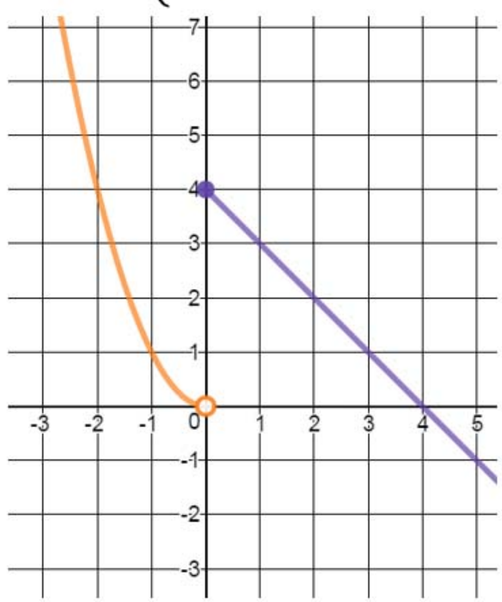
Objective: Graph piecewise functions.

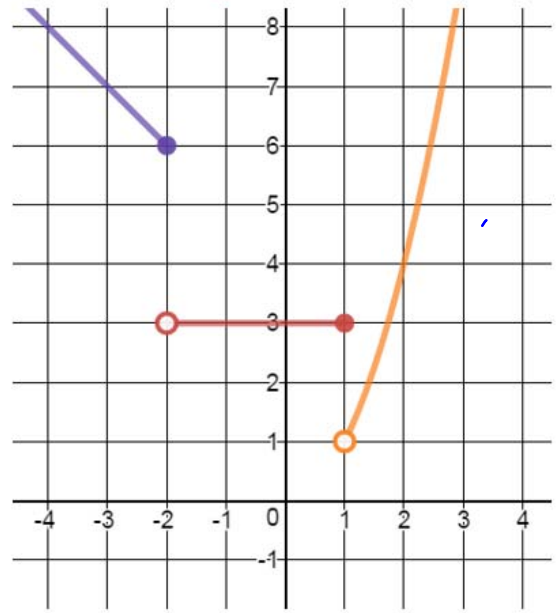
Concept

Piecewise Function: **A function defined by two or more sub-functions** (pieces). Each piece has a domain with a given interval. The domains never overlap.

$$f(x) = \begin{cases} -x + 4; & x \geq 0 \\ x^2; & x < 0 \end{cases}$$



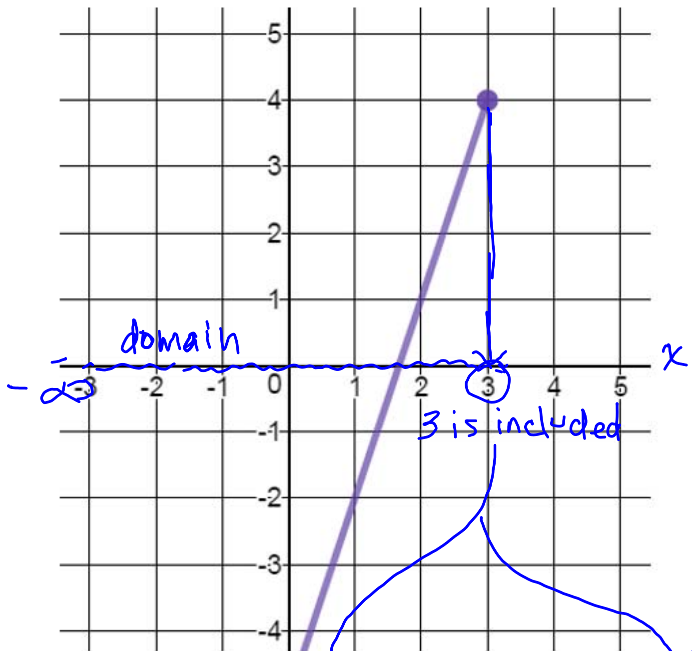
$$f(x) = \begin{cases} -x + 4; & x \leq -2 \\ x^2; & x > 1 \\ 3; & -2 < x \leq 1 \end{cases}$$



