College Algebra
Functions 2-1
Date: 10/5/15

Functions:

Book: A function f from a set A to a set B is a rule of correspondence that assigns to each element x in the set A exactly one element y in the set B

The set A is the DOMAIN of the function , and the set B contains the RANGE

*For every one input there is only one output $y = x^2$

*Pass the vertical line test (Input, output) (x , y)

x	y
-2	4
-1	1
0	0
1	1
2	4

x Domain Independent Input

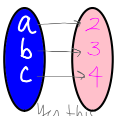
y Range dependent Output f(x)

Example 1 Testing for functions

Which of the following sets of ordered pairs or figures represent functions form set A to set B?

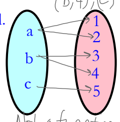
$A = \{a,b,c\}$ $B = \{1,2,3,4,5\}$ $\{(a,1)(a,2)(b,3)(b,4)(c,5)\}$

a. $\{(a,2),(b,3),(c,4)\}$

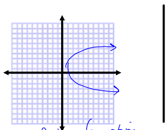


Yes this function

d.



Not a function b/c a has two outputs for a and b.



Not a function b/c fails the VLT

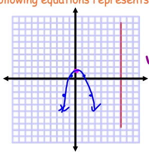
x	f(x)
-1	0
0	1
3	2

x	f(x)
-1	0
0	-1
3	-2

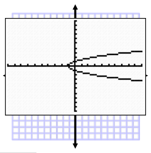
Example 2 Which of the following equations represents y as a function of x

$x^2 + y = 2$
$-x^2 \quad -x^2$
$f(x) = -x^2 + 1$
$y = -x^2$

x	y
-2	-4
-1	-1
0	0
1	-1
2	-4



$-x + y^2 = 1$
$+x \quad +x$
$\sqrt{y^2} = \sqrt{x+1}$
$f(x) = \begin{cases} \sqrt{x+1} \\ -\sqrt{x+1} \end{cases}$



Function NOTATION or f(x) notation can also be called Euler notation

$f(x) = 3 - 2x$
$f(-1) = 5$
$f(0) = 3$
$f(2) = -1$

Domain input independent x

Range output dependent y f(x)

$y = -2x + 3$
$f(x) = 3 - 2x$

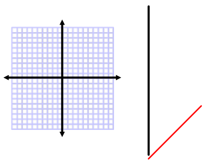
Input always inside parenthesis

Example 3 evaluating a function Let $g(x) = -x^2 + 4x + 1$

$g(-2) = -1(-2)^2 + 4(-2) + 1$ $y = -x^2 + 4x + 1$
$-4 - 8 + 1$
$g(-1) = -4$
$g(0) = 1$
$g(1) =$

Example 4 evaluate the following function when x= -1,0,1

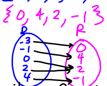
$$f(x) = \begin{cases} x^2 + 1, & x < 0 \\ x - 1, & x \ge 0 \end{cases}$$



Example 5 finding the domain

$a.\{(-3,0),(-1,4),(0,2),(2,2),(4,-1)\}$

$D = \{-3, -1, 0, 2, 4\}$
$R = \{0, 4, 2, -1\}$

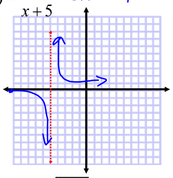


Yes it is a function b/c

Volume of a sphere:

$V = \frac{4}{3}\pi r^3$

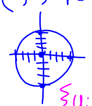
$g(x) = \frac{1}{x+5}$ $\{x : x \neq -5\}$



$h(x) = \sqrt{4 - x^2}$

$r(x) = \sqrt[3]{x+3}$

$x^2 + y^2 = 16$
$(0,0)$ $r = 4$ $\{x : [-4, 4]\}$



$\{y : [-4, 4]\}$

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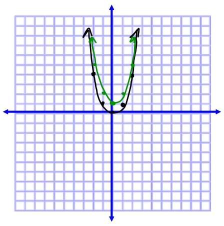
EOOO

(31) $h(x) = x^4 - x^2 + 1$
$h(2) = 2^4 - 2^2 + 1 = 13$
$h(-x) = (-x)^4 - (-x)^2 + 1$
$h(-x) = x^4 - x^2 + 1$

43) $f(x) = x^2$ $g(x) = x^2 + 1$

x	f(x)
-2	4
-1	1
0	0
1	1
2	4



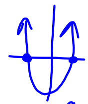
College Algebra Graphs of functions
Lesson 2-2

Date: 10/21/14

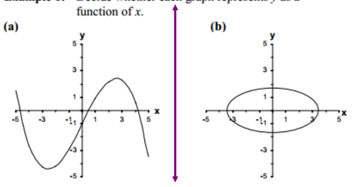
The **Vertical Line Test** for functions states that. . . a set of points in a coordinate plane is the graph of *y* as a function of *x* if and only if no vertical line intersects the graph at more than one point.

The **zeros of a function** *f* of *x* are . . .

X-intercepts
Zeros
Solutions
Roots



Example 1: Decide whether each graph represents *y* as a function of *x*.



Example 2: Find the zeros of the function $f(x)=4x^2+19x-5$.

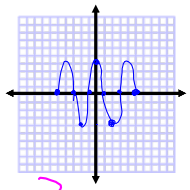
-20, -1, 19, 20

$-\frac{19}{2(4)}$

$0=4x^2+19x-5$

$0=(4x-1)(x+5)$

$x=\frac{1}{4}$ $x=-5$



Example 1 use the graph of the function f, shown to find

a. the domain of f $[-5,5]$ $\{x: -5\le x\le 5\}$

b the function values $f(-1)$ $f(2)$

c. the range $[-4, 4]$ $\{y\mid -4\le y\le 4\}$

Example 3 finding the zeros of a function

Find all Values Such that $f(x)=0$

task 1

$f(x)=3x^2+x-10$

$0=3x^2+x-10$ -30

$(3x-5)(x+2)=0$

$x=\frac{5}{3}$ $x=-2$

task 3

$g(x)=\sqrt{10-x^2}$

$(0)^2=(\sqrt{10-x^2})^2$

$0=10-x^2$

$-10 \quad -10$

$-10=-x^2$

$\frac{-10}{-1}=\frac{-x^2}{-1}$

$\sqrt{10}=\sqrt{x^2}$

$x=\sqrt{10}$

$(\sqrt{10},0)$

$(-\sqrt{10},0)$

task 5

$h(t)=\frac{2t-3}{t+5}$

$\frac{a}{b}=\frac{c}{d}$ $bc=ad$

$(x+5)\,0=\frac{2x-3}{x+5}\,(x+5)$

$0=2x-3$

$+3 \quad +3$

$\frac{3}{2}=\frac{2x}{2}$

$x=\frac{3}{2}$

III. Increasing and Decreasing Functions (Pages 206–207)

A function *f* is **increasing** on an interval if, for any x_1 and x_2 in the interval, . . . $x_1<x_2$ implies $f(x_1)<f(x_2)$.

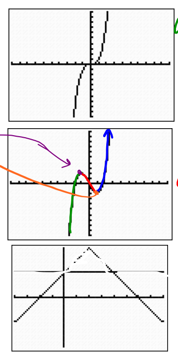
A function *f* is **decreasing** on an interval if, for any x_1 and x_2 in the interval, . . . $x_1<x_2$ implies $f(x_1)>f(x_2)$.

A function *f* is **constant** on an interval if, for any x_1 and x_2 in the interval,. . . $f(x_1)=f(x_2)$.

A function value $f(a)$ is called a **relative minimum** of *f* if . . . there exists an interval (x_1,x_2) that contains *a* such that $x_1<x<x_2$ implies $f(a)\le f(x)$.

A function value $f(a)$ is called a **relative maximum** of *f* if . . . there exists an interval (x_1,x_2) that contains *a* such that $x_1<x<x_2$ implies $f(a)\ge f(x)$.

