Trig 3.5

Determine whether a function is continuous
Identity end behavior of a function
Determine whether a function is increasing or decreasing on an interval

continuous *traceable*
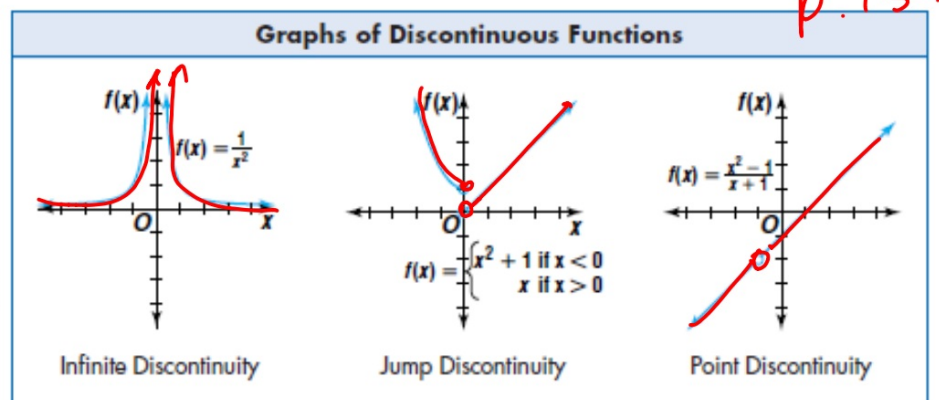
discontinous *not "*

end behavior *(algebra 2)*

increasing } *related*
decreasing } *to slope*

interval

infinite discontinuity

jump discontinuity

point discontinuity

p.159

Graphs of Discontinuous Functions

$f(x) = \frac{1}{x^2}$

Infinite Discontinuity

$f(x) = \begin{cases} x^2 + 1 & \text{if } x < 0 \\ x & \text{if } x > 0 \end{cases}$

Jump Discontinuity

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

Point Discontinuity
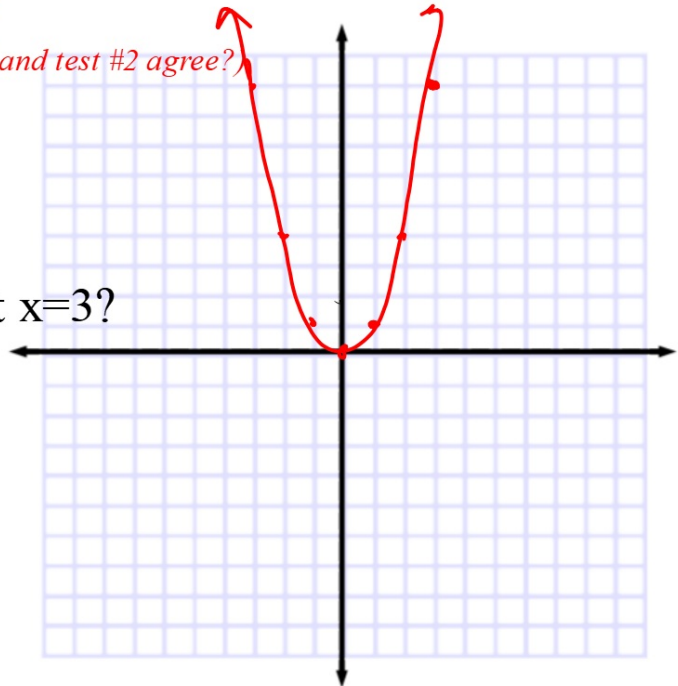
Continuity test: Is the graph continuous at c?   y/n

· 1. What function?   *(Can I find f(c) from the equation?)*
· 2. Where?   *(Look at the graph)*
· 3. Do they match?   *(Do test #1 and test #2 agree?)*

Ex. $f(x) = x^2$
Is the function continuous at x=3?

