1. Evaluate the following integrals:

(a) $\int (3+2x-x^2)^{3/2}dx.$

(b) $\int_1^2 \frac{2^{\ln x}}{x}dx.$

(c) $\int \frac{1}{x^3+x}dx.$

(d) $\int x\arctan(x^2)dx.$

(e) $\int \frac{x^3+4x^2}{x^2+4x+3}dx.$

(f) $\int_1^2 \frac{\sqrt{x^2-1}}{x}dx.$

(g) $\int \frac{dt}{t^2-2t+5}.$

(h) $\int \frac{x^3}{(x+1)^{10}}dx.$

(i) $\int \frac{\sin^3 x}{\cos^6 x}dx.$

(j) $\int \sec^6 x\,\sqrt{\tan x}dx.$

(k) $\int \frac{\sin 3z}{\cos 7z}dz.$

(l) $\int \frac{\sqrt{1-x^2}}{x^4}dx.$

(m) $\int \frac{x+1}{x^4+6x^3+9x^2}dx.$

(n) $\int \sec^2 x\tan x dx.$

2. Find the area between the curve $y = 2(\ln x)/x$ and the $x-$axis from $x = 1$ to $x = e$.

3. Evaluate the following improper integrals:

(a) $\int_0^\infty \frac{2}{x^2-2x+2}dx.$

(b) $\int_0^3 \frac{1}{\sqrt[3]{x-1}}dx.$

(c) $\int_{-\infty}^\infty \frac{1}{(x^2+1)(1+\arctan(x))}dx.$

(d) $\int_{-\infty}^0 \frac{1}{x^2+2x+5}dx.$

(e) $\int_0^1 \frac{x+1}{\sqrt{x^2+2x}}dx.$

(f) $\int_1^3 \frac{dt}{t^2-6t+8}.$

4. Check for convergence or divergence:

(a) $\int_1^\infty \frac{e^x}{\sqrt{x}}dx.$

(b) $\int_\pi^\infty \frac{1+\sin x}{x^2}dx.$

(c) $\int_0^\infty \frac{1}{\sqrt{x^6+x^3+1}}dx.$

(d) $\int_1^\infty \frac{1+\sin^2(2x)}{x^2+\cos^2 x}dx.$

(e) $\int_1^\infty \frac{x}{\sqrt{x^6-x+2}}dx.$

(f) $\int_1^\infty \frac{dt}{t+\cos^2 t}.$

5. Determine the arc length of the path $x(t) = e^t+e^{-t};\quad y(t) = 5-2t,\quad 0 \le t \le 4.$

6. A ball rolls along a marked table and its position at any time can be determined by the parametric equations: $x(t) = t^3-t^2$ and $y(t) = t^3-3t$. Determine dy/dx when $t = 3$.

7. Consider the curve of the function $f(x) = \ln(\cos x)$ from $x = 0$ to $x = \pi/3$.
   (a) Find the arc length of the curve.
   (b) **Set up** an integration representing the area of the surface generate by rotating the curve about the $x-$axis.

8. i.) Sketch the curve by using the parametric equations to plot points. Indicate with an arrow the direction in which the curve is traced as t increases.
   ii.) Eliminate the parameter to find a Cartesian equation of the curve.
   (a) $x = 1 - 2t, \quad y = t/2 - 1, \qquad -2 \leq t \leq 4.$
   (b) $x = t - 1, \quad y = t^3 + 1, \qquad -2 \leq t \leq 2.$

9. A curve C is defined by the parametric equations

$$x = t^2 \text{ and } y = t^3 - 3t, \quad -2.5 \leq t \leq 2.5.$$

   (a) Find the horizontal and vertical velocities and describe the motion at $t = 2$.
   (b) Find the points on C where the tangent is horizontal or vertical.
   (c) Determine where the curve is concave upward or downward.
   (d) Sketch the curve.
   (e) Find the slope of the tangent to the curve at $t = 2$.
   (f) Find the area inside the loop.
   (g) Set up an integral (Do not evaluate) that represents the arc length of the loop.
   (h) Set up an integral (Do not evaluate) that represents the area of the surface generated by rotating the loop about the $y-$axis.