

College Algebra Math 1050

January 7-8, 2019

Final Exam Version 1

Name: _____

School: _____ Instructor: _____

Scientific (not graphing) calculators are allowed. Time limit is 120 minutes. The point value of each problem is written next to the problem. **You must show your work to receive any credit, except on problems 1–29.** Work neatly.

Fill in the blank or circle the correct answer.

1. (2 points) Simplify: $2 \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} - 3 \begin{bmatrix} -2 & 1 \\ 3 & -4 \end{bmatrix} =$ _____.

2. (2 points) The domain of the function $f(x) = \sqrt{4 - 3x}$ is _____.

3. (3 points) Nutsa wants to double her initial investment of \$5000. Her account offers 5.5% annual interest, **compounded monthly**. Set up an equation that enables her to calculate how many years it will take for her investment to double. **Do not solve.**

4. (3 points) Convert the exponential equation: $a^3 = 4$ into logarithmic form. _____

5. (3 points) If $\log_b x^2 = 9$, evaluate $\log_b x$. _____

For problems 6-8, consider the function $f(x) = \frac{x^2 - 3x - 7}{x^2 - 4}$.

6. (3 points) The domain of the function $f(x)$ is _____ . **Write your answer in any form.**

7. (3 points) The x -intercept(s) of the function $f(x)$ is (are) _____ .
Write your answer(s) as ordered pair(s) and leave in exact form.

8. (3 points) The y -intercept(s) of the function $f(x)$ is (are) _____ .
Write your answer(s) as ordered pair(s).

For problems 9-10, consider the function $g(x) = \frac{x + 5}{x^2 + 3x + 2}$.

9. (3 points) The vertical asymptote(s), if any, of the function $g(x)$ is (are) _____.

Write your answer(s) as equation(s).

10. (3 points) The non-vertical asymptote(s), if any, of the function $g(x)$ is (are) _____.

Write your answer(s) as equation(s).

11. (3 points) Write an expression to find the term containing a^3 in the expansion of $(3a - 1)^{16}$.

Do not simplify. _____.

12. (3 points) Consider matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ -2 & 7 & 0 \\ -4 & 5 & 7 \end{bmatrix}$. Which student is proposing a valid first step to find the inverse matrix, A^{-1} ? Circle all that apply.

(a) Beqa's first step to find the inverse of matrix A is: $\begin{bmatrix} \frac{1}{3} & \frac{1}{2} & 1 \\ -\frac{1}{2} & \frac{1}{7} & 0 \\ -\frac{1}{4} & \frac{1}{5} & \frac{1}{7} \end{bmatrix}$.

(b) Maka's first step to find the inverse of matrix A is: $\left[\begin{array}{ccc|ccc} 3 & 2 & 1 & 1 & 0 & 0 \\ -2 & 7 & 0 & 0 & 1 & 0 \\ -4 & 5 & 7 & 0 & 0 & 1 \end{array} \right]$.

(c) Khatuna says that matrix A does not have an inverse because one of the entries is zero.

(d) None of the students are proposing a valid first step to find the inverse of A .

13. (3 points) If $f(x) = \frac{2x+1}{x-1}$ and $g(x) = \frac{2}{x}$, then $(f \circ g)(x) = \frac{4+x}{2-x}$. The domain of $f \circ g$ is

_____ . Write your answer in set builder notation.

14. (3 points) f is a one-to-one function defined by: $\{(5, \frac{1}{9}), (-2, 9), (9, -1), (-9, 4), (\frac{1}{9}, 3)\}$.

Find $f^{-1}(9)$ _____.

15. (3 points) Let $f(x) = x^3 + 2$ and $g(x) = x^2$. Which of the following is (are) the composition $f \circ g$? Circle all that apply.

(a) $(f \circ g)(x) = (x^3 + 2)^2$.

(b) $(f \circ g)(x) = x^6 + 2$.

(c) $(f \circ g)(x) = x^6 + 4$.

(d) $(f \circ g)(x) = x^5 + 2$.

16. (3 points) Given the table:

x	-3	-2	-1	0	1	2	3
$f(x)$	-7	-5	-3	-1	3	5	7
$g(x)$	8	3	0	-1	0	3	8

Evaluate $(f \circ g)(2)$ _____.

17. (3 points) Consider the equation: $\log_3(2x + 1) + \log_3(x - 1) = 4$. Which student is proposing a valid first step for solving the equation? Circle all that apply.

(a) Giorgi's first step to solve the equation is: $\log_3[(2x + 1) + (x - 1)] = 4$.

(b) Lado's first step to solve the equation is: $(2x + 1) + (x - 1) = \log_3 4$.

(c) Both Giorgi and Lado are proposing a valid first step to solve the equation.

(d) Neither Giorgi nor Lado are proposing a valid first step to solve the equation.

18. (3 points) The **minimum value** of the function $f(x) = x^2 - 6x + 7$ is _____.

