

Compute these limits  $\lim_{x \rightarrow a^-} f(x)$ ,  $\lim_{x \rightarrow a^+} f(x)$ , and  $\lim_{x \rightarrow a} f(x)$  at the indicated value,  $a$ , for each of these functions.

$$1. a = 1, f(x) = \begin{cases} 3x - 4 & \text{if } x \leq 1 \\ 7 - 2x & \text{if } x > 1 \end{cases}$$

$$(a) \lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^-} 3x - 4 = -1$$

$$(b) \lim_{x \rightarrow 1^+} f(x) = \lim_{x \rightarrow 1^+} 7 - 2x = 5$$

$$(c) \lim_{x \rightarrow 1} f(x) = DNE$$

$$2. a = 0, f(x) = \begin{cases} x^4 - x + 1, & \text{if } x < 0 \\ x^2 - 4x + 1, & \text{if } x \geq 0 \end{cases}$$

$$(a) \lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} x^4 - x + 1 = 1$$

$$(b) \lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 - 4x + 1 = 1$$

$$(c) \lim_{x \rightarrow 0} f(x) = 1$$

$$3. a = 0, f(x) = \begin{cases} x^4 - x + 1, & \text{if } x < 0 \\ 4, & \text{if } x = 0 \\ x^2 - 4x + 1, & \text{if } x > 0 \end{cases}$$

$$(a) \lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} x^4 - x + 1 = 1$$

$$(b) \lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 - 4x + 1 = 1$$

$$(c) \lim_{x \rightarrow 0} f(x) = 1$$

$$4. a = -1, f(x) = \begin{cases} 3x + 6, & \text{if } x < -1 \\ x^2 - 1, & \text{if } -1 \leq x < 2 \\ 3x^2 - 5x + 1, & \text{if } x \geq 2 \end{cases}$$

$$(a) \lim_{x \rightarrow -1^-} f(x) = \lim_{x \rightarrow -1^-} 3x + 6 = 3$$

$$(b) \lim_{x \rightarrow -1^+} f(x) = \lim_{x \rightarrow -1^+} x^2 - 1 = 0$$

$$(c) \lim_{x \rightarrow -1} f(x) = DNE$$

$$5. a = 2, f(x) = \begin{cases} 3x + 6, & \text{if } x < -1 \\ x^2 - 1, & \text{if } -1 \leq x < 2 \\ 3x^2 - 5x + 1, & \text{if } x \geq 2 \end{cases}$$

$$(a) \lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^-} x^2 - 1 = 3$$

$$(b) \lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^+} 3x^2 - 5x + 1 = 3$$

$$(c) \lim_{x \rightarrow 2} f(x) = 3$$

$$6. a = 1, f(x) = \begin{cases} -x + 1, & \text{if } x < 1 \\ \frac{2}{1-x}, & \text{if } x > 1 \end{cases}$$

$$(a) \lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^-} -x + 1 = 0$$

$$(b) \lim_{x \rightarrow 1^+} f(x) = \lim_{x \rightarrow 1^+} \frac{2}{1-x} = -\infty$$

$$(c) \lim_{x \rightarrow 1} f(x) = DNE$$

$$7. a = 2, f(x) = \begin{cases} \frac{-1}{x-2}, & \text{if } x > 2 \\ \frac{4}{2-x}, & \text{if } x < 2 \end{cases}$$

$$(a) \lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^-} \frac{4}{2-x} = \infty$$

$$(b) \lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^+} \frac{-1}{x-2} = -\infty$$

$$(c) \lim_{x \rightarrow 2} f(x) = DNE$$