

LIMITS

Find the indicated limit analytically.

$$1. \lim_{x \rightarrow -3} (3x+2) = 3(-3)+2 \\ = -9+2 \\ = \boxed{-7}$$

$$2. \lim_{x \rightarrow 1} \frac{2x^2+x-3}{x-1} = \lim_{x \rightarrow 1} \frac{(2x+3)(x-1)}{x-1} \\ = \lim_{x \rightarrow 1} (2x+3) \\ = 2(1)+3 = \boxed{5}$$

$$3. \lim_{x \rightarrow 2} \frac{x^2-5x+6}{x-2} = \lim_{x \rightarrow 2} \frac{(x-3)(x-2)}{x-2} \\ = \lim_{x \rightarrow 2} (x-3) \\ = 2-3 = \boxed{-1}$$

$$4. \lim_{x \rightarrow 1} \frac{\sqrt{x+3}-2}{x-1}$$

multiply by conjugate
☺

$$5. \lim_{x \rightarrow 9} \frac{\sqrt{x}-3}{x-9}$$

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

$$= \lim_{x \rightarrow 9} \frac{x-9}{(x-9)(\sqrt{x}+3)}$$

$$= \lim_{x \rightarrow 9} \frac{1}{\sqrt{x}+3}$$

$$= \frac{1}{\sqrt{9}+3}$$

$$= \frac{1}{2+3}$$

$$= \frac{1}{5}$$

$$= \boxed{\frac{1}{5}}$$

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

$$= \lim_{x \rightarrow 9} \frac{x-9}{(x-9)(\sqrt{x}+3)}$$

$$= \lim_{x \rightarrow 9} \frac{1}{\sqrt{x}+3}$$

$$= \frac{1}{\sqrt{9}+3}$$

$$= \frac{1}{3+3}$$

$$= \boxed{\frac{1}{6}}$$

multiply by conjugate
☺

$$6. \lim_{x \rightarrow \infty} \frac{5x^3-6x^2+3}{2x^3+7x^2-9} = \frac{5}{2}$$

b/c degree of N = degree of D
so, limit uses coefficients of leading terms

$$7. \lim_{x \rightarrow \infty} \frac{9x^4+7x^2+8x}{4x^3+3x-12} = \infty$$

b/c degree of N > degree of D
so, limit is $\pm \infty$

$$8. \lim_{x \rightarrow -\infty} \frac{3x^3-7x^2+5x+1}{7x^5+2x+5} = 0$$

b/c degree of N < degree of D
so, limit is zero

$$9. \lim_{x \rightarrow 0} \frac{\sin 5x}{3x} = \lim_{x \rightarrow 0} \frac{5 \cdot \sin 5x}{3 \cdot 5x}$$

multiply by $\frac{5}{5}$
☺

$$= \lim_{x \rightarrow 0} \frac{5}{3} \cdot \frac{\sin 5x}{5x}$$

becomes 1

$$= \frac{5}{3} \cdot 1$$

$$= \frac{5}{3}$$