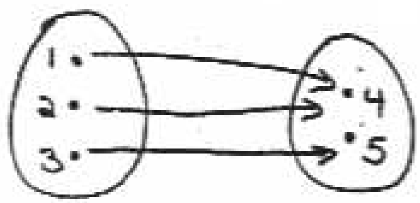
Domains & Ranges of Functions

<u>Domain</u>: set of input values (usually the "x's")

<u>Range</u>: set of output values (usually the "y's")

Examples

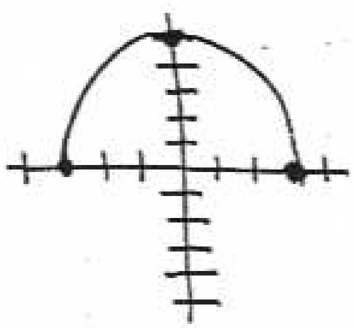


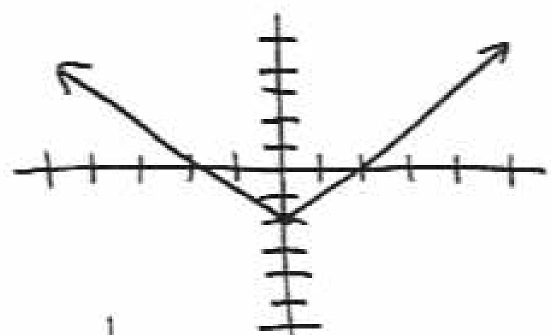
$D = \{1, 2, 3\}$

$R = \{4, 5\}$

$A = \{(1,4), (2,6), (5,8)\}$ $\quad D = \{1, 2, 5\}$

$R = \{4, 6, 8\}$



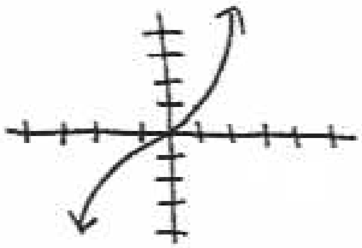


D: $-3 \le x \le 3$ or $[-3, 3]$

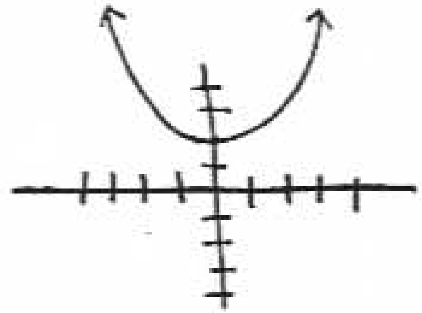
R: $0 \le y \le 5$ or $[0, 5]$

D: $\mathbb{R}$

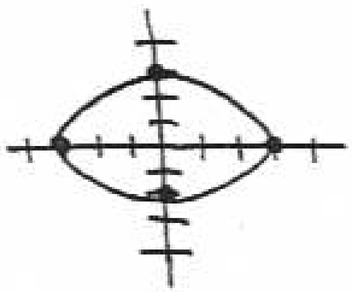
R: $y \ge 2$ or $[2, \infty)$



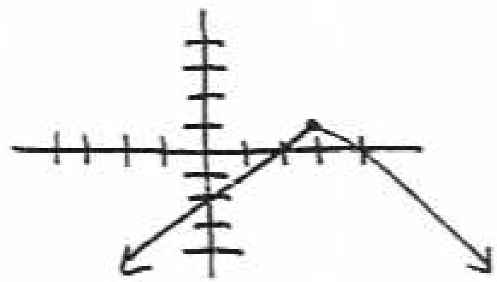
D: $\mathbb{R}$
R: $\mathbb{R}$



D: $\mathbb{R}$
R: $y \geq 2$ or $[2, \infty)$



D: $[-3, 3]$
R: $[-2, 3]$



D: $\mathbb{R}$
R: $y \leq 1$ or $(-\infty, 1]$

When you are looking at a graph to determine a domain, follow the x-axis. To determine a range, follow the y-axis.

When you are considering equations to determine domains & ranges, think about the following:

1) Does the equation contain a radical or a denominator.
   yes $\longrightarrow$ possible restriction to domain
   no $\longrightarrow$ most likely $\mathbb{R}$

Ranges are more difficult to see. They usually involve the "vertex". Thinking about the graph of the function usually helps.

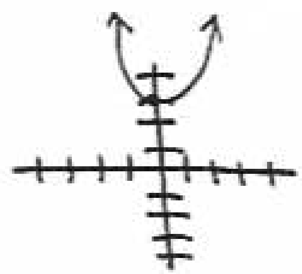
Determine a domain & range for each of the following:

$\boxed{1)\ f(x) = x^2+3}$ → parabola with vertex $(0,3)$ opens up

$\boxed{\text{Domain}}$ no $\sqrt{\ }$ or denominator → $\boxed{D: \mathbb{R}}$

$\boxed{\text{Range}}$ opens up, so it has a minimum → $\boxed{R: y \geq 3 \text{ or } [3,\infty)}$

the graph looks like:



x	y
−2	7
−1	4
0	3 ← smallest y value
1	4
2	7

$\boxed{2)\ f(x) = \sqrt{x-4}}$ → $\frac{1}{2}$ parabola vertex $= (4,0)$ opens up/right

x	y
3	und.
4	0
5	1
6	$\sqrt{2}$

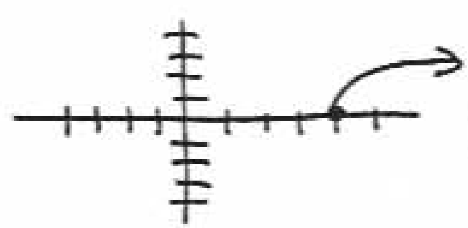
$\boxed{\text{domain}}$ restricted by $\sqrt{\ }$

$x-4 \geq 0$

$x \geq 4$ (notice it corresponds to the vertex

$\boxed{D: x \geq 4 \text{ or } [4,\infty)}$

$\boxed{\text{range}}$ → corresponds to the vertex



$\boxed{R: y \geq 0 \text{ or } [0,\infty)}$

$\boxed{\text{more examples}}$

<u>function</u>	<u>Domain</u>	<u>Range</u>
$f(x) = x^2+6$ (vertex $(0,6)$)	$\mathbb{R}$	$y \geq 6$
$f(x) = x^3+2$	$\mathbb{R}$	$\mathbb{R}$
$f(x) = \sqrt{x+2}$ ("vertex") $(-2,0)$	$x \geq -2$	$y \geq 0$
$f(x) = \dfrac{x}{x+3}$	$\mathbb{R}$ except $x = -3$	
$f(x) = \dfrac{x(x+3)(x-6)}{(x-6)}$	$\mathbb{R}$ except $x = 6$	
$f(x) = \lvert x-5 \rvert + 2$ vertex $= (5,2)$ opens up	$\mathbb{R}$	$y \geq 2$

opens up

no den. or root

radical

denom

[Do not cancel first !!]

no rad or denom.