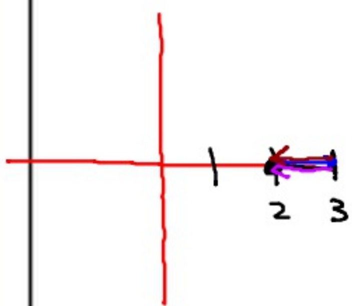
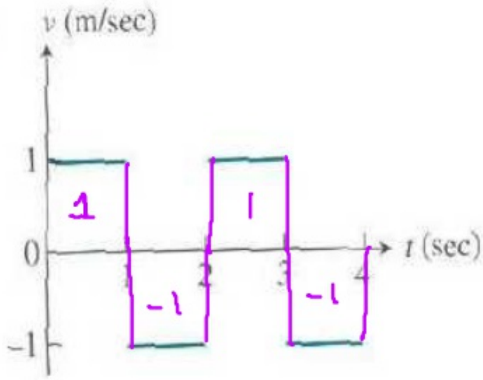
What you'll Learn About

- The integral is a tool that can be used to calculate net change and total accumulation



18.



The graph of the velocity of a particle moving on the x-axis is given. The particle starts at $x = 2$ when $t = 0$

a) Find the particles displacement for the first 4 seconds.

displacement = 0

b) Where is the particle at the end of the trip?

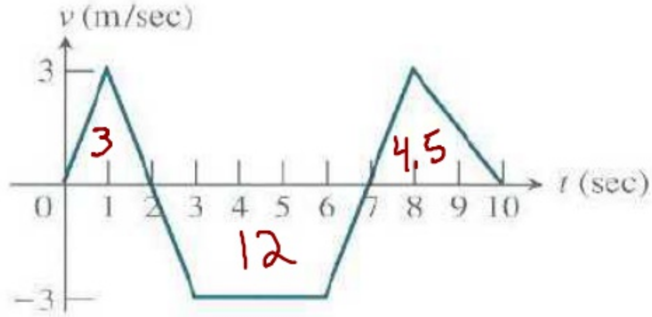
Back where we started

$\xrightarrow{\text{start}} 2 + (\text{displacement}) = 2 + 0 = 2$

c) Find the total distance traveled by the particle.

$1 + |-1| + 1 + |-1| = 4$

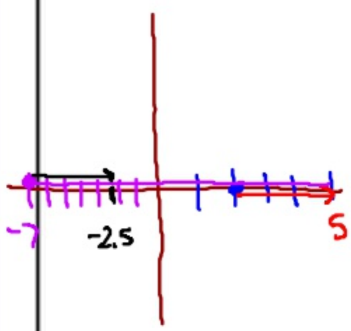
20.



The graph of the velocity of a particle moving on the x-axis is given. The particle starts at x = 2 when t = 0.

a) Find the particles displacement for the first ~~x~~ 10 seconds.

change in position: $3 - 12 + 4.5 = -4.5$



b) Where is the particle at the end of the trip?

Start + displacement

$2 + (-4.5) = -2.5$

c) Find the total distance traveled by the particle.

$3 + |-12| + 4.5 = 19.5$

* Use starting point only when you need to find position (where you are at)

* Total Distance / Displacement

– Don't use starting point

The function $v(t) = 16 - 4t$ is the velocity in m/sec of a particle moving along the x-axis from [0, 6].

a) Determine when the particle is stopped and when the particle is moving to the right and left.

stopped: $v(t) = 0$

$16 - 4t = 0$

$t = 4$

$v(1) = 12 > 0$ right from $(0, 4)$

$v(5) = -4 < 0$ left from $(4, 6)$

b) Find the particle's displacement for the given time interval.

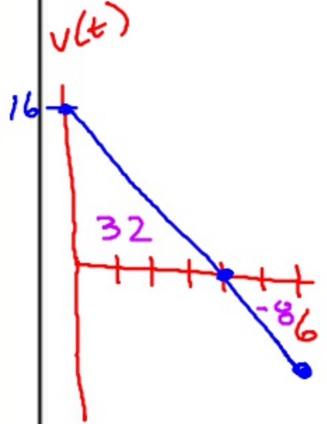
$$\int v(t)\,dt = \int_0^6 16 - 4t\,dt = 16t - 2t^2\Big]_0^6$$

$$\left[16(6) - 2(6)^2\right] - \left[0\right]$$

$$96 - 72 = 24$$

c) If $s(0) = 3$, what is the particle's final position?

$$3 + \int_0^6 16 - 4t\,dt = 3 + 24 = 27$$

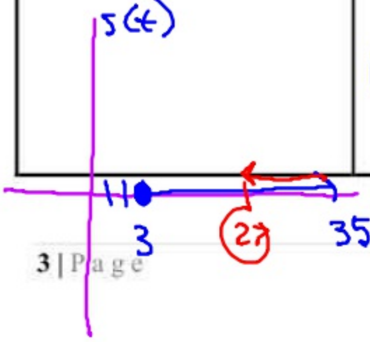


d) Find the total distance traveled by the particle.

$$\int_0^4 16 - 4t\,dt + \int_4^6 |16 - 4t|\,dt$$

$$16t - 2t^2\Big]_0^4 + \left|16t - 2t^2\right|_4^6$$

$$(64 - 32) - (0 - 0) + \left|(96 - 72) - (64 - 32)\right|$$



$$32 + \left|24 - 32\right|$$

$$32 + 8 = 40 \text{ meters}$$

$s(t)=\frac{1}{3}t^3-2t^2+3t$	The function $v(t) = t^2 - 4t + 3$ is the velocity in m/sec of a particle moving along the x-axis from [0, 5]. a) Determine when the particle is stopped and when the particle is moving to the right and left. $0 = t^2 - 4t + 3$ $0 = (t-3)(t-1)$ $t = 3 \quad t = 1$ $v(0) = 3 > 0 \quad s(t)$ right $(0,1)$ $v(2) = -1 < 0 \quad s(t)$ left $(1,3)$ $v(4) = 3 > 0 \quad s(t)$ right $(3,5)$ b) Find the particle's displacement for the given time interval. $\int v(t) = \int_0^5 t^2-4t+3 = \frac{1}{3}t^3-2t^2+3t\Big]_0^5$ $\frac{1}{3}(5)^3-2(5)^2+3(5)$ c) If s(0) = 4, what is the particle's final position? $4+\int_0^5 v(t) = 4+\left[\frac{1}{3}(5)^3-2(5)^2+3(5)\right]$ d) Find the total distance traveled by the particle. $\int_0^1 v(t)\,dt + \int_1^3 \lvert v(t)\rvert\,dt + \int_3^5 v(t)\,dt$ $\frac{1}{3}t^3-2t^2+3t\Big]_0^1 + \left\lvert \frac{1}{3}t^3-2t^2+3t \right\rvert_1^3 + \frac{1}{3}t^3-2t^2+3t\Big]_3^5$ $\left(\frac{1}{3}-2+3\right)-(0-0)+\left\lvert(9-18+9)-\left(\frac{1}{3}-2+3\right)\right\rvert+\left(\frac{1}{3}(5)^3-2(5)^2+3(5)-0\right)$