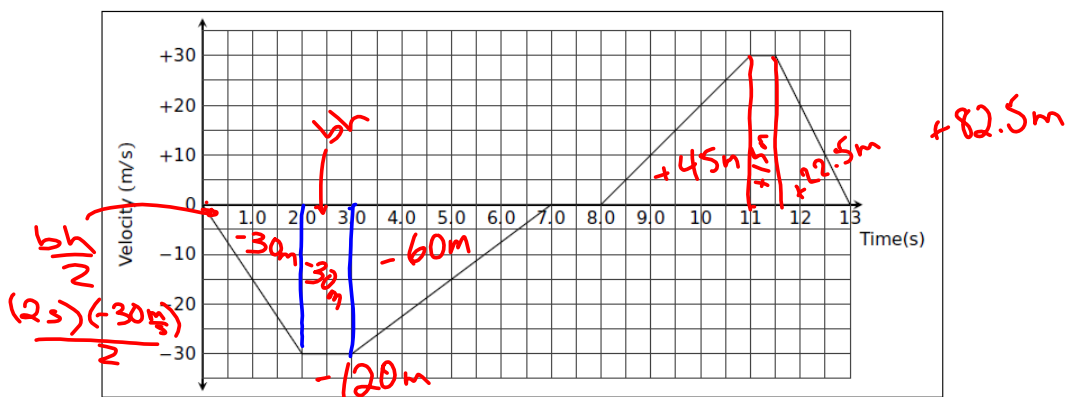
$$\begin{aligned}d &= |A_1| + |A_2| + |A_3| \\ &= |+3| + |\text{☺}| + |-3| \text{ steps} \\ &= 3 + \text{☺} + 3 \text{ steps} \\ &= \underline{\underline{6 \text{ steps}}}\end{aligned}$$

Motion Graph #5 - The following graph indicates the motion of a cart along a East-West path.



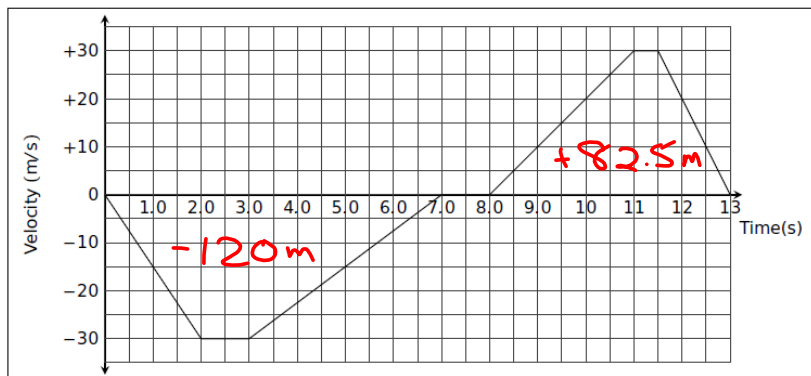
1. What is the cart's maximum velocity? Y-axis up AND down $\pm 30 \text{ m/s}$
2. What is the velocity of the cart at 5.0 s? -15 m/s
3. What is its acceleration at 5.0 s? slope $+7.5 \text{ m/s}^2$
4. When did the cart have constant velocity? slope = \ominus $2-3, 7-8, 11-11.5 \text{ s}$
5. When did it have negative acceleration? \ominus slope $0-2, 11.5-13 \text{ s}$

Motion Graph #5 - The following graph indicates the motion of a cart along a East-West path.



6. When did the cart have negative velocity? y-axis ☺ -7.0 s
7. What was the displacement of the cart at 3.0 s? Area = -30 + (-30)m = -60m
8. What distance had it moved by 7.0 s? Areas ignore signs = |-30| + |-30| + |-60| = 120m
9. When did the cart first start to travel east? 8.0 s
10. What was the cart's total displacement? -120 + 82.5m = -37.5m

Motion Graph #5 - The following graph indicates the motion of a cart along a East-West path.



$$\frac{\text{m}}{\text{s}^2} = \frac{\frac{\text{m}}{\text{s}}}{\text{s}}$$

metres
s per s.

So $+5 \text{ m/s}^2$ means the \vec{v} is changing by $+5 \frac{\text{m}}{\text{s}}$ EACH s.

11. What was the total distance travelled?

$$|-120| + |82.5| = 202.5 \text{ m}$$

12. What was the average velocity in the first 13 s?

$$\vec{v}_{\text{ave}} = \frac{\vec{d}}{t} = \frac{-37.5 \text{ m}}{13 \text{ s}} = -2.9 \text{ m/s}$$

13. What was the average speed in the first 13 s?

$$v_{\text{ave}} = \frac{d}{t} = \frac{202.5 \text{ m}}{13 \text{ s}} = 15.6 \text{ m/s}$$

14. Did the cart ever return to the starting point?

Nope.

Graph #6 is for homework