Calculus Worksheet #3 Unit 4 Selected Solutions

This is the key relationship between the three functions, where s represents position, v represents velocity, and a represents acceleration. If s = f(t) , then v = f '(t) and a = f ''(t).

3. The velocity at time t of a particle moving on a straight line is $v = t^2 - 2$ (fps) where $t \geq 0$.

a. Express the acceleration, a, of the particle as a function of t. $a = 2t$

$$\text{Given: } v = f'(t) = t^2 - 2t.$$

$$a = f''(t) = 2t$$

b. Find the acceleration of the particle when t = 6 s.

$$\text{When } t = 6 \text{ s, } a = f''(6) = 2(6) = 12$$

When t = 6 s, the acceleration is 12 feet per second per second.

c. If s is the distance that the particle is from its starting point, then express s as a function of t.

$$\text{Given: } v = f'(t) = t^2 - 2$$

$$s = f(t) = \int (t^2 - 2)dt$$

$$s = f(t) = \frac{1}{3}t^3 - 2t + C$$

Since s is the distance from starting position, f(0) = 0! Therefore C = 0.

$$s = f(t) = \frac{1}{3}t^3 - 2t$$

d. How far does the particle move from t = 3s to t = 4s?

When t = 3s, s = f(3) = 3 feet. When t = 4s, s = f(4) = 40/3 feet. Since v > 0 during the entire time interval, (This is important !!) the particle is moving in the same direction for the entire interval. Therefore the distance moved is f(4) – f(3) = 40/3 – 3.

The particle moved $10\frac{1}{3}$ feet from t = 3s to t = 4s.