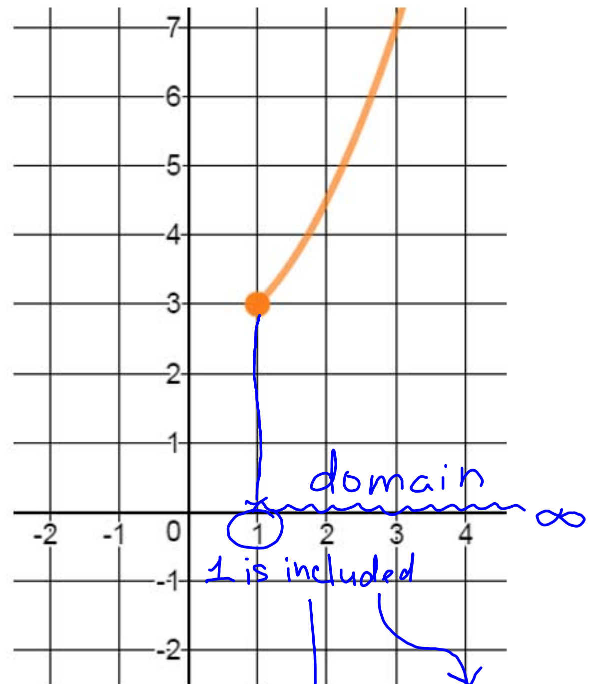
Objective: Graph piecewise functions.

Concept

Determine the domain for each function as an inequality and interval.



Domain: $\{x \mid x \le 3\}$ / $(-\infty, 3]$
(inequality) (interval)

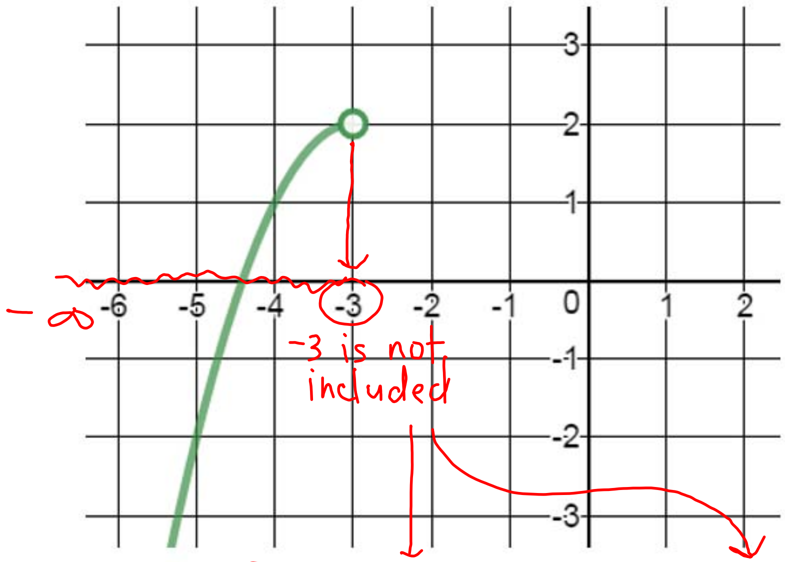


Domain: $\{x \mid x \ge 1\}$ / $[1, \infty)$
(inequality) (interval)

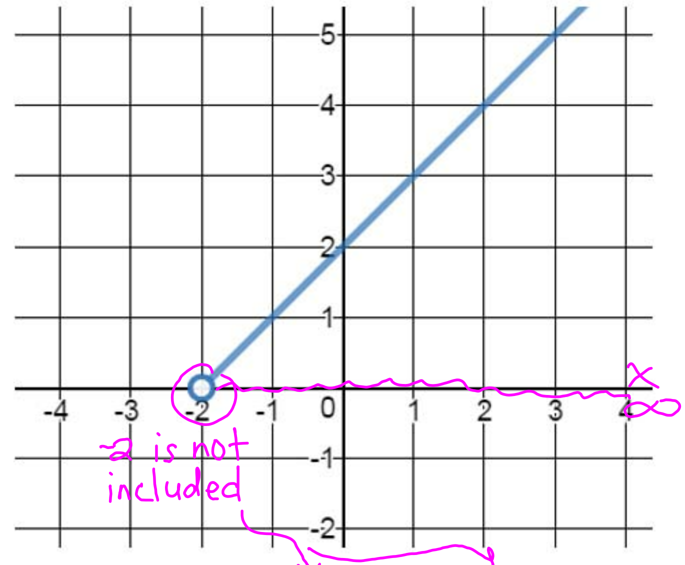
Objective: Graph piecewise functions.