Example 4 use the graphs to describe the increasing and decreasing behavior of each function



a) Increase entire # Line $(-\infty,\infty)$

Increase $(-\infty,-1)$
decrease $(-1,1)$
Increase $(1,\infty)$

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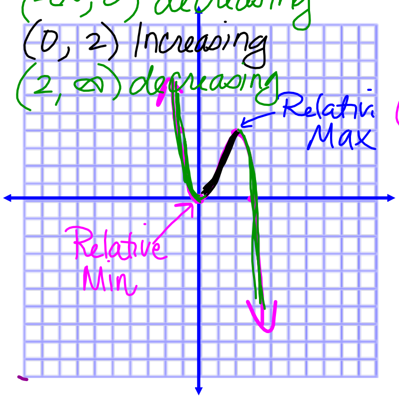
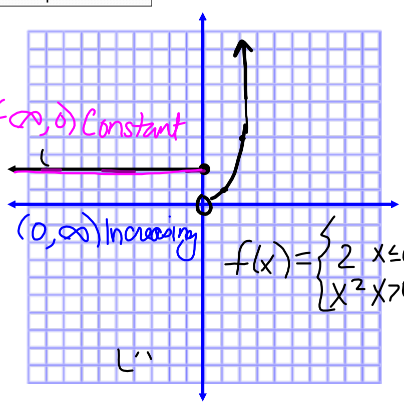
EOOO

$(-\infty,0)$ decreasing
$(0,2)$ Increasing
$(2,\infty)$ decreasing



$(-\infty,0)$ Constant
$(0,\infty)$ Increasing

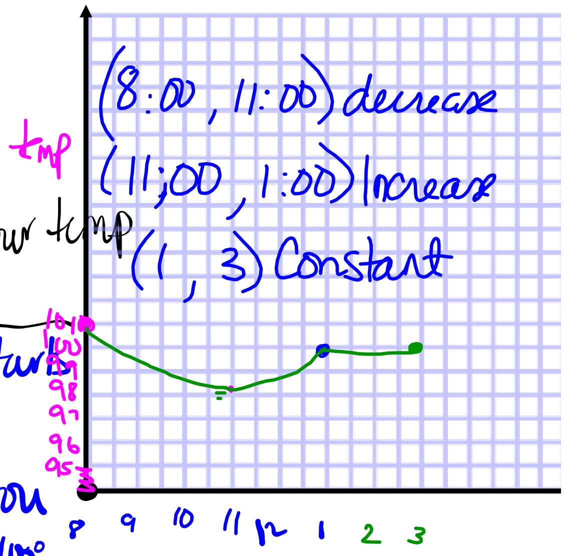


$f(x)=\begin{cases}2 & x\le 0\\ x^2 & x>0\end{cases}$

2-2 Continued

At 8 AM your temp is 101°F and you are not feeling well. However, your temp starts to decrease. It reaches normal (98.6°F) by 11 AM. Feeling energized you construct the graph representing your temp for the interval 8:00 AM – 11 AM

Then at 11:00 am your temp starts to rise and it reaches 100°F. and remain that temp until you get home @ 3:00pm. It stays at 100°



EVEN FUNCTION

$f(-x) = f(x)$ for all x in the domain

$f(x) = x^2$

x	f(x)
-2	4
-1	1
0	0
1	1
2	4

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

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

$= x^4 - 2x^2$

$f(2) = 2^4 - 2(2^2)$

$16 - 8 = 8$

$f(-2) = (-2)^4 - 2(-2)^2$

$= 16 - 8$

8

ODD FUNCTION

$f(-x) = -f(x)$

$f(x) = x^3$

x	f(x)
-2	-8
-1	-1
0	0
1	1
2	8

$\boxed{\text{ODD}}$

$f(x) = x^3 - 6x$

$f(-x) = (-x)^3 - 6(-x)$

$-x^3 + 6x$

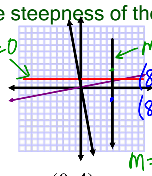
College Algebra
Lines in a plan 2-3

Date 10/7/15

Slope: of a non vertical line is the measure of the steepness of the line

Rise / Run

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{Change\ in\ y}{Change\ in\ x}$



m=0 m=Undefined
(8, 3)
(8, -2)

Example 1 Finding the slope of a line Beyonce Method

$(-2,0)$ $m = \frac{0-1}{-2-3}$
$(3,1)$ $m = \frac{-1}{-5}$ $m = \frac{1}{5}$

Horizontal
$(-1,2)$ $m = \frac{2-2}{-1-2}$
$(2,2)$ $m = \frac{0}{-3}$ $m=0$

$(0,4)$ $m = \frac{3-2}{8-8}$
$(1,-1)$ $m = \frac{5}{0}$

Three equations for lines

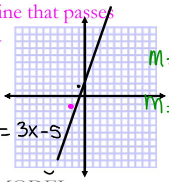
Slope intercept form
$y = mx + b$
$m = slope$
$b = y-\text{int}\,(0,b)$

Standard form
$Ax + By = C$
$m = \frac{-A}{B}$
cover up method
y=3x

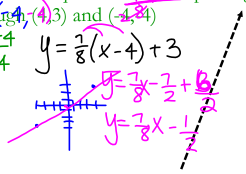
point slope form
PINK BLUE GREEN
$\boxed{y = m(x-h)+k}$
$y - y_1 = m(x - x_1)$
$m = slope$
(h, k)
(x_1, y_1)

Example 2
a. Find an equation of a line that passes through $(1,-2)$ and has a slope of 3

$y - y_1 = m(x - x_1)$ $y = m(x-h)+k$
$y = 3(x-1) - 2$
$y = 3x - 3 - 2$
$y = 3x - 5$



b. Find an equation of a line passing through (4, 3) and (-4, -4)
$m = \frac{3--4}{4--4}$
$m = \frac{7}{8}$
$y = \frac{7}{8}(x-4)+3$
$y = \frac{7}{8}x - \frac{7}{2} + \frac{6}{2}$
$y = \frac{7}{8}x - \frac{1}{2}$



Example 3 a LINEAR MODEL
during the first two quart...

$(1, 3.4)$ $m = \frac{3.7-3.4}{2-1}$
$(2, 3.7)$
$m = .3$ mill

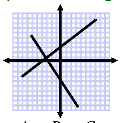
$y = .3x + 3.1$

...o predict the sales during the 4th quarter
)

$y = .3(x-1) + 3.4$
$y = .3x - .3 + 3.4$

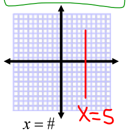
Remember there are 3 types of lines

Oblique
Will have an x and a y in the equation
m=positive or negative



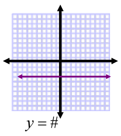
$Ax + By = C$
$y = mx + b$

Vertical
Will only have an x in the equation
m is Undefined



$x = \#$ X=5
$Ax + 0y = C$
X+0y=5

Horizontal
Will only have a y in the equation
m=0

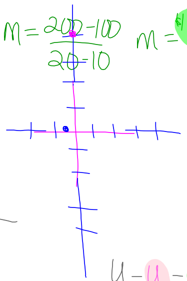


$y = \#$
$y = 0x + b$
$0x + By = C$

Output depends on Input
Paycheck depends on hours you work

(10, 100)
(20, 200)
$m = \frac{200-100}{20-10}$ $m = 10$

$y - y_1 = m(x - x_1)$
$y - 100 = 10(x - 10)$
$y - 100 = 10x - 100$
+100 +100
$y = 10x$



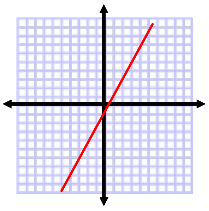
X-inter $-\frac{1}{2}$ $(-\frac{1}{2}, 0)$
y-inter 4 $(0, 4)$
$m = \frac{4-0}{0-\frac{-1}{2}}$ $m = \frac{4}{\frac{1}{2}}$
$m = 8$

$y - y_1 = m(x - x_1)$
$y - 4 = 8(x - 0)$
$y - 4 = 8x + 0$
+4 +4
$\boxed{y = 8x + 4}$

Example 4 $m = \frac{\text{rise}}{\text{run}}$

GRAPH

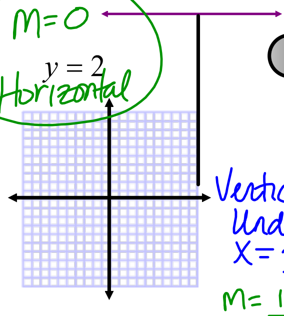
$y = 2x + 1$



$m = 0$

$y = 2$

Horizontal



Vertical

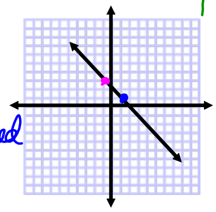
Undefined

$x = 3$

$m = \frac{1}{0}$

$m = -\frac{A}{B}$

$x + y = 2$ $m = \frac{-1}{1}$



Parallel lines have the SAME SLOPE

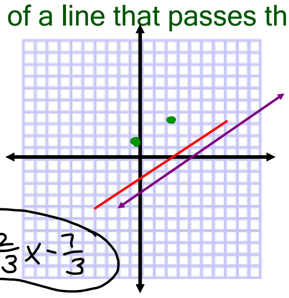
Example 5 find an equation of a line that passes through (2,-1) and is PARALLEL to $2x - 3y = 5$ $m = \frac{-2}{-3}$

