1. Find the limit. Use L'Hospital's Rule where appropriate.

(a) $\lim_{x\to\infty} xe^{-\sqrt{x}}$

(b) $\lim_{x\to\infty} x^{1/\sqrt{x}}$

(c) $\lim_{x\to 0^+} (1+x)^{1/x^2}$

(d) $\lim_{x\to 0} \left(\frac{\cos x}{x^2} - \frac{\sin x}{x^3}\right)$

2. Evaluate the integral using integration by parts.

(a) $\int t^2 e^{-t} dt$

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

(c) $\int e^{-x} \cos(10x) dx$

(d) $\int \sin(10\sqrt{x}) dx$ (Hint: let $u = \sqrt{x}$)

3. Evaluate the trig integral.

(a) $\int \tan^2 x dx$

(b) $\int \sin^3 x dx$

(c) $\int \sec^4 x dx$

4. Evaluate the integral using trig substitution.

(a) $\displaystyle\int \frac{1}{(1+x^2)^{3/2}}dx$

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

(c) $\displaystyle\int \frac{(4x^2-1)^{3/2}}{x}dx$

5. Evaluate the integral using partial fractions.

(a) $\displaystyle\int \frac{x^3}{1+x^2}dx$

(b) $\displaystyle\int \frac{x+1}{x^2-x}dx$

(c) $\displaystyle\int \frac{x^2+1}{x^3-2x^2+x}dx$

6. Evaluate the improper integral, if it is convergent.

(a) $\displaystyle\int_0^\infty \frac{1+x}{1+x^2}dx$

(b) $\displaystyle\int_0^\infty e^{-\sqrt{x}}dx$

(c) $\displaystyle\int_0^{1/e} \frac{1}{x(\ln x)^2}dx$

(d) $\displaystyle\int_0^{\pi/2} \frac{1}{\cos x}dx$

7. The region enclosed by the given curves is rotated about the x-axis. Find the volume of the resulting solid using cross-sections.

(a) $y = |x|,\ y = 2 - x^2$

(b) $y = \cos x,\ y = \sin x,\ 0 \le x \le \pi/4$

8. Use the method of cylindrical shells to find the volume generated by rotating about the y-axis the region bounded by the given curves.

(a) $y = |x|,\ y = 2 - x^2$

(b) $y = \sqrt{x^2 + 1},\ y = 0,\ x = 0,\ x = 1$

9. Find the arc length of the curve.

(a) $\ln(\cos x),\ 0 \le x \le \pi/4$

(b) $y = \dfrac{x^2}{4} - \dfrac{\ln x}{2},\ 1 \le x \le 2$

10. Find the area of the surface obtained by rotating the curve about the specified axis.

(a) $y = \sqrt{1 + e^x},\ 0 \le x \le 1;$ about the x-axis

(b) $y = \dfrac{x^2}{4} - \dfrac{\ln x}{2},\ 1 \le x \le 2;$ about the y-axis