Section 1.2
Limits and Continuity

Example 1: Finding the following limits using direct substitution

a. $\lim_{x \to 4} x^2 - 3x + 7$

b. $\lim_{x \to 2} x^4 - 5x^3 + x^2 - 7$

c. $\lim_{x \to 0} \sqrt{x^3 - 3x + 2}$

d. $\lim_{x \to 3} \frac{x^2-8}{x-2}$

e. $\lim_{x \to 5} \sqrt{x^2 - 16}$

f. $\lim_{x \to 2} \sqrt{x^2 - 9}$

g. $\lim_{x \to 2} 7$

h. $\lim_{x \to 2} \frac{x-2}{x^2+4}$

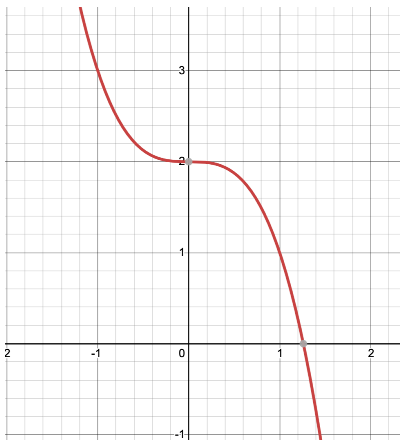
Example 2: Finding limits of indeterminate form $\frac{0}{0}$. Try factoring.

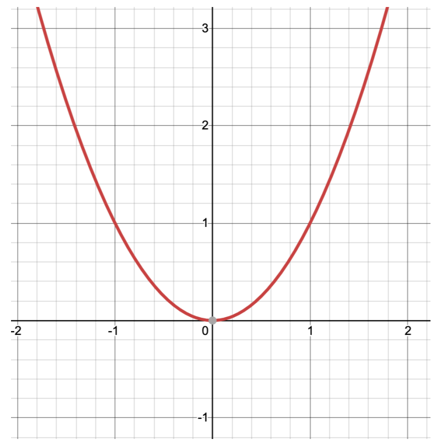
a. $\lim_{x \to -3} \frac{x^2-x-12}{x+3}$

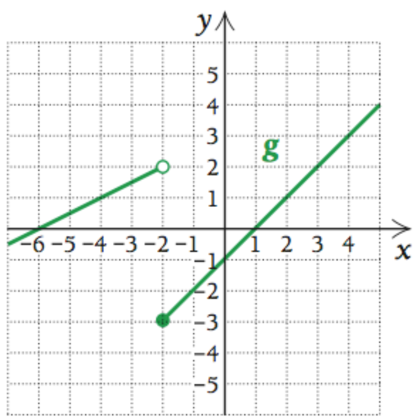
b. $\lim_{x \to 2} \frac{3x^2+x-14}{x^2-4}$

Continuity

Big Idea- The graph is connected, can draw without lifting your pencil.







Definition

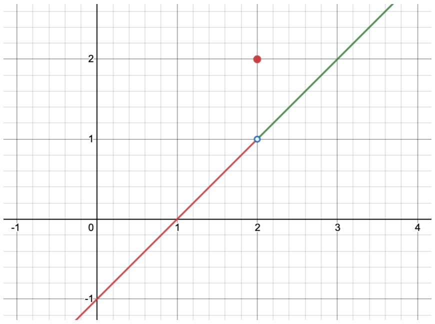
A function f is ______________________________ at ______________ if the following conditions are met.

1.$f(a)$

2.$\lim_{x \to a} f(x)$

3. $\lim_{x \to a} f(x) = f(a)$

Example 3: Explore limits and continuity in the following examples



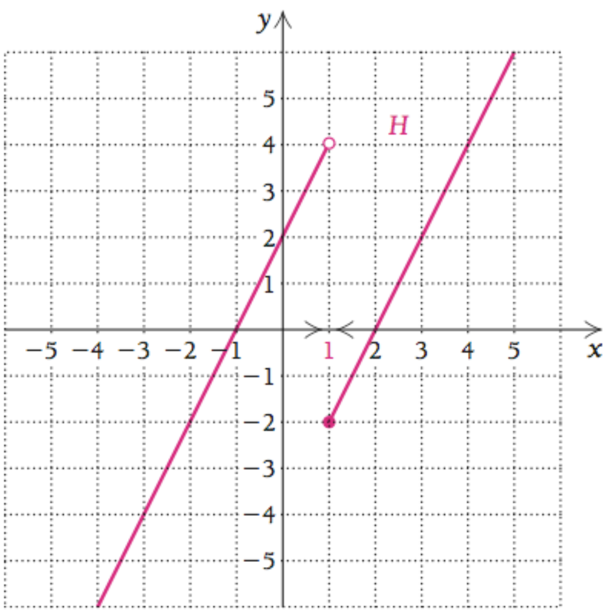
$f(2)$

$\lim_{x\to 2^+} f(x)$

$\lim_{x\to 2^-} f(x)$

$\lim_{x\to 2} f(x)$

Is $f(x)$ continuous at x=2?



