1. Integrate the following

(a) \[ \int 4x \sin(3x) \, dx \]

(b) \[ \int \sin(2x) \sqrt{1 - \cos(2x)} \, dx \]

(c) \[ \int \frac{5x + 4}{x^2 + x - 2} \, dx \]
(d) \[ \int \frac{dx}{x^2 \sqrt{4 - x^2}} \]

(e) \[ \int \frac{\sqrt{x - 4}}{x + 5} \, dx \]

(f) \[ \int \tan^3(x) \, dx \]

(g) \[ \int x^4 \ln(x) \, dx \]
2. Tell whether the integral converges or diverges. If it converges, give the limit. If it diverges, show why.

(a) \[\int_0^\infty \frac{x}{1 + x^2} \, dx\]

(b) \[\int_{1.5}^{15} \frac{dx}{\sqrt{2x - 3}}\]

3. Solve the following differential equation for \(y(x)\).

\[y' = x + xy^2\quad \quad y(0) = 1\]

4. Suppose a company’s net worth increases at a continuous rate of 5% \((.05 = \frac{1}{20})\) per year due to interest on its assets. At the same time, the company’s payroll obligations amount to $200 million a year, paid out continuously. Let \(W(t)\) be the net worth of the company in millions of dollars. Write and solve the differential equation assuming \(W(0) = 3000\).

Hint:

rate in = ________________

rate out = ________________