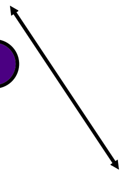
$\cancel{y - y_1 = m(x - x_1)}$

$m = \frac{2}{3}$ Right 2 down 1

$y = \frac{2}{3}(x - 2) - 1$

$y = \frac{2}{3}x - \frac{4}{3} - \frac{3}{3}$ $y = \frac{2}{3}x - \frac{7}{3}$





Perpendicular lines have slops that are negative reciprocals

Example 6 find an equation that passes through the point (2,-1) and is perpendicular to $2x - 3y = 5$

$2x - 3y = 5$

$m = \frac{-2}{-3}$

$m = \frac{2}{3}$ Perpendicular $\to m = -\frac{3}{2}$

y-intercept

$(0, -\frac{5}{3})$

$(0, -1\frac{2}{3})$

$Ax + By = C$

$m = -\frac{A}{B}$

Perpendicular

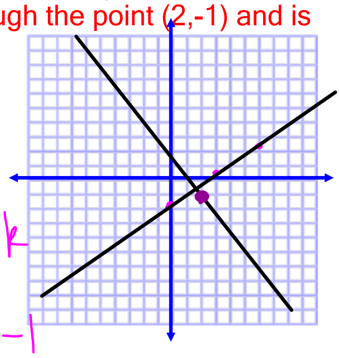
$(2, -1)$

$y = m(x - h) + k$

$y = -\frac{3}{2}(x - 2) - 1$

$y = -\frac{3}{2}x + 3 - 1$

$\boxed{y = -\frac{3}{2}x + 2}$



IBOT $x = -1$

$(1\frac{1}{2}, -3)$

$(1, -4)$

$m = \frac{-3 - -4}{1\frac{1}{2} - 1}$ $m = \frac{1}{\frac{1}{2}}$ $\frac{2}{1} =$

$\frac{ad}{bc}$

Year, Million #

$(1990, 14.0)$

$(2008, 18.3)$

$m = \frac{18.3 - 14.0}{2008 - 1990}$ $m = \frac{4.3}{18}$ $m = \frac{.24 \text{ million}}{1 \text{ year}}$

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EOOO

14) $f(x) = 6x$

$x_1 = 0$ $x_2 = 4$

$(0, 0)$

$(4, 24)$

$m = \frac{24 - 0}{4 - 0}$ $m = \frac{24}{4}$ $m = 6$

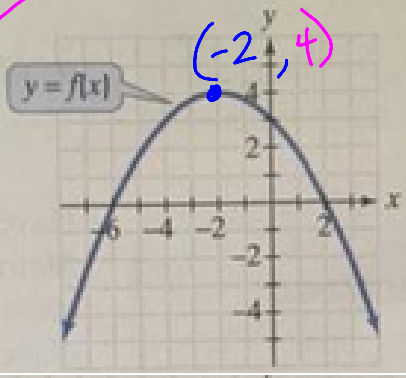
Use the graph of f to solve Exercises 9–24. Where applicable, use interval notation.

$(-2, 4)$

$y = -\frac{1}{4}(x+2)^2 + 4$ left 2, up 4

$y = -\frac{1}{4}x^2$ Parent

x	y
-4	-4
-2	-1
0	0
2	-1
4	-4



$(-\infty, -2)$

9. Explain why f represents the graph of a function.
10. Find the domain of f. [redacted]
11. Find the range of f. [redacted]
12. Find the x-intercept(s). [redacted]
13. Find the y-intercept. [redacted]
14. Find the interval(s) on which f is increasing. [redacted]
15. Find the interval(s) on which f is decreasing. [redacted]
16. At what number does f have a relative maximum? [redacted]
17. What is the relative maximum of f? [redacted]
18. Find $f(-4)$. [redacted]
19. For what value or values of x is $f(x) = -2$? [redacted]
20. For what value or values of x is $f(x) = 0$? [redacted]
21. For what values of x is $f(x) > 0$? [redacted]
22. Is $f(100)$ positive or negative? [redacted]
23. Is f even, odd, or neither? [redacted]
24. Find the average rate of change of f from $x_1 = -4$ to $x_2 = 4$. [redacted]

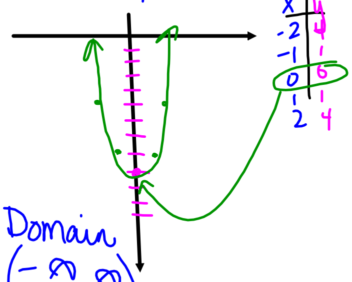
Graph and State the domain Range

12. $y = x^2 - 9$

Parabola $(0, -9)$

Parent $y = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4



Domain $(-\infty, \infty)$

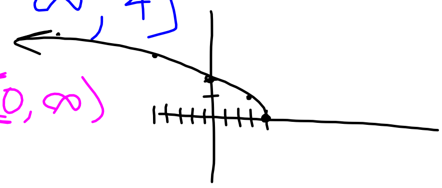
Range $[-9, \infty)$

13. $y = \sqrt{4 - x}$

Domain $(-\infty, 4]$

x	y
4	0
3	1
0	2
-5	3
-12	4

$[0, \infty)$

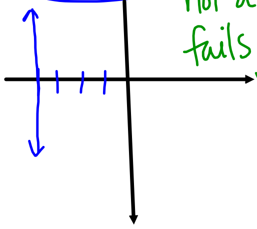


Is y a function of x

$\frac{4x}{4} = \frac{-16}{4}$

$x = -4$

Not a function fails the VLT



Find all Values of x Such that $f(x) = 0$

$f(x) = 25 - x^2$

$0 = 25 - x^2$

$+x^2 \quad +x^2$

$\sqrt{x^2} = \sqrt{25}$

$x = 5$

$x = -5$

16. $\frac{1}{x-2} \times \frac{10}{4x+3}$

$10x - 20 = 4x + 3$

$-4x \quad -4x$

$6x - 20 = 3$

$+20 \quad +20$

$\frac{6x}{6} = \frac{23}{6}$

$x = \frac{23}{6}$

26. $(\sqrt{x+10})^2 = (x-2)^2$

$x + 10 = x^2 - 4x + 4$

$-x \quad -10 \quad -x \quad -10$

$0 = x^2 - 5x - 6$

$0 = (x-6)(x+1)$

-6, 1 ; -6, 1 ; -5

	x	-2
x	x^2	$-2x$
-2	$-2x$	4

$x = 6$ $\quad x = -1$ Extraneous

Solve

$\frac{7x-2}{x-2} \geq \frac{2}{1}\frac{(x-2)}{(x-2)}$

$\frac{7x-2}{(x-2)} \geq \frac{2x-4}{(x-2)}$

$7x - 2 \geq 2x - 4$

$-2x \quad -2x$

$5x - 2 \geq -4$

$+2 \quad +2$

$\frac{5x}{5} \geq \frac{-2}{5}$

$x \geq -\frac{2}{5}$

$[-\frac{2}{5}, \infty)$

$y = m(x - h) + k$ Slope $= m$ (h, k)

Write an equation for a line through $(-2, 5)$ Parallel to $3x - 4y = 12$

$m = -\frac{A}{B}$

$m = \frac{-3}{-4}$

Parallel $m = \frac{3}{4}$

$y = \frac{3}{4}(x + 2) + 5$

$y = \frac{3}{4}x + \frac{6}{4} + \frac{5}{1}$ $\frac{20}{4}$

$y = \frac{3}{4}x + \frac{26}{4}$

$y = \frac{3}{4}x + \frac{13}{2}$

2-5 Date: 10/14/13

College algebra PARENT FUNCTIONS

EVEN and ODD functions

A function given by $y = f(x)$ is EVEN if for each x in the domain of f, $f(-x) = f(x)$