1. $f(3) = 9$
2. $(3, 9)$
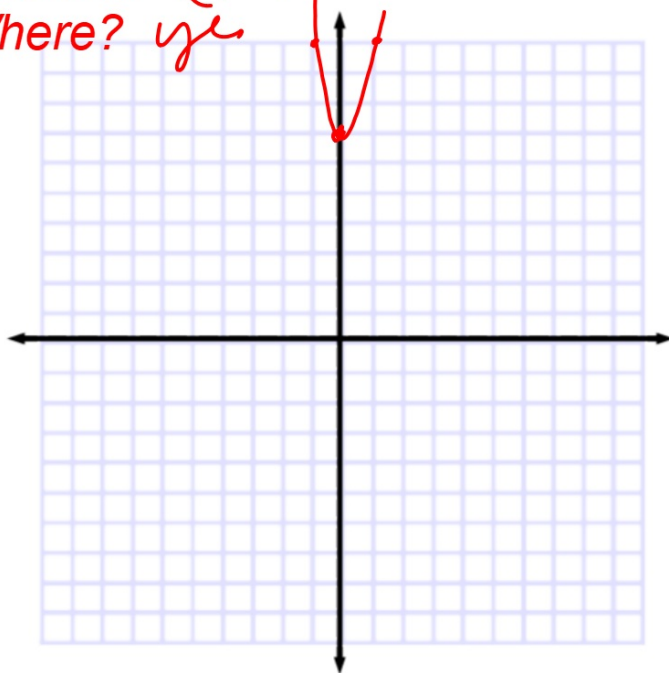3. yes

1 **Determine whether each function is continuous at the given x-value.**

a. $f(x) = 3x^2 + 7; x = 1$

What function? $f(1) = 3+7 = 10$

$(1, 10)$

Where? yes

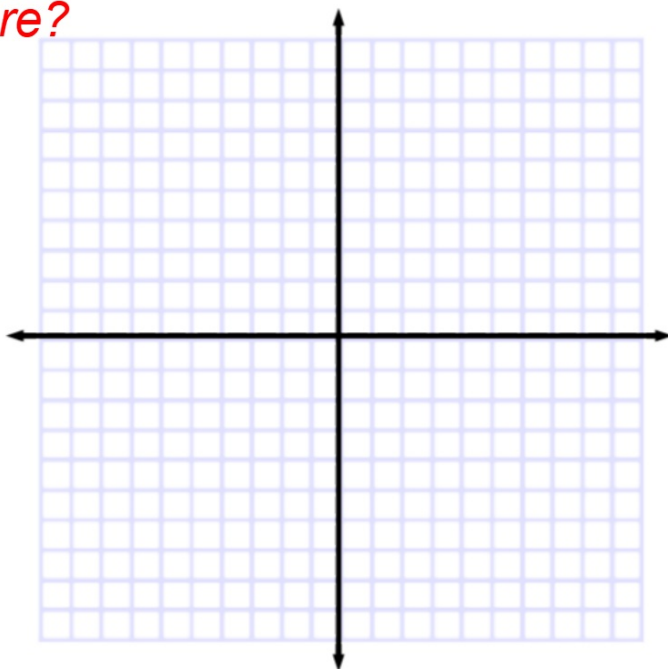1. What function? $f(\_)$
2. Where? $(\ ,\_)$
3. Do they match?

b $f(x) = \dfrac{x-2}{x^2-4}; x = 2$

$f(2) = \dfrac{0}{0}$

What function? Where?

$n\,o$

1. What function?
2. Where?
3. Do they match?

Piecewise function (alg 2)

