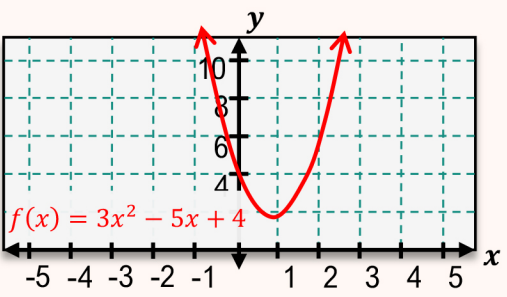


TOPIC: FINDING LIMITS ALGEBRAICALLY

Finding Limits by Direct Substitution

◆ For many functions, like **polynomials** & **basic roots**, the limit is *ALWAYS* the _____ as the function value.

Recall	Evaluating a Function	New	Finding a Limit
	Evaluate $f(x) = 3x^2 - 5x + 4$ at $x = 2$ $\begin{aligned} f(2) &= 3(2)^2 - 5(2) + 4 \\ &= 12 - 10 + 4 \\ &= 6 \end{aligned}$		Find $\lim_{x \rightarrow 2} f(x)$ $\lim_{x \rightarrow 2} f(x) =$ 

EXAMPLE

Find the limit.

(A)

$$\lim_{x \rightarrow 2} 6x^3 + 3x^2 - x + 5$$

(B)

$$\lim_{x \rightarrow 0} \sqrt{7x^2 + 4x + 16}$$

(C)

$$\lim_{x \rightarrow 0} \frac{x^2 + 3x + 2}{x + 1}$$

◆ For **rational** functions, the limit is the same as the function value as long as the denom. 0.

TOPIC: FINDING LIMITS ALGEBRAICALLY

EXAMPLE

Find the limit.

(A) $\lim_{x \rightarrow 2} 7$

(B) $\lim_{x \rightarrow -1} 2x^2 + 3x$

(C) $\lim_{x \rightarrow 3} \sqrt{3x^2 - 2}$

PRACTICE

Find the limit.

(A) $\lim_{x \rightarrow 0} x^3 + 5x^2 - 7x + 3$

(B) $\lim_{x \rightarrow 2} \sqrt{x^2 + 5}$

(C) $\lim_{x \rightarrow 3} \frac{x^2 + 2x - 3}{x - 2}$

TOPIC: FINDING LIMITS ALGEBRAICALLY

Limits of Rational Functions: Denominator = 0

◆ Recall: For **rational** functions, the limit is the same as the function value as long as the denom. $\neq 0$.

- If denom. = 0, _____ top & bottom, _____ common factor, then evaluate.

Recall	Denominator $\neq 0$	New	Denominator = 0
	$\lim_{x \rightarrow 0} \frac{x^2 + 3x + 2}{x + 1} = \frac{(0)^2 + 3(0) + 2}{0 + 1}$ $= \frac{2}{1}$ $= 2$		$\lim_{x \rightarrow -1} \frac{x^2 + 3x + 2}{x + 1} =$ $\lim_{x \rightarrow -1} \frac{\quad}{\quad}$ $\lim_{x \rightarrow -1} \frac{\quad}{\quad}$

EXAMPLE

Find the limit.

(A)

$$\lim_{x \rightarrow 3} \frac{x^2 + 2x - 15}{x - 3}$$

(B)

$$\lim_{x \rightarrow -2} \frac{x + 2}{x^2 - x - 6}$$

TOPIC: FINDING LIMITS ALGEBRAICALLY

EXAMPLE

Find the limit.

(A)

$$\lim_{x \rightarrow 1} \frac{x^3 - 2x^2 + x}{x - 1}$$

(B)

$$\lim_{x \rightarrow 2} \frac{x^3 - 2x^2 + x}{x - 1}$$

PRACTICE

Find the limit.

(A)

$$\lim_{x \rightarrow 0} \frac{3x^2 + 7x}{x}$$

(B)

$$\lim_{x \rightarrow 2} \frac{x^2 - 7x + 12}{x - 3}$$

(C)

$$\lim_{x \rightarrow -2} \frac{x^2 - 5x - 14}{x + 2}$$

(D)

$$\lim_{x \rightarrow -\pi} \frac{\sin x}{x}$$

TOPIC: FINDING LIMITS ALGEBRAICALLY

Limits of Rational Functions with Radicals

◆ Recall: For **rational** functions, the limit is the same as the function value as long as the denom. $\neq 0$.

- ▶ If denom. = 0 & function has a $\sqrt{\quad}$, multiply top & bottom by _____, cancel common factor, then evaluate.

Recall	Rational Functions	New	Rational Functions with Radicals
	$\lim_{x \rightarrow -1} \frac{x^2 + 3x + 2}{x + 1} = \lim_{x \rightarrow -1} \frac{(\cancel{x} + 1)(x + 2)}{\cancel{x} + 1}$ $= \lim_{x \rightarrow -1} (x + 2)$ $= (-1) + 2$ $= 1$		$\lim_{x \rightarrow 2} \frac{x - 2}{\sqrt{x} - \sqrt{2}}$ $\lim_{x \rightarrow 2}$ $\lim_{x \rightarrow 2}$ Recall $a + \sqrt{b} \leftrightarrow a - \sqrt{b}$ (Conjugates)

EXAMPLE

Find the limit.

$$\lim_{x \rightarrow 0} \frac{\sqrt{x + 9} - 3}{x}$$

TOPIC: FINDING LIMITS ALGEBRAICALLY

EXAMPLE

Find the limit.

$$\lim_{x \rightarrow 0} \frac{\sqrt{4-x} - 2}{x}$$

PRACTICE

Find the limit.

(A)

$$\lim_{x \rightarrow 3} \frac{\sqrt{x} - \sqrt{3}}{x - 3}$$

(B)

$$\lim_{x \rightarrow 0} \frac{\sqrt{x+1} - 1}{x}$$

(C)

$$\lim_{x \rightarrow 5} \frac{x - 5}{\sqrt{x} - \sqrt{5}}$$