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: $\{(1,3),(2,5),(1,7)\}$

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**

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 $+\uparrow, -\downarrow$

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.**

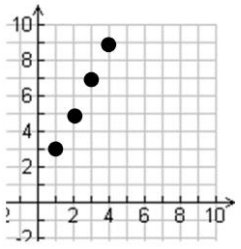
Different Ways to View a Function

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

Table

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

Graph



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 ( )

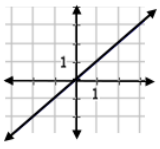
→Inequality

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

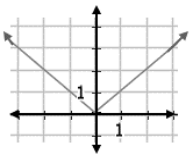
$\leq$ $\geq$ for closed points/includes

∞ and $-\infty$ always use $<$ $>$

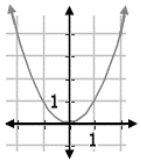
Parent Functions



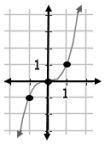
$f(x) = x$
linear



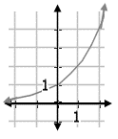
$f(x) = |x|$
absolute value



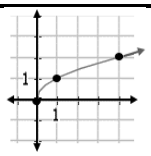
$f(x) = x^2$
quadratic



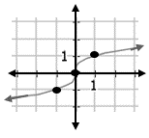
$f(x) = x^3$
cubic



$f(x) = 2^x$
exponential



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

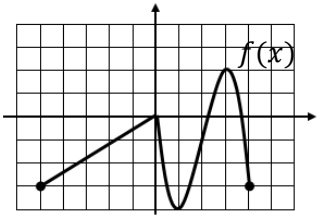


$f(x) = \sqrt[3]{x}$
cube root

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

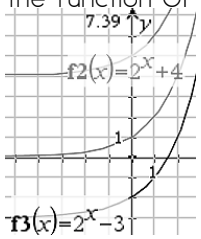
Interpreting a Function



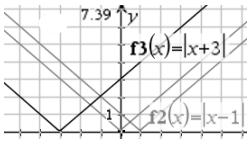
A. Find $f(-5)$
Means… find y when x = –5
ANSWER: y = –3
B. Find all values of x when $f(x) = 2$
Means… find x when y = 2
ANSWER: x = 3
C. What is the maximum of $f(x)$?
Means… find the highest y-value
ANSWER: 2
D. What is the minimum of $f(x)$?
Means… find the lowest y-value
ANSWER: –4
E. What is the 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

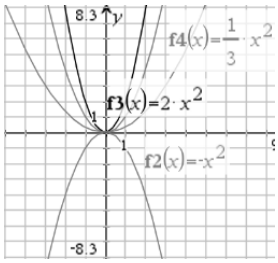
The number OUTSIDE of the parenthesis moves the function UP + or DOWN –
EXAMPLES:
$f(x) = 2^x + 4$
up 4
$f(x) = 2^x - 3$
down 3



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