Math 111 – College Algebra
CCC – Fall 2021
Instructor: Tim Brown

SCORE: _____

NAME: _____

TEST #3

✓ Pick 10 of 11. If you work all 11 problems, your grade will reflect your best 10 answers.

✓ You may use approved technology (such as a graphing calculator) on this test.

✓ You may use your own paper on this test.

✓ You may submit your answers in Canvas or directly to me by email.

✓ You **must** show all of your work to receive full credit when appropriate.

✓ You **must** show all of your work symbolically (algebraically) unless otherwise instructed.

✓ NO WORK = NO CREDIT!!

✓ Complete the box below. This is mandatory! If you are unable to print this page, make a duplicate of the box below and submit it along with your paper.

By checking the box and signing below, you are certifying that the following answers to this test are yours and yours alone. You are certifying that you did not collaborate with anyone, nor access any material except the textbook, homework, eLearn content, notes that you produced and approved technology.

☐ **I agree. The following answers are mine and mine alone.**

_____
Sign Here

The questions for this test start on the next page.

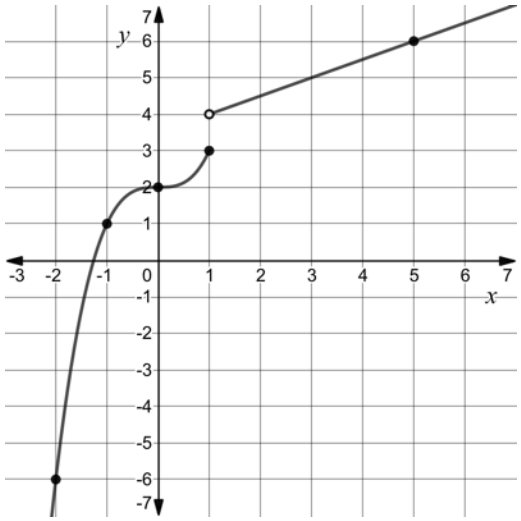
1. The table below is a complete representation of relation $\mathcal{R}$. Is $\mathcal{R}$ one-to-one? Circle your answer.

$\mathcal{R}$	INPUT	-4	1	0	1	4
	OUTPUT	-2	-1	0	1	2

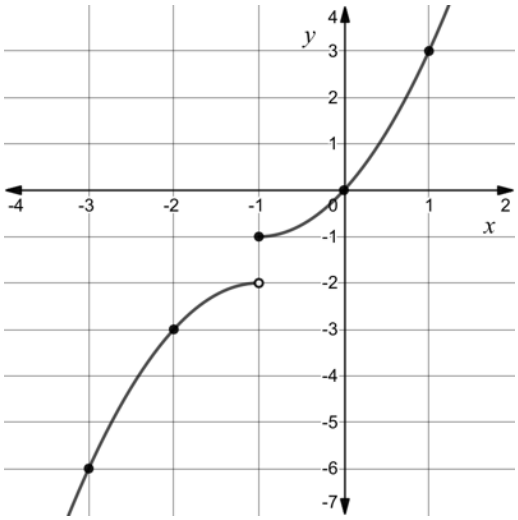
Yes No

2. Use the graphs of the functions $f(x)$ and $g(x)$ to complete (a) – (d). If any of the values are not defined, mark them "UNDEF."

$y = f(x)$



$y = g(x)$



(a) $(f+g)(0) =$	(c) $(f \circ g)(-1) =$
(b) $\left(\frac{f}{g}\right)(-2) =$	(d) $g^{-1}(-3) =$

3. Suppose \$50,000 is invested at an interest rate of 5.1% per year, compounded monthly.

   (a) Write the formula used to determine future value.

   (b) Find the future value after 10 years. Round to the nearest cent.

   (c) Derive the formula used to determine doubling time ($i.e.$, solve for t in Part 3a).

   (d) Determine how long it will take to double the investment. Round to 2 decimal places.

