

Key Concepts:

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|-------------------------|------------------------|
| 1. Domain | 2. Transformations |
| 3. Discontinuity | 4. Function Operations |
| 5. Inverse Functions | 6. Analyzing Functions |
| 7. Piece-Wise Functions | 8. Odd/Even Functions |
| 9. Optimization | |

1. Determine the domain of the following functions

| | |
|---------------------------------|--|
| a. $\frac{4x^2}{x^2-7x+10}$ | b. $\sqrt{8-x} + 3 x-12 $ |
| c. $\log(2x+8) + 4\sqrt{12-3x}$ | d. $\frac{3^x-2\sqrt{4x+16}}{6x^2-5x-6}$ |

2. Transformations: Write the steps to transform the function from its parent function

| | |
|---|--|
| a. $f(x) = \frac{1}{2}(-x+6)^2 - 5$ | b. $g(x) = -\frac{3}{x-2} + 3$ |
| c. $h(x) = -\log\left(\frac{2}{3}x\right) + \frac{5}{2}$ | d. $y = 3\sin(\pi x - 4)$ |
| e. $f(c) = -\frac{4}{3}\left \frac{1}{4}c + 1\right - 6$ | f. $g(\theta) = 5 * 4^{3-6\theta} + 2$ |

3. Discontinuity

a. Explain what makes a function continuous.

b. Draw and label the three types of discontinuities

c. List the types of discontinuities and where they occur on the graph of:

$$f(x) = \frac{x^2 - 16}{x^2 + 3x - 4}$$

d. List the types of discontinuities and where they occur on the graph of:

$$g(x) = \begin{cases} |x| & \text{if } x < 2 \\ 4 & \text{if } x \geq 2 \end{cases}$$

4. Function Operations

Use the functions below to perform the given operations:

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

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

$$h(x) = \frac{1}{5 - x}$$

a. $f(x) - h(x)$

b. $\frac{f(x)}{h(x)}$

c. $f(h(x))$

d. $f \circ g$

e. $g \circ f$

f. $g(h(x))$

5. Inverse Functions

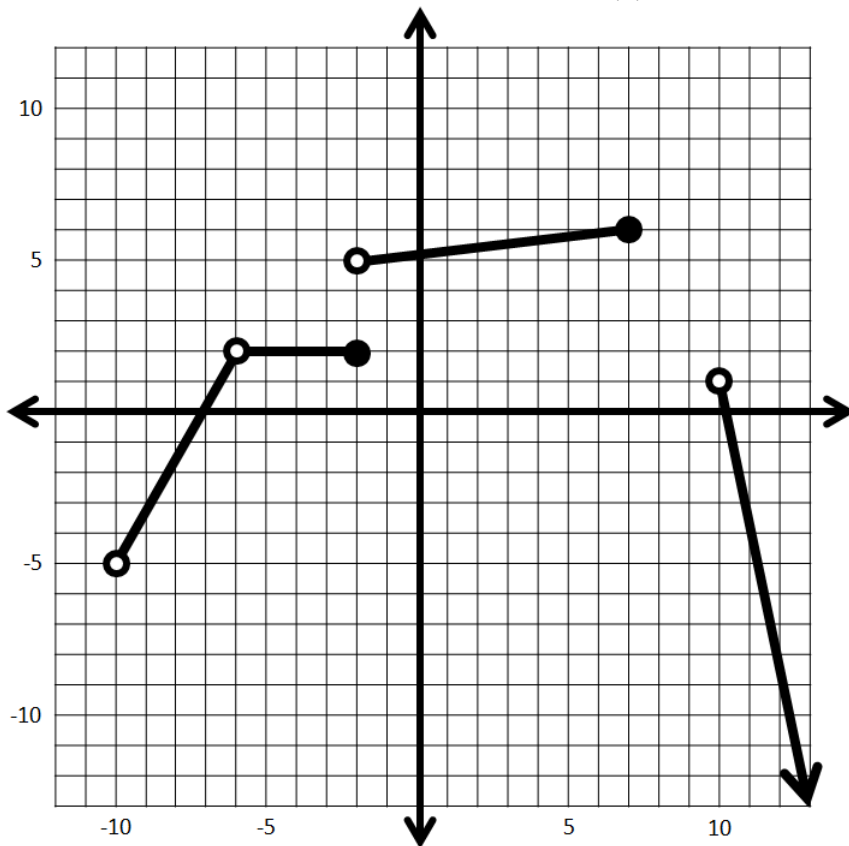
a. What are the three things you need to know about inverse functions?

b. Find the inverse of $f(x) = x^3 + 6$

c. Find the inverse of $g(x) = \frac{3-x}{3x+2}$

6. Analyzing Functions

a. The graph below represents the function $h(x)$. Fill in the information about $h(x)$.



i. Domain

ii. Range:

iii. Increasing:

iv. Decreasing:

v. Constant:

vi. Bound?

vii. Symmetric?