19. (3 points) Let $b_1 = 3$ and $b_n = 2b_{n-1} + 3$. Then $b_3 =$ _____.

20. (3 points) How long will it take an initial investment of \$1000 to be worth \$2500 if the investment compounds continuously at an annual interest rate of 5%?

Round your answer to the nearest tenth of a year. _____

21. (3 points) Consider the equation: $15 = 3 \cdot 2^{4x}$. Which student is proposing a valid first step to solve the equation? Circle all that apply.

(a) Dato's first step to solve the equation is: $15 = 6^{4x}$.

(b) Vaja's first step to solve the equation is: $5 = 2^{4x}$.

(c) Maka's first step to solve the equation is: $\ln 15 = 4x \ln 3 \ln 2$.

(d) All three of the students are proposing a valid first step to solve the equation.

(e) None of the students are proposing a valid first step to solve the equation.

22. (4 points) The form of the partial fraction decomposition of the rational function

$f(x) = \frac{2x + 1}{x^3 + 4x}$ is _____.

23. (4 points) Let $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ -1 & 0 & -4 & 3 \\ 2 & 2 & 1 & -1 \end{bmatrix}$. Some row operation(s) have been applied to A to obtain $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 2 & \mathbf{x} & \mathbf{y} \\ 2 & 2 & 1 & -1 \end{bmatrix}$. What are the values of \mathbf{x} and \mathbf{y} _____.

24. (4 points) Find the quotient: $\frac{3x^2 - x + 5}{x - 2}$ _____.

25. (4 points) Consider the inequality: $\frac{1}{x + 4} < \frac{3}{x - 2}$. Which student is proposing a valid first step to solve the inequality? Circle all that apply.

(a) Levan's first step to solve the inequality is: $\frac{1}{x + 4} - \frac{3}{x - 2} < 0$.

(b) Ladi's first step to solve the inequality is: $x - 2 < 3(x + 4)$.

(c) Both Levan and Ladi are proposing a valid first step to solve the inequality.

(d) Neither Levan nor Ladi are proposing a valid first step to solve the inequality.

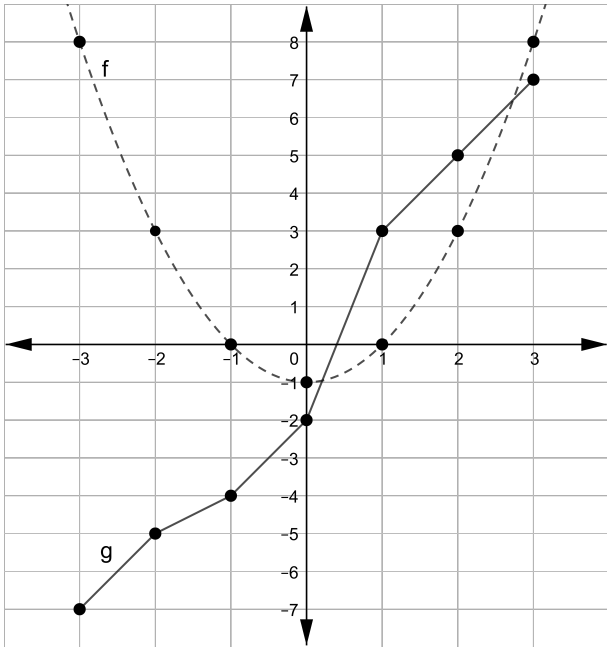
26. (4 points) The rational expression $\frac{x+1}{x^2-5x+6}$ has critical numbers at $x = -1$, $x = 2$ and $x = 3$. Find the solution to the inequality $\frac{x+1}{x^2-5x+6} > 0$.

Write the solution in interval notation. _____.

27. (4 points) Consider the inequality: $2x^2 - 5x - 3 > 0$. Which student is proposing a valid first step to solve the inequality? Circle all that apply.

- (a) Elene's first step to solve the inequality is: $2x^2 - 8x > 0$.
- (b) Keti's first step to solve the inequality is: $-3x^3 - 3 > 0$.
- (c) Masho's first step to solve the inequality is: $(2x + 1)(x - 3) > 0$.
- (d) All three students are proposing a valid first step to solve the inequality.
- (e) None of the students are proposing a valid first step to solve the inequality.

28. (4 points) $f(x)$ is graphed below in a dashed line and $g(x)$ is graphed below in a solid line. Use the graphs to evaluate $(f - g)(3)$. _____.



29. (4 points) Consider the function: $f(x) = e^x + 1$.

