

Math113 College Algebra  
**First Midterm Exam**  
Colorado Mesa University Fall 2023

NAME: \_\_\_\_\_

1. If  $f(x) = 3x^2 - 1$ , what is the value of  $f(2)$ ?

2. This table reports input/output pairs for a function  $g$ . What is the value of  $g(3)$ ?

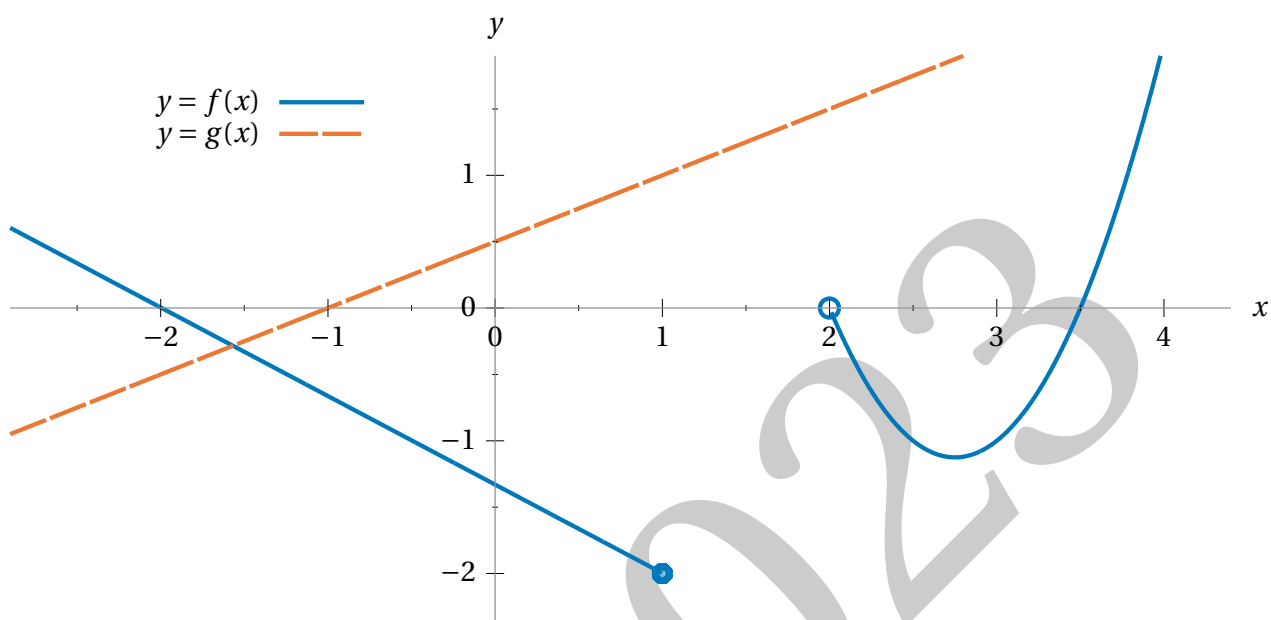
$x$	-1	0	2	3	4	5
$g(x)$	3	22	0	9	32	-1

3. What's an equation for the line that intersects the  $y$ -axis at 3 and has a slope of  $-\frac{5}{2}$ ?

4. What's the value of the  $x$ -intercept of the line  $y = 3x - 4$ ?

5. Does the point  $(3, 4)$  lie on the graph of the function  $h(x) = \frac{1}{2}x^2 - \frac{1}{5}x$ ? In one sentence, state how you figured out the answer this question.

6. Consider these graphs of functions  $f$  and  $g$ .



- Estimating, what is  $f(-1)$ ?
  - Estimating, for what value(s) of  $x$  does  $f(x) = 0$ ?
  - What appears to be the domain of  $f$ ?
  - What appears to be the range of  $f$ ?
  - Estimating, for what input(s)  $x$  do  $f$  and  $g$  share a common output?
  - Notice from its graph that  $g$  appears to be a linear function. What is a plausible formula for  $g(x)$ ?
- (g) On this same set of axes above, plot a line perpendicular to the graph of  $g$  that passes through the point  $(1, 0)$ . What must the slope of this line be?

7. Recall the formula for the future value  $A$  of an initial investment of  $P$  dollars at a simple annual interest rate  $r$  invested for  $t$  years is given by the formula  $A = P(1 + rt)$ .

(a) Solve this equation for  $t$  in terms of the other variables.

(b) If you make an initial investment of \$900 at a simple annual interest rate of 0.7%, how many years until your investment appreciates to be worth \$1000?

8. In Spring 2023 a new Elkay ezH<sub>2</sub>O water bottle refill station was installed outside the CMU Math Department main office. It has a digital display that reports the number of “Bottles Saved”. Here’s a record of that number on varies days since the beginning of that semester.

Days since the beginning of the semester	15	29	43	64	99	106
“Bottles Saved”	393	762	1193	1591	2890	3117

(a) Using technology perform *linear regression* to find a linear model  $f$  for the number of bottles saved  $x$  days after the beginning of the semester. Write the formula for your model below with parameters rounded to two decimal places.

(b) According to your model, at what *rate* are bottles saved per day?

(c) (INTERPOLATE) There’s a notable gap in the data between  $x = 64$  and  $x = 99$ . According to your model how many bottles had been saved by the 77th day of the Spring 2023 semester?

(d) (EXTRAPOLATE) According to the model, assuming this model remains accurate well beyond the domain of the data, on what day since the beginning of the Spring 2023 semester will the number of “Bottles Saved” surpass 6,890? In one sentence, explain how you figured this out.

(e) (BONUS) The data point for  $x = 64$  is further from the linear model than the other data points. There is a good reason for this. Can you think of what this reason is?

9. What is an equation of the line that passes through the points  $(-1, 2)$  and  $(4, -4)$ ? In one sentence, state how you can tell from the equation if this line is *increasing* or *decreasing* as  $x$  increases.

10. Demonstrate algebraically how to find the coordinates of the point where the lines corresponding to these two equations intersect.

$$3x + 4y = 17$$

$$x - 8y = 1$$

\* (OPTIONAL) The prompts on this exam were designed to elicit evidence of your understanding of the mathematics we've discussed in this course. But perhaps you've learned things that weren't prompted for. Perhaps you've gained some mathematical understanding that you haven't had an opportunity yet to exhibit on this exam. Now is your opportunity. On this page, write about anything you've learned in this class that you haven't already gotten a chance to demonstrate on this exam.

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