1. Determine whether the following integrals converge or diverge.

(a) $\int_1^\infty e^{-x^3}\,dx$

(b) $\int_3^\infty \frac{1}{x^{1.1}}\,dx$

(c) $\int_3^\infty \frac{1}{x^{0.9}}\,dx$

(d) $\int_3^\infty \frac{1}{\sqrt{x^2-1}}\,dx$

(e) $\int_3^\infty \frac{1}{\sqrt{x^2+1}}\,dx$

(f) $\int_5^\infty \frac{1}{(x+4)^{3/2}}\,dx$

(g) $\int_5^\infty \frac{1}{(x-4)^{3/2}}\,dx$

(h) $\int_4^\infty \frac{x}{x^3-1}\,dx$

(i) $\int_4^\infty \frac{x}{x^3+1}\,dx$

2. Evaluate the following integrals.

(a) $\int_0^1 \frac{1}{\sqrt{x}}\,dx$

(b) $\int_0^1 \frac{1}{x^{3/2}}\,dx$

(c) $\int_0^4 \frac{1}{x}\,dx$

3. Evaluate the following limits

(a) $\lim_{x\to\infty} \frac{x^{10}}{e^x}$

(b) $\lim_{x\to\infty} \frac{(\ln(x))^2}{\sqrt{x}}$

(c) $\lim_{x\to\infty} \left(1+\frac{e}{x}\right)^x$

(d) $\lim_{x\to 0^+} \sqrt{x}\ln(x)$

(e) $\lim_{x\to 0} \frac{8x^2}{\cos(x)-1}$

(f) $\lim_{x\to\infty} \frac{\ln(x)}{2\sqrt{x}}$

(g) $\lim_{x\to\infty} \frac{e^{3x}}{x^3}$

(h) $\lim_{x\to\infty} (2x-\sqrt{4x^2+7x+12})$

4. Evaluate the following integral. Note: some of these may diverge - justify

(a) $\int \frac{x}{\sqrt{16-x^2}}\,dx$

(b) $\int \sin^3(x)\cos^4(x)\,dx$

(c) $\int \frac{1}{x(9-x^2)}\,dx$

(d) $\int \tan^4(x)\sec^2(x)\,dx$

(e) $\int_0^\infty xe^{-x}\,dx$

(f) $\int_0^\infty xe^{-x^2}\,dx$

(g) $\int x\sqrt{16-x^2}\,dx$

(h) $\int \sqrt{16-x^2}\,dx$

(i) $\int \frac{x+1}{x^2+1}\,dx$

(j) $\int x\sqrt{16-x}\,dx$

(k) $\int \frac{1}{(2x+3)^2+16}\,dx$

(l) $\int_7^\infty \frac{1}{x^2-3x-4}\,dx$

(m) $\int (x^{3/2}+x^{1/2}-\frac{4}{\sqrt{x}})\,dx$

(n) $\int (2x+1)^2\,dx$

(o) $\int \sqrt{2x+7}\,dx$

(p) $\int \frac{\sin(x)}{\cos^4(x)}\,dx$

(q) $\int \frac{x+1}{x^2+x+1}\,dx$

(r) $\int \frac{2x}{x^2+1}\,dx$

(s) $\int (x+1)^2\sqrt{x}\,dx$

(t) $\int x\sin(x)\,dx$

(u) $\int x\sin^2(x)\,dx$

(v) $\int \frac{1}{x(1+\ln(x))}\,dx$

(w) $\int \cos^3(x)\sin^2(x)\,dx$

(x) $\int \cos^2(x)\sin^2(x)\,dx$