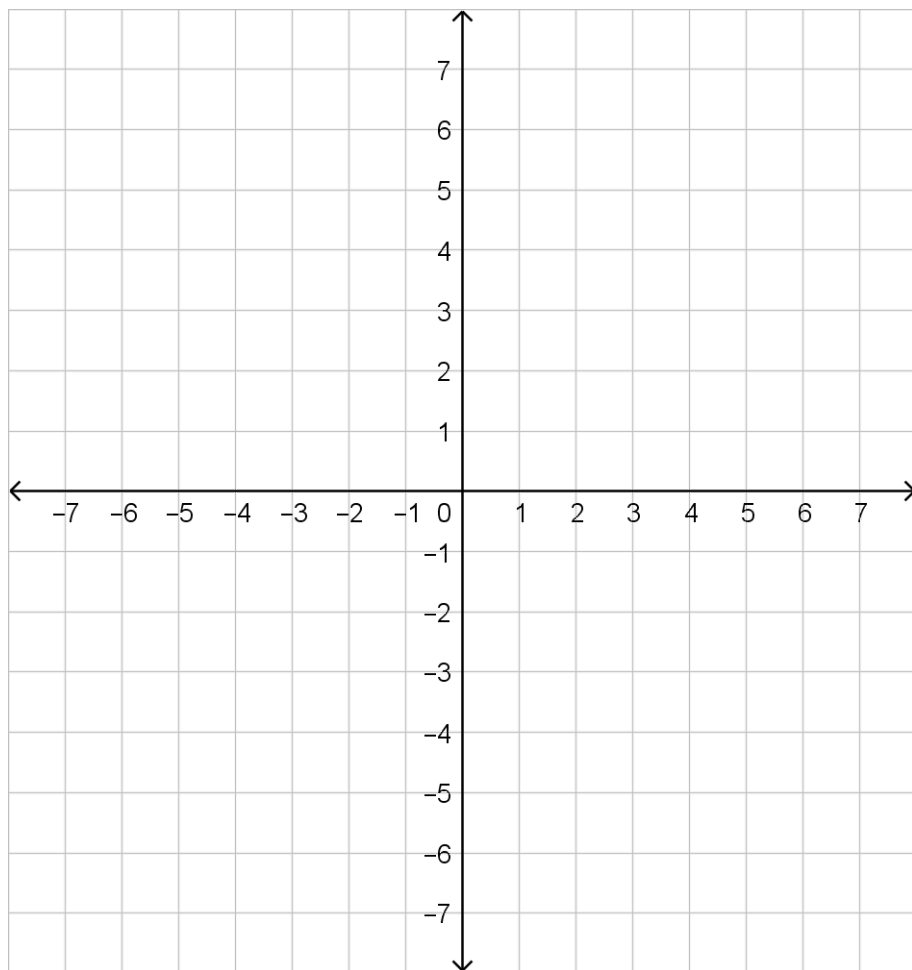
(a) What is the range of f ? _____. Write your answer in any form you choose.

(b) What is the intercept of f ? _____. Write your answer as an ordered pair.

30. (7 points) Assume the following sequence is geometric: $4 - \frac{8}{3} + \frac{16}{9} - \dots$. Find the infinite sum using appropriate formulas.

30. Answer _____.

31. (9 points) Graph the rational function $f(x) = \frac{x^2}{x^2 + x - 2}$. Your graph should clearly show and label all x - and y -intercept(s) and asymptotes.



32. (7 points) Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 10 \\ -1 & -2 & -2 \end{bmatrix}$. Find the inverse, A^{-1} .

32. Answer:

33. (7 points) Solve $2 \ln x = \ln(14 - 5x)$. **No points will be awarded if the solution is found by trial and error.**

33. Answer _____

34. (7 points) Seroja Credit Union offers to open an account with the condition that an initial investment double every 7 years.

(a) Dachi opens an account with \$10,000,000. How much money will he have in 14 years?

34. (a) Answer _____

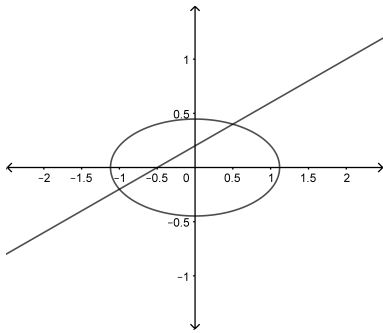
(b) Due to certain regulations, the balance of any given account in Seroja Credit Union cannot exceed \$500,000,000. Write a sentence or two identifying the limitations of the financial model the credit union is using.

35. (7 points) Consider the system of nonlinear equations:

$$-2x + 5y = 1$$

$$4x^2 + 25y^2 = 5$$

(a) Use the graph of the equations below to estimate the real solution(s).



35. (a) Answer _____

(b) Algebraically solve the system of equations given above. Keep the solutions as fractions, not decimals. **No points will be awarded if the solution is found by trial and error.**

35. (b) Answer _____

36. (5 points) Let $f(x) = 2x + 1$ and $g(x) = \frac{1}{3x - 2}$. Find $f \circ g$ and **simplify completely**.

36. Answer _____

37. (8 points) Solve the inequality: $\frac{3}{x - 1} \leq \frac{4}{x + 2}$. **Write the solution in interval notation.**

37. Answer _____