Fall 2007 Math 151

courtesy: Amy Austin
(covering sections 3.10-3.12)

Section 3.10

1. Water leaking onto a floor creates a circular pool with an area that increases at a rate of 3 square inches per minute. How fast is the radius of the pool increasing when the radius is 10 inches?

2. When a rocket is 2 miles high, it is moving vertically upward at a speed of 300 mph. At that instant, how fast is the angle of elevation of the rocket increasing, as seen by an observer on the ground 5 miles from the launching pad?

3. A filter in the shape of a cone is 6 inches high and has a radius of 2 inches at the top. A solution is poured in the cone so that the water level is rising at a rate of $\frac{3}{2}$ inches per second. How fast is the water being poured in when the water level has a depth of 2 inches?.

4. The length of a rectangle is increasing at a rate of 2 feet per second, while the width is decreasing at a rate of 1 foot per second. When the length is 5 feet and the perimeter is 20 feet, how fast is the area changing?

5. One end of a 13 foot ladder is on the ground, and the other end rests on a vertical wall. If the top of the ladder is being pushed up the wall at a rate of 1 foot per second, how fast is the base of the ladder approaching the wall when it is 3 feet from the wall?

6. A point moves around the circle $x^2 + y^2 = 9$. When the point is at $(-\sqrt{3}, \sqrt{6})$, its x coordinate is increasing at a rate of 20 units per second. How fast is its y coordinate changing at that instant?

Section 3.11

7. Given $y = 4 - x^2$

   a.) Find Δy if x changes from $x = 1$ to $x = 1.5$

   b.) Find dy for $x = 1$ and $dx = 0.5$.

8. Use differentials to approximate :

   a.) $(2.01)^8$

   b.) $\sin 59°$

9. Find the linear approximation for $y = \frac{1}{x}$ at $x = \frac{1}{2}$. Sketch the graph of y as well as the linear approximation.

10. Find the linear approximation for $y = \sqrt{1+x}$ at $a = 0$ and use it to approximate $\sqrt{0.9}$ and $\sqrt{1.2}$.

11. Find the quadratic approximation for $y = \cos x$ at $a = 0$ and use it to estimate $\cos(0.1)$.

12. The radius of a circular disk is given as 24 cm with a maximum error in measurement of 0.2 cm. Use differentials to estimate the maximum error in the calculated area of the disk.

Section 3.12

13. Given $f(x) = x^3 + x^2 + 2$, use Newtons Method with $x_1 = -2$ to find the third approximation to the root of the given equation.

14. Use Newtons method to approximate $\sqrt[10]{100}$ to 6 decimal places. HINT: Define $f(x) = x^{10} - 100$ and use $x_1 = 1.5$.

15. Use Newtons Method to approximate the root of $x^4 + x^3 - 22x^2 - 2x + 41 = 0$ in the interval $[1, 2]$ to 6 decimal places.