Concept

Determine the domain for each function as an inequality and interval.



Domain: $\{x \mid x < -3\}$ / $(-\infty, -3)$
(inequality) (interval)

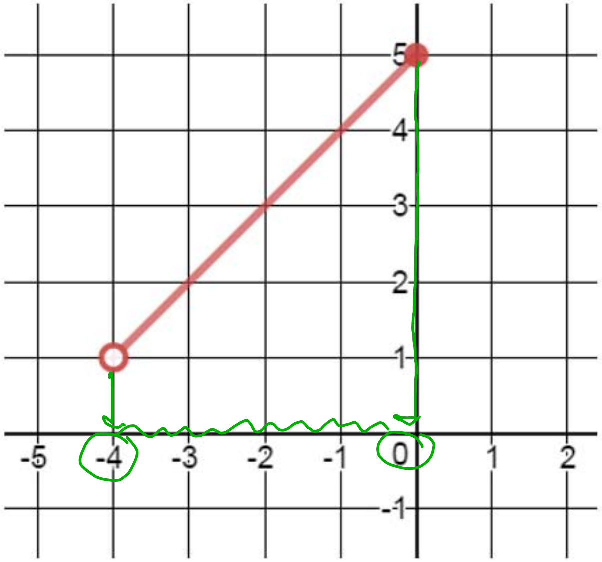


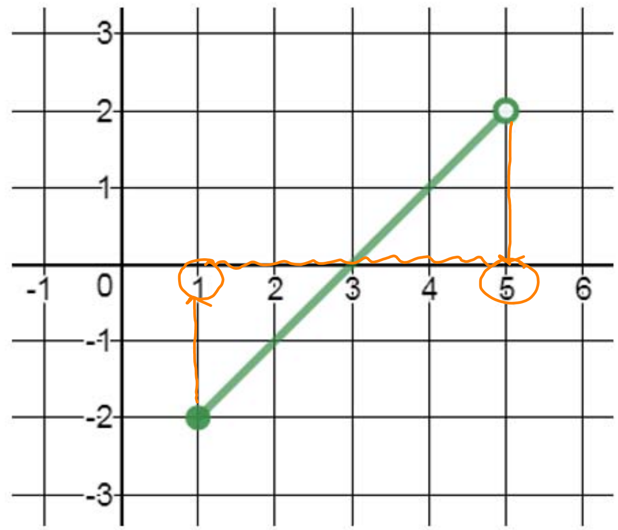
Domain: $\{x \mid x > -2\}$ / $(-2, \infty)$
(inequality) (interval)

Objective: Graph piecewise functions.

Concept

Determine the domain for each function as an inequality and interval.





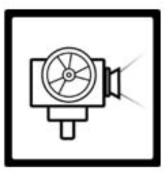
Domain: $\{x \mid -4 < x \leq 0\}$ / $(-4, 0]$
(inequality) (interval)

Domain: $\{x \mid 1 \leq x < 5\}$ / $[1, 5)$
(inequality) (interval)

Objective: Graph piecewise functions.

