

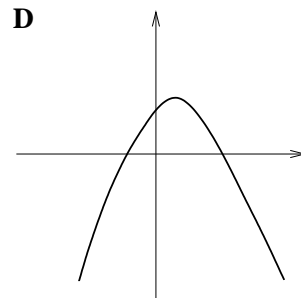
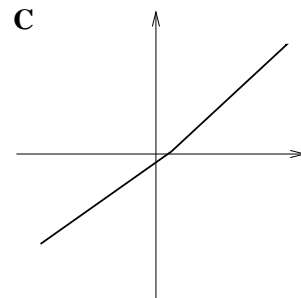
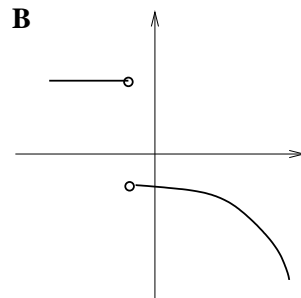
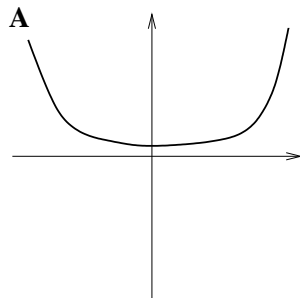
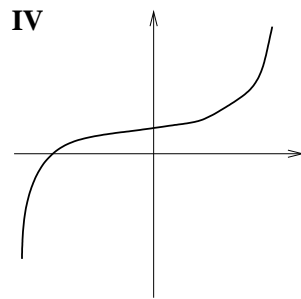
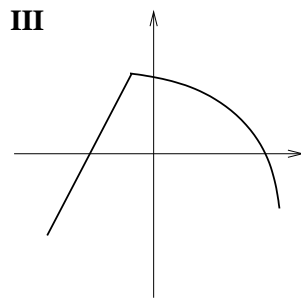
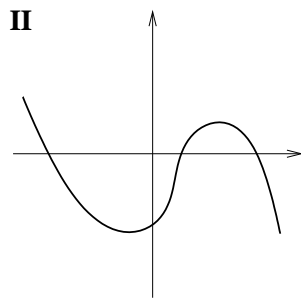
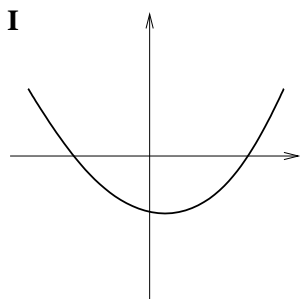
1. (a) If possible, sketch a graph of a function that is continuous on $(-\infty, +\infty)$ and does not have a derivative at $x = 2$.

(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 2×10^{-3} seconds. Find the acceleration of the particle.
5. A cylindrical tank is being filled with water at the constant rate of 0.2 m³/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.