

Name _____

Read and follow all instructions. Try to answer every part of every question; a partially correct answer is better than no answer at all. For this quiz, you are not permitted to use any resources other than a basic, non-graphing scientific calculator and your own brain; no notes, no book, no phone, no computer, etc.

1 point each
(5 pts total)

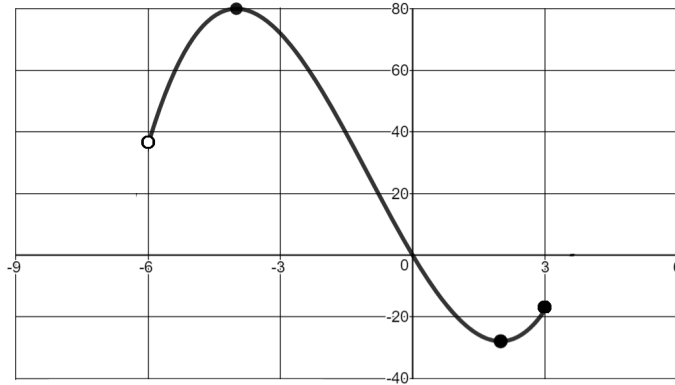
1. Fill in each of the blanks below with either x or y .
 - (a) A function takes certain values as inputs (____-values) and assigns to each input value one and only one output value (____-values).
 - (b) The Vertical Line Test is a test to see if a graph is a function. It works because all of the points on a vertical line have the same ____-value but different ____-values.
 - (c) The domain is the set of all possible ____-values.
 - (d) The range is the set of all possible ____-values.
 - (e) When we say where a function is increasing or decreasing, we are listing ____-values.

1 point each
(5 pts total)

2. Fill in the blanks in each of the following sentences.
 - (a) The _____ of a polynomial is the highest exponent.
 - (b) The _____ coefficient is the coefficient of the term with the highest exponent.
 - (c) Two more names for the x -intercepts of a polynomial are _____ and _____.
 - (d) To find the x -intercepts of a rational function, set the _____ equal to zero and solve.
 - (e) To find the vertical asymptotes of a rational function, set the _____ equal to zero and solve.

1 point each
(7 pts total)

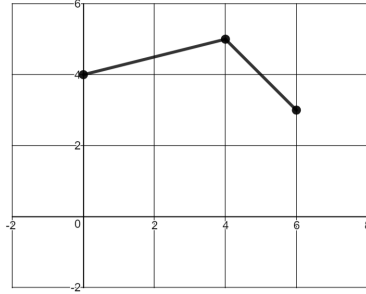
3. Use the graph of $f(x)$ below to answer the questions that follow. Use interval notation when appropriate. If you are unsure of an exact value, give your best integer estimate.



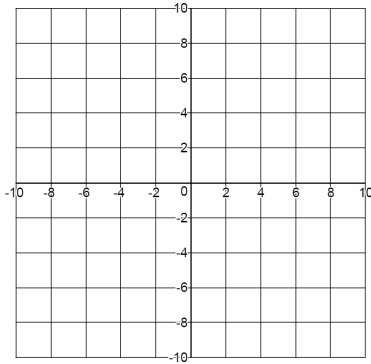
- (a) What is the domain?
- (b) What is the range?
- (c) Where is $f(x)$ increasing?
- (d) Where is $f(x)$ decreasing?
- (e) The inverse function $f^{-1}(x)$ does not exist. How can you tell by looking at the graph?
- (f) Where does $f(x)$ have a relative maximum?
- (g) What is the relative maximum of $f(x)$?

4 points each
(8 pts total)

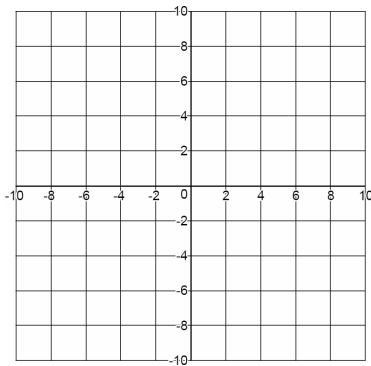
4. Use the graph below to graph the transformations that follow.



(a) $-f(2x) + 4$



(b) $f(-x + 5) - 1$



5. Consider $f(x) = -6x^4 - 23x^3 - 19x^2 + 8x + 4$.

3 point

- (a) Find the degree and leading coefficient, and use those values to determine the end behavior. You can either describe the end behavior in words or just draw two arrows.

Deg $f =$ LC = End behavior:

1 point

- (b) Suppose you are told that one of the roots is -2 . How does that make finding the other roots easier?

4 points

- (c) Find all of the roots of the polynomial and their multiplicities. SHOW YOUR WORK.