Procedure to Graph a Piecewise Function

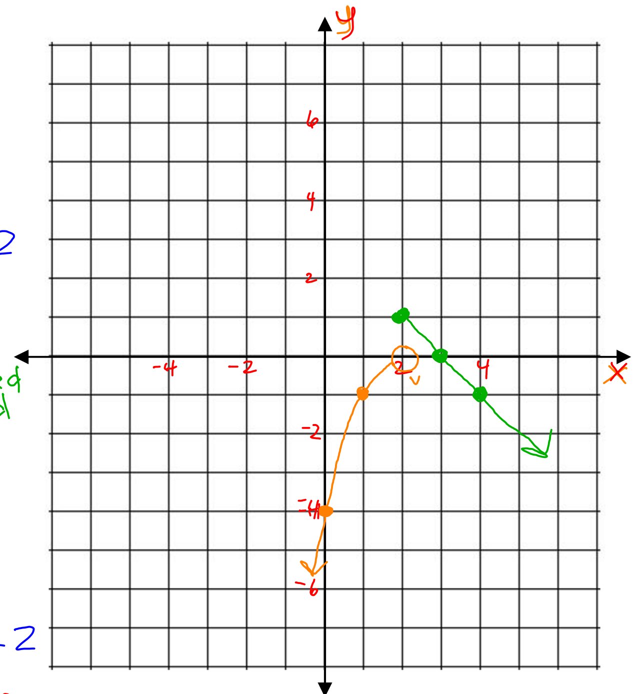
1. Separate the graph into intervals for each piece using the domains
2. Identify the type of function for the first piece: linear (a piece of a line), quadratic (a piece of a parabola), or absolute value (a piece of a V).
3. Make a table of values for the first piece. **Find the endpoint first**. Determine if the endpoint is open or closed. **Then find at least two more points** for this piece using values from the given domain.
4. Graph the points for the first piece and connect them according to the type of function it represents.
5. Repeat the steps for the other pieces.



Objective: Graph piecewise functions.

Ex) Graph the piecewise function.

$$f(x)=\begin{cases} -x+3; & x\geq 2 \quad (a) \\ -(x-2)^2; & x<2 \quad (b) \end{cases}$$



(a) $f(x)=-x+3,\ x\geq 2$

$y=mx+b$

linear/line

$x\geq 2$

x	$y=-1x+3$	
2	$-1(2)+3=1$	$(2,1)$ closed end
3	$-1(3)+3=0$	$(3,0)$
4	$-1(4)+3=-1$	$(4,-1)$

(b) $f(x)=-(x-2)^2,\ x<2$

quadratic/parabola

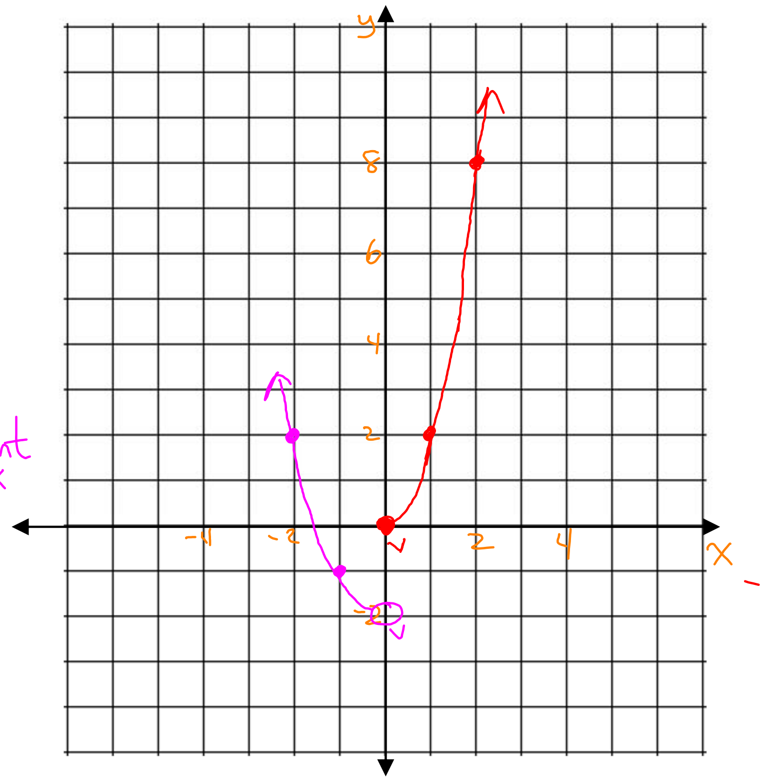
$x<2$

x	$y=-1(x-2)^2$	
2	$-1(2-2)^2=0$	$(2,0)$ open endpoint/vertex
1	$-1(1-2)^2=-1$	$(1,-1)$
0	$-1(0-2)^2=-4$	$(0,-4)$

Objective: Graph piecewise functions.