$y = x^2$

x	y
-2	4
2	4

A function given by $y = f(x)$ is ODD if for each x in the domain of f, $f(-x) = f(-x)$

$f(x) = y^3$

x	y
-2	-8
2	8

Example 7 in your book PROVE either is odd or even

$f(-x) = -f(x)$

$g(x) = x^3 - x$

$g(-x) = (-x)^3 - (-x)$

$g(-x) = -x^3 + x$

$-g(x) = -x^3 + x$

odd

$h(x) = x^2 + 1$

$h(-x) = (-x)^2 + 1$

$h(-x) = x^2 + 1$

$h(-x) = h(x)$

even

$g(2) = 2^3 - 2$

$g(2) = 6$

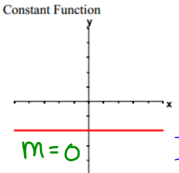
$g(-2) = -2^3 - (-2)$

$-8 + 2$

$g(-2) = -6$

Common GRAPHS

Constant Function

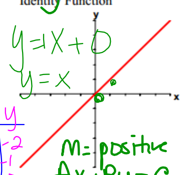


$m = 0$

$y = -2$

$y = mx + b$

Identity Function



$y = 1x + 0$

$y = x$

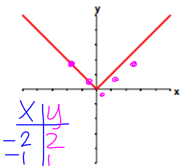
x	y
-2	-2
-1	-1
0	0

m: positive

$Ax + By = C$

$y = |x|$

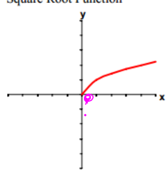
Absolute Value Function



x	y
-2	2
-1	1
0	0

$y = \sqrt{x}$

Square Root Function



List several important features of the graph of the linear function $f(x) = ax + b$.

- The domain of the function is the set of all real numbers.
- The range of the function is the set of all real numbers.
- The graph has an x-intercept of $(-b/m, 0)$ and a y-intercept of $(0, b)$.
- The graph is increasing if $m > 0$, decreasing if $m < 0$, and constant if $m = 0$.

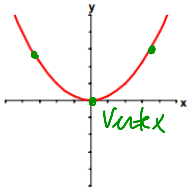
Not a function if line Vertical

List several important features of the graph of the **square root function** $f(x) = \sqrt{x}$.

- The domain of the function is the set of all nonnegative real numbers.
- The range of the function is the set of all nonnegative real numbers.
- The graph has an intercept at (0, 0).
- The graph is increasing on the interval $(0, \infty)$.

$y = x^2$

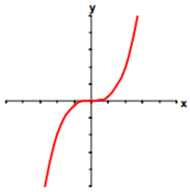
Quadratic Function



Vertex

$y = x^3$

Cubic Function



List several important features of the graph of the **cubic function** $f(x) = x^3$.

- The domain of the function is the set of all real numbers.
- The range of the function is the set of all real numbers.
- The function is odd.
- The graph has an intercept at (0, 0).
- The graph is increasing on the interval $(-\infty, \infty)$.
- The graph is symmetric with respect to the origin.

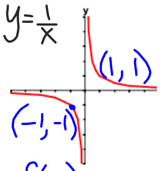
$y = x^{-1}$

List several important features of the U-shaped graph of the **squaring function** $f(x) = x^2$.

- The domain of the function is the set of all real numbers.
- The range of the function is the set of all nonnegative real numbers.
- The function is even.
- The graph has an intercept at (0, 0).
- The graph is decreasing on the interval $(-\infty, 0)$ and increasing on the interval $(0, \infty)$.
- The graph is symmetric with respect to the y-axis.
- The graph has a relative minimum at (0, 0).

Reciprocal Function

$y = \frac{1}{x}$



(1, 1)

(-1, -1)

$f(-1) = -1$

$f(1) = 1$

List several important features of the graph of the **reciprocal function** $f(x) = \frac{1}{x}$.

- The domain of the function is $(-\infty, 0) \cup (0, \infty)$.
- The range of the function is $(-\infty, 0) \cup (0, \infty)$.
- The function is odd.
- The graph does not have any intercepts.
- The graph is decreasing on the intervals $(-\infty, 0)$ and $(0, \infty)$.
- The graph is symmetric with respect to the origin.

Example 1 Write a linear function f for which f(1)=3 and f(4)=0

$y - y_1 = m(x - x_1)$

$f(1) = 3$ (1, 3)

$f(4) = 0$ (4, 0)

$m = \frac{0-3}{4-1}$ $m = \frac{-3}{3}$ $m = -1$

$y - 0 = -1(x - 4)$

$y = -1(x - 4)$

$\boxed{y = -x + 4}$

2-4 continued

Greatest integer function or step functions

$y = [\![x]\!]$

$f(x) = [\![x]\!]$

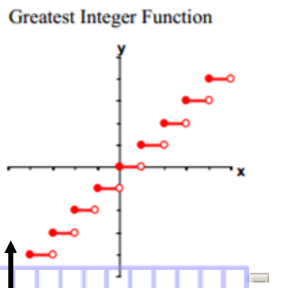
$f(x) = [\![x]\!] = the\ greatest\ integer\ less\ than\ or\ equal\ to\ x$

x	y
0	0
.1	0
.5	0
.99	0
1	1
1.1	1
1.5	1
1.99	1
2	2

x	y
-.5	-1
-.8	

List several important features of the graph of the **greatest integer function.**

- The domain of the function is the set of all real numbers.
- The range of the function is the set of all integers.
- The graph has a y-intercept at (0, 0) and x-intercepts in the interval [0, 1).
- The graph is constant between each pair of consecutive integers.
- The graph jumps vertically one unit at each integer value.

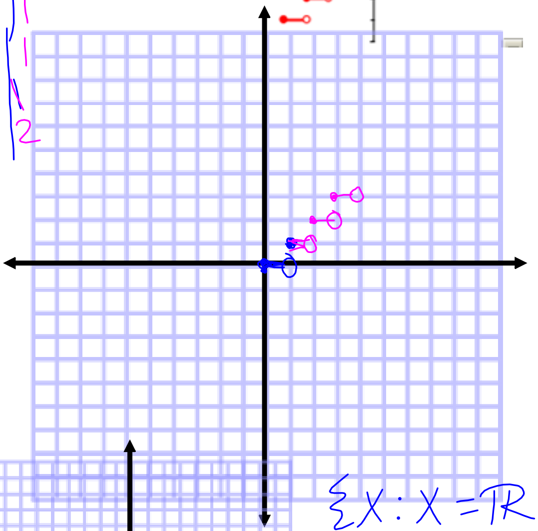


Example 2 evaluate a step function when x=-1,2 and 3/2

$f(x) = [\![x]\!] + 1$

$f(x) = [\![x-h]\!] + k$

$f(x) = [\![x]\!]$

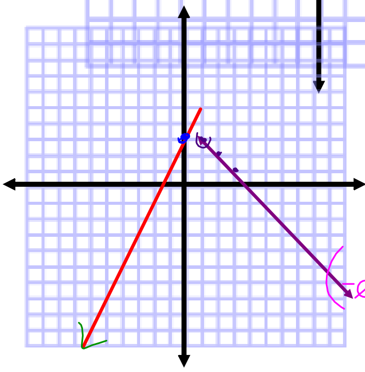


Piecewise-defined function

Example 3:Sketch the graph of

$$f(x) = \begin{cases} 2x+3, & x \le 1 \\ -x+4, & x > 1 \end{cases}$$

$m = \frac{-1}{1}$

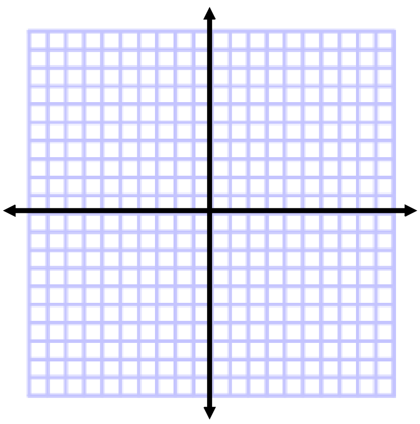


$\{x : x = \mathbb{R}\}$

$(-\infty, \infty)$

$\{y : y \le 5\}$

$(-\infty, 5]$



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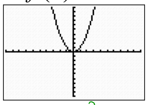
College Algebra 2-5
Transformations

