

**Section 2.5: Continuity - Worksheet**

1. For each function, find the values of the constants  $a, b$  that make it continuous.

$$(a) f(x) = \begin{cases} 3x - b & \text{if } x \leq 1 \\ ax + 4 & \text{if } 1 < x \leq 3. \\ bx - 2a & \text{if } x > 3 \end{cases} \quad (b) f(x) = \begin{cases} bx + 4 & \text{if } x < 1 \\ a & \text{if } x = 1. \\ \frac{x^{-1} - 1}{x^2 - 1} & \text{if } x > 1 \end{cases}$$

$$(c) \text{ [Advanced] } f(x) = \begin{cases} \frac{\sin(ax)}{3x} & \text{if } x < 0 \\ b & \text{if } x = 0. \\ \frac{x^2 + 5x}{\sqrt{x+4} - 2} & \text{if } x > 0 \end{cases}$$

$$2. \text{ Consider the function } f(x) = \begin{cases} x^2 + 4x + 5 & \text{if } x < -2 \\ 3 & \text{if } x = -2 \\ \cos(\pi x) & \text{if } -2 < x < 3. \\ x + 2 & \text{if } 3 \leq x \leq 4 \\ 6 - \ln(x - 3) & \text{if } x > 4 \end{cases}$$

(a) Find the values of  $a$  for which  $\lim_{x \rightarrow a} f(x)$  does not exist.

(b) Find the values of  $x$  where  $f$  is discontinuous.

3. Show that each equation has a solution in the given interval.

(a)  $x^3 = 14 + 2\sqrt{x}$  in  $[0, 4]$ .

(b)  $\ln(x) = 2 - x$  in  $[1, e]$ .

(c) **[Advanced]**  $\cos(x) = \arcsin(x)$  in  $[0, 1]$ .