Assignment 7 (SOLUTION from Textbook Manual Solution)

Text: *Calculus for the Life Sciences, S. Schreiber, K. Smith and W. Getz, Wiley, 2014*

Section 3.6

1. $f'(x) = e^{-x} - xe^{-x} = (1-x)e^{-x}$, thus $f''(x) = (-1)e^{-x} - (1-x)e^{-x} = (x-2)e^{-x}$.

11. $f(w) = (1+w)^{-1}$, so we get $f'(w) = (-1)(1+w)^{-2}$ and $f''(w) = 2(1+w)^{-3}$.

27. $f'(x) = e^{-x} - xe^{-x} = (1-x)e^{-x}$, and $f''(x) = -e^{-x} - (1-x)e^{-x} = (x-2)e^{-x}$. Now $f'(x) = 0$ when $x = 1$; checking the sign of f' gives that f is increasing on $(-\infty, 1)$, and decreasing on $(1, \infty)$. $f''(x) = (x-2)e^{-x}$, thus f is concave down on $(-\infty, 2)$ and concave up on $(2, \infty)$. The inflection point is at $x = 2$.

29. $f'(x) = (1+x-x)/(1+x)^2 = 1/(1+x)^2$, $f''(x) = -2/(1+x)^3$. The function is not defined at $x = -1$. Now $f'(x) \neq 0$; checking the sign of f' gives that f is increasing on $(-\infty, -1)$ and $(-1, \infty)$. Also, $f''(x) = -2/(1+x)^3$, thus f is concave up on $(-\infty, -1)$ and concave down on $(-1, \infty)$. There is no inflection point.

48. If the function is prices, then the derivative is positive (they are rising), but the second derivative would be smaller if the law is passed.

49. a. It seems the function is concave up on $(1980, 1987)$ and concave down on $(1987, 1995)$.

b. It means that the spread of the epidemic is slowing.

Section 4.2

6. $f'(x) = 6 - 2x$, thus the only critical point is at $x = 3$; $f' > 0$ for $x < 3$ and $f' < 0$ for $x > 3$, thus $f(x)$ has a local (and global) maximum at $x = 3$.

7. $f'(t) = 2te^{-t} - t^2e^{-t} = t(2-t)e^{-t}$. The critical points are $t = 0$ and $t = 2$. $f' < 0$ for $t < 0$ and $t > 2$ and $f' > 0$ for $0 < t < 2$. Thus $t = 0$ is a local minimum and $t = 2$ is a local maximum.

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12. $y' = (2t-2)e^{t^2-2t+1}$. The only critical point is $t = 1$. $y' < 0$ when $t < 1$ and $y' > 0$ when $t > 1$. Thus $t = 1$ is a local minimum.

13. $y' = -12 - 9x + 3x^2 = 3(x+1)(x-4)$. The critical points are at $x = -1$ and $x = 4$. $y'' = -9 + 6x$; $y''(-1) = -15$ and $y''(4) = 15$ thus $x = -1$ is a local maximum and $x = 4$ is a local minimum.