4. The Center for Disease Control (CDC) and World Health Organization (WHO) track cases of illnesses around the world as potential new pandemics are identified. The following fictitious data represents the number of reported cases of H1N1 during the first outbreak in 2009, where t is the time measured in days since the first reported incident and $P(t)$ is the number of reported cases.

t	2	4	6	8	10	12	14
$P(t)$	84	135	203	327	609	1014	1800

(a) Circle the appropriate type of regression for the data set above. Be sure to justify your answer.

linear exponential power

Justification:

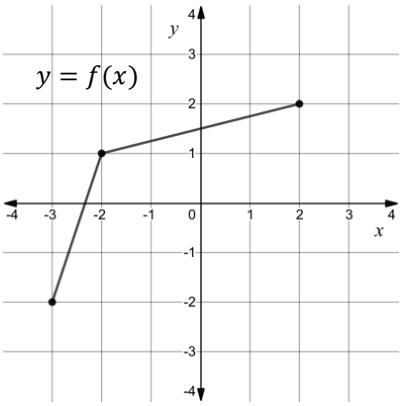
(b) Use your graphing calculator to perform the regression from Part 4a. Write down the equation. Round to 2 decimal places.

(c) Using the model developed in Part 4b, determine when the number of reported cases is 1,000,000. Round to the nearest day.

5. Follow the instructions below to find the inverse functions.

(a) Find a formula for $f^{-1}(x)$ given $f(x) = \frac{1}{3}x - 5$. (Use the 4-step procedure for full credit.)

(b) Use the graph of $y = f(x)$ to sketch a graph of $y = f^{-1}(x)$.



6. Use properties of logarithms to fully expand the following expression.

$$\log \sqrt{\frac{y+1}{x^3 z^2}}$$

7. For the following, consider the functions:

$$f(x) = \frac{1}{x^2 - 9} \text{ and } g(x) = \sqrt{x+1}$$

(a) Find $h(x) = (f \circ g)(x)$.

(b) State the domain of $h(x)$.

8. The barometric air pressure in inches of mercury (inHg) at a distance of x miles (mi) from the eye of a hurricane is modeled by the logarithmic function:

$$f(x) = 0.48 \ln(x + 1) + 27.$$

At what distance from the eye of the hurricane is the air pressure 27.65 inHg? Round to the nearest tenth.

9. City Engineers build an artificial lake designed to sustain up to 2000 fish. Upon completion, they release fish into the lake but fail to record the initial amount. The table below reflects fish counts beginning one month after the initial release.

Time (months)	t	1	3	6	9	12
Fish Population	P(t)	128	246	584	1098	1465

(a) Use a graphing calculator to fit a logistic function to the data. Round to 2 decimal places.

(b) Use the function to estimate the initial population (t = 0) and predict the population after 2 years (t = 24 months).

(c) According to your model, will the fish population ever reach 2000?

10. Ahmed stopped by the local bakery and bought 3 apple fritters, 2 berry scones and 1 cheese danish for $14.60. Maria visited the same bakery and was charged $16.90 for 2 apple fritters, 1 berry scone and 4 cheese danishes. Abigail paid $19.80 for 1 apple fritter, 5 berry scones and 3 cheese danishes.

    (a) Convert the information above into a system of 3 equations.

    (b) Write your system as an augmented matrix.

    (c) Use your graphing calculator to find the reduced row echelon form (RREF) of your matrix.

    (d) What are the solutions of your system? Interpret your result.

11. VIDEO LINK (copy/paste): video.chemeketa.edu/media/1_jzdpcg9n

The Balloon Popping Dog

In 2014 a Jack Russell Terrier from California named Twinkie set a world record for the fastest time to pop 100 balloons by a dog

Your goal is to create a mathematical model for how quickly Twinkie pops balloons and then use it to make predictions.

To help with that, this video syncs a counter and a timer with the dog's progress.



video.chemeketa.edu/media/1_jzdpcg9n

You should begin with the following:

1. A table of data. Use the video to collect a sufficient number of data points.
2. A graphical representation of your data. Clearly label both axes.
3. A mathematical model that you think fits the data best. Include a brief explanation of why, out of all the functions we've learned about, you chose that specific type of function. Give the equation for your model and describe what each variable represents.

Then address each of these questions:

4. How many balloons does your model predict Twinkie can pop in 1 minute? 5 minutes? 10 minutes?
5. Using your model, how long would it take Twinkie to pop 500 balloons? 5000 balloons? 50000 balloons?
6. How confident are you in your model? Are the results reasonable? Explain.

Please show your work on a separate piece of paper, using complete sentences when appropriate.