C12 - 1.4 - Algebra Limits Notes

$$\lim_{x\to 1} x^2+1 \quad (1^*)^2+1 \quad (2)$$

x	y
0.999	1.998
1	Don't Care
1.001	2.002

$$\lim_{x\to 1} \frac{1}{x-1} \quad (DNE)$$

Can't divide by zero

$$\lim_{x\to 1} \frac{1}{x^2-1} \quad (\infty)$$

$$\lim_{x\to 1} \frac{1}{x^2+1} \quad \left(\frac{1}{2}\right)$$

$$\lim_{x\to 2} \frac{x^2-2x}{x^2-5x-6} \quad \lim_{x\to 2} \frac{x}{x-3} \quad \frac{2}{2-3} = (-2)$$

$$\lim_{x\to -2} \frac{2x^2+7x+6}{x+2} \quad \lim_{x\to -3} 2x+3 \quad 2(-3)+3 = (-3)$$

$$\lim_{x\to 2} \frac{x^2-4}{x^3-8} \quad \lim_{x\to 2} \frac{(x-2)(x+2)}{(x-2)(x^2+2x+2^2)} \quad \lim_{x\to 2} \frac{x+2}{x^2+2x+4} \quad \frac{(2)+2}{(2)^2+2(2)+4} = \left(\frac{1}{3}\right)$$

$$\lim_{x\to 1} \frac{x-1}{x^4-1} \quad \lim_{x\to 1} \frac{x-1}{(x^2+1)(x^2-1)} \quad \lim_{x\to 1} \frac{x-1}{(x^2+1)(x+1)(x-1)} \quad \lim_{x\to 1} \frac{1}{(x^2+1)(x+1)} = \left(\frac{1}{4}\right)$$

Do it in your head!

$$\lim_{x\to 0} \frac{\frac{1}{x+3}-\frac{1}{3}}{x} \quad \lim_{x\to 0} \frac{\frac{1}{x+3}-\frac{1}{3}}{\frac{x}{1}} \times \boxed{\frac{LCD}{3(x+3)}} \quad \lim_{x\to 0} \frac{3-(x+3)}{3x(x+3)} \quad \lim_{x\to 0} \frac{-x}{3x(x+3)} \quad \lim_{x\to 0} \frac{-1}{3(x+3)} \quad \frac{-1}{3(0+3)} = \left(-\frac{1}{9}\right)$$

$$3\times\frac{1}{x+3}-\frac{1}{3}\times(x+3)$$
$$3\times\frac{-x}{3(x+3)}-\frac{1}{3}\times(x+3)$$
$$\frac{-x}{3(x+3)} \quad \text{Add Fractions}$$
$$\frac{\frac{-x}{3(x+3)}}{\frac{x}{1}}$$
$$\frac{-x}{3(x+3)}\times\frac{1}{x} \quad \text{Flip and Multiply}$$
$$\frac{-1}{3(x+3)}$$

$$\lim_{h\to 0} \frac{\frac{1}{x+h}-\frac{1}{x}}{h} \quad \lim_{h\to 0} \frac{\frac{1}{x+h}-\frac{1}{x}}{\frac{h}{1}} \times \boxed{\frac{LCD}{x(x+h)}} \quad \lim_{h\to 0} \frac{x-(x+h)}{xh(x+h)} \quad \lim_{h\to 0} \frac{-h}{xh(x+h)} \quad \lim_{h\to 0} \frac{-1}{x(x+h)} \quad \frac{-1}{x(x+0)} = \left(\frac{-1}{x^2}\right)$$

$$\lim_{x\to 9} \frac{9-x}{3-\sqrt{x}} \quad \lim_{x\to 9} \frac{9-x}{3-\sqrt{x}} \boxed{\times 3+\sqrt{x} \atop \times 3+\sqrt{x}} \quad \lim_{x\to 9} \frac{(9-x)(3+\sqrt{x})}{9-x} \quad \lim_{x\to 9} 3+\sqrt{x} \quad 3+\sqrt{9} = (6)$$

Conjugate

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

Only FOIL the Conj.

$$\lim_{x\to 11} \frac{\sqrt{x-2}-3}{x-11} \boxed{\times\sqrt{x-2}+3 \atop \times\sqrt{x-2}+3} \quad \lim_{x\to 11} \frac{x-2-9}{(x-11)(\sqrt{x-2}+3)} \quad \lim_{x\to 11} \frac{1}{(\sqrt{x-2}+3)} \quad \frac{1}{(\sqrt{(11)-2}+3)} = \left(\frac{1}{6}\right)$$