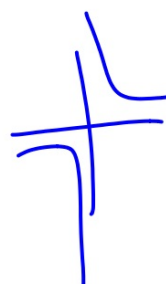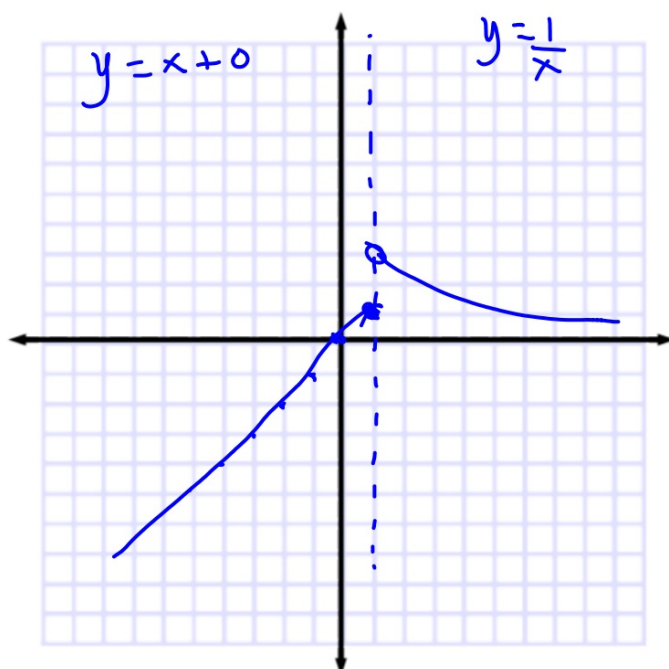c. $f(x) = \begin{cases} \frac{1}{x} & \text{if } x > 1 \\ x & \text{if } x \leq 1 \end{cases}; x = 1$

o pen

closed

$y = x$

$f(1) = 1$

What function?
Where?

$f(1) = 1$

$(1, 1)$

x	y
2	1/2
3	1/3
4	1/4
1.5	2/3
1	1

$y = x + 0$

$y = \frac{1}{x}$

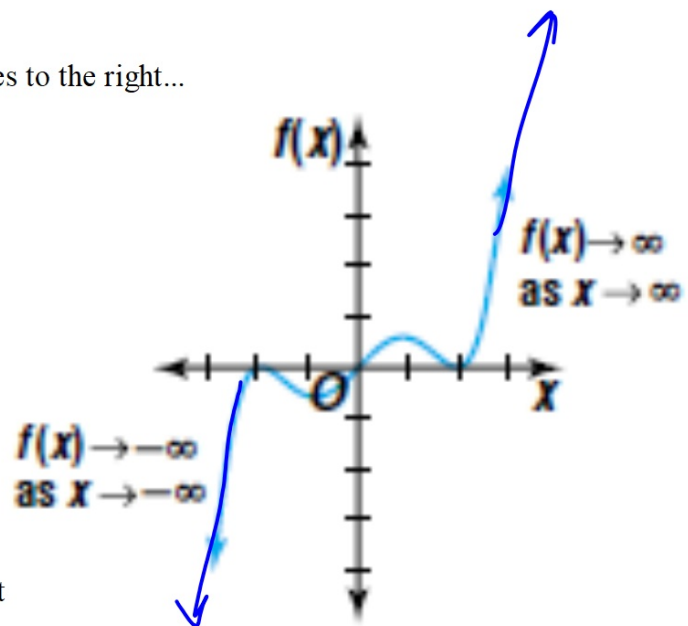| Continuity on an Interval	A function $f(x)$ is continuous on an interval if and only if it is continuous at each number x in the interval.

Where am I looking?

$$f(x) = \begin{cases} 3x - 2 & \text{if } x > 2 \\ 2 - x & \text{if } x \leq 2 \end{cases}$$
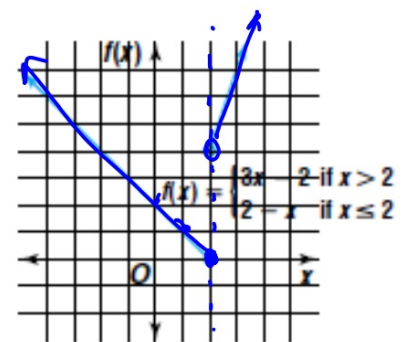
Doesn't have to be continuous everywhere. Where are they asking about?

End behavior:
The function goes up as x goes to the right...
Words...code...

