$$\sin^2 u = \frac{1}{2}(1-\cos 2u) \qquad \cos^2 u = \frac{1}{2}(1+\cos 2u) \qquad \sin 2u = 2(\sin u \cos u)$$

$$\int \tan u\ du = \ln|\sec u| + C \qquad \int \sec u\ du = \ln|\sec u + \tan u| + C \qquad \int \frac{du}{u^2+a^2} = \frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right) + C$$

1. Evaluate the integral $\int_0^1 x\cos \pi x\ dx$.

2. Evaluate the integral $\int \frac{\ln x}{x^2}\ dx$.

3. Evaluate the integral $\int \sin^3 t\ dt$.

4. Evaluate the integral $\int_0^2 \sqrt{16-x^2}\ dx$.

5. Evaluate the integral $\int \frac{\sqrt{x^2-1}}{x}\ dx$.

6. Evaluate the integral $\int \frac{4x+1}{x(x+1)^2}\ dx$.

7. Evaluate the integral $\int \frac{-2}{(x^2+1)(x-1)}\ dx$.

8. Determine if the improper integral converges or diverges. If it converges evaluate it. $\int_0^1 \frac{e^{\frac{1}{x}}}{x^2}\ dx$.

9. Determine if the improper integral converges or diverges. If it converges evaluate it. $\int_0^1 \frac{dx}{x-1}$.

10. Use the comparison theorem to determine if the improper integral converges or diverges. Be very clear about the comparison you are using. Do not evaluate the integral. $\int_1^\infty \frac{dx}{\sqrt{x^3+1}}$.