Ex) Graph the piecewise function.

$$g(x)=\begin{cases} x^2-2; & x<0 \\ 2x^2; & x\geq 0 \end{cases}$$



ⓐ $g(x)=x^2-2, \quad x<0$

quadratic/parabola

$x<0$

x	$y=x^2-2$	
0	$0^2-2=-2$	$(0,-2)$ open endpoint vertex
-1	$(-1)^2-2=-1$	$(-1,-1)$
-2	$(-2)^2-2=2$	$(-2,2)$

ⓑ $g(x)=2x^2, \quad x\geq 0$

quadratic/parabola

$x\geq 0$

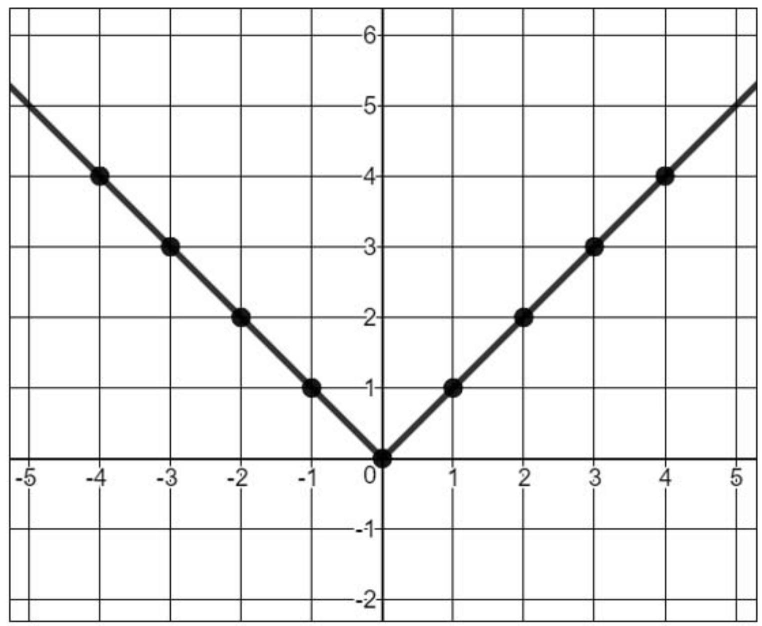
x	$y=2x^2$	
0	$2(0)^2=0$	$(0,0)$ closed endpoint/vertex
1	$2(1)^2=2$	$(1,2)$
2	$2(2)^2=8$	$(2,8)$

Objective: Graph piecewise functions.

The absolute value of a number is always positive because it represents a number's distance from 0 on a number line.

x	$f(x) = \|x\|$
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3

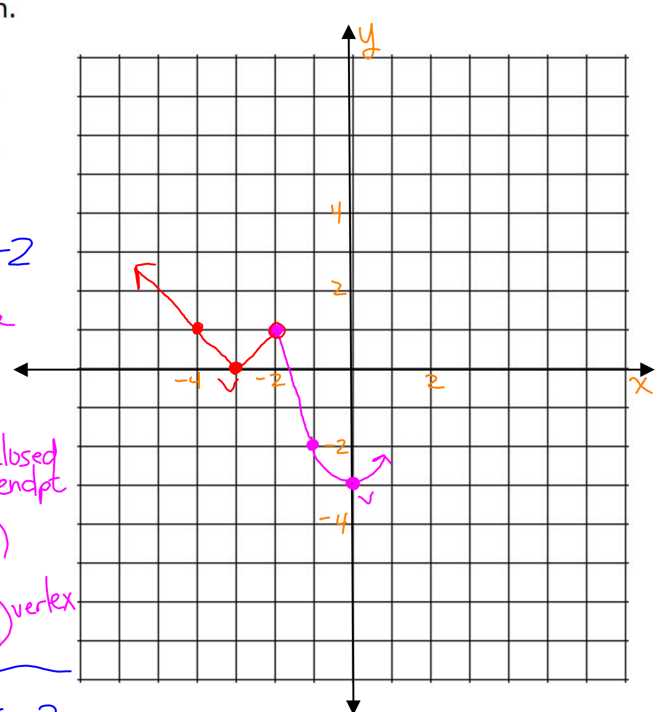
$f(x) = |x|$



Objective: Graph piecewise functions.

