

unit 2 - What's My Function? - study guide



Relations and Functions

→Relation – a set of input and output values listed in ordered pairs

- Describes a relationship between two different sets of information

→Function – a relation in which each element of the domain has one and only one element of the range associated with it

- For each x /input/domain there is *one and only one* y /output/range

EXAMPLE: $\{(1, 3), (2, 5), (6, 3), (-2, 1)\}$

NON-EXAMPLE: $\{(\textcircled{1} 3), (2, 5), (\textcircled{1} 7)\}$

Function Notation

- $f(x)$ replaces y
- $f(x)$ is the name of the function
- Use substitution to evaluate a function
- x is the input; $f(x)$ is the output

Domain and Range

→Domain

- Left to right
- Input
- x -value
- Independent variable

→Range

- Down to up
- Output
- y -value
- Dependent variable
- $f(x)$

Is it a function?

If it is...

Every x -value has only ONE y -value!!!!!!!!!!!!!!

Vertical Line Test

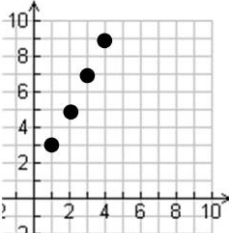
If any vertical line can be drawn through the graph and pass through only one or no points, then your graph IS a function.

Ordered Pair/Point (x, y)

- On a graph, an ordered pair shows the position on a graph
- First number, x , is the horizontal coordinate + \rightarrow , - \leftarrow
- Second number, y , is the vertical coordinate + \uparrow , - \downarrow

Different Ways to View a Function

EXAMPLE: $f(x) = 2x + 1$ with a domain of $\{1, 2, 3, 4\}$

Table			Graph
x	$f(x) = 2x + 1$	$f(x)$	
1	$f(1) = 2(1) + 1$	3	
2	$f(2) = 2(2) + 1$	5	
3	$f(3) = 2(3) + 1$	7	
4	$f(4) = 2(4) + 1$	9	

Translating Functions Basics

Function: $f(x)$

- $f(x) + 3$ means...move $f(x)$ up 3
- $f(x) - 3$ means...move $f(x)$ down 3
- $f(x + 3)$ means...move $f(x)$ left 3
- $f(x - 3)$ means...move $f(x)$ right 3
- $-f(x)$ means...reflect $f(x)$ over x -axis
- $3f(x)$ means... $f(x)$ is thinner
- $\frac{1}{3}f(x)$ means... $f(x)$ is wider

Notations

→Interval

() for open points/doesn't include

[] for closed points/includes

∞ and $-\infty$ always use ()

