Midterm Exam Two

Math 113-007/8 College Algebra

Colorado Mesa University Spring 2023

Name: _____

1. What are the coordinates of the vertex of the parabola given by the graph of $f(x) = -2x^2 + x + 3$? Does this vertex represent a minimum or maximum of f?

2. What are the values of x where the graph of $g(x) = x^2 + 4x - 77$ crosses the x-axis?

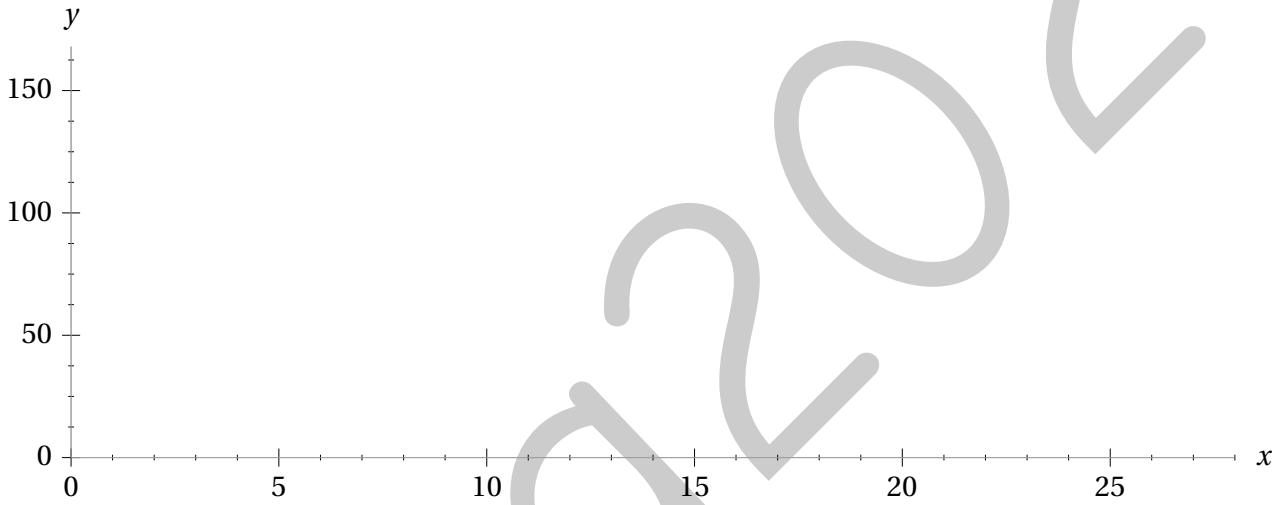
3. Approximately what must r be if $1 = 0.369(1 + r)^{3.14}$? Express your answer as a decimal.

4. Find all the values of x that satisfy the equation $|x-3| = 3x$.

5. The function h defined by the formula $h(x) = \frac{1}{7}(x-3)^5$ is a one-to-one function. Write down a formula for its inverse function h^{-1}.

6. In 2024, the city of Grand Junction is planning on updating the way it charges residents for city water use[1]. They're reducing the number of rate tiers to three and introducing a *fee* for anyone who uses more than 20,000 gallons per month by charging $C(w)$ dollars each month per w *thousand gallons* of water used according to this piecewise function.

$$C(w) = \begin{cases} 21.86 & \text{if } 0 < w \le 3 \\ 0.7\,w^{1.5546} + 18 & \text{if } 3 < w \le 20 \\ 5.74\,(w-20) + 102.74 & \text{if } 20 < w \end{cases}$$



(a) Graph $y = C(w)$, and label the points $(3, C(3))$ and $(20, C(20))$ with their coordinates.

(b) How much will GJ charge a resident that used $2,100$ gallons of water in a month? What about a resident that used $7,200$ gallons?

(c) Analyzing the function $C(w)$, figure out how much the *fee* for a resident using more than 20,000 gallons a month must be.

[1]Not true, but based on a true story: gjcity.org/314/Utility-Rates.

7. A projection for the population of earth (in billions) according to the UN[2] is given in this table.

year	2000	2020	2040	2060
population (in billions)	6.15	7.84	9.19	10.07

(a) Using your TI graphing calculator, perform quadratic regression to find a formula $P(x)$ for the quadratic function that best models these projections as a function of x years after 2000. Write the formula for your model below[3]. Feel free to round the coefficients.

(b) According to your model, what is the current world population?

(c) According to your model, what year will the earth's population hit a maximum, and what will this maximum population be?

8. Was there anything you were expecting to be on this exam, but was not?

[2] From population.un.org/dataportal

[3] Recall that on your calculator, the notation $3.7\text{E}{-2}$ is *scientific notation* and means 3.7×10^{-2}.