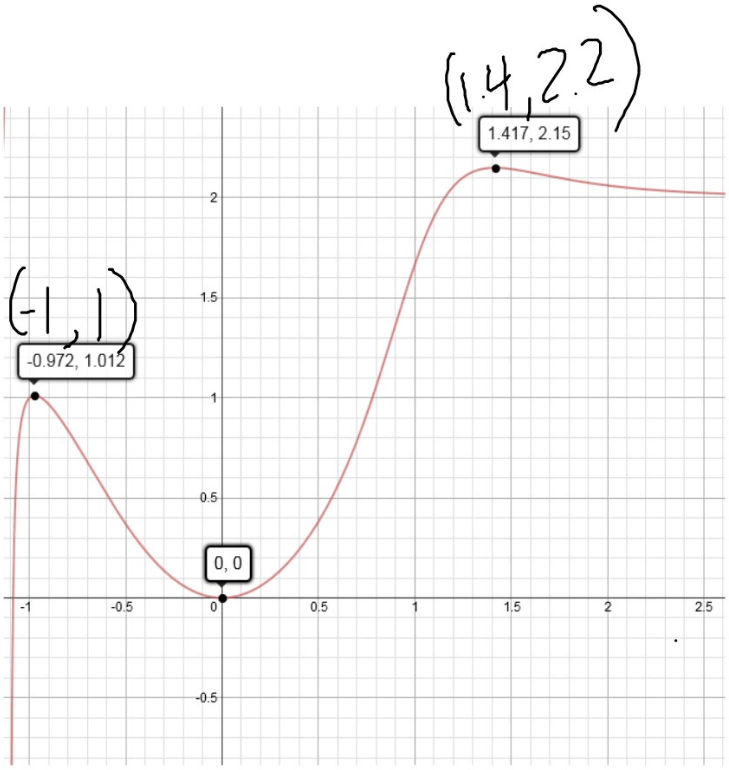
Warm up

Find the domain for #1 & 2 (interval notation)

1. $f(x) = \frac{x^2+5x-4}{2x+3}$

2. $f(x) = \sqrt{2x+6}$

3. Find all relative and absolute extrema (max/min) and when the graph is increasing and decreasing (interval notation)



Homework 1-2

In Exercises 1–4, determine whether the formula determines y as a function of x. If not, explain why not.

1. $y = \sqrt{x - 4}$ Function

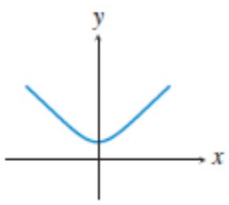
2. $y = x^2 \pm 3$ Not Function

3. $x = 2y^2$ Not Function

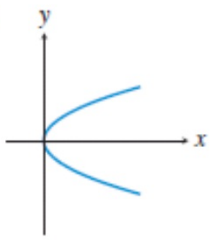
4. $x = 12 - y$ Function

In Exercises 5–8, use the vertical line test to determine whether the curve is the graph of a function.

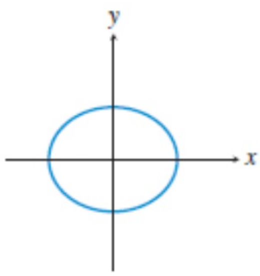
5. Yes



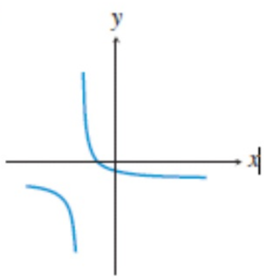
6. No



7. No



8. Yes



Section 1.2 Homework

In Exercises 9–16, find the domain of the function algebraically and support your answer graphically.

10. $h(x) = \dfrac{5}{x - 3}$ **10.** $(-\infty, 3) \cup (3, \infty)$

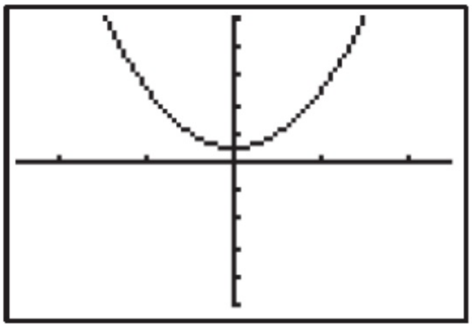
14. $h(x) = \dfrac{\sqrt{4 - x^2}}{x - 3}$ $[-2, 2]$

In Exercises 21–24, graph the function and tell whether or not it has a point of discontinuity at $x = 0$. If there is a discontinuity, tell whether it is removable or nonremovable.

