

# Final Exam

Math 113-001/6 College Algebra  
Colorado Mesa University Fall 2022

Name: \_\_\_\_\_

1. What's a formula for the linear function  $f$  for which  $f(0) = 2$ , and for which the graph of  $f$  is parallel to the line  $y = \frac{5}{7}x - 6$ ?

2. What's a formula of the linear function  $g$  corresponding to the input/output pairs listed in this table?

$t$	-2	-1	0	1	2
$g(t)$	4	1	-2	-5	-8

3. For which value(s) of  $r$  is it true that

$$\frac{2(r-1)}{4} = 5 - \frac{r}{3}?$$

4. The function  $h$  defined by the formula

$$h(x) = \sqrt[5]{\frac{2}{3}x + 1}$$

is a one-to-one function. Write down a formula for its inverse function  $h^{-1}$ .

5. What must  $s$  be if  $2.71 = 4.44s^{1.23}$ ?

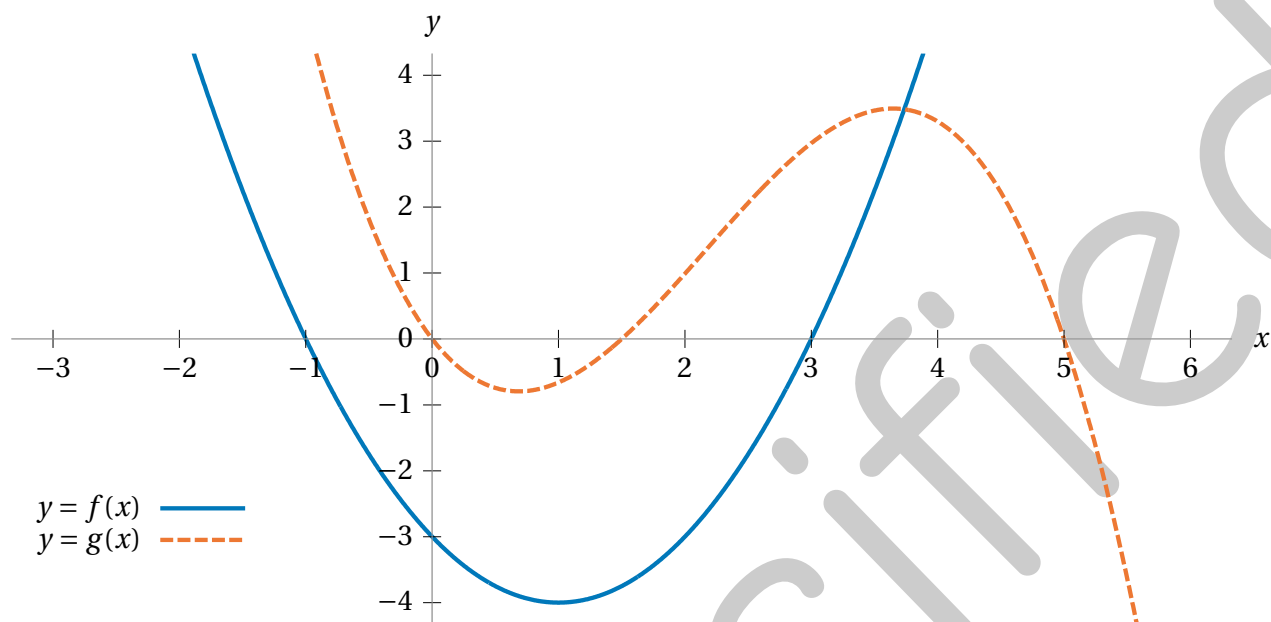
6. What must  $t$  be if  $2.71 = 4.44(1.23)^t$ ?

7. Write the following expression in a simpler equivalent form that only has a single  $x$  and no parenthesis.

$$\left( \frac{2x^5}{(2x)^2} \right)^3$$

8. The expression  $\log(x^4) + 2\log(3x)$  can be written as a single logarithm  $\log(\text{stuff})$ . What must the stuff be?

9. Below are the graphs of polynomial functions  $f$  and  $g$ .



(a) Estimating, what is the value of  $g(-\frac{1}{2})$ ?

(b) Estimating, for what value(s) of  $x$  does  $f(x) = -2$ ?

(c) What's a possible formula  $f(x)$  for the function  $f$ ?

(d) What's a possible formula  $g(x)$  for the function  $g$ ?

(e) On these same axes, without the aid of technology, sketch the graphs of these functions.