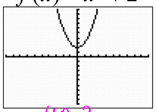
Date: 10/19/15

$f(x)=x^2$



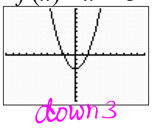
$y=x^2$

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



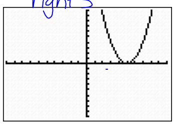
up 2

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

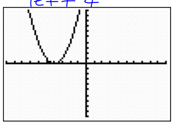


down 3

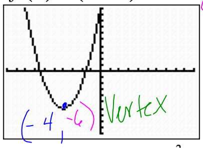
$f(x)=(x-5)^2$ right 5



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



$f(x)=(x+4)^2-6$ left 4 down 6



(-4, -6) Vertex

$f(x)=x^3$

x	f(x)
-2	-8
-1	-1
0	0
1	1
2	8

$f(x)=x^3+1$ up 1

$f(x)=(x+2)^3$ Left 2

$f(x)=(x+2)^3+1$ left 2 up 1

In general RIGID transformation: The basic shape of the graph from the parent is unchanged

Horizontal Shifts Parenthesis
h will always move it left or right
-h will move it to the right
+h will move it to the left
Vertical shifts
k will always move it up or down
+k will move it up k
-k will move it down k

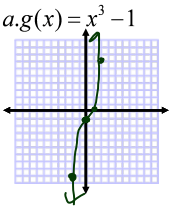
$y=(x--4)^2-6$
$y=(x+4)^2-6$

a reflections in the coordinate axes of the graph of y=f(x) are represented as follows
1. Reflection in the x-axis
$y=-1x^3$ $h(x)=-f(x)$ opposite of the output
2. Reflections in the y-axis
$h(x)=f(-x)$ opposite input

$y=(x-h)^2+k$ Parabola
$y=(x-h)^3+k$ John Travolta
$y=\sqrt{x-h}+k$ Radical
$y=\frac{1}{x-h}+k$ Rational
$y=[\![x-h]\!]+k$ Greatest Integer Function

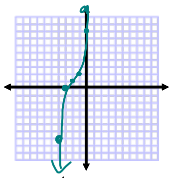
Example 1 Use the graph of $f(x)=x^3$ to sketch a graph of each function

a. $g(x)=x^3-1$



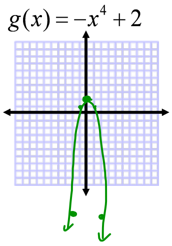
x	f(x)
-2	-8
-1	-1
0	0
1	1
2	8

b. $h(x)=(x+2)^3+1$ Left 2 up 1



Example 2 Use the graph of the function $f(x)=x^4$ to sketch a graph

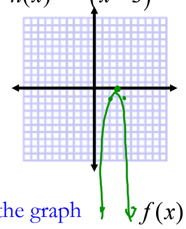
$g(x)=-x^4+2$



$f(x)=x^4$

x	f(x)
-2	16
-1	1
0	0
1	1
2	16

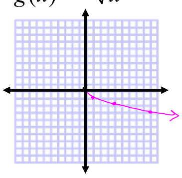
$h(x)=-(x-3)^4$



Example 3 Compare each function with the graph $f(x)=\sqrt{x}$
tell me

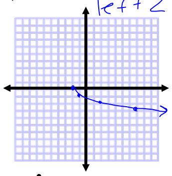
x	y
0	0
1	1
4	2
9	3

$g(x)=-\sqrt{x}$



reflected over x-axis

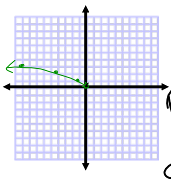
$k(x)=-\sqrt{x+2}$ left 2



Moves left 2 reflects x

$h(x)=\sqrt{-x}$

$h(x)=\sqrt{-(-9)}$

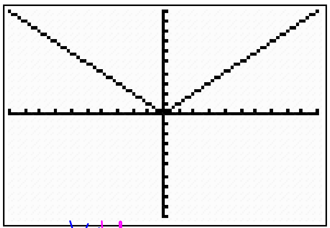


Reflects over y

2-5 continued NONRIGID transformation: are those that cause distortion- a change in the original graph

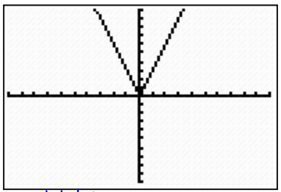
Example 4

$f(x)=|x|$



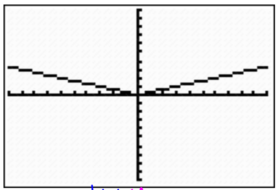
x	y
-4	4
-2	2
-1	1
0	0
2	2
4	4

$h(x)=3|x|$



x	y
-2	6
-1	3
0	0
1	3
2	6

$g(x)=\frac{1}{3}|x|$



x	y
-9	3
-3	1
0	0
3	1
9	3

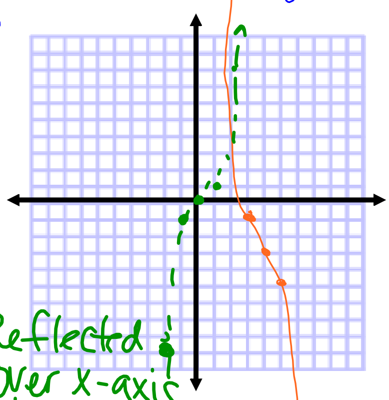
Example 5 Compare the graph of each with the function $f(x)=x^3$

$f(x)=-2(x-4)^3-3$

Right 4 down 3

$y=-2x^3$

x	y
-2	16
-1	2
0	0
1	-2
2	-16



Reflected over x-axis
Vertical Stret

x	y
-2	-8
-1	-1
0	0
1	1
2	8

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Compare the graph of each function with the graph of $f(x)=2-x^3$

$g(x)=f(2x)$

$h(x)=f\left(\frac{1}{2}x\right)$

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

College Algebra 2-6 Date:__________
Combinations of functions: Composite functions

Just as two real numbers can be combined with arithmetic operations, two functions can be combined by the operations of addition, subtraction, multiplication, and division to create new functions. A combined function like this is called an **arithmetic combination of functions.**

The domain of an arithmetic combination of functions f and g consists of . . . all real numbers that are common to the domains of f and g. In the case of the quotient $f(x)/g(x)$, there is the further restriction that $g(x) \neq 0$.

$f(x) = 2x-7$
$g(x) = 4x+5$

Let f and g be two functions with overlapping domains. Complete the following arithmetic combinations of f and g for all x common to both domains:

$2x-7+4x+5$
1) Sum: $(f+g)(x) =$ $f(x) + g(x)$ $6x-2$

$(2x-7)-(4x+5)$
2) Difference: $(f-g)(x) =$ $f(x) - g(x)$ $-2x-12$

$(2x-7)(4x+5)$
3) Product: $(fg)(x) =$ $f(x) \cdot g(x)$ $8x^2-18x-35$

$8x^2+10x-28x-35$

4) Quotient: $\left(\frac{f}{g}\right)(x) =$ $f(x) / g(x),\ g(x) \neq 0$ $\frac{f(x)}{g(x)}$

$\frac{2x-7}{4x+5} = \frac{f(x)}{g(x)}$

$(-\infty, -\frac{5}{4}) \cup (-\frac{5}{4}, \infty)$

Example 1 and 2: Given $f(x) = 2x+1$ $g(x) = x^2+2x-1$

find $(f+g)(x) =$ find $(f-g)(x) =$ $(f-g)(2)$

Example 3 finding the domain or quotients of functions given $f(x) = \sqrt{x}$ $g(x) = \sqrt{4-x^2}$

Then find the domains

find $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$

Expression

$\frac{\sqrt{x}}{\sqrt{4-x^2}}$ $[0, 2)$

Domain

$\left(\frac{g}{f}\right)(x)$ $\frac{g(x)}{f(x)}$

$\frac{\sqrt{4-x^2}}{\sqrt{x}}$

Domain

$(0, 2]$

The **composition** of the function f with the function g is defined as $(f \circ g)(x) =$ $f(g(x))$.

For the composition of the function f with g, the domain of $(f \circ g)$ is . . . the set of all x in the domain of g such that $g(x)$ is in the domain of f.

For two functions f and g, to find $(f \circ g)(x)$, . . . replace each occurrence of x in f with the algebraic expression which defines $g(x)$. Then simplify.