viii. Discontinuities

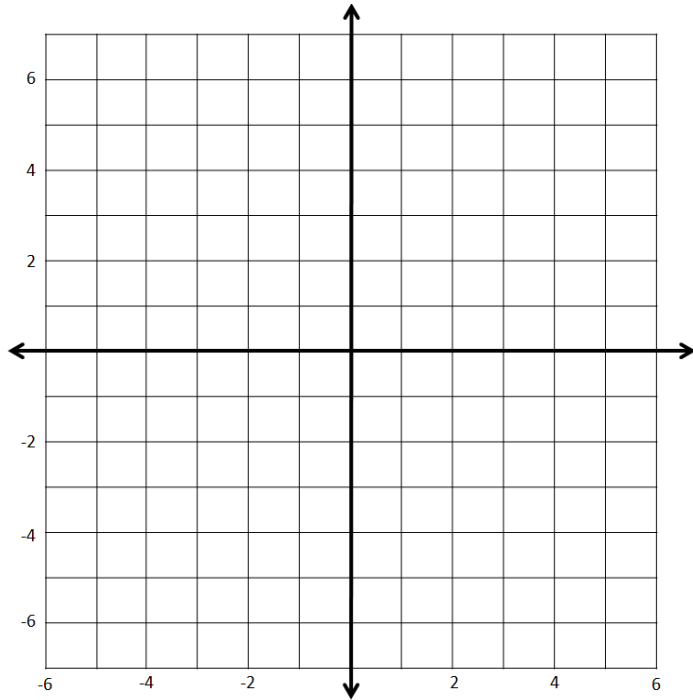
ix. Is the graph a function? Explain why/why not.

x. What type of a function is this?

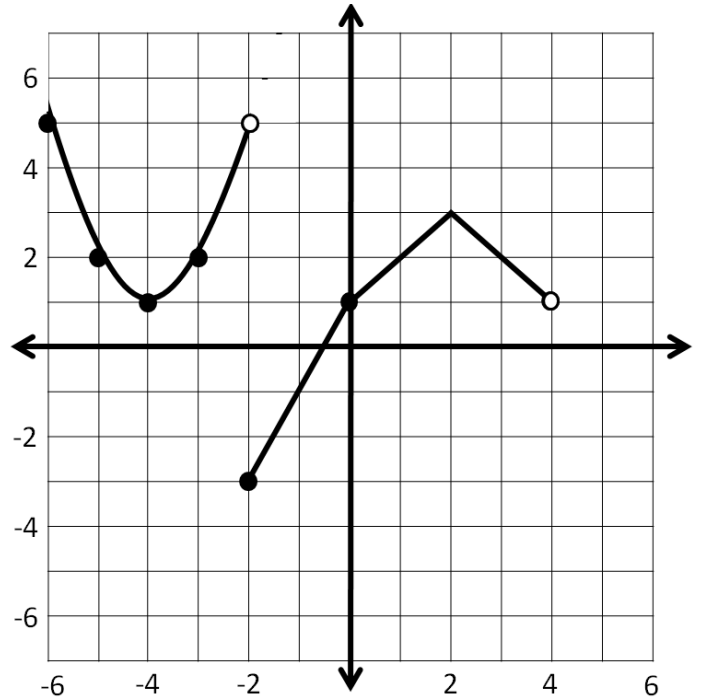
7. Piece-Wise Functions

a. Graph the piece-wise function:

$$f(x) = \begin{cases} |x| - 3 & \text{if } x < -1 \\ x^2 & \text{if } -1 \leq x < 2 \\ 4 & \text{if } x \leq 2 \end{cases}$$



b. Write an equation for the piece-wise function.



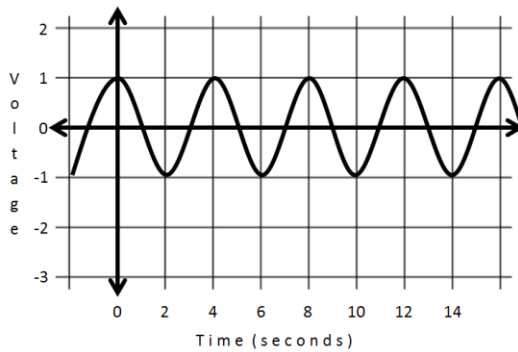
8. Odd/Even Functions: Determine whether the functions are odd, even, or neither.

a. What makes a function odd or even?

b. $f(x) = x^3 - 3x$

c. $g(x) = |x| - 4$

d.



e. $h(x) = \sin(x)$

9. Optimization:

- a. Luckily for you there is extra credit available. To raise your grade you will design a box for Mr. Hurni. He needs a box large enough to store all of his marbles so he doesn't lose them. He has lots of marbles and they take up 20 ft^3 . He would also like the height to be twice the width. However, since he is so very poor he needs you to minimize the amount of material used. Determine the dimensions of the box you will create for Mr. Hurni so he will have a safe place to store his marbles. Oh, and before you get too excited this is not an extra credit problem. You should just study really hard for the final.

- b. Karl needs help! Karl would like to build a fence for his pet turtle Timmy because Timmy likes to run away from Karl. Karl came up with a great idea, he would like to build the fence next to the river so Timmy can get water when he gets thirsty, and that way he can use the river as one of the sides of his fence. Genius! Karl has enough money to buy 500 feet of fencing. Will you help Karl determine the dimensions of the fence so it will provide Timmy with the largest area to crawl around and do whatever turtles do. And while you're at it you should probably tell Karl that turtles can swim and the river won't stop Timmy from running away!