

Math 121 HW #6

Due: Apr. 6

Chapter 11.1

24. Find an equation of the tangent line to the curve $y = 3x^2 - 4$ at the point $(1, -1)$.

27. Find an equation of the tangent line to the curve

$$y = \frac{3}{x-1}$$

at $x = 2$.

Chapter 11.2

84. Find an equation of the tangent line to the curve

$$y = \frac{\sqrt{x}(2-x^2)}{x}$$

when $x = 4$.

85. Find all points on the curve $y = \frac{5}{2}x^2 - x^3$ where the tangent line is horizontal (i.e. $y' = 0$).

89. If $f(x) = \sqrt{x} + x^{-1/2}$, evaluate the expression

$$\frac{x-1}{2x\sqrt{x}} - f'(x)$$

Chapter 11.3

10. Find the rate of change of the area of a disc, with respect to its radius r , when $r = 3$. The area A of a disc is given by $A(r) = \pi r^2$.

Chapter 11.4

58. The position of a baseball hit by a batter follows the function

$$s = \frac{t+3}{t^2+7}$$

where t is in seconds and s is in meters. The velocity of an object is defined as the derivative of its position function. Find the positive values of t for which the velocity of the object is 0.

73. A host-parasite relationship can be described as

$$y = \frac{900x}{10+45x}$$

where x is the host density and y is the parasite density. At what rate is the density of parasites changing when the host density is $x = 2$?

Chapter 11.5

Apply the chain rule to these problems to find $y'(x) = f'(g(x))g'(x)$ where you are already given the composite functions $y(x) = f(g(x))$:

1. $f(x) = x^2 - 2x$, $g(x) = x^2 - x$
2. $f(x) = 2x^3 - 8x$, $g(x) = 7x - x^3$
4. $f(x) = x^{1/4}$, $g(x) = x^5 - x^4 + 3$

Find the derivative of these functions

9. $y = (3x+2)^6$
13. $y = (3+2x^3)^{100}$
16. $y = (2x^3 - 8x)^{-12}$
24. $y = 7(x^5 - 3)^{5/3}$

40. $y = (3x + 2)^5(4x - 5)^2$

43.

$$\sqrt{\frac{x-2}{x+3}}$$

45.

$$\frac{2x-5}{(x^2+4)^3}$$

51.

$$y = 8t + \frac{t-1}{t+4} - \left(\frac{8t-7}{4}\right)^2$$

61. Find an equation of the tangent line to the curve

$$y = \frac{\sqrt{7x+2}}{x+1}$$

at the point $x = 4$.

Chapter 12.1

Find the following derivatives

4. $y = \log(5x - 6)$

6. $y = \log(3x^2 + 2x + 1)$

9. $y = \log(4x^6 + 2x^3)$

15. $y = \log_3(8x - 1)$

21.

$$y = \frac{x^2 + 3}{(\log x)^2}$$

26.

$$f(t) = \log\left(\frac{t^5}{1 + 3t^2 + t^4}\right)$$

37. $y = \log(x^3) + (\log x)^3$

43. $y = \sqrt{4 + 3\log x}$

45. Find an equation of the tangent line to the curve $y = \log(x^2 - 3x - 3)$ when $x = 4$.

51. The supply of q units of a product at a price of p dollars per unit is given by $q(p) = 25 + 10\log(2p + 1)$. Find the rate of change of supply with respect to price.

Chapter 12.2

Differentiate the following functions.

7. $f(r) = \exp(3r^2 + 4r + 4)$

11. $y = x^2 e^{-x^2}$

18. $y = \exp(x - \sqrt{x})$

20. $y = (e^{2x} + 1)^3$

29. $f(x) = e e^x e^{x^2}$

39. Suppose you have a function $f(x) = c^x - x^c$ where $c > 0$ is a constant. What value of c gives $f'(1) = 0$?

42. For the normal density function

$$f(x) = \frac{1}{\sqrt{2\pi}} \exp\left(\frac{-x^2}{2}\right)$$

find $f'(1)$.

44. Consider the function

$$Y = k\alpha^{\beta t}$$

which apparently has something to do with free markets. Prove that the derivative is

$$\frac{dY}{dt} = k\alpha^{\beta t} (\beta^t \log \alpha) \log \beta$$