Example 4 composition functions GIVEN $f(x) = x+2$ $g(x) = 4-x^2$

a. $(f \circ g)(x) = -x^2+6$

$f(g(x)) =$

$f(4-x^2)$

$4-x^2+2$

$-x^2+6$

$(g \circ f)(x) =$

$g(f(x)) = -x^2-4x$

$g(x+2)$

$4-(x+2)^2$

	x	2
x	x^2	$2x$
2	$2x$	4

$4-(x^2+4x+4)$

$-x^2-4x$

$(g \circ f)(-2) = 4$

$g(f(-2))$

$g(0)$

4

Example 5 Finding the domain of a composite function GIVEN
find the composition $f \circ g$ then find the domain

$f(x) = x^2-9$ $g(x) = \sqrt{9-x^2}$

Insidefunction

$(f \circ g)(x)$

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

$f(\sqrt{9-x^2})$

$(\sqrt{9-x^2})^2 - 9$

$9-x^2-9$

$-x^2$

Domain

$[-3, 3]$

To decompose a composite function, LOOK for an "inner" function and then an "outer" function

$h(x) = (3x-5)^3$

inner function $f(x) = 3x-5$

Outer function $g(x) = x^3$

$g(f(x))$

Example 6 Write a function given functions as a composition of two functions

$$h(x) = \frac{1}{(x-2)^2}$$

$f(x) = x-2$

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

$g \circ f(x)$

$$h(x) = \sqrt{9-x}$$

$f(x) = 9-x$

$g(x) = \sqrt{x}$

III. Applications of Combinations of Functions (Page 237)

The function $f(x) = 0.06x$ represents the sales tax owed on a purchase with a price tag of x dollars and the function $g(x) = 0.75x$ represents the sale price of an item with a price tag of x dollars during a 25% off sale. Using one of the combinations of functions discussed in this section, write the function that represents the sales tax owed on an item with a price tag of x dollars during a 25% off sale.

$f(x) = .06x \quad g(x) = .75x$

$f(g(x)) = .06(.75x)$

$f(.75x)$

$f(x) = x^2+1 \quad g(x) = x-4$

$\frac{f}{g}(-1) - g(3)$

$\frac{f(-1)}{g(-1)} \quad \frac{(-1)^2+1}{-1-4} \quad \frac{2}{-5}$

$g(3) = 3-4$

$g(3) = -1$

$-\frac{2}{5} - -1$

$-\frac{2}{5} + \frac{5}{5} = \boxed{\frac{3}{5}}$

#9

$f(x) = x^2+5 \quad g(x) = \sqrt{1-x}$

a) $f+g(x) = x^2+5+\sqrt{1-x} \quad (-\infty, 1]$

b) $f-g(x) = x^2+5-\sqrt{1-x} \quad (-\infty, 1]$

c) $(x^2+5)\cdot\sqrt{1-x} \quad (-\infty, 1]$

$x^2\cdot\sqrt{1-x} + 5\sqrt{1-x}$

d) $\frac{x^2+5}{\sqrt{1-x}}$

$\{x : x < 1\}$

$(-\infty, 1)$

$1-x > 0$

$-1 \quad 1-x = 0 \quad -1$

$-x = -1$

$\frac{-x}{-1} = \frac{-1}{-1}$

$x = 1$

yes no

0 1 2

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

$g(x) = -|x+4|$

$f+g(3)$

$2+1 = 3$

5

Partner Math!

Name: College Alg partner Math

Review 2-4-2-7

1st TASK: NUMBER

Write an equation in Slope intercept form for a line perpendicular to $-x+5y=10$ and through the point $(6,-2)$

$m=\frac{1}{3}$

$y=m(x-h)+k$

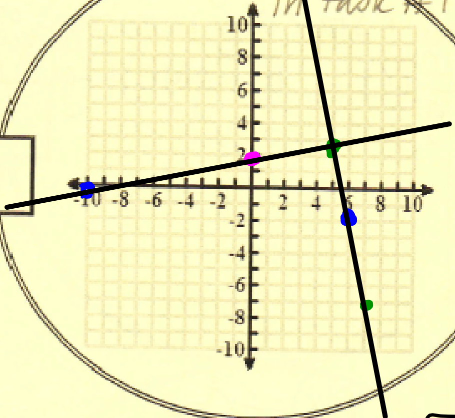
$y=-5(x-6)-2$

$y=-5x+30-2$

$y=-5x+28$

2nd TASK: NUMBER

Graph Both lines in task #1



$(6,-2)$

$m=\frac{-5}{1}$

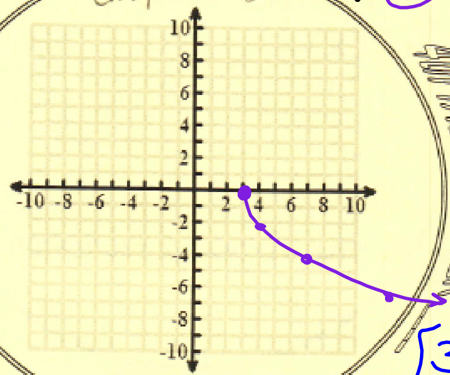
3rd TASK: NUMBER

Explain Using Math Vocabular. Compare the graph of $y=-2\sqrt{x-3}$ to the function $y=\sqrt{x}$.

The graph is a reflection over the x-axis is Vertical Stretch Translated 3 Units Right.

4th TASK: NUMBER

Graph $f(x)=-2\sqrt{x-3}$



$y=-2\sqrt{x}$

x	y
0	0
1	-2
4	-4
9	-6

$[3,\infty)$

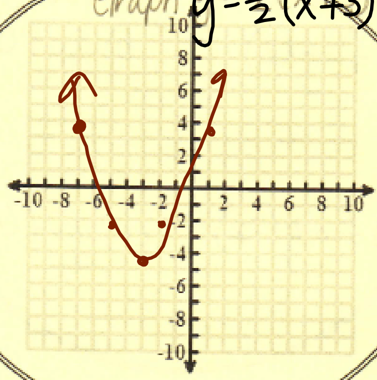
5th TASK: NUMBER

Explain using Math Vocabulary. Compare the graph of $y=\frac{1}{2}(x+3)^2-4$ to the function $y=x^2$

Vertical Shrink Translated Left 3 down 4

6th TASK: NUMBER

Graph $y=\frac{1}{2}(x+3)^2-4$



$y=\frac{1}{2}x^2$

x	y
-4	8
-2	2
0	0
2	2
4	8

7th TASK: NUMBER

Use the functions $f(x)=x^2+5$ $g(x)=3x-4$

Find & State any restrictions on Domain

a) $\frac{f}{g}(x)$ b) $f \cdot g(x)$ c) $f-g(x)$

a) b) c)

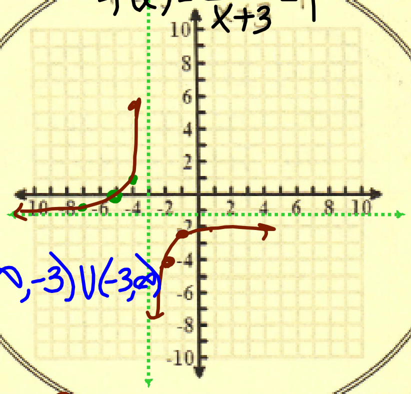
8th TASK: NUMBER

Graph and find the Domain

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

$y=-\frac{2}{x}$

x	y
-4	$\frac{1}{2}$
-2	1
-1	2
1	-2
2	-1
4	$-\frac{1}{2}$



$(-\infty,-3)\cup(-3,\infty)$

9th TASK: NUMBER

$y=\frac{1}{2}x+2$

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

Find the Inverse

$f^{-1}(x)=2x-4$

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

$x=\frac{1}{2}y+2$

$2(x-2)=\frac{1}{2}y\cdot 2$

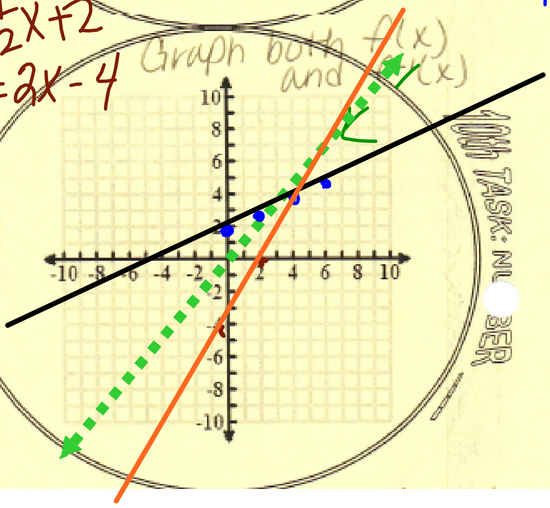
Is the Inverse a function?