22. $h(x) = \dfrac{x^3 + x}{x}$

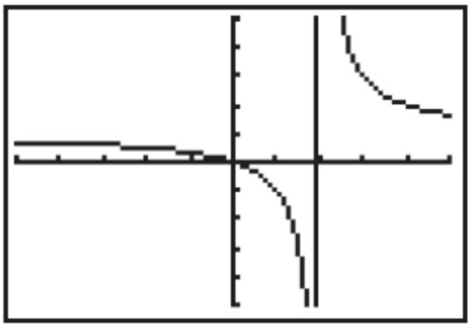
24. $g(x) = \dfrac{x}{x - 2}$

22. Yes, removable



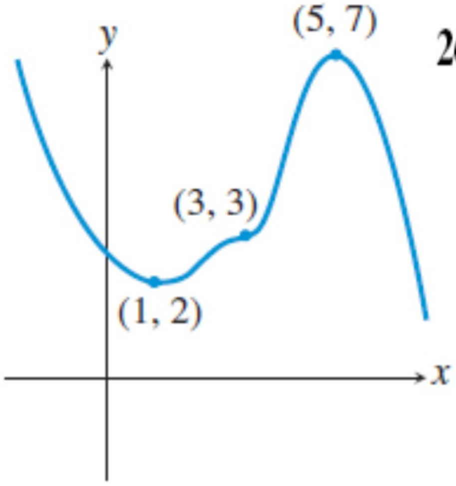
$[-5, 5]$ by $[-10, 10]$

24. Yes, non-removable



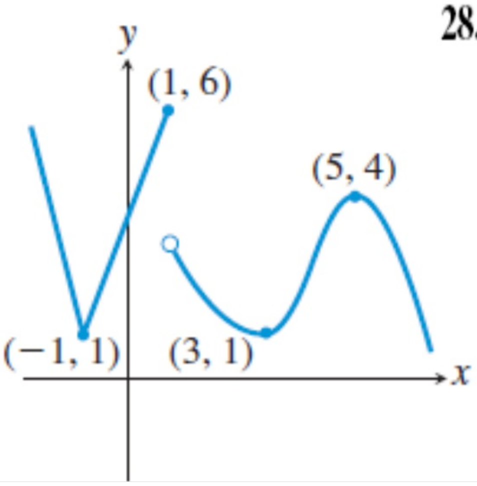
$[-5, 5]$ by $[-5, 5]$

26.



26. Local minimum at $(1, 2)$, $(3, 3)$ is neither, and $(5,$
local maximum. The function decreases on $(-\infty,$
increases on $[1, 5]$, and decreases on $[5, \infty)$.

28.



28. $(-1, 1)$ and $(3, 1)$ are local minima, while $(1, 6)$ and
are local maxima. The function decreases on $(-\infty, -$
increases on $[-1, 1]$, decreases on $(1, 3]$, increases o
$[3, 5]$, and decreases on $[5, \infty)$.

48. $g(x) = x^3$ Odd

50. $g(x) = \dfrac{3}{1 + x^2}$ Even

52. $f(x) = x^3 + 0.04x^2 + 3$ Neither

54. $h(x) = \dfrac{1}{x}$ Odd

Factor the following

ADD MULT

1. $x^2 - 9x - 10$

$(x+1)(x-10)$

2. $25y^2 - x^2$

$(5y+x)(5y-x)$

3. $x^2 - 5x + 6$

$(x-3)(x-2)$

4. $9x^2 - 12x + 4$

5. $3x^2 + 2x + 12x + 8$

6. $4x^2 - 12x$

$4x(x-3)$

Factor the following

1) $x^2 - 12x - 45$

2) $1 - 64x^2$

3) $10x^2 - 11x - 6$

1.3 Functions and Piecewise

Objective:

> Graph Piecewise Functions.

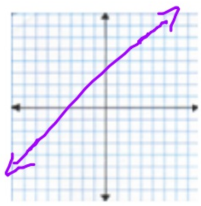
Objective: Identify basic functions and graph piece wise functions

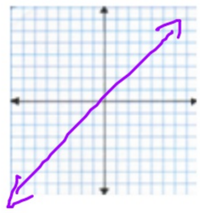
The Library of Functions

The Library of functions provides us with a reference for some of the most used functions in our class. Knowing the graphs of these functions and some key information will allow us to work with any altered form of each.

