1. Put the letter of the slope field in the box of the corresponding equation. All slope fields are graphed on \([-2, 2] \times [-2, 2]\).

\[
\begin{array}{cccc}
\text{A} & \text{B} & \text{C} \\
\text{D} & \text{E} & \text{F}
\end{array}
\]

\[
\begin{array}{cccc}
i: & y' = x^2 - y^2 & \text{iii}: & y' = \cos(2y) \\
\text{ii}: & y' = x - 2y & \text{iv}: & y' = xy \\
\text{v}: & y' = x^3 - x & \text{vi}: & y' = \sin(3(x - y))
\end{array}
\]

2. Match each differential equation to the corresponding solution.

\[
\begin{array}{cccc}
i: & 1/x & \text{iii}: & \sqrt{1 + x} \\
\text{ii}: & e^{2x} & \text{iv}: & \cos(x)
\end{array}
\]

A: \( y' = -y/x \)  \quad B: \( y' = 1/(2y) \)  \quad C: \( y'' = 4y \)  \quad D: \( y' = -\sqrt{1 - y^2} \)

3. Put a ‘C’ (for converges) or ‘D’ (for diverges) in the box next to each infinite series and explain why this is correct using tests from the textbook.

\[
\begin{array}{cc}
\text{(a)} & \sum_{n=1}^{\infty} \frac{n^2}{n^3 + 10} \\
\text{(b)} & \sum_{n=1}^{\infty} \frac{\sqrt{n}}{1 + n^2} \\
\text{(c)} & \sum_{n=1}^{\infty} \frac{\sqrt{n}}{n^2} \\
\text{(d)} & \sum_{n=1}^{\infty} \sin(2^{-n}) \\
\text{(e)} & \sum_{n=1}^{\infty} a_n, \quad \text{where } a_1 = 1 \text{ and } a_{n+1} = \frac{1}{3}(a_n + a_n^2) \text{ for } n > 1.
\end{array}
\]
4. Evaluate each of the following infinite series.
   (a) \( \sum_{n=1}^{\infty} 5^{-n} \)
   (b) \( \sum_{n=1}^{\infty} \frac{1}{(n+1)(n+2)} \)
   (c) \( \sum_{n=1}^{\infty} \ln\left(\frac{1+2^{-n-1}}{1+2^{-n}}\right) \)
   (d) \( \sum_{n=0}^{\infty} e^n \)
   (e) \( 1 + x + y^2 + x^3 + y^4 + x^5 + y^6 + \ldots \)

5. Solve each of the following differential equations.
   (a) \( 2\sqrt{xy} \frac{dy}{dx}, x, y > 0 \)
   (b) \( \frac{dy}{dx} = e^{x-2y} \)
   (c) \( \frac{dy}{dx} = \sqrt{y} \cos^2(\sqrt{y}) \)
   (d) \( 2y' = e^{x/2} + y \)
   (e) \( (x - 1)^3 y' + r(x - 1)^2 y = x + 1, x > 1 \)

6. A tank contains 100 gallons of brine in which 50 lbs or salt are dissolved. A brine containing 2 lbs/gal of salt runs into the tank at a rate of 5 gals/min. The solution is kept uniformly mixed and flows out of the tank at 4 gals/min. Write down and solve the initial value problem described by the mixing process.

7. Apply Euler’s method with \( n = 4 \) to the initial value problem \( y' = y + 1, y(0) = 1 \) to estimate \( y(1) \). Find the exact value of \( y(1) \). Which is larger?

8. Let \( a_n = 2^{-n} \) if \( n \) is even and \( a_n = n/2^n \) if \( n \) is odd. Does \( \sum_{n=1}^{\infty} a_n \) converge? Explain why.

9. Suppose \( \{a_n\} \) is a sequence which converges to 0. Prove there is a subsequence \( \{b_n\} \) of \( \{a_n\} \) so that \( \sum_{n=1}^{\infty} b_n \) converges.