1. (*8 points each*) Evaluate the integral.

   (a) $\int x\cos(3x)\,dx$

   (b) $\int \sec^4(5x)\,dx$

   (c) $\int \frac{3\cos^5\alpha}{\sqrt{\sin\alpha}}\,d\alpha$

2. (*8 points each*) Evaluate the integral.

   (a) $\int \frac{dx}{(25+x^2)^{\frac{3}{2}}}$

   (b) $\int \frac{x^2}{x^2+9}$

   (c) $\int \frac{x+a}{x^2-x}\,dx$

3. (*10 points*) Determine whether the integral is convergent or divergent. If it is convergent, evaluate it.

   (a) $\int_1^\infty \frac{dx}{\sqrt[3]{x}}$

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

4. (*8 points*)

   For any twice differentiable function f on $[a,b]$, $P_a^b(f)$ will approximate $\int_a^b f(x)\,dx$ to an error no more than $K_2\frac{(b-a)^4}{32}$ when $|f''(x)| \leq K_2$ for all x in $[a,b]$. You use $P(f)$ to numerically approximate the integral $\int_1^3 \sqrt{1+x^3}\,dx$ by subdividing the interval into 10 equal pieces and applying $P(f)$ to each of the smaller intervals.

Using that the absolute value of the second derivative of $\sqrt{1+x^3}$ is never more than 2 over $[1,3]$, what is an upper bound for the error of your approximation (*4 points*) and why (*6 points*)?

5. (*12 points, 8/4*) Let $a > 0$. Evaluate the integrals.

   (a) $\displaystyle\int \sin(x)e^{-ax}\,dx$

   (b) $\displaystyle\int_0^\infty \sin(x)e^{-ax}\,dx$