I. **Linear function**

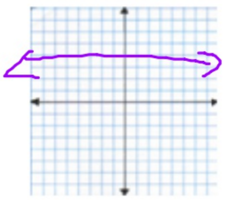
- $f(x) = mx + b$, where m and b are elements of the real numbers
- domain: all real numbers if $y \neq 0$
- range: all real numbers if $x \neq 0$
- increasing function if $m > 0$
- decreasing function if $m < 0$
- constant if $m = 0$





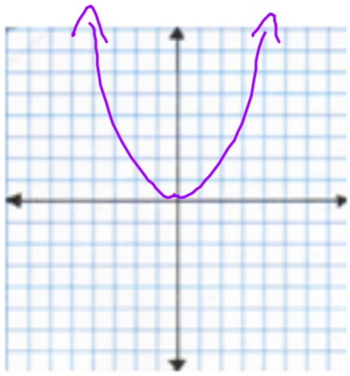
A. **Constant function**

- $f(x) = b$, where b is an element of the real numbers
- domain: $(-\infty, \infty)$
- range: $\{b\}$
- even function



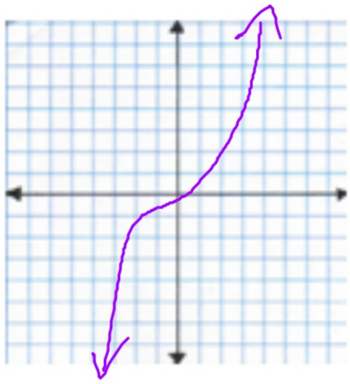
II. Quadratic function

- $f(x) = x^2$
- domain: $(-\infty, \infty)$
- range: $[0, \infty)$
- even function
- decreasing: $(-\infty, 0)$
- increasing: $(0, \infty)$



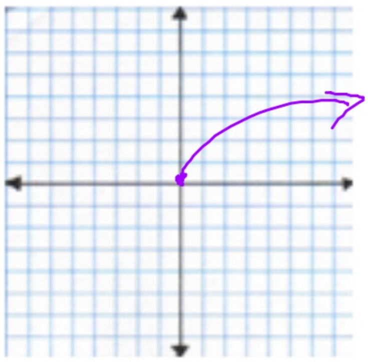
III. Cubic function

- $f(x) = x^3$
- domain: $(-\infty, \infty)$
- range: $(-\infty, \infty)$
- odd function
- increasing: $(-\infty, \infty)$



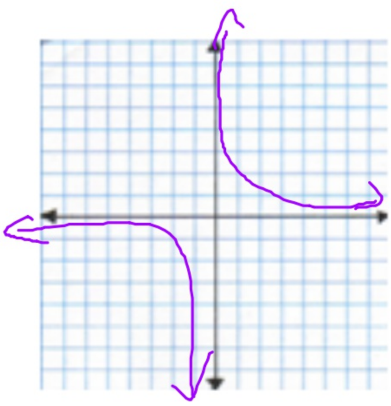
IV. **Square Root Function**

- $f(x) = \sqrt{x}$
- domain: $[0, \infty)$
- range: $[0, \infty)$
- neither even or odd
- increasing: $[0, \infty)$



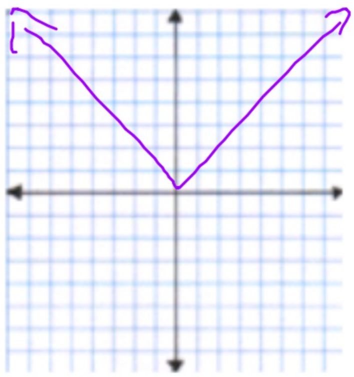
V. **Recipriocal Function**

- $f(x) = \dfrac{1}{x}$
- domain: $(-\infty, 0) \cup (0, \infty)$
- range: $(-\infty, 0) \cup (0, \infty)$
- odd function
- decreasing: $(-\infty, 0) \cup (0, \infty)$



VI. Absolute Function

- $f(x) = |x|$
- domain: $(-\infty, \infty)$
- range: $[0, \infty)$
- even function
- decreasing: $(-\infty, 0)$
- increasing: $(0, \infty)$



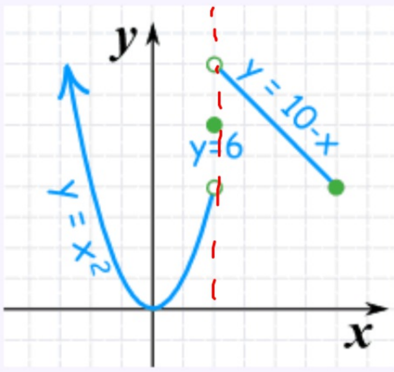
Definition of Piecewise Functions

A piecewise function is usually defined by more than one formula: a fomula for each interval.