$f(x)$
up/down

ceo

X left/right

$f(x)$

$f(x) \to \infty$
as $x \to \infty$

$f(x) \to -\infty$
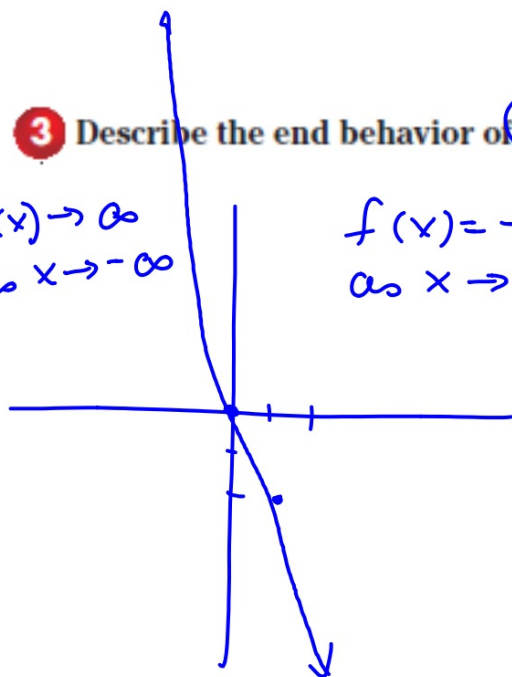as $x \to -\infty$

0

x

The function goes down as x goes to the left

3 Describe the end behavior of $f(x) = -2x^3$ and $g(x) = -x^3 + x^2 - x + 5$.

$f(x) \to \infty$
as $x \to -\infty$

$f(x) = -\infty$
as $x \to \infty$

$f(x) \to \infty$
if $x \to -\infty$
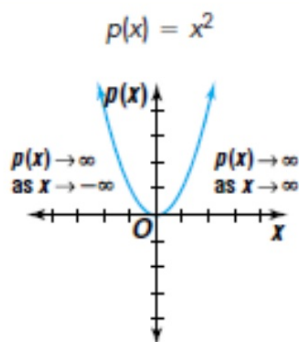
$f(x) \to -\infty$
if $x \to \infty$
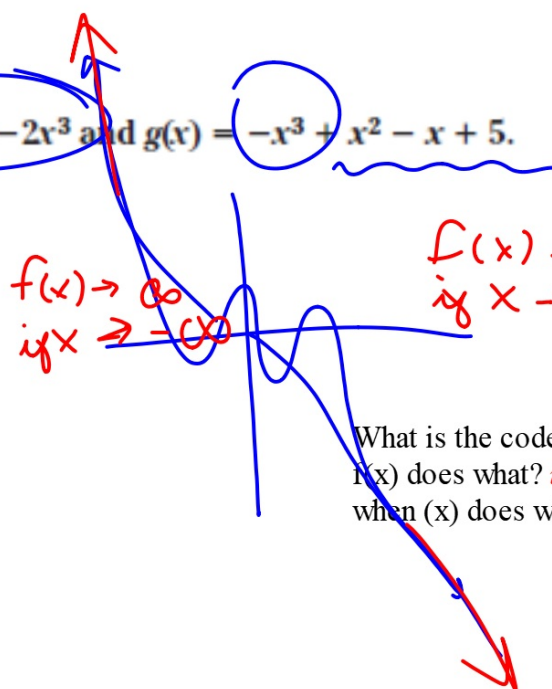
What is the code?
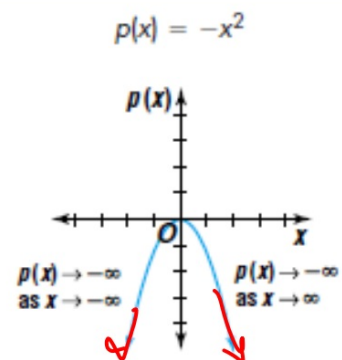f(x) does what? *up or down*
when (x) does what? *left or right*