Root	Multiplicity

3 points

- (d) Sketch a graph of the polynomial. Label the x -intercepts with the values you found in part (b). You might need to plug in some extra x -values to give you an idea of how big the y -values are, especially relative maxima or minima. If so, include them on the chart below.

x	y

6 points

6. Craig wants to buy a new 55" TV, but he doesn't know how well it will fit in his entertainment center. He knows the 55" measurement for the TV is the length of the diagonal. The box says the diagonal makes a 36° angle with the bottom, but it doesn't say how wide the TV is. How wide is the TV? Round to one place past the decimal and SHOW YOUR WORK.

1 point each
(5 pts total)

7. Suppose θ is in quadrant 2 with $\sin \theta = \frac{5}{9}$. What are the exact values of the other trig functions? Rationalize denominators and simplify as necessary. It may help if you draw a picture.

$$\sin \theta = \frac{5}{9}$$

$$\tan \theta =$$

$$\sec \theta =$$

$$\cos \theta =$$

$$\cot \theta =$$

$$\csc \theta =$$

2 points

8. Identify the parameters listed and then sketch a graph of the function.

$$y = -5 \sin \left(2x + \frac{\pi}{3} \right) - 4$$

$$\text{Amplitude} =$$

$$\text{Phase Shift} =$$

$$\text{Period} =$$

$$\text{Vertical Shift} =$$

5 points

- Start at the phase shift, and include one full period in your graph. Label five x -values that split the period into quarters.

9. Sum-to-product formulas:

$$\begin{aligned}\sin \alpha + \sin \beta &= 2 \sin \left(\frac{\alpha + \beta}{2} \right) \cos \left(\frac{\alpha - \beta}{2} \right) \\ \sin \alpha - \sin \beta &= 2 \sin \left(\frac{\alpha - \beta}{2} \right) \cos \left(\frac{\alpha + \beta}{2} \right) \\ \cos \alpha + \cos \beta &= 2 \cos \left(\frac{\alpha + \beta}{2} \right) \cos \left(\frac{\alpha - \beta}{2} \right) \\ \cos \alpha - \cos \beta &= -2 \sin \left(\frac{\alpha + \beta}{2} \right) \sin \left(\frac{\alpha - \beta}{2} \right)\end{aligned}$$

7 points

Use a sum-to-product formula to find all of the solutions with $0 \leq x < 2\pi$ to the equation below. Circle the formula you used, and SHOW YOUR WORK. Hint: There are 7 solutions.

$$3 \cos \left(\frac{7x}{2} \right) = -3 \cos \left(\frac{5x}{2} \right)$$

7 points

10. Find all missing measurements for all possible triangles where a is the longest side. Round your answers to the nearest tenth. SHOW YOUR WORK.

$$a = 12.5 \quad b = 10 \quad B = 25^\circ$$

2 points each
(6 pts total)

11. Consider the complex number $z = 4 - 4\sqrt{3}i$. SHOW YOUR WORK as you answer the questions below.

(a) Write z in polar form. You may use cosine and sine or Euler's formula, and your angle can be measured in either degrees with $0 \leq \theta < 360^\circ$ or radians with $0 \leq \theta < 2\pi$.

(b) Use DeMoivre's Theorem to calculate z^5 . Leave your answer in polar form. Again, your angle can be measured in either degrees with $0 \leq \theta < 360^\circ$ or radians with $0 \leq \theta < 2\pi$.

(c) Find the cube roots of z .

2 points each
(6 pts total)

12. Use the vectors below to perform the operations that follow. SHOW YOUR WORK.

$$\mathbf{u} = -6\mathbf{i} - 2\mathbf{j} \quad \mathbf{v} = 3\mathbf{i} - 9\mathbf{j}$$

(a) $\frac{1}{2}\mathbf{u} - 3\mathbf{v}$

(b) $\|2\mathbf{v}\|$

(c) $\mathbf{u} \cdot \mathbf{v}$

3 points each
(6 pts total)

13. Two tugboats are pulling a large ship. One tugboat pulls with a force of 2000 pounds on a bearing of N55°E and the other pulls with a force of 2500 pounds on a bearing of S80°E. SHOW YOUR WORK.

(a) What is the magnitude of the resultant force?

(b) What is the direction of the resultant force?

6 points

14. Multiply the two matrices shown below or say such a multiplication is impossible.

$$A = \begin{bmatrix} 2 & 3 \\ 0 & -4 \end{bmatrix} \quad B = \begin{bmatrix} 7 \\ -2 \end{bmatrix}$$

(a) $AB =$

(b) $BA =$

8 points

15. A person invested \$17,000 for one year, part at 10%, part at 12%, and part at 15%. The total revenue from these investments was \$2110. The amount of money invested at 12% was \$1000 less than the amount invested at 10% and 15% combined. Find the amount invested at each rate. SHOW YOUR WORK.