

Limit Worksheet

$$\begin{aligned}
 1. \quad \lim_{x \rightarrow \infty} \frac{4x^3 - 6x^2 + 3}{5x^3 + 7x^2 - 9} \\
 \lim_{x \rightarrow \infty} \frac{\frac{4x^3}{x^3} - \frac{6x^2}{x^3} + \frac{3}{x^3}}{\frac{5x^3}{x^3} + \frac{7x^2}{x^3} - \frac{9}{x^3}} \\
 = \frac{4 - 0 + 0}{5 + 0 - 0} \\
 = \frac{4}{5}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad \lim_{x \rightarrow \infty} \frac{9x^4 + 7x^2 + 3x}{4x^5 + 3x - 12} \\
 \lim_{x \rightarrow \infty} \frac{\frac{9x^4}{x^5} + \frac{7x^2}{x^5} + \frac{3x}{x^5}}{\frac{4x^5}{x^5} + \frac{3x}{x^5} - \frac{12}{x^5}} \\
 = \frac{0 + 0 + 0}{4 + 0 - 0} \\
 = 0
 \end{aligned}$$

$$\begin{aligned}
 3. \quad \lim_{x \rightarrow \infty} \frac{3x^3 + 7x^2 + 5x}{7x^2 + 2x + 5} \\
 \lim_{x \rightarrow \infty} \frac{\frac{3x^3}{x^2} + \frac{7x^2}{x^2} + \frac{5x}{x^2}}{\frac{7x^2}{x^2} + \frac{2x}{x^2} + \frac{5}{x^2}} \\
 = \infty
 \end{aligned}$$

$$\begin{aligned}
 4. \quad \lim_{x \rightarrow \infty} \frac{(-1)^x}{x} \\
 \lim_{x \rightarrow \infty} \frac{(-1)}{\infty} \\
 = \frac{-1}{\infty} \\
 = 0
 \end{aligned}$$

$$\begin{aligned}
 5. \quad \lim_{x \rightarrow 2} \frac{x^2 - 3x}{x + 5} \\
 \frac{(2)^2 - 3(2)}{(2) + 5} \\
 \frac{4 - 6}{7} \\
 -\frac{2}{7}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad \lim_{x \rightarrow 5} \frac{x^2 - 25}{x - 5} \\
 \lim_{x \rightarrow 5} \frac{(x+5)(x-5)}{(x-5)} \\
 \frac{(5)+5}{10}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad \lim_{x \rightarrow 4} \frac{x-4}{\sqrt{x}-2} \cdot \frac{\sqrt{x}+2}{\sqrt{x}+2} \\
 \lim_{x \rightarrow 4} \frac{(x-4)(\sqrt{x}+2)}{(x-4)} \\
 \frac{\sqrt{4}+2}{4}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad \lim_{x \rightarrow 3} \frac{x^2 - 5x + 6}{x - 3} \\
 \lim_{x \rightarrow 3} \frac{(x-3)(x+2)}{(x-3)} \\
 \frac{3+2}{1}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad \lim_{x \rightarrow -3} \frac{x^2 - 2x + 1}{x + 7} \\
 \frac{(-3)^2 - 2(-3) + 1}{(-3) + 7} \\
 4
 \end{aligned}$$

$$10. \lim_{x \rightarrow 0} \frac{\sqrt{x+1} - 1}{x} \cdot \frac{\sqrt{x+1} + 1}{\sqrt{x+1} + 1}$$

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

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

$$\frac{1}{2}$$

$$11. \lim_{x \rightarrow -1} \frac{x^3 + 1}{x + 1}$$

$$\lim_{x \rightarrow -1} \frac{(\cancel{x} + 1)(x^2 + \cancel{x} + 1)}{(\cancel{x} + 1)}$$

$$\frac{(-1)^2 + (-1) + 1}{1 + 1 + 1}$$

$$3$$

$$12. \lim_{x \rightarrow 0^+} \frac{x}{|x|}$$

$$\frac{(0.00001)}{0.00001}$$

$$1$$

$$13. \lim_{x \rightarrow 0^-} \frac{x}{|x|}$$

$$\frac{(-.99999)}{|-.99999|}$$

$$-1$$

$$14. \lim_{x \rightarrow 4^-} \frac{|x-4|}{x-4}$$

$$\frac{|3.99-4|}{3.99-4}$$

$$-1$$

$$15. \lim_{x \rightarrow 4} \frac{|x-4|}{x-4}$$

$$\lim_{x \rightarrow 4^+} \frac{|4.001-4|}{4.001-4}$$

$$1$$

dne

$$16. \lim_{x \rightarrow \infty} \frac{2^{-x}}{2^x}$$

$$\lim_{x \rightarrow \infty} \frac{1}{2^x \cdot 2^x}$$

$$\lim_{x \rightarrow \infty} \frac{1}{2^{2x}}$$

$$0$$

$$17. \lim_{x \rightarrow 3} \frac{\frac{1}{x} - \frac{1}{3}}{x-3} \cdot \frac{3x}{3x}$$

$$\lim_{x \rightarrow 3} \frac{\cancel{3} - x}{3x(\cancel{3}/x)}$$

$$\lim_{x \rightarrow 3} \frac{-1}{3x}$$

$$\frac{-1}{3(3)}$$

$$-\frac{1}{9}$$

$$18. \lim_{x \rightarrow 0} \frac{\sqrt{2} - \sqrt{2+x}}{x} \cdot \frac{\sqrt{2} + \sqrt{2+x}}{\sqrt{2} + \sqrt{2+x}}$$

