1. Evaluate the following integrals

(a). $\displaystyle\int_0^{\pi/2} \sin(9x)\cos(x)\,dx$

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

(c). $\displaystyle\int \tan^3 x \sec^4 x\,dx$

(d). $\displaystyle\int \frac{1}{x^3-4x^2+4x}\,dx$

(e). $\displaystyle\int x^3(\ln 2x)\,dx$

(f). $\displaystyle\int \sqrt{9-x^2}\,dx$

(g). $\displaystyle\int \sin^{-1} x\,dx$

(h). $\displaystyle\int \frac{4x}{(x^2-1)(x^2+1)}\,dx$

2. Use a rationalizing substitution to evaluate $\displaystyle\int \frac{x}{\sqrt{x+9}}\,dx$

3. Approximate the integral $\displaystyle\int_4^6 \frac{1}{x^2}\,dx$, using [Do **NOT** simplify.]

(a). Simpson's Rule with $n = 4$

(b). The Trapepzoid Rule with $n = 6$

4. Evaluate the following improper integral: $\displaystyle\int_0^\infty (7x-3)e^x\,dx$

5. Evaluate the following integrals or show that it is a divergent improper integral.

(a). $\displaystyle\int_0^1 \frac{1}{4-2x}\,dx$ **(b).** $\displaystyle\int_0^4 \frac{1}{4-2x}\,dx$ **(c).** $\displaystyle\int_{-\infty}^\infty 2x^2 e^{-x^3}\,dx$

6. Integrate: $\displaystyle\int e^x \sin 2x\,dx$

7. Find the area bounded by $f(x) = \sin^2 x \cos^2 x$ on the interval $[0, \pi/2]$.

8. Write out the ***form*** of the partial fraction decomposition for the following function. Do **NOT** determine the values of the coefficients.

$$\frac{3x-4}{x^2(x-2)(x^2+9)^3}$$

9. Determine whether the following **sequences** converge or diverge. Find the limit if it converges.

(a). $a_n = \dfrac{1}{n} + (-1)^n$ **(b).** $a_n = \dfrac{1}{5^n}$ **(c).** $b_n = \dfrac{\cos n}{n}$ **(d).** $\left\{\dfrac{5n^2+n}{3-2n^2}\right\}_{n=1}^{\infty}$