Calculus Story Problems Set #3 Answers

(47) a) $D'(p) = \lim_{h\to 0} \frac{-2(p+h)^2 - 4(p+h) + 300 - (-2p^2 - 4p + 300)}{h}$

$= \lim_{h\to 0} \frac{-2p^2 - 4ph - 2h^2 - 4p - 4h + 300 + 2p^2 + 4p - 300}{h}$

$= \lim_{h\to 0} -4p - 2h - 4 \rightarrow \boxed{D'(p) = -4p - 4}$

b) $D'(10) = -4(10) - 4 = \boxed{-44}$

The demand decreases by 44 when the price is \$10.

(54) a) $\lim_{h\to 0} \frac{I(5+h) - I(5)}{h} = \lim_{h\to 0} \frac{27 + 72(5+h) - 1.5(5+h)^2 - (27 + 72(5) - 1.5(5^2))}{h}$

$\lim_{h\to 0} \frac{27 + 360 + 72h - 37.5 - 15h - 1.5h^2 - 27 - 360 + 37.5}{h} = \lim_{h\to 0} \frac{57h - 1.5h^2}{h}$

$= \boxed{57 \text{ grams/minute}}$

b) $\lim_{h\to 0} \frac{27 + 72(24+h) - 1.5(24+h)^2 - (27 + 72(24) - 1.5(24^2))}{h}$

$= \lim_{h\to 0} \frac{27 + 1728 + 72h - 864 - 72h - 1.5h^2 - 27 - 1728 + 864}{h} = \lim_{h\to 0} -1.5h = \boxed{0}$

c) Not useful after 24 minutes. Can you eat for 24 straight minutes? $0 < t < 24$

(55) a) $150 = .0312443v^2 - 101.39v + 82264$

$0 = .0312443v^2 - 101.39v + 82114$

$V = \frac{101.39 \pm \sqrt{(-101.39)^2 - 4(.0312443)(82114)}}{2(.0312443)}$

$\boxed{V = 1689.585 \frac{m}{s}}$ & ~~1550.48~~ $\frac{m}{s}$ $v \geq 1620$

b) $\lim_{h\to 0} \frac{.0312443(1700+h)^2 - 101.39(1700+h) + 82264 - (.0312443v^2 - 101.39v + 82264)}{h}$ (1700 under v^2, 1700 under v)

$\lim_{h\to 0} \frac{90296.027 + 106.23062h + .0312443h^2 - 17363 - 101.39h + 82264 - 90296.027 + 17363 - 82264}{h}$

$\lim_{h\to 0} 4.84062 + .0312443h = 4.84062 \approx \boxed{5 \text{ Days}}$

(56) 1st point

$m \approx -\frac{4}{1000}$

Temp. drops 4°C for every 1000 Ft altitude.

2nd point

$m \approx \frac{11}{2000}$

Temp increases 11°C for every 2000' altitude

3rd point

$m \approx \frac{-4}{4000} \approx \frac{-1}{1000}$

Temp. drops 1°C for every 1000' altitude

(57) a) $\approx$ 45-46 min. $\left(\frac{3}{4}\text{ hr}\right)$ & 3 Hr

b) $T'(.5) \approx 1200\,°F/_{Hr}$ - oven is heating up by 1200°F per hour

c) $T'(2) \approx 0\,°F/_{Hr}$ - Oven doesn't change temp

d) $T'(3.5) \approx -1200\,°F/_{Hr}$ - Oven is cooling down by 1200°F per Hr

(58) 24 oz

$m_{Tangent} \approx \frac{40}{9}\frac{Ft}{oz} \approx 4.5\frac{ft}{oz}$ Ball travels 4.5' further per oz

5 / oz

$m_{Tangent}$ is just shy of zero on the negative side, meaning you are losing some distance per oz.

(59) At this point, the hands are moving there fastest. This is where the bat is accelerating the most (slope of tangent $\frac{mph}{sec}$ is the steepest)