

MTH 161, Practice Final Exam, Spring 2019

1. Write the system of equations represented by the augmented matrix

$$\left[ \begin{array}{ccc|c} 2 & -1 & 8 & 1 \\ 3 & 0 & 3 & -1 \\ -1 & -3 & 0 & 5 \end{array} \right]$$

2. Explain the meaning of  $-3R_1 + R_2 \rightarrow R_2$
3. Suppose that the x-intercepts of  $f(x) = y$  are 7 and  $-2$ . What are the x-intercepts of the graph of  $-f(x + 2)$ .

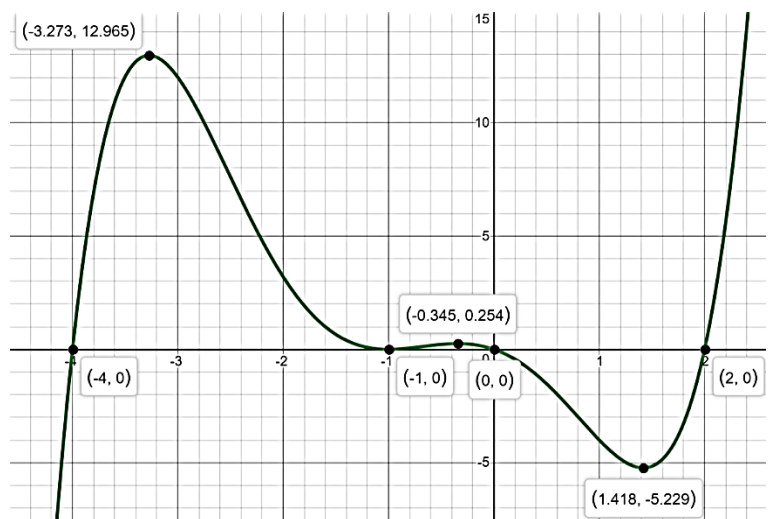
4. For the system of equations 
$$\begin{cases} x - 2y + 3z = 7 \\ 3y = 5 \\ 2z = -1 \end{cases}$$

- a. Write as an augmented matrix.
- b. What is the dimension of the resulting matrix?
- c. Solve the system.

5. Consider the matrix 
$$\left[ \begin{array}{ccc|c} 1 & -1 & 2 & 6 \\ 0 & 1 & 5 & -12 \\ 0 & 4 & 2 & -10 \end{array} \right]$$

- a. Perform row operations to put the matrix in reduced row echelon form.
- b. Solve the system.

6. Given the graph of  $f(x)$  shown,
- a. Find the intervals on which  $f$  is increasing.
- b. Where is it decreasing?
- c. State any relative minima or maxima.

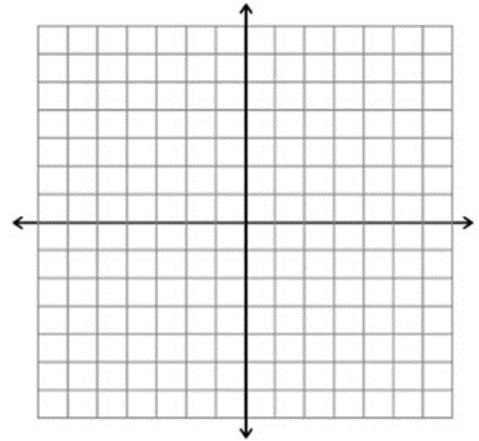


7. The daily revenue  $R$  in dollars achieved by selling  $x$  boxes of cookies is found to be  $R(x) = 6.5x - 0.03x^2$ . The daily cost to produce  $x$  boxes of cookies is found to be  $C(x) = 1.10x + 150$ .
- a. Profit = Revenue - Cost. What is the profit function? Simplify completely.
- b. How many boxes of cookies will need to be produced to maximize profit? What is the maximum profit? (Warning: boxes must be an integer.)

8. Given the polynomial  $f(x) = x^5 + 6x^4 - 24x^2 - x - 30$ ,
- List all possible rational zeros of  $f$  by using the rational zeros theorem.
  - Factor  $f(x)$  as a product of linear factors using any method.
  - List all zeros of  $f(x)$  both real and imaginary.

9. Given the rational function  $f(x) = \frac{x^2-1}{x+2}$

- Find the x- and y-intercepts
- Write the equation of any vertical, horizontal or slant asymptotes.
- Evaluate  $f(2), f(-3), f(5)$
- Using this information, sketch an accurate graph of  $f(x)$  by hand on axes shown. Label all information from the parts above.



10. Solve the equations algebraically. Answers should be intervals, exact values or expressions.

a.  $\sqrt[3]{x-4} + 5 = -1$

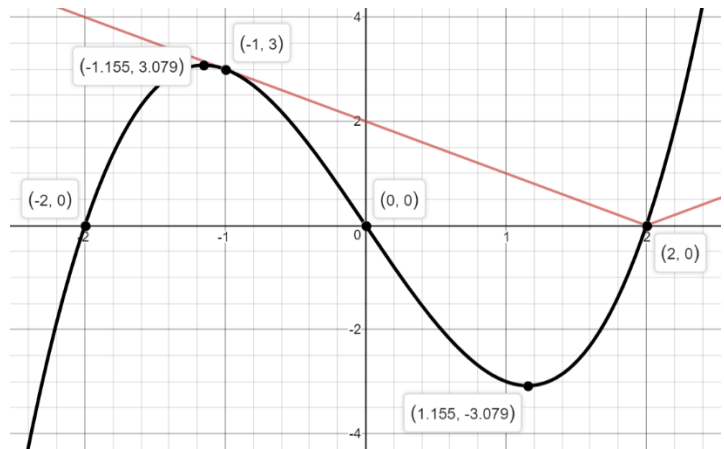
c.  $\frac{(x-3)^2}{x^2-1} \geq 0$

b.  $3(2^{5x}) = 48$

d.  $\log_4 x + \log_4(x-10) = 2$

11. Use the graph of  $f(x)$  and  $g(x)$  shown to answer the following.

- $g(x) = 0$
- $f(x) > 0$
- $f(x) = g(x)$



12. The population of a colony of fire ants obeys the law of uninhibited growth following the model  $A(t) = A_0 e^{kt}$ . If there are 500 ants initially and 800 ants after 1 week.

- Solve for  $A_0$  and  $k$  for the model.
- What is the size of the colony after 3 weeks?
- After how many days will there be 5000 ants?

13. Given that  $x - c$  divides evenly into  $f(x)$ , which statements are true (check all).
- a.  $(x - c)$  is a factor of  $f(x)$
  - b.  $-c$  is a zero of  $f(x)$
  - c. The remainder of dividing  $f(x)$  by  $x - c$  is 0
  - d. The y-intercept of  $f(x)$  is  $c$
  - e. One x-intercept of  $f(x)$  is  $c$
14. The graph of  $f(x) = \frac{3x^2+2}{5x^2}$  will behave like which function for large values of  $|x|$ ?
15. Given the piecewise function  $f(x) = \begin{cases} 5 - 2x, & x > -1 \\ x^2, & x \leq -1 \end{cases}$ , what is  $f(-1)$ ?
16. Which statement(s) is(are) equivalent to  $\log_2 \frac{1}{64} = -6$
- a.  $2^{1/6} = 64$
  - b.  $-\frac{\ln(64)}{\ln 2} = -6$
  - c.  $2^{-6} = \frac{1}{64}$
  - d.  $(-6)^2 = \frac{1}{64}$
17. Is the statement true or false: The function  $f(x) = x^3 \ln(4 - x^2)$  is odd.