

Continuity Practice

- (1) For which values of x is the function $f(x) = x^2 + 3x + 4$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (2) For which values of x is the function $f(x) = \begin{cases} \frac{x^2-x-6}{x-3}, & \text{if } x \neq 3 \\ 5, & \text{if } x = 3 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (3) For which values of x is the function $f(x) = \begin{cases} x - 1, & \text{if } 1 \leq x < 2 \\ 2x - 3, & \text{if } 2 \leq x \leq 3 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (4) For which values of x is the function $f(x) = \begin{cases} \cos x, & \text{if } x \geq 0 \\ -\cos x, & \text{if } x < 0 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (5) For which values of x is the function $f(x) = \begin{cases} \sin(1/x), & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (6) Find the value of a for which the function $f(x) = \begin{cases} ax + 5, & \text{if } x \leq 2 \\ x - 1, & \text{if } x > 2 \end{cases}$ is continuous. Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

- (7) For which values of x is the function $f(x) = \begin{cases} x^3 - x^2 + 2x - 2, & \text{if } x \neq 1 \\ 4, & \text{if } x = 1 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

(8) For which values of x is the function $f(x) = \begin{cases} \frac{|x-a|}{x-a}, & \text{if } x \neq a \\ x-1, & \text{if } x = a \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

(9) (Harder) For which values of x is the function $f(x) = \begin{cases} \frac{x^n-1}{x-1}, & \text{if } x \neq 1 \\ n, & \text{if } x = 1 \end{cases}$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

(10) For which values of x is the function $f(x) = |x| + |x-1|$ continuous? Justify your answer with limits if necessary and draw a graph of the function to illustrate your answer.

Answers:

- (1) $(-\infty, \infty)$
- (2) $(-\infty, \infty)$
- (3) $[1, 3]$
- (4) $(-\infty, 0) \cup (0, \infty)$

- (5) $(-\infty, 0) \cup (0, \infty)$
- (6) $a = -2$
- (7) $(-\infty, 1) \cup (1, \infty)$
- (8) $(-\infty, a) \cup (a, \infty)$

- (9) $(-\infty, \infty)$
- (10) $(-\infty, \infty)$