

Math 120
Final Review (December 2019)

1. Solve for x : $3x^2 - 4x = 7$:
a. $\frac{2+\sqrt{11}}{3}$ b. 1 c. $-1, \frac{7}{3}$ d. $1, -\frac{7}{3}$

2. Solve for p : $-p(p+8) = 48$
a. $-4 \pm 4\sqrt{2}i$ b. $-48, -8$ c. $-12, 4$ d. $-4 \pm 4\sqrt{2}$

3. Solve for t : $36t^4 + 29t^2 - 7 = 0$
a. $\pm i, \pm \frac{\sqrt{7}}{6}$ b. $-1, \frac{7}{36}$ c. $\pm 1, \pm \frac{7}{36}$ d. $\pm 1, \pm \frac{\sqrt{7}}{6}$

4. Solve for r : $\sqrt{r+8} = 2+r$
a. -4 b. $-1, 4$ c. $-4, 1$ d. 1

5. Solve for x : $|2x-5| - 11 = 0$
a. $-8, 3$ b. $-3, 8$ c. $-6, 16$ d. No Solution

6. Solve for x : $\frac{3}{x} + \frac{x}{x+2} = \frac{4}{x^2+2x}$
a. 1, 2 b. $-2, -1$ c. -1 d. 1

7. Solve the rational inequality: $\frac{x^2+x-6}{x} \geq 0$
a. $[-3, 0] \cup [2, \infty)$ b. $(0, 2]$ c. $[-3, 0) \cup [2, \infty)$ d. $(-\infty, -3] \cup (0, 2]$

8. Simplify and express the answer in standard form: $(16+2i) - (3+4i^2)$
a. $9+2i$ b. $13-2i$ c. $15+2i$ d. $17+2i$

9. Find the domain of the function: $f(x) = \sqrt{2x + 10} - 4$
 a. $(-\infty, -5] \cup [-4, \infty)$ b. $(-5, -\infty)$ c. $[-5, \infty)$ d. $[-4., \infty)$
10. Find the domain of the function: $f(x) = \frac{x+2}{x^2-5x+4}$
 a. $(-\infty, -4) \cup (-4, -1) \cup (-1, \infty)$ b. $(-\infty, 1) \cup (1, 4) \cup (4, \infty)$
 c. $(-\infty, -2) \cup (-2, 1) \cup (1, 4) \cup (4, \infty)$ d. $(-\infty, \infty)$
11. For $f(x) = x^2$ and $g(x) = x + 1$, find $(f + g)(x)$ and $(f + g)(-1)$
 a. $(f + g)(x) = x^2 + 2x + 1$ b. $(f + g)(x) = x^2 + x + 1$
 $(f + g)(-1) = 0$ $(f + g)(-1) = -1$
 c. $(f + g)(x) = x^2 + 1$ d. $(f + g)(x) = x^2 + x + 1$
 $(f + g)(-1) = 2$ $(f + g)(-1) = 1$
12. For $f(x) = x^2 + 2$ and $g(x) = \sqrt{x - 1}$, find $(f \circ g)(x)$ and $(f \circ g)(5)$
 a. $(f \circ g)(x) = \sqrt{x^2 + 1}$ b. $(f \circ g)(x) = x$
 $(f \circ g)(5) = \sqrt{26}$ $(f \circ g)(5) = 5$
 c. $(f \circ g)(x) = x^2 + 1$ d. $(f \circ g)(x) = x + 1$
 $(f \circ g)(5) = 26$ $(f \circ g)(5) = 6$
13. For $g(x) = -x^2 + 3$, find $\frac{g(x+h)-g(x)}{h}$
 a. $\frac{-2x^2+2xh-h^2+6}{h}$ b. $-2x + h$
 c. -2 d. $-2x$
14. Given the piecewise function $f(x) = \begin{cases} x^2 + 2, & x \leq -1 \\ 2x + 3, & x > -1 \end{cases}$ find $f(-1) + f(1)$
 a. 8 b. 4 c. 12 d. 6

15. Find the x and y intercepts of the function $f(x) = x^2 - 4x - 12$

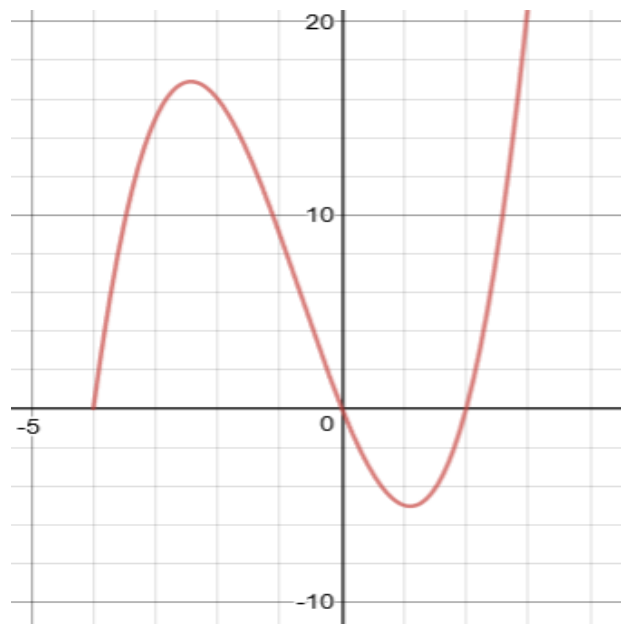
a. x-intercepts: (2, 0), (-6, 0)
y-intercept: (0, -12)

b. x-intercepts: (-2, 0), (6, 0)
y-intercept: (0, -12)

c. x-intercepts: (0, -2), (6, 0)
y-intercept: (-12, 0)

b. x-intercept: (-2, 0), (-6, 0)
y-intercept: (0, 12)