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

$$j(x) = \frac{x - 3}{x - 4}$$

10. A projection for the population of earth (in billions) according to the UN<sup>1</sup> is given in this table.

year	1990	2000	2010	2020	2030	2040	2050	2060
population (in billions)	5.32	6.15	6.99	7.84	8.55	9.19	9.71	10.07

- (a) Using your TI graphing calculator, perform *quadratic* regression to find a formula  $P(t)$  for the quadratic function that best models this data as a function of  $t$  years after 1980. (So the value of  $t$  corresponding to 1990 will be 10.) Write a formula for your model below. If you do not have a calculator capable of data regression, write "NO CALC" below and use the model  $P(t) = -\frac{t^2}{2000} + \frac{t}{9} + \frac{21}{5}$  for the rest of this page.
- (b) According to your model, how many people are alive on the earth right now?
- (c) According to your model, in what year will the earth's population hit a peak, i.e. attain its maximum value?
- (d) According to your model, what year in the future will the world population hit zero?
- (e) What other function(s) could serve as a reasonable choice to model the world population? Comment on the pros and cons of using this function as a model versus a quadratic model.

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<sup>1</sup><https://population.un.org/dataportal>

11. You decide to take out a \$10,000 federal unsubsidized student loan to cover tuition and fees next year at CMU<sup>2</sup>. This loan comes with an interest rate of about 5% compounded monthly<sup>3</sup>.
- (a) Because the loan is unsubsidized, it'll accrue interest while you're still in college. Assuming this is the only loan you take out, what will the loan's total balance be after *three* years?
- (b) Suppose that after those three years you graduate and land a job. You can now begin making monthly payments on this loan. Suppose the agreement was that you pay off the loan *six* years after you get a job. What must your monthly loan payments be under this agreement?
- (c) You decide you'd like to make higher monthly payments to pay off your loan faster. If you instead pay \$400 per month, how long before your student loan is paid off?

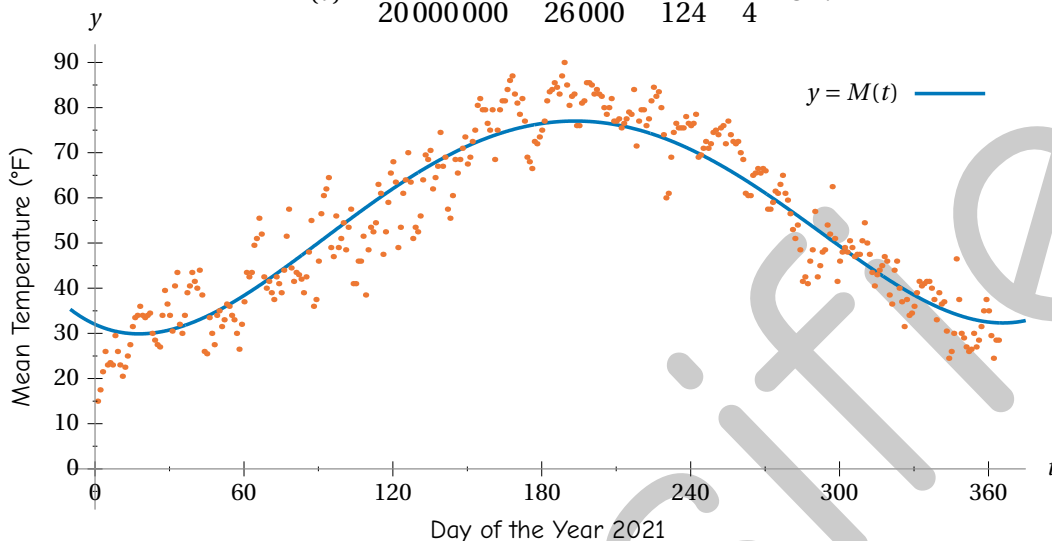
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<sup>2</sup>[coloradomesa.edu/student-accounts/expenses.html](http://coloradomesa.edu/student-accounts/expenses.html)

<sup>3</sup>[studentaid.gov/understand-aid/types/loans/subsidized-unsubsidized](http://studentaid.gov/understand-aid/types/loans/subsidized-unsubsidized)

12. Below is a plot of the mean (average) temperature in Grand Junction on a given day  $t$  of the year 2021<sup>4</sup>, along with a quadratic model  $M$  for data, defined by the formula

$$M(t) = \frac{t^4}{20000000} - \frac{t^3}{26000} + \frac{t^2}{124} - \frac{t}{4} + 32.$$



- (a) Relying on the model, what day(s) of last year had an average temperature around 55°F? Estimate the answer(s) using the plot above. Then use the model  $M$  to refine your estimate and find which day(s) the model indicates the average temperature was closest to 55°F.
- (b) Estimating, during what month of 2021 was the average temperature the highest?
- (c) For how many days in 2021 does it appear the average temperature was above 70°F?
- (d) Recall that the function  $f(x) = \frac{5}{9}(x - 32)$  takes a temperature  $x$  measured in °F and returns the same temperature measured in °C. How would the formula for the model  $M$  have to change if we wanted the output to be in °C instead?

<sup>4</sup>[weather.gov/wrh/climate?wfo=gjt](https://weather.gov/wrh/climate?wfo=gjt)