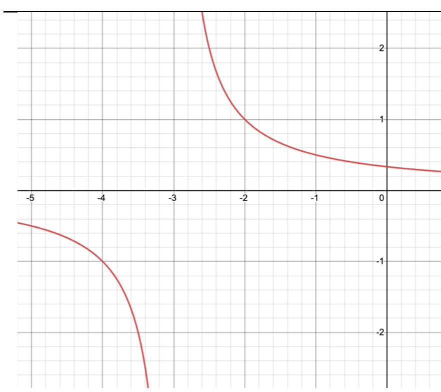
$f(1)$

$\lim_{x\to 1^+} f(x)$

$\lim_{x\to 1^-} f(x)$

$\lim_{x\to 1} f(x)$

Is $f(x)$ continuous at x=1?



$f(-3)$

$\lim_{x\to -3^+} f(x)$

$\lim_{x\to -3^-} f(x)$

$\lim_{x\to -3} f(x)$

Is $f(x)$ continuous at x=-3?

Section 1.2
Limits and Continuity

Example 1: Finding the following limits using direct substitution

a. $\lim_{x\to 4} x^2 - 3x + 7$

$4^2 - 3(4) + 7 = 16 - 12 + 7 = 11$

b. $\lim_{x\to 2} x^4 - 5x^3 + x^2 - 7$

$2^4 - 5(2)^3 + 2^2 - 7 = 16 - 40 + 4 - 7$
$= -27$

c. $\lim_{x\to 0} \sqrt{x^3 - 3x + 2}$

$\sqrt{0^3 - 3(0) + 2} = \sqrt{2}$

d. $\lim_{x\to 3} \frac{x^2-8}{x-2} = \frac{3^2-8}{3-2} = \frac{9-8}{3-2} = \frac{1}{1} = 1$

e. $\lim_{x\to 5} \sqrt{x^2 - 16}$

$\sqrt{5^2 - 16} = \sqrt{25-16} = \sqrt{9} = 3$

f. $\lim_{x\to 2} \sqrt{x^2 - 9}$

$\sqrt{2^2 - 9} = \sqrt{4-9} = \cancel{\sqrt{-5}}$
does not exist

g. $\lim_{x\to 2} 7 = 7$

h. $\lim_{x\to 2} \frac{x-2}{x^2+4} = \frac{2-2}{2^2+4} = \frac{0}{4+4} = \frac{0}{8} = 0$

Example 2: Finding limits of <u>indeterminate</u> form $\frac{0}{0}$. Try factoring.

a. $\lim_{x\to -3} \frac{x^2-x-12}{x+3} = \frac{(-3)^2 - (-3) - 12}{-3+3} = \frac{0}{0}$ try again

$\lim_{x\to -3} \frac{x^2 - x - 12}{x+3} = \lim_{x\to -3} \frac{(x+3)(x-4)}{x+3} = \lim_{x\to -3} \frac{x-4}{1} = -3-4 = -7$

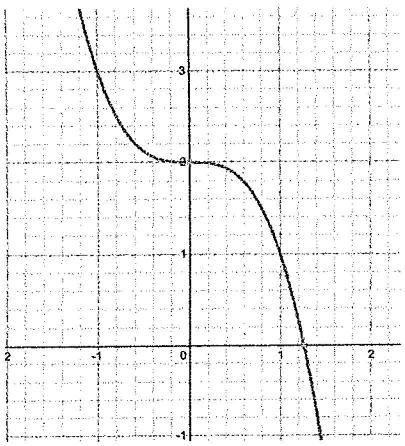
b. $\lim_{x\to 2} \frac{3x^2+x-14}{x^2-4} = \frac{3(2)^2 + 2 - 14}{2^2 - 4} = \frac{12+2-14}{4-4} = \frac{0}{0}$ try again

$\lim_{x\to 2} \frac{3x^2 + x - 14}{x^2 - 4} = \lim_{x\to 2} \frac{(3x+7)(x-2)}{(x-2)(x+2)} = \lim_{x\to 2} \frac{3x+7}{x+2} = \frac{3(2)+7}{2+2}$