10th TASK: NUMBER

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

$f^{-1}(x)=2x-4$

Graph both $f(x)$ and $f^{-1}(x)$



$f(f^{-1}(x))=x$

$f^{-1}(f(x))=x$

$g \circ f(x)=\sqrt{x^2-4}$

$g(f(x))=$

Calculator

11th TASK: NUMBER

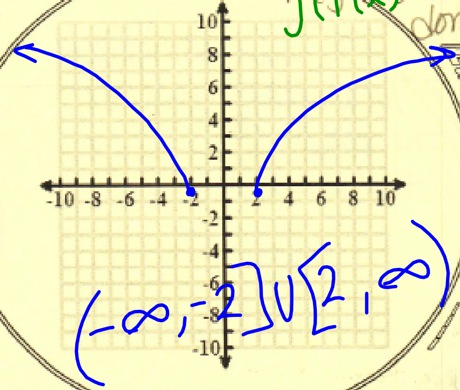
Use the functions $f(x)=x^2-4$ $g(x)=\sqrt{x}$

a) $f \circ g(x)$ b) $g \circ f(x)$

c) $g \circ f(-2)$ d) $f \circ g(4)$

12th TASK: NUMBER

Graph $g(f(x))$ State domain



$(-\infty,-2]\cup[2,\infty)$

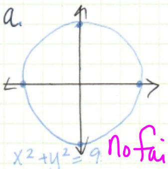
c

College Algebra
Station Math Ch 2 Review

STATION #1

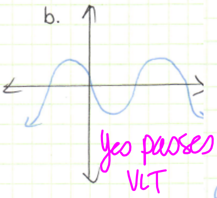
Are the following relations functions? Explain your answer

a.



$x^2+y^2=9$ no fails VLT

b.



yes passes VLT

c. $\{(7,5),(8,5),(9,5)\}$

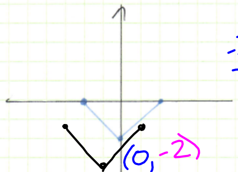
yes

d. $\{(5,1)(5,4)(5,-3)\}$

no

STATION #3

use the graph below



x	y
-2	0
-1	-1
0	-2
1	-1
2	0

a) what are the zeros of f 2 ; -2
b) find value(s) of x for which f(x) = -1 1, -1
c) find value(s) of x for which f(x) = -2 0
d) is f even, odd, or neither even
e) Does f have an inverse? Does not have an Inverse fails HLT
f) is f(0) a relative min or max?
g) Graph $g(x) = f(x+1) - 1$ Left 1 down 1
h) Graph $h(x) = \frac{1}{2}f(\frac{1}{2}x)$
i) Find the average rate of change from $x_1 = -2$ to $x_2 = 1$ hint Beyonce Method
(-2, 0)
(1, -1)

College Algebra
Ch 2 Review

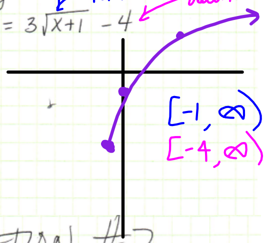
STATION #5

Graph and State the domain and Range

$y = 3\sqrt{x+1} - 4$ left 1 down 4

Parent $y = 3\sqrt{x}$

x	y
0	0
1	3
4	6
9	9



$[-1, \infty)$
$[-4, \infty)$

STATION #7

$f(x) = x^2 - x - 4$ $g(x) = 2x - 6$

a) Find $g - f(x)$
$2x - 6 - (x^2 - x - 4)$
$-x^2 + 3x - 2$

b) $\frac{f}{g}(x)$ State the domain
$\frac{x^2-x-4}{2x-6}$ $(-\infty, 3) \cup (3, \infty)$
$\{x : x \neq 3\}$

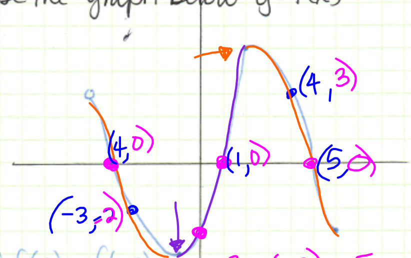
c) $f \circ g(x)$ $(2x-6)(2x-6)$
$f(g(x))$ $(2x-6)^2 - (2x-6) - 4$
$f(2x-6)$ $4x^2 - 24x + 36 - 2x + 6 - 4$
$4x^2 - 26x + 38$

d) $g \circ f(-1) = 10$
$g(f(-1))$ $(-1)^2 - (-1) - 4$
$1 + 1 - 4$
$g(-2)$
$2(-2) - 6$
$-4 - 6$

College Alg Station Math
Ch 2 Review

Station #2

use the graph below $y = f(x)$



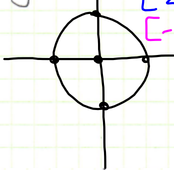
a) $f(4) - f(-3)$ $3 - (-2) = 5$
b) What is the domain $(-5, 6]$
c) What is the Range $[-4, 5]$
d) On which interval or intervals is f increasing $(-1, 2)$
e) which intervals or interval is the function f decreasing $(-5, -1)$ $(3, 6)$
f) for what number does f have a relative Maximum? 2 What is it? 5
g) for what # does f have a relative Minimum -1 What is the relative min? -4
h) name x-intercepts
i) name y-intercept

College Algebra
Ch 2 Review

STATION #4

Graph the equation. State the domain and Range

$x^2 + y^2 = 4$ $(0, 0)$ $r = 2$



$[-2, 2]$
$[-2, 2]$

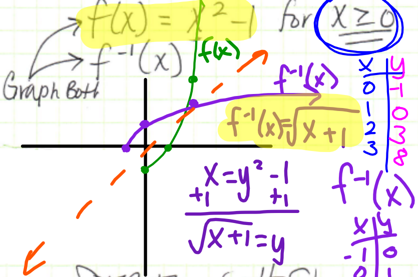
STATION #6

Graph both functions and State the Domain and Range

$f(x) = x^2 - 1$ for $x \geq 0$

$f^{-1}(x)$

Graph Both



x	y
0	-1
1	0
2	3
3	8

$x = y^2 - 1$
$+1 \quad +1$
$\sqrt{x+1} = y$

$f^{-1}(x)$

x	y
-1	0
0	1
3	2
8	3

STATION #8

In 2004 the number of deaths due distracted driving was 4978 and in 2008 the number of deaths was 5870. If the data was linear write me an equation that models this situation. hint

$y = m(x - h) + k$

$(2004, 4978)$ $m = \frac{5870 - 4978}{2008 - 2004}$
$(2008, 5870)$

$m = \frac{223 \text{ deaths}}{\text{year}}$

$y = 223(x - 2004) + 4978$
$y = 223x - 446892 + 4978$
$\boxed{y = 223x - 441914}$

College Algebra Lesson 2-7 Date:____________

inverse functions

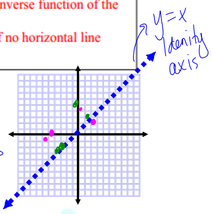
Important Vocabulary Define each term or concept.

Inverse function Let f and g be two functions. If $f(g(x)) = x$ for every x in the domain of g and $g(f(x)) = x$ for every x in the domain of f, then g is the inverse function of the function f. The function g is denoted by f^{-1}.

Horizontal Line Test A function f has an inverse if and only if no horizontal line intersects the graph of f at more that one point.

$f(x) = \{(0, -2)\ (2, 5)\ (4, 3)\ (-1, -3)\}$

$f^{-1}(x) = \{(-2, 0)\ (5, 2)\ (3, 4)\ (-3, -1)\}$



I. Inverse Functions (Pages 242–243)

For a function f that is defined by a set of ordered pairs, to form the inverse function of f, . . . interchange the first and second coordinates of each of these ordered pairs.

For a function f and its inverse f^{-1}, the domain of f is equal to the range of f^{-1}, and the range of f is equal to the domain of f^{-1}.