$$\lim_{x \rightarrow 0} \frac{2 - (2+x)}{x(\sqrt{2} + \sqrt{2+x})}$$

$$\lim_{x \rightarrow 0} \frac{-\cancel{x}}{\cancel{x}(\sqrt{2} + \sqrt{2+x})}$$

$$\frac{-1}{\sqrt{2} + \sqrt{2+0}} = \frac{-1}{2\sqrt{2}} = \frac{-\sqrt{2}}{4}$$

$$19. \lim_{x \rightarrow 0} \frac{\frac{1}{5-x} - \frac{1}{5}}{x} \cdot \frac{5(5-x)}{5(5-x)}$$

$$\lim_{x \rightarrow 0} \frac{5 + (5+x)}{5x(5-x)}$$

$$\lim_{x \rightarrow 0} \frac{x}{5x(5-x)}$$

$$\frac{1}{5(5-0)}$$

$$\frac{1}{25}$$

$$20. \lim_{x \rightarrow 2} \frac{x^2}{x-2} + \frac{-4}{x-2}$$

$$\lim_{x \rightarrow 2} \frac{x^2 - 4}{x-2}$$

$$\lim_{x \rightarrow 2} \frac{(x+2)(x/2)}{(x/2)}$$

$$\frac{(2)+2}{4}$$

$$21. \lim_{x \rightarrow -4} (x+3)^{.967}$$

$$(-4+3)^{.967}$$

$$-1$$

$$22. \lim_{x \rightarrow 2} [x]$$

$$\lim_{x \rightarrow 2^-} [1.99]$$

$$1$$

$$\lim_{x \rightarrow 2^+} [2.01]$$

$$2$$

dne

$$23. \lim_{x \rightarrow 3^+} [x]$$

$$[3.01]$$

$$3$$

$$24. \lim_{x \rightarrow 3^-} [2.99]$$

$$2$$

$$25. \lim_{x \rightarrow 2^+} [5x]$$

$$[5(2.01)]$$

$$[10.001]$$

$$10$$

$$26. \lim_{x \rightarrow -2^-} [5x]$$

$$[5(-2.001)]$$

$$[-10.0001]$$

$$-11$$

$$27. \lim_{x \rightarrow 3^-} [x+2]$$

$$[2.99+2]$$

$$[4.99]$$

$$4$$

$$28. \lim_{x \rightarrow 3^+} [3.01+2]$$

$$[5.01]$$

$$5$$

$$29. \lim_{x \rightarrow 3^+} \frac{1}{x-3}$$

$$\frac{1}{3.01-3}$$

$$\infty$$

$$30. \lim_{x \rightarrow 3^-} \frac{1}{x-3}$$

$$\frac{1}{299-3}$$

$$-\infty$$

$$31. \lim_{x \rightarrow 3} \frac{1}{x-3}$$

dne

$$32. \lim_{x \rightarrow \infty} \left(\frac{1}{3}\right)^x$$

$$\lim_{x \rightarrow \infty} \frac{1^x}{3^x}$$

$$\frac{1}{\infty}$$

$$0$$

$$33. \lim_{x \rightarrow \infty} \frac{\sqrt{x}+3}{x-4}$$

← compare powers in original

$$\lim_{x \rightarrow \infty} \frac{x^{1/2}+3}{x-4}$$

$$\lim_{x \rightarrow \infty} \frac{\frac{x^{1/2}}{x} + \frac{3}{x}}{\frac{x}{x} - \frac{4}{x}}$$

$$= \frac{0+0}{1-0}$$

$$= 0$$

$$* \frac{\sqrt{x}+3}{x-4} \cdot \frac{\sqrt{x}-3}{\sqrt{x}-3}$$

$$\frac{x-9}{(x-4)(\sqrt{x}-3)} = \frac{x-9}{x^{3/2}-3x-4x^{1/2}+12}$$

$$= 0$$

↳ bigger exponent in denominator

$$34. \lim_{x \rightarrow \infty} \frac{3x}{\sqrt{x^2+2}}$$

$$\lim_{x \rightarrow \infty} \frac{(3x)^2}{\sqrt{x^2+2}}$$

$$\lim_{x \rightarrow \infty} \frac{9x^2}{\sqrt{x^2+2}}$$

$$\lim_{x \rightarrow \infty} \frac{\frac{9x^2}{x^2}}{\sqrt{\frac{x^2}{x^2} + \frac{2}{x^2}}}$$

$$\sqrt{\frac{9}{1}}$$

$$3$$

$$35. \lim_{x \rightarrow \infty} \frac{3x-2}{\sqrt{4x^2-1}}$$

$$\lim_{x \rightarrow \infty} \frac{(3x-2)^2}{\sqrt{4x^2-1}}$$

$$\lim_{x \rightarrow \infty} \frac{9x^2-12x+4}{\sqrt{4x^2-1}}$$

$$\lim_{x \rightarrow \infty} \frac{\frac{9x^2}{x^2} - \frac{12x}{x^2} + \frac{4}{x^2}}{\sqrt{\frac{4x^2}{x^2} - \frac{1}{x^2}}}$$

$$\sqrt{\frac{9}{4}}$$

$$\frac{3}{2}$$