1. (a) If possible, sketch a graph of a function that is continuous on \((-\infty, +\infty)\) and does not have a derivative at \(x = 2\).

(b) If possible, sketch a graph of a function that is continuous and increasing on \((-\infty, 2)\), continuous and decreasing on \((2, +\infty)\), discontinuous at \(x = 2\), and has a derivative at \(x = 2\).

(c) If possible, sketch a graph of a function that is continuous and increasing on \((-\infty, 2)\), continuous and decreasing on \((2, +\infty)\), discontinuous at \(x = 2\), and does not have a derivative at \(x = 2\).

(d) If possible, sketch a graph of a function that is differentiable on \((-\infty, +\infty)\), is increasing on \((-\infty, 2)\), and decreasing on \((2, +\infty)\). Also, sketch the graph of this function’s derivative.

2. Below are sketches of graphs of four functions (I–IV) and their derivatives (A–D). Match each function with its derivative. Give a brief justification for your choices.

3. For what values of constants \(a\) and \(b\) does \(y = ae^{x} + bx \sin x\) satisfy \(y'' + y = \cos x\)?
4. A charged particle is projected into a linear accelerator. The particle undergoes a constant acceleration that changes its velocity from 1,400 m/s to 7,000 m/s in $2 \times 10^{-3}$ seconds. Find the acceleration of the particle.

5. A cylindrical tank is being filled with water at the constant rate of 0.2 m$^3$/s. The radius of the base of the tank is 3 m. Find the rate of change of the height of water in the tank.