To verify that two functions, f and g, are inverse functions of each other, . . . find $f(g(x))$ and $g(f(x))$. If both of these compositions are equal to the identity function x for every x in the domain of the inner function, then the functions are inverses of each other.

Example 1

Verify that the functions $f(x) = 2x - 3$ and $g(x) = \frac{x+3}{2}$ are inverse functions of each other.

$f(g(x)) = x$ and $g(f(x)) = x$

$f\left(\frac{x+3}{2}\right)$ $g(2x-3)$

$2\left(\frac{x+3}{2}\right) - 3$ $\frac{2x-3+3}{2}$ $\frac{2x}{2}$

$x+3-3$

Example 2 Which function is an inverse of

$f(x) = \frac{5}{x-2}$ $h(x) = \frac{5}{x} + 2$ $g(x) = \frac{x-2}{5}$

$f(h(x)) = \frac{5}{\;} = x$ $h(f(x)) = x$

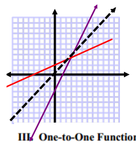
$f\left(\frac{5}{x} + 2\right)$ $\frac{5}{x} + 2 - 2$ $h\left(\frac{5}{x-2}\right)$

II. The Graph of an Inverse Function (Page 244)

If the point (a, b) lies on the graph of f, then the point (b, a) must lie on the graph of f^{-1} and vice versa. The graph of f^{-1} is a *reflection* of the graph of f in the line $y = x$.

Example 3 sketch the graphs of

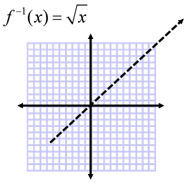
$f(x) = 2x - 3 \text{ and } f^{-1}(x) = \frac{1}{2}(x+3)$



Sketch

$f(x) = x^2 \quad x \geq 0$

$f^{-1}(x) = \sqrt{x}$



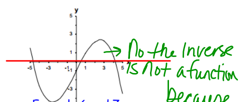
III. One-to-One Functions (Page 245)

To tell whether a function has an inverse function from its graph, . . . simply use the Horizontal Line Test, that is, check to see that no horizontal line intersects the graph of the function at more than one point.

A function f is **one-to-one** if . . . each value of the dependent variable corresponds to exactly one value of the independent variable.

A function f has an inverse function if and only if f is one-to-one.

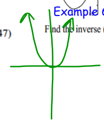
Example 5 Does this graph have an inverse function. explain



No the Inverse is Not a function because the function fails the HLT

Example 6 and 7

Find the inverse (if it exists) of $f(x) = 4x - 5$



IV. Finding Inverse Functions Algebraically (Pages 246–247)

To find the inverse of a function f algebraically, . . .

1) Use the Horizontal Line Test to decide whether f has an inverse function.
2) In the equation for $f(x)$, replace $f(x)$ by y.
3) Interchange the roles of x and y, and solve for y.
4) Replace y by $f^{-1}(x)$ in the new equation.
5) Verify that f and f^{-1} are inverse functions of each other by showing that the domain of f is equal to the range of f^{-1}, the range of f is equal to the domain of f^{-1}, and $f(f^{-1}(x)) = x = f^{-1}(f(x))$.

$f(x) = \sqrt[3]{x+1}$

$f^{-1}(x) = x^3 - 1$

Find the inverse

Graph and

$f(x) = \sqrt[3]{x+1}$ $f^{-1}(x) = \boxed{x^3 - 1}$

$y = \sqrt[3]{x}$

x	y
-8	-2
-1	-1
0	0
1	1
8	2

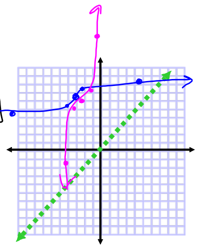
$x^3 = (\sqrt[3]{y+1})^3$

$x^3 = y + 1$

$y = x^3 - 1$

$y = x^3$

x	y
-2	-8
-1	-1
0	0
1	1
2	8



b) verify

$f(x) = \frac{7}{x} - 3$

$f^{-1}(x) = \frac{7}{x+3}$

a)

$x = \frac{7}{y} - 3$

$+3 \qquad +3$

$\frac{x+3}{1} = \frac{7}{y}$

$\frac{y(x+3)}{x+3} = \frac{7}{x+3}$

$y = \frac{7}{x+3}$

(get y by itself)

~~b) $f(f^{-1}(x)) = x$~~ $f^{-1}(f(x)) = x$

$f\left(\frac{7}{x+3}\right)$

$\frac{\frac{7}{1}}{\frac{7}{x+3}} - 3$

$\frac{7(x+3)}{7} - 3$

$x+3-3$

$f^{-1}\left(\frac{7}{x} - 3\right)$

$\frac{\frac{7}{1}}{\frac{7}{x} - 3 + 3}$

$\frac{\frac{7}{1}}{\frac{7}{x}}$ $\frac{7x}{7}$

$x+3-3$

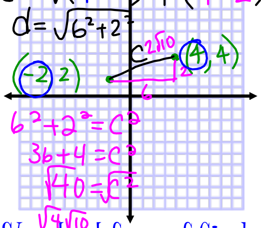
College Algebra 2-8 Distance and Midpoint

Distance Formula

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$d=\sqrt{(4-2)^2+(4-2)^2}$

$d=\sqrt{6^2+2^2}$



$(-2,2)$ $(4,4)$ c $2\sqrt{10}$ 6 2

$6^2+2^2=c^2$

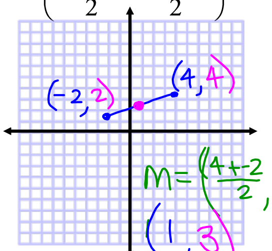
$36+4=c^2$

$\sqrt{40}=\sqrt{c^2}$

$\sqrt{4}\sqrt{10}$

Midpoint Formula

$$\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$



$(-2,2)$ $(4,4)$

$m=\left(\frac{4+-2}{2},\ \frac{4+2}{2}\right)$

$(1\ \ 3)$

Standard form of Circle

$$(x-h)^2+(y-k)^2=r^2$$

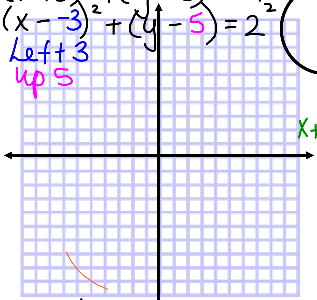
$x^2+y^2=1$

$(x+3)^2+(y-5)^2=4$

$(x--3)^2+(y-5)^2=2^2$

Left 3

up 5



$(1,-7)$ and radius 3

$(x-1)^2+(y+7)^2=9$

$x+4$

$(x+4)^2$

General form of Circle

$$x^2+y^2+Dx+Ey+F=0$$

D, E, and F are real numbers

53) $x^2+y^2+6x+2y+6=0$

$x^2+6x+\boxed{9}+y^2+2y+\boxed{1}=-6+\boxed{9}+\boxed{1}$

$x+3$ | x^2 | $3x$ | $3x$ | 9

$y+1$ | y^2 | y | y

$(x+3)^2+(y+1)^2=4$

$$\frac{\frac{-7}{2}+\frac{-5}{2}}{2}\quad\frac{\frac{-12}{2}}{2}\quad\frac{-6}{2}=-3\qquad\frac{\frac{3}{2}+\frac{-11}{2}}{2}\quad\frac{\frac{-8}{2}}{2}=\frac{-4}{2}=-2$$

31) $(0,0)$ $r=7$

$\boxed{(x-h)^2+(y-k)^2=r^2}$

$x^2+y^2=7^2$

37) $(-3,-1)$ $r=\sqrt{3}$

$(x--3)^2+(y--1)^2=(\sqrt{3})^2$

$(x+3)^2+(y+1)^2=3$

55) $x^2+y^2-10x-6y-30=0$

$x^2-10x+\boxed{25}+y^2-6y+\boxed{9}=30+\boxed{25}+\boxed{9}$

	x	-5
x	x^2	
-5		25

	y^2	-3
	-3	9

$(x-5)^2+(y-3)^2=64$

$(5,3)$ $r=8$

$f(x)=x^2$

$g(x)=x-4$

$f\circ g(x)$

$f(x-4)$

$(x-4)^2=x^2-8x+16$

	x	-4
x	x^2	$-4x$
-4	$-4x$	16

Attachments

Chapter 1 MULT choice.pdf

Cummulative review Chapters p-2.pdf

Chapter 2 Review book.pdf

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