Math 1432
Exam 3 Review

1. Integrate:
   a. $\int \frac{3x^2+3x+3}{x^2+1}\,dx$
   b. $\int \frac{x^2}{(x+1)(x-1)^2}\,dx$
   c. $\int \frac{x^2+5x+2}{(x+1)(x^2+1)}\,dx$
   d. $\int \frac{2x^2}{\sqrt{9-x^2}}\,dx$
   e. $\int \frac{2}{x\sqrt{9+x^2}}\,dx$
   f. $\int \frac{5}{36+(x-1)^2}\,dx$
   g. $\int \frac{1}{\sqrt{4+x^2}}\,dx$
   h. $\int \frac{5x+14}{(x+1)(x^2-4)}\,dx$

2. Write the equation in polar coordinates:
   a. $x^2+y^2=4$
   b. $x^2+y^2=4x$
   c. $\left(x^2+y^2\right)^2=4xy$
   d. $x=4y$

3. Write the given equations in rectangular coordinates:
   a. $r=-2\sin\theta$
   b. $r\cos\theta=5$

4. Recognize all types of polar graphs.

5. Given $r=4-8\cos\theta$, give the formula (only) for the area inside the inner loop.

6. Given $r=2\sin(3\theta)$, give the formula (only) for the area of one petal.

7. Find the arc length for the following:
   a. $f(x)=\frac{2}{3}(x-1)^{3/2} \quad x\in[1,2]$
   b. $x(t)=\sin(2t),\ y(t)=\cos(2t), \quad t\in\left[0,\frac{\pi}{2}\right]$
   c. $r=2\sec(\theta), \quad t\in\left[0,\frac{\pi}{4}\right]$
8. Find the equation of the tangent and the normal lines to the parametric curves at the given points:
   a. $x(t)=-2\cos 2t,\ y(t)=4+2t,\ (-2,4)$
   b. $x(t)=3\cos(3t)+2t,\ y(t)=1+5t,\ (3,1)$
9. Find the points (x, y) at which the curve $x(t)=3-4\sin(t), \quad y(t)=4+3\cos(t)$ has: (a) a horizontal tangent; (b) a vertical tangent.
10. Give an equation relating x and y for the curve given parametrically by
    a. $x(t)=-1+3\cos t \quad y(t)=1+2\sin t$
    b. $x(t)=-1+3\cosh t \quad y(t)=1+2\sinh t$
    c. $x(t)=-1+4e^{t} \quad y(t)=2+3e^{-t}$
11. Find a parameterization for:
    a. Line segment from (-1, 3) to (5, 4)
    b. Circle with radius 2 and center (2, -1)
12. Write an expression for the nth term of the sequence:
    a. 1, 4, 7, 10, …
    b. 2, -1, $\frac{1}{2},-\frac{1}{4},\frac{1}{8},\ldots$
13. Determine if the following sequences are monotonic. Also indicate if the sequence is bounded and if it is give the least upper bound and/or greatest lower bound.
    a. $a_n=\frac{2n}{1+n}$
    b. $a_n=\frac{\cos n}{n}$
14. Determine if the following sequences converge or diverge. If they converge, give the limit.
    a. $\left\{(-1)^n\left(\frac{n}{n+1}\right)\right\}$
    b. $\left\{\frac{6n^2-2n+1}{4n^2-1}\right\}$

c. $\left\{\frac{(n+2)!}{n!}\right\}$

d. $\left\{\frac{3}{e^n}\right\}$

e. $\left\{\frac{4n+1}{n^2-3n}\right\}$

f. $\left\{\frac{e^n}{n^3}\right\}$

15. Determine the values of n which guarantee a theoretical error less than ε if the integral is estimated by the trapezoidal rule and then by Simpson's rule if ε = 0.01.

a. $\int_1^3 \left(\frac{1}{4}x^2 + 3x - 2\right) dx$

b. $\int_1^3 \cos(5x)dx$