End Behavior of Polynomial Functions

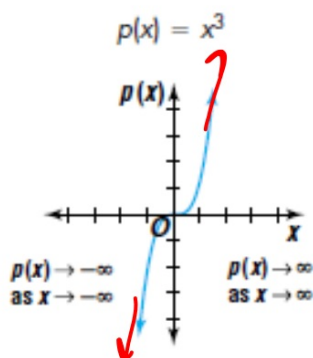$$p(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0, \; n > 0$$
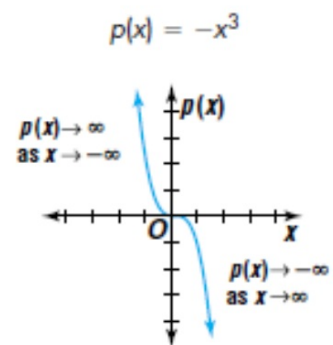
a_n: positive, n: even	a_n: negative, n: even
$p(x) = x^2$	$p(x) = -x^2$
$p(x) \to \infty$ as $x \to -\infty$ $\qquad$ $p(x) \to \infty$ as $x \to \infty$	$p(x) \to -\infty$ as $x \to -\infty$ $\qquad$ $p(x) \to -\infty$ as $x \to \infty$

a_n: positive, n: odd	a_n: negative, n: odd
$p(x) = x^3$	$p(x) = -x^3$
$p(x) \to -\infty$ as $x \to -\infty$ $\qquad$ $p(x) \to \infty$ as $x \to \infty$	$p(x) \to \infty$ as $x \to -\infty$ $\qquad$ $p(x) \to -\infty$ as $x \to \infty$

related to slope *(but not exactly...)*

$$f(x) = x^2$$

f(x)

Decreasing

Increasing

O

x
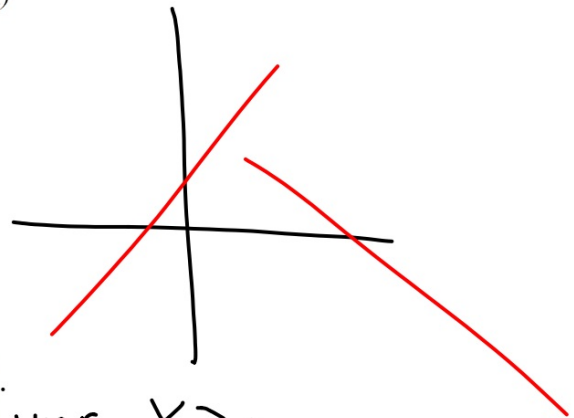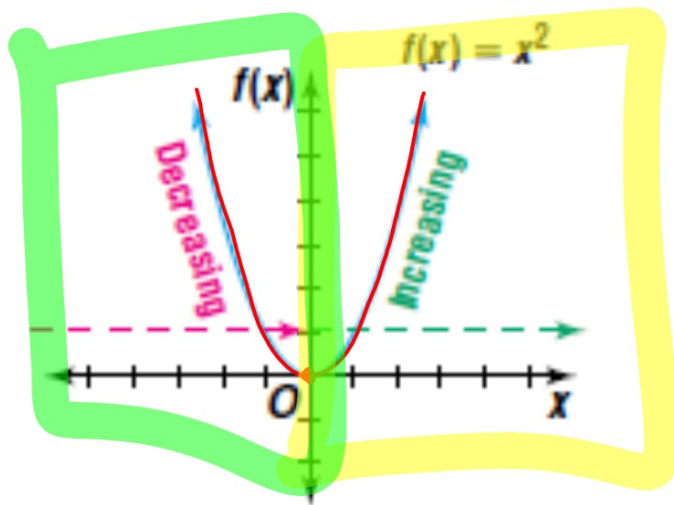
incr. $X > 0$