Example: A function with three pieces:

- when x is less than 2, it gives $\mathbf{x^2}$,
- when x is exactly 2 it gives **6**
- when x is more than 2 and less than or equal to 6 it gives the line **10-x**

It looks like this:



(a solid dot means "including",
an open dot means "not including")

And this is how you write it:

$$f(x) = \begin{cases} x^2 & \text{if } x < 2 \\ 6 & \text{if } x = 2 \\ 10 - x & \text{if } x > 2 \text{ and } x \leq 6 \end{cases}$$

Let's just dive in and do one:

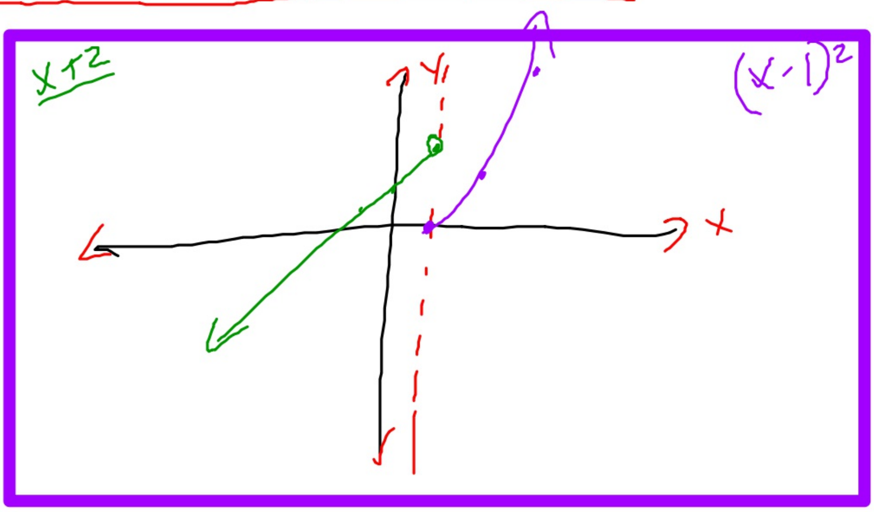
Graph

$$y = \begin{cases} x + 2 \; ; \; x < 1 \leftarrow (1) \\ (x-1)^2 \; ; \; x \geq 1 \leftarrow (2) \end{cases}$$

It's in two pieces!

Each piece must live ONLY in its own neighborhood.

Let's put up a fence, so we don't make any mistakes:



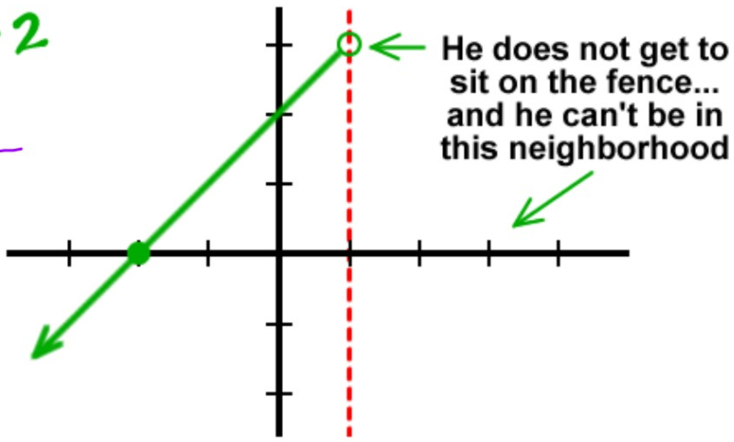
Now, we just need to figure out who the fence owner is...

