Practice Problems for Test 2
Set 1

1. An object is thrown from the top of a 126 foot tall building with an initial velocity of 80 ft./sec in the horizontal (x) direction with an initial velocity of 64 ft/sec. in the vertical (y) direction.
   (a) Sketch a graph of the path of the object.
   (b) Find the parametric equations that describe the velocity at any time t.
   (c) Find the parametric equations that describe the position at any time t.
   (d) Find the maximum height that the object attains.
   (e) Find the speed of the object at its maximum height.
   (f) Find when the object passes the top of the building on its way down.
   (g) Find the distance of the object from the building at the time found in (f).
   (h) Find the displacement of the object at the time found in (e).
   (i) Find the total distance traveled at time found in (e).
   (j) Find the speed with which the object strikes the ground.
   (k) Find the distance from the building of the object when it strikes the ground.
   (l) Find the total distance that the object travels. Show both the integral and the value.
   (m) Find the displacement of the object when it is on the ground.

2. Determine if each of the following sequences converge or diverge. Explain your answer (This means: If the sequence converges find the limit. If the sequence diverges show the limit does not exist.)
   (a) $\left\{\tan\frac{(n^5+5n^3-10)\pi}{4n^5+7n^4+1}\right\}$
   (b) $\left\{\ln\frac{n^3+n-10}{101n^2+3n+1}\right\}$
   (c) $\left\{\cos\frac{(4n^3+71n^2-10)\pi}{3n^5+1}\right\}$

3. Find:
   (a) $\int_0^1 \ln x\,dx$
   (b) $\int_1^\infty xe^{-x}\,dx$

4. Use integrations by parts to find $\int e^x \cos x\,dx$. Calculators should not be used.

5. Show that $\sum_{n=0}^{\infty} \frac{4n^3+n}{2n^3+5}$ diverges. Explain your answer.

6. Find a geometric series whose sum is $\frac{1}{1-x}$ when $|x| < 1$.

7. Consider the 4 leaf rose $r = f(\theta) = \sin 2\theta$ (polar coordinates).

(a) Sketch the graph of f when $0 \le \theta \le \pi$. If you use calculator be sure to include the size of the window that you are using.

(b) Find the area of one of the leafs.

8. This problem is in polar coordinates. The region, R, bounded by

$r = \csc\theta$ for $\frac{\pi}{4} \le \theta \le \frac{\pi}{2}$

$r = \sec\theta$ for $0 \le \theta \le \frac{\pi}{4}$

$r = \frac{1}{\sin\theta + \cos\theta}$ for $0 \le \theta \le \frac{\pi}{2}$.

a. Sketch R.

b. Find the area of R.

9. Find an equation of the line tangent to the curve described by the parametric equations $\begin{cases} x(t) = e^t \\ y(t) = \cos t + \sin t \end{cases}$ at $(e^{\frac{\pi}{4}}, \sqrt{2})$.

10. Find $\int e^x \sin x \, dx$.

11. If the curve C is described by $\begin{cases} x = \tan t \\ y = \sec t \end{cases}$ find an equation of the line tangent to C at $(1, \sqrt{2})$.