Rectilinear Motion HW Answers

1. $\frac{dA}{dt} = \frac{2t+1}{2\sqrt{t}} + 2\sqrt{t} \;\; cm^2/s$

2. $\frac{dV}{dt} = \frac{\pi}{2}\left(\frac{3t+2}{2\sqrt{t}}\right) \; in^3/s$

3. $\frac{dC}{dx} = 100\left(\frac{-400}{x^3} + \frac{30}{(x+30)^2}\right) \; dollars/order$
    a. at x=10, -38.13 $dollars/order$
    b. at x=15, -10.37 $dollars/order$
    c. at x=20, -3.80 $dollars/order$

    As the order size increases the cost per order decreases.

4.
    a. Average Velocity = $\frac{1}{2}$
    b. $v(1) = 1,\; v(2) = \frac{1}{4}$
    c. Speed at x=1 is 1, Speed at x=2 is $\frac{1}{4}$

5.
    a. Average Velocity = $\frac{3}{\pi}$
    b. $v(0) = 1,\; v\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$
    c. Speed at x=0 is 1, Speed at x= $\frac{\pi}{6}$ is $\frac{\sqrt{3}}{2}$

6.
    a. $v(t) = 20t^3 - 8t + 3$
    b. $v(0) = 3$
    c. $a(t) = 60t^2 - 8$
    d. $a(0) = -8$

7.
    a. $v(t) = \frac{-3}{5t^2}$
    b. $v(2) = \frac{-3}{20}$
    c. $a(t) = \frac{6}{5t^3}$
    d. $a(2) = \frac{6}{40}$

8.

a. Moving right on (2, ∞) because $v(t) > 0$
b. Moving Left on (0, 2) because $v(t) < 0$

9.

a. Moving right on (0, 1) because $v(t) > 0$
b. Moving Left on (1, ∞) because $v(t) < 0$

10.

a. t =1 hr
b. $s(1) = \frac{1}{12}$ miles

11.

a. t = $\frac{1}{12}$hr
b. $s\left(\frac{1}{12}\right) = -3\sqrt{12} - \frac{\sqrt{12}}{12}$ miles

12.

a. $v(t) = -2\pi t \sin\left(\frac{\pi}{2}t^2\right)$
b. $a(t) = -2\pi^2 t^2 \cos\left(\frac{\pi}{2}t^2\right) - 2\pi \sin\left(\frac{\pi}{2}t^2\right)$
c. Average Velocity = 0
d. The ant is moving right on (-1, 0) because $v(t) > 0$
e. The particle changes directions at t=0 because $v(t)$ changes signs there.

13.

a. $v(t) = 3\pi t\left(1 - \cos\left(\frac{3}{2}\pi t^2\right)\right)$
b. $a(t) = 3\pi + 9\pi^2 t^2 \sin\left(\frac{3}{2}\pi t^2\right) - 3\pi \cos\left(\frac{3}{2}\pi t^2\right)$
c. t = $0, \sqrt{\frac{4}{3}}, \sqrt{\frac{8}{3}}$
d. $x(0) = 0$, $x\left(\sqrt{\frac{4}{3}}\right) = 2\pi$, $x\left(\sqrt{\frac{8}{3}}\right) = 4\pi$