
Directions: Please read all questions carefully. Answer all parts of each question. Please circle or box your final answers. Show all work and justify all answers for full credit. Partial credit is always given for correct methods, partial correct calculations, and correct justification (rules, theorems, definitions, etc). Point values for each question are indicated in parentheses. Good luck.

1) (5pts) Write the equation of the circle with center at the point $(1, -4)$ and with a diameter of length $\frac{3}{2}$.

2) (5pts) Determine whether the following equation is symmetric about the x-axis, the y-axis, and/or the origin. Justify your answer with an algebraic analysis.

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

- 3) (5pts) Given the function $f(x) = x^2 - 1$, **find the difference quotient** $\frac{f(x+h)-f(x)}{h}$ and show that it can be simplified to $(2x + h)$.

- 4) Given $g(x) = x^{5/3}$ and $f(x) = 2 - x$. (Recall that $x^{m/n} = \sqrt[n]{x^m}$.)

a. (5pts) Find the composition function $(g \circ f)(x)$.

b. (10pts) Find the **inverse** of the function $(f \circ g)(x)$.

6) (8) Consider the graph of $h(x) = -(x + 3)^2$:

(Hint: It might help to use graph transformations and quickly sketch this graph)

a. On what interval is $h(x)$ **increasing**?

b. Identify any **relative minima** and/or a **relative maxima** for the function $h(x)$.

c. What is the domain of $h(x)$?

d. What is the range of $h(x)$?

7) Suppose the Western Widget Corp. makes a pledge to the American Red Cross. They will donate \$10,000 now, and also promise to donate an additional \$2 for every widget that the company sells in the next year.

Let “y” be the total amount of Western Widget’s donation to the Red Cross and let “x” be the number of widgets that they sell.

a. (5pts) Write a linear equation **in slope-intercept form** that gives the cash donation as a function of the number of widgets sold.

b. (4pts) Compute how many widgets must be sold for the children to make \$100,000 donation.

9) (3 pts each) Briefly answer the following question.

a. Is the following equation defined piece-wise a **function**? Explain why or why not.

$$f(x) = \begin{cases} 2x - 3, & x \geq 1 \\ x^2 - 2, & x \leq 1 \end{cases}$$

b. Explain the **relationship between** a one-to-one function and the horizontal line test.

c. Define the term FUNCTION.

d. _____ of the function f are the x -values for which $f(x)=0$.

e. Suppose you earn 5% simple interest on a bank account. Does the amount of interest you receive for one year **vary directly** or **vary inversely** with the amount of money you have deposited in the bank?

f. If $f(x)$ is a one-to-one function and $f(a)=b$ whenever $g(b)=a$, then the function $g(x)$ is

_____.

BONUS (+5)

Construct a function that **IS NOT** one-to-one, **IS** linear, and **IS** symmetric about the origin.