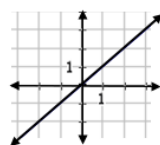
→Inequality

$<$ $>$ for open points/doesn't include

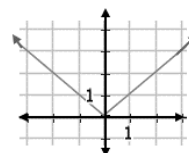
\leq \geq for closed points/includes

∞ and $-\infty$ always use $<$ $>$

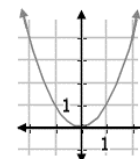
Parent Functions



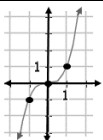
$f(x) = x$
linear



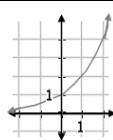
$f(x) = |x|$
absolute value



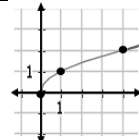
$f(x) = x^2$
quadratic



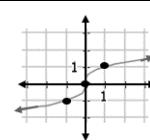
$f(x) = x^3$
cubic



$f(x) = 2^x$
exponential



$f(x) = \sqrt{x}$
square root



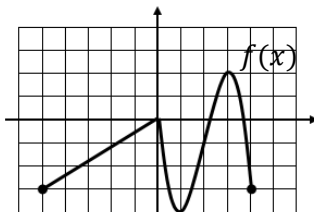
$f(x) = \sqrt[3]{x}$
cube root

Important Vocabulary

- maximum** – the highest Y-VALUE on a graph
minimum – the lowest Y-VALUE on a graph
domain – the set of all of x-values (LEFT to RIGHT)
range – the set of all of y-values (DOWN to UP)
increasing – the INTERVAL where the X-VALUES have a positive slope
decreasing – the INTERVAL where the X-VALUES have a negative slope
turning point – where a graph changes slopes
x-intercept – the point(s) where the graph crosses the x-axis
zeros – the x-coordinate of the x-intercept
y-intercept – the point(s) where the graph crosses the y-axis
linear – a graph that makes a straight line
non-linear – a graph that is not a straight line
axis of symmetry – the line that divides a graph into two mirror images of each other.
slope/average rate of change – change in y-values divided by the change in x-values
end behavior – how a graph begins or ends (EX: as x increases, y decreases)
asymptote: a line that a graph approaches but won't touch

Interpreting a Function

- A. Find $f(-5)$
 Means... find y when $x = -5$
 ANSWER: $y = -3$
- B. Find all values of x when $f(x) = 2$
 Means... find x when $y = 2$
 ANSWER: $x = 3$
- C. What is the maximum of $f(x)$?
 Means... find the highest y-value
 ANSWER: 2
- D. What is the minimum of $f(x)$?
 Means... find the lowest y-value
 ANSWER: -4
- E. What is the domain of $f(x)$ written in inequality notation?
 Means... how far left to right does the graph go
 ANSWER: $-5 \leq x \leq 4$
- F. What is the range of $f(x)$ written in interval notation?
 Means... how far down to up does the graph go
 ANSWER: $[-4, 2]$
- G. What are the turning points of $f(x)$?
 Means... where does the graph change from + to - slope or vice versa
 ANSWER: $(0, 0)$, $(1, -4)$, and $(3, 2)$
- H. Where is the graph increasing? decreasing?
 Means... going from left to right (x), is the graph going up or down
 ANSWER: increasing: $[-5, 0)$ and $(1, 3)$ decreasing: $(0, 1)$ and $(3, 4]$



Translating Functions

The number **OUTSIDE** of the parenthesis moves the function UP + or DOWN -

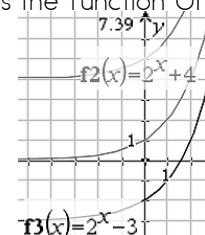
EXAMPLES:

$$f(x) = 2^x + 4$$

up 4

$$f(x) = 2^x - 3$$

down 3



The number **INSIDE** of the parenthesis moves the function LEFT + or RIGHT -

*** opposite of what you think!

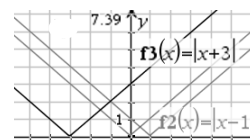
EXAMPLES:

$$f(x) = |x - 1|$$

right 1

$$f(x) = |x + 3|$$

left 3



The number **IN FRONT** of the parenthesis reflects the function over the x-axis if -, makes wider if a fraction, stretches if bigger than 1

EXAMPLES:

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

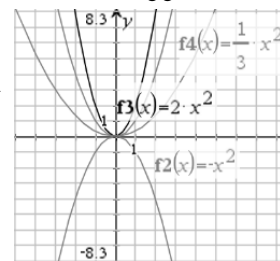
reflects over x-axis

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

narrower

$$f(x) = \frac{1}{3}x^2$$

wider



Other Functions Examples

What is the range of the function $f(x) = 2x + 3$ over the domain $\{0, 1, 2, 3\}$?

ANSWER: $\{3, 5, 7, 9\}$

What domain should I use for this situation? A parking garage charges the customer \$2 every half hour.

ANSWER: $\{0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}, \dots\}$

Given $f(x) = 2x + 1$

→ find $f(3)$

ANSWER: $f(3) = 2(3) + 1 = 7$

→ find x when $f(x) = 5$

ANSWER: $5 = 2x + 1 \rightarrow x = 2$