**Name:**
**Homework 5 solutions**
**Math 151, Applied Calculus, Spring 2016**

**Section 3.1 – 10,11,17,23,26,28,43,48,51,60,63,65**

10. $f'(x) = -4x^5$.

11. $y' = 18x^2 + 8x - 2$

17. $f'(z) = 6.1z^{-7.1}$

23. $\dfrac{dz}{dt} = 2t$

26. $y' = 15t^4 - \dfrac{5}{2}t^{-1/2} - \dfrac{7}{t^2}$

28. $y' = 6t - \dfrac{6}{t^{3/2}} + \dfrac{2}{t^3}$

43. $f(5) = 625cm$, $f'(5) = -30cm/year$ In the year 2010, the sand dune will be 625 cm high and eroding at a rate of $30cm/year$.

48. $f(10) = 400$ tons. $f'(10) = 60tons/year$ then Relative rate of change = 15% per year. In 2010, there were 400 tons of waste at the site. The quantity was growing at a rate of 15% per year.

51. The equation of the tangent is $y = -4 - x$.

60. The marginal cost of producing the $25^{th}$ item is $C'(24)$. $C'(q) = 4q$ so this means that the marginal cost is \$96.

63. (a) 770 bushels per acre.
    (b) 40 bushels per acre per pound of fertilizer.
    (c) More should be used, because at the level of use, more fertilizer will result in a higher yield.

65. (a) Marginal cost function $C'(q) = 0.24q^2 + 75$.
    (b) $C(50)$ is the cost of producing 50 items. $C'(50) = 675$ is the approximate change to produce one more item, also known as the Marginal cost.

**Section 3.2 – 1,6,7,15,18,31,39,41,47,49,52**

1. $P'(t) = 9t^2 = 2e^t$

6. $\dfrac{dy}{dx} = (\ln 2)2^x - 6x^{-4}$

7. $\dfrac{dy}{dx} = 4\ln 10)10^x - 3x^2$

15. $\dfrac{dP}{dt} = 200(0.12)e^{0.12t}$

18. $P'(t) = 3000(ln(1.02))(1.02)^t$

31. $\dfrac{f'(t)}{f(t)} = -7$.

39. (a) $P(12) = 10e^{7.2}$
    (b) $P'(12) = 6e^{0.6(12)}$

41. $f(2) = 6065$, $f'(2) = -1516$. Thus, at a price of \$2, a \$1 increase in price results in a decrease in quantity sold of 1516 units.

47. $c = -\dfrac{1}{\ln 2}$

49. $C(50) = 1000 + 30e^{2.5}$, $C'(50) = 1.5e^{2.5}$. These are the cost of producing 50 units and the Marginal cost, respectively.

52. The US population is growing faster. To show this set up the equations describing the population of each country and take the derivative. Mexico should have a rate of 1.247 million people per year and the U.S should have a rate of 2.979 million people per year.

**Section 3.3 – 2,8,13,18,24,35,36,50**

2. $g'(x) = 7(4x^2 + 1)^6 \cdot 8x$.

8. $y' = \dfrac{3s^2}{2\sqrt{s^3 + 1}}$

13. $y' = \dfrac{5}{5t + 1}$

18. $f'(x) = \dfrac{1}{1 - e^{-x}}(-e^{-x})(-1)$

24. $y' = \dfrac{e^x}{2\sqrt{e^x + 1}}$

35. Class example. See notes.

36. $MR = 2000q \cdot \dfrac{1}{1 + 1000q^2}$ When $q = 10$, Marginal Revenue $= 0.2\$/unit$.

50. (a) $10(1.14)^4$ dollars per hour.
    (b) Wages without additional education $= 10e^{0.035(20)} = 20.14$ dollars per hour.
    Wages with additional education $= 16.89e^{0.035(20)} = 34.01$ dollars per hour.
    The difference is \$13.87
    (c) The difference has increased. Difference $= 16.89e^{0.035t} - 10e^{0.035t} = 6.89e^{0.035t}$. The rate of change of the difference is $0.241e^{0.035t}$ dollars per hour per year.

**Section 3.4 – 5,9,13,19,23,29,36,38,40,42**

5. $2t(3t + 1)^3 + 9t^2(3t + 1)^2$.

9. $y' = (3t^2 - 14t)e^t + (t^3 - 7t^2 + 1)e^t$

13. $f'(x) = 1 - \dfrac{3}{x^2}$

19. $f'(w) = 2we^{w^2}(5w^2 + 8)$

23. $\dfrac{dz}{dt} = \dfrac{-2}{(1+t)^2}$

29. $f'(x) = (ax)(e^{-bx}(-b)) + (a)(e^{-bx})$

36. $f'(1) = 100e^{-0.5} - 50e^{-0.5}$ and $f'(5) = 100e^{-2.5} - 250e^{-2.5}$.

38. (a) $q(10) = 5000e^{-0.8}$

    (b) $q'(10) = -400e^{-0.8} \approx -180$. This means that at a price of \$10, a \$1.00 increase in price will result in a decrease in quantity demanded by 180 units.

40. (a) $R(p) = p \cdot 1000e^{-0.02p}$

    (b) $R'(p) = 1000e^{-0.02p} + 1000pe^{-0.02p}(-0.02)$

    (c) $R(10) = 10,000e^{-0.2}$, $R'(10) = e^{-0.2}(1000 - 20)$. They each represent the revenue when the product is sold for \$10 and the Marginal Revenue when the price increases by a dollar, respectively.

42. (a) $f(140) = 15,000$, $f'(140) = -100$. These represent the number of skateboards sold when the price is \$140 and the decrease in the boards resulting from an increase in price of \$1.00.

    (b) $R'(p) = f(p) + pf'(p)$ therefore $\dfrac{dR}{dp}\Big|_{p=140} = R'(140) = f(140) + 140f'(140) = 1000$.

    (c) From (c) we see that Revenue will increase by about \$1000 if the price is raised by 1.