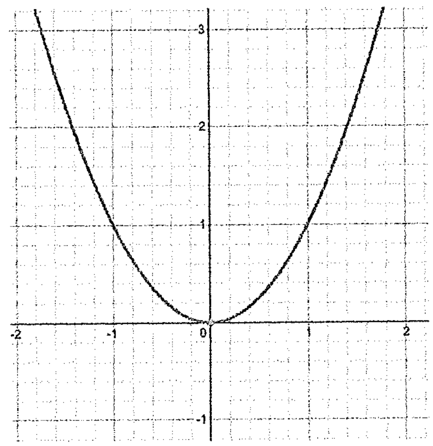
$= \frac{13}{4}$

Continuity

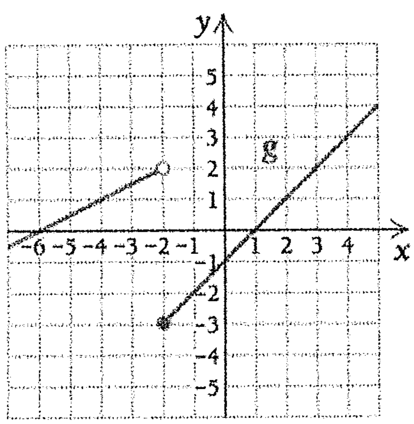
Big Idea- The graph is connected, can draw without lifting your pencil.



continuous



continuous



discontinuous at $x = -2$

Definition

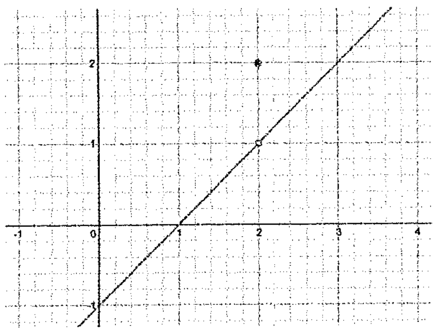
A function f is <u>continuous</u> at <u>$x=a$</u> if the following conditions are met.

1. $f(a)$ is defined

2. $\lim_{x \to a} f(x)$ exists

3. $\lim_{x \to a} f(x) = f(a)$

Example 3: Explore limits and continuity in the following examples



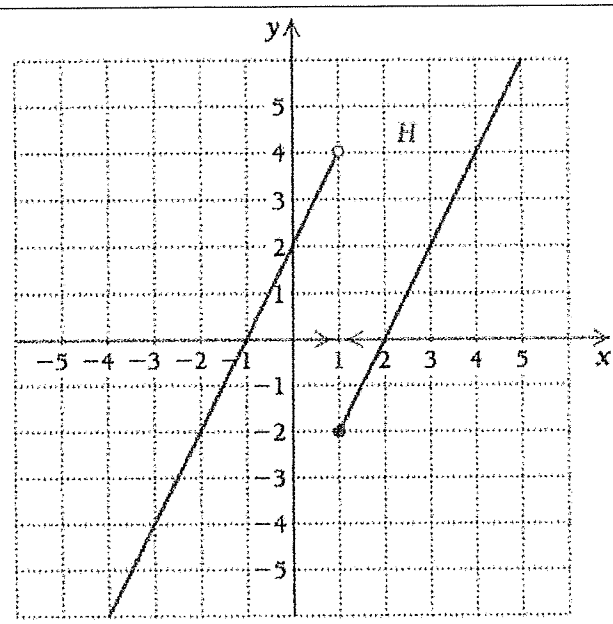
$f(2)$ = 2

$\lim_{x\to 2^+} f(x)$ = 1

$\lim_{x\to 2^-} f(x)$ = 1

$\lim_{x\to 2} f(x)$ = 1

Is $f(x)$ continuous at x=2? No



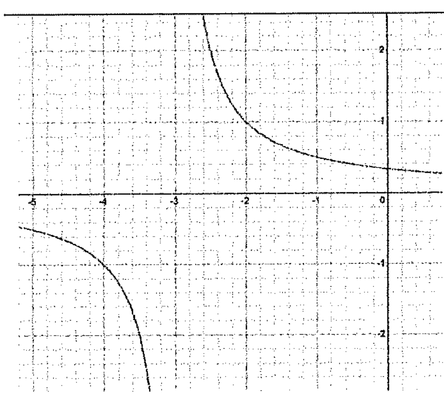
$f(1)$ = -2

$\lim_{x\to 1^+} f(x)$ = -2

$\lim_{x\to 1^-} f(x)$ = 4

$\lim_{x\to 1} f(x)$ DNE

Is $f(x)$ continuous at x=1? No



$f(-3)$ undefined

$\lim_{x\to -3^+} f(x)$ = $+\infty$

$\lim_{x\to -3^-} f(x)$ = $-\infty$

$\lim_{x\to -3} f(x)$ Does not exist

Is $f(x)$ continuous at x=-3? No