16. From the graph below, find the domain and range of the function and identify the intervals where the function is decreasing.



a. Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
Decreasing: (0, 2)

b. Domain: $[-4, \infty)$
Range: $[-5, \infty)$
Decreasing: $(-2.5, 1.2)$

c. Domain: $[-5, \infty)$
Range: $[-4, \infty)$
Decreasing: (0, 2)

d. Domain: $(-4, \infty)$
Range: $(-5, \infty)$
Decreasing: $(-2.5, 1.2)$

17. Which of the following equations represent y as a function of x ?
- a. $y = x^2 + 2x - 1$ b. $xy^2 = 4$ c. $|y| = x + 4$ d. $x^2 + y^2 = 9$

18. Classify the following function as even, odd, or neither: $f(x) = x^3 - 2x + 4$
- a. even b. odd c. neither d. not enough information

19. Determine whether the following equation has any types of symmetry:

$$x^2 + y^2 = 16$$

- a. Origin b. x-axis c. y-axis d. All 3
20. Find the inverse function of $f(x) = x^2 - 4$, $x \geq 0$
- a. $f^{-1}(x) = \sqrt{x-4}$ b. $f^{-1}(x) = \sqrt{x^2-4}$
c. $f^{-1}(x) = \frac{1}{x^2-4}$ d. $f^{-1}(x) = \sqrt{x+4}$

21. If a function $h(x) = \sqrt{x+4} - 2$, has the following domain: $[-4, \infty)$ and range: $[-2, \infty)$, what are the domain and range of the inverse function $h^{-1}(x)$?

- a. domain: $(-\infty, -4]$ b. domain: $[-2, \infty)$
range: $(-\infty, -2]$ range: $[-4, \infty)$
- c. domain: $(-2, \infty)$ d. domain: $[-4, \infty)$
range: $(-4, \infty]$ range: $[-2, \infty)$

22. Determine whether the two lines are Parallel, Perpendicular, or Neither:

Line 1: $4x + 5y = 10$ Line 2: $10x - 8y = 2$

- a. Parallel b. Perpendicular c. Neither d. Not enough Information

23. Find the average rate of change of the function from x_1 to x_2 :

$$f(x) = x^2 - 8x + 4, \quad x_1 = 0, \quad x_2 = 2$$

- a. -12 b. -6 c. -4 d. 6
24. For the parent function $f(x) = x^2$, write a function $g(x)$ that has the following transformations: Right by 3, Up by 2, X-axis reflection.
- a. $g(x) = (x - 2)^2 + 3$ b. $g(x) = (-x - 3)^2 + 2$
c. $g(x) = -(x + 3)^2 + 2$ d. $g(x) = -(x - 3)^2 + 2$
25. Convert the quadratic function given in general form $f(x) = ax^2 + bx + c$ to standard/vertex form $f(x) = a(x - h)^2 + k$. $f(x) = 3x^2 + 12x + 4$.
- a. $f(x) = (x + 2)^2 + 8$ b. $f(x) = 3(x + 2)^2 + 8$
c. $f(x) = 3(x + 2)^2 - 8$ d. $f(x) = (3x + 2)^2 - 8$
26. Determine the End Behavior of the graph of $f(x) = -6x^3 + 4x^2 - 2x + 3$
- a. Rises Left, Rises Right b. Falls Left, Falls Right
c. Rises Left, Falls Right d. Falls Left, Rises Right
27. List the possible rational zeros of the function: $f(x) = 4x^3 - 2x^2 + 3x - 9$
- a. $\pm 1, \pm 2, \pm 3, \pm 4, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}, \pm \frac{1}{4}, \pm \frac{3}{4}, \pm \frac{9}{4}$
b. $\pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}, \pm \frac{1}{4}, \pm \frac{3}{4}, \pm \frac{9}{4}, \pm 2, \pm \frac{2}{3}, \pm \frac{2}{9}, \pm 4, \pm \frac{4}{3}, \pm \frac{4}{9}$
c. $\pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}, \pm \frac{1}{4}, \pm \frac{3}{4}, \pm \frac{9}{4}$
d. $\pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}, \pm \frac{1}{5}, \pm \frac{3}{5}, \pm \frac{9}{5}$

28. Divide $(3x^3 + 2x^2 - 4) \div (x + 1)$

a. $3x^2 - x + 1 - \frac{5}{x+1}$

b. $3x^2 - x + 1$

c. $3x^2 - x - 3$

d. $3x^2 + 5x + 5 + \frac{1}{x+1}$

29. Find the zeros of the function: $f(x) = x^3 - x^2 - 12x$

a. $x = -3, 0, 4$

b. $x = -4, 0, 3$

c. $x = 0, 1$

d. $x = 4, -3$

30. State the zeros of the function along with their multiplicities and the behavior near each zero. $f(x) = -2x(x + 1)^2(x - 2)^3$

<u>Zeros</u>	<u>Mult</u>	<u>Behavior</u>
$x = -1$	2	<i>Touch or Bounce</i>
$x = 2$	3	<i>Cross</i>

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$