Ex) Graph the piecewise function.

$$d(x)=\begin{cases} x^2-3; & x\geq -2 \\ |x+3|; & x<-2 \end{cases}$$



a $d(x)=x^2-3 \quad x\geq -2$

$x\geq -2$ quadratic/parabola

x	y	
-2	$(-2)^2-3=1$	$(-2,1)$ closed endpt
-1	$(-1)^2-3=-2$	$(-1,-2)$
0	$(0)^2-3=-3$	$(0,-3)$ vertex

b $d(x)=|x+3| \quad x<-2$

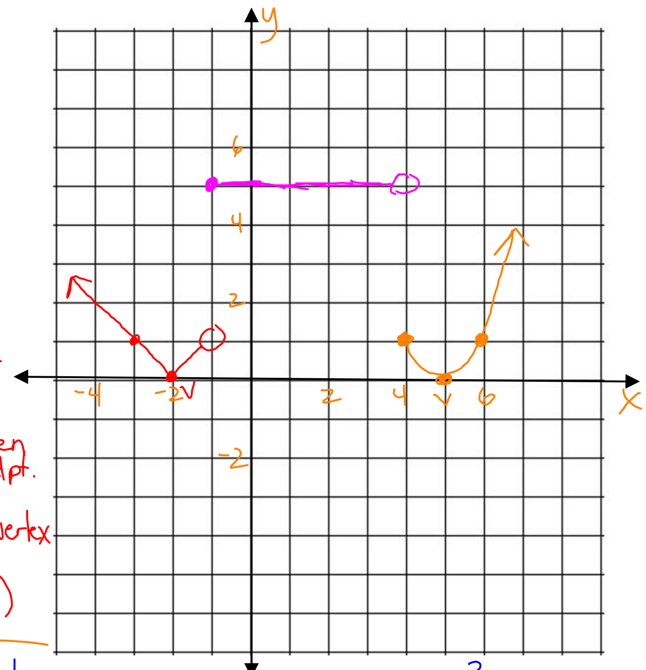
$x<-2$ absolute value/ V shape

x	y	
-2	$\lvert -2+3\rvert=\lvert 1\rvert=1$	$(-2,1)$ open endpt.
-3	$\lvert -3+3\rvert=\lvert 0\rvert=0$	$(-3,0)$ vertex
-4	$\lvert -4+3\rvert=\lvert -1\rvert=1$	$(-4,1)$

Objective: Graph piecewise functions.

Ex) Graph each piecewise function.

$$f(x)=\begin{cases} |x+2|; & x<-1 \quad (a)\\ 5; & -1\le x<4 \quad (b)\\ (x-5)^2; & x\ge 4 \quad (c)\end{cases}$$



(a) $f(x)=|x+2| \quad x<-1$

$x<-1$ absolute value/ V shape

x	$y=\lvert x+2\rvert$	
-1	$\lvert -1+2\rvert = \lvert 1\rvert = 1$	$(-1,1)$ open endpt.
-2	$\lvert -2+2\rvert = \lvert 0\rvert = 0$	$(-2,0)$ vertex
-3	$\lvert -3+2\rvert = \lvert -1\rvert = 1$	$(-3,1)$

(b) $f(x)=5 \quad -1\le x<4$

linear/constant function

$-1\le x<4$

x	$y=5$	
-1	5	$(-1,5)$ closed endpt
4	5	$(4,5)$ open endpt.

(c) $f(x)=(x-5)^2 \quad x\ge 4$

quadratic/parabola

$x\ge 4$

x	$y=(x-5)^2$	
4	$(4-5)^2=1$	$(4,1)$ closed endpt
5	$(5-5)^2=0$	$(5,0)$ vertex
6	$(6-5)^2=1$	$(6,1)$