

1. Calculate the following limits. Be sure to show all of your work.

$$\begin{array}{llll}
 \text{(a)} \lim_{n \rightarrow \infty} n (\sqrt[n]{n} - 1) & \text{(b)} \lim_{x \rightarrow 0} (\cos x)^{\csc x} & \text{(c)} \lim_{x \rightarrow +\infty} x^{25} e^{-x} & \text{(d)} \lim_{x \rightarrow \infty} \frac{x e^{-x^2/2}}{e^{-x}} \\
 \text{(e)} \lim_{x \rightarrow -\infty} (e^{-x} - x) & \text{(f)} \lim_{x \rightarrow 1^+} \frac{\int_1^x \sin t \, dt}{x - 1} & \text{(g)} \lim_{x \rightarrow 0} \frac{\int_0^x (e^{t^2} - 1) \, dt}{x^3} & \\
 \text{(h)} \lim_{x \rightarrow \infty} \frac{3x}{\ln(100x + e^x)} & \text{(i)} \lim_{x \rightarrow 0} \frac{\cos x - 1}{x^2} & &
 \end{array}$$

2. Calculate the following integrals. Be sure to show all of your work.

$$\begin{array}{llll}
 \text{(a)} \int_{-\pi}^{\pi} \sin mx \cos nx \, dx & \text{(b)} \int_0^{2\pi} \sin mx \sin nx \, dx, \quad m = n & & \\
 \text{(c)} \int \tanh x \ln(\cosh x) \, dx & \text{(d)} \int \frac{e^x dx}{e^{2x} + 2e^x + 5} & \text{(e)} \int \frac{3x - 1}{x^2 - 4} \, dx & \\
 \text{(f)} \int \cos(\ln x) \, dx & \text{(g)} \int \frac{x \, dx}{2x^3 + 6x^2} & \text{(h)} \int (t + 1)e^{-t^2 - 2t - 5} \, dt & \\
 \text{(i)} \int \sin^3 x \, dx & \text{(j)} \int x e^x \, dx & \text{(k)} \int \frac{3x - 13}{x^2 + 3x - 10} \, dx &
 \end{array}$$

3. Section 7.1 #9, 19, 34

4. Section 7.2 #17, 39, 41

5. Section 7.3 #5, 15, 30

6. Determine whether the following improper integrals converge or diverge. Be sure to justify your answer completely.

$$\begin{array}{lll}
 \text{(a)} \int_e^{\infty} \frac{dx}{x\sqrt{\ln x}} & \text{(b)} \int_1^{\infty} \frac{\ln x}{\sqrt{x^3 + 2x + 1}} \, dx & \text{(c)} \int_0^{\infty} e^{-x} \cos x \, dx \\
 \text{(d)} \int_{-\infty}^{\infty} \frac{e^{-x^2}}{x^2} \, dx & \text{(e)} \int_0^{\infty} x^{16,000} e^{-x} \, dx & \text{(f)} \int_0^1 \frac{e^{-x} \sqrt{1+x}}{\sqrt[3]{\sin x \tan x}} \, dx
 \end{array}$$

7. Find the limits of the following sequences or prove they diverge. Be sure to justify your answer completely.

$$\begin{array}{ll}
 \text{(a)} \lim_{n \rightarrow \infty} (-1)^n \frac{n}{n+2} & \text{(b)} \lim_{n \rightarrow \infty} \frac{\sqrt{n^2 + 4}}{2n + 1} \\
 \text{(c)} \lim_{n \rightarrow \infty} \frac{\cos(2n)}{n^{1/2}} & \text{(d)} \lim_{n \rightarrow \infty} \ln n - \ln(n+1)
 \end{array}$$