decr. $x < 0$

Slope is not constant: that would be linear.
Changing but still negative slope ...zero... changing but still positive slope
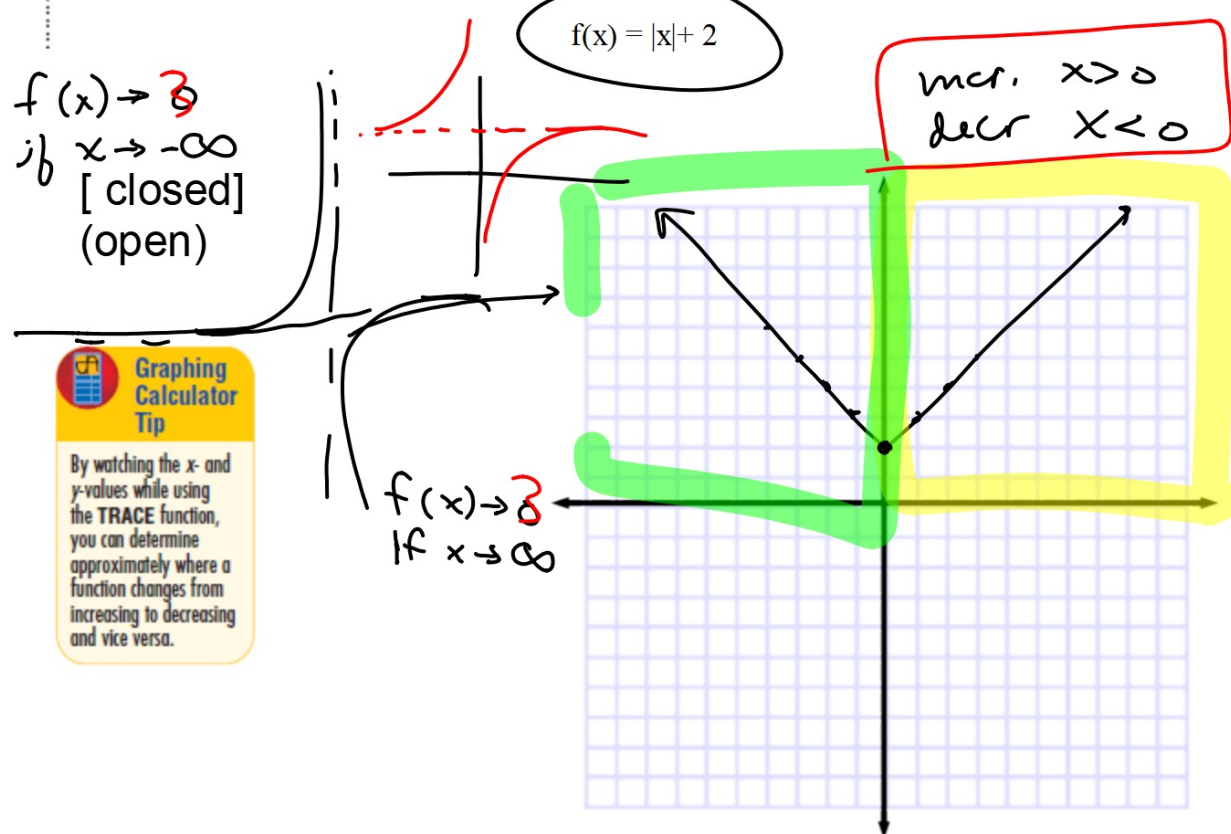
Use interval notation *(here's the code)*

④ Graph each function. Determine the interval(s) on which the function is increasing and the interval(s) on which the function is decreasing.

$f(x) = |x| + 2$

$f(x) \to 3$

$if \; x \to -\infty$

[closed]

(open)

Graphing Calculator Tip

By watching the x- and y-values while using the **TRACE** function, you can determine approximately where a function changes from increasing to decreasing and vice versa.

$f(x) \to 3$

If $x \to \infty$

incr. $x > 0$

decr $x < 0$

15—25 0
41—45 0

4 Graph each function. Determine the interval(s) on which the function is increasing and the interval(s) on which the function is decreasing.

a. $f(x) = 3 - (x - 5)^2$