$$y = \begin{cases} x+2 & ; \ x < 1 \\ (x-1)^2 & ; \ x \geq 1 \end{cases}$$

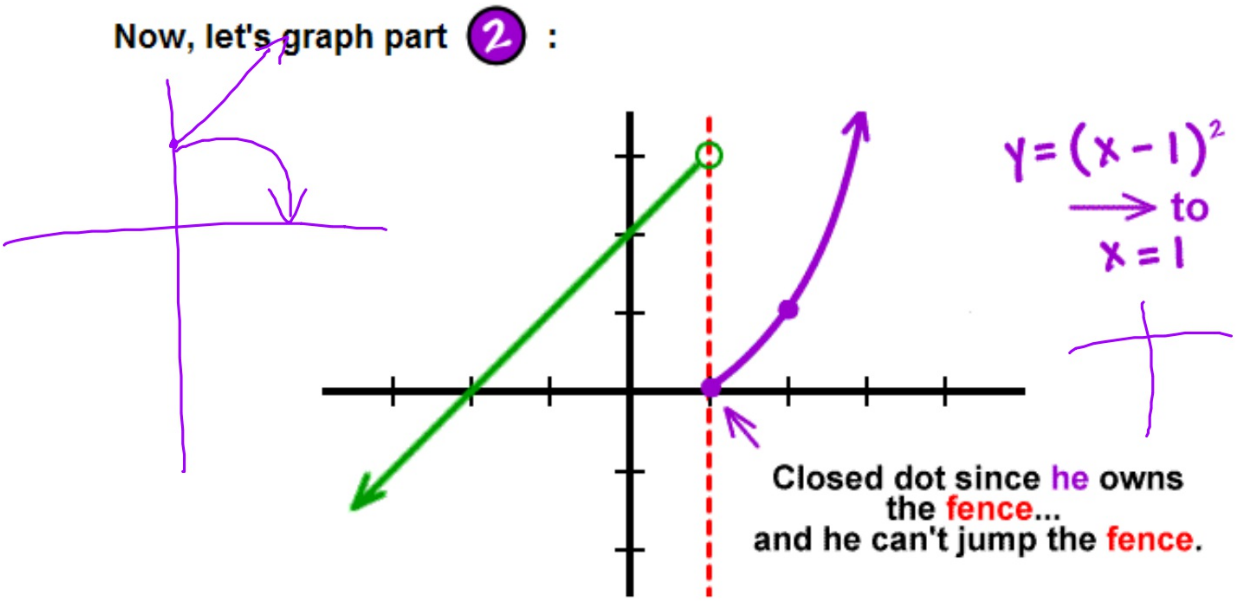
← This guy has the "=", so he gets to live ON the fence.

Let's graph part (1) :

$y = x + 2$



Now, let's graph part 2 :



Done!

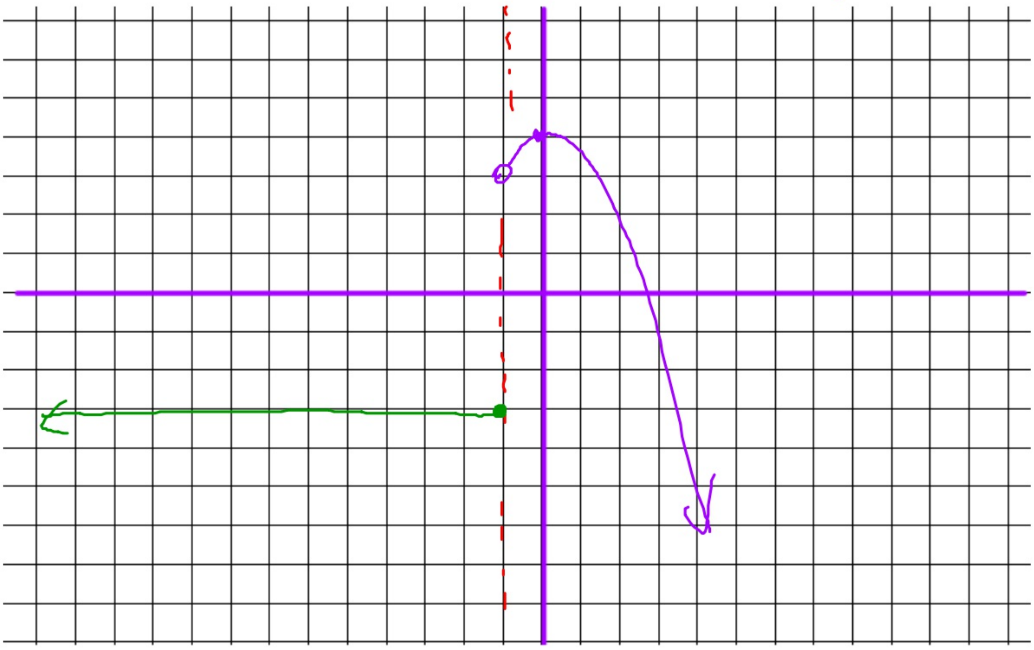
TRY ONE:

$$y = \begin{cases} -3 & ; x \le -1 \\ -x^2 + 4 & ; x > -1 \end{cases}$$

x	y
-1	3
0	4
1	3
2	0

$>$ $<$ OPEN

$\le$ $\ge$ CLOSED



Graph

$$y = \begin{cases} |x+3| \; ; & x \le -3 \quad \leftarrow ① \\ 4 \; ; & -3 < x \le 2 \quad \leftarrow ② \\ 5 - x \; ; & x > 2 \quad \leftarrow ③ \end{cases}$$