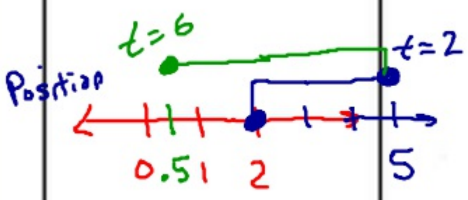
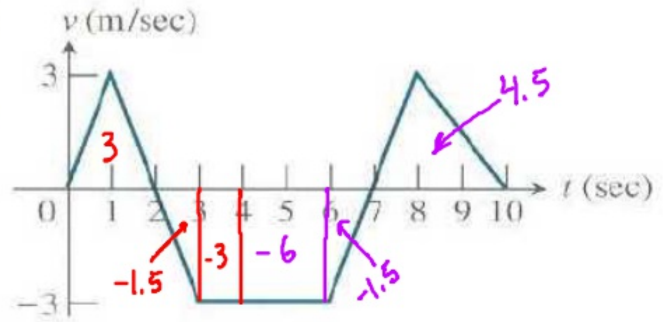
What you'll Learn About

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



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.

t x
(0, 2)
(4, .5)

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

Displacement: change in position
Final − Start

starting point does not matter

$3 + (-4.5) = -1.5$

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

$x(10) = 2 + 3 + (-12) + 4.5$

$\boxed{x(10) = -2.5}$

Final Position = Starting Point + Displacement

$\boxed{\text{starting pt does matter}}$ $x(4) = 2 + (3 + (-4.5)) = .5$

c) Find the total distance traveled by the particle.

Total Distance $= |v(t)| = 3 + |-12| + 4.5$

$= 19.5$

$\boxed{\text{starting point does not matter}}$

No Calculutor

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: $v(t) = 0$

$16 - 4t = 0$

$16 = 4t$

$4 = t$

0 4 6

$v(1) = 16 - 4 = 12 > 0$ right $[0, 4)$

$v(5) = 16 - 20 = -4 < 0$ left $(4, 6]$

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

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

$(96 - 72) - (0 - 0)$

24 meters

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

Starting pt + displacement

$3 + \int_0^6 v(t)dt = 3 + 24 = 27$ meters

d) Find the total distance traveled by the particle.

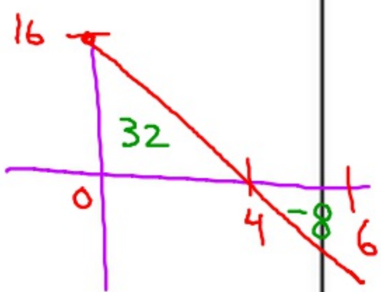
stopped left/right

$\int_0^6 |v(t)|dt = \int_0^4 (16 - 4t)dt + \left|\int_4^6 (16 - 4t)\, dt\right|$

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

$= (64 - 32) + |(96 - 72) - (64 - 32)|$

$= 32 + |24 - 32|$



$= 40$ meters