



## Calculus AB: section 5.5 (Net or Total Change as the Integral of a Rate)

### Example 1

At 7 am, water begins leaking from a tank at a rate of  $2 + 0.25t$  gal/hour ( $t$  is the number of hours after 7 am). How much water is lost between 9 and 11 am?

$$\int_2^4 (2 + 0.25t) dt = 2t + \frac{1}{8}t^2 \Big|_2^4$$

$$= 2(4) + \frac{1}{8}(4)^2 - \left(2 \cdot 2 + \frac{1}{8} \cdot 2^2\right)$$

$$= 8 + 2 - \left(4 + \frac{1}{2}\right) = 10 - 4.5 = 5.5 \text{ gallons}$$

---

if calculator active:

$$\int_2^4 (2 + 0.25t) dt = 5.5 \text{ gallons}$$

### Example 2

The rate of snowfall (in/hr) during a 6-hour storm is given by

$\frac{ds}{dt} = 2 \sin \frac{\pi}{6} t$ . How much snow falls during the storm?

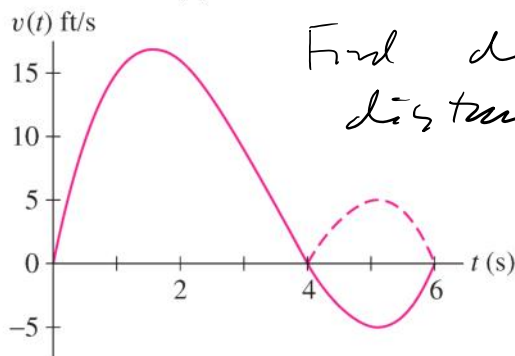
$$2 \int_0^6 \sin \frac{\pi}{6} t \, dt = 2 \cdot \frac{6}{\pi} \cdot -\cos \frac{\pi}{6} t \Big|_0^6$$
$$\frac{12}{\pi} \cdot -(\cos \pi - \cos 0) = -\frac{12}{\pi} (-1 - 1) = \frac{24}{\pi}$$

inches

335 : 29-34, 37, 39

### Example 3

The velocity of a particle is  $v(t) = t^3 - 10t^2 + 24t$  ft/s. (Figure 2)



Find displacement + distance traveled on  $(0, 6)$

**FIGURE 2** Graph of  $v(t) = t^3 - 10t^2 + 24t$ . Over  $[4, 6]$ , the broken curve is the graph of  $|v(t)|$ .

$$\text{displacement} = \int_0^6 v(t) dt$$

$$\text{distance traveled} = \int_0^6 |v(t)| dt$$

without a calculator? or  $\int_0^4 v(t) dt + \left| \int_4^6 v(t) dt \right|$

$$\int_0^4 v(t) dt - \int_4^6 v(t) dt$$

Compute the

a) Displacement over  $[0, 4]$ ,  $[4, 6]$  and  $[0, 6]$

b) Total distance traveled over  $[0, 6]$

Example 4

The marginal cost of producing  $x$  computer chips (in units of 1000) is

$$C'(x) = 150x^2 - 3,000x + 17,500 \text{ (dollars per thousand chips).}$$

a) Find the cost of increasing production from 10,000 to 15,000 chips.

$$C(15,000) - C(10,000) = \int_{10}^{15} (150x^2 - 3000x + 17,500) dx$$

$$341,100$$

b) Determine the total cost of producing 15,000 chips, assuming that  $C(0) = 35,000$  (in other words, it costs \$35,000 to set up the manufacturing run)

Tuesday, December 4, 2018

10:08 AM

(34)

$$\frac{d}{dx}$$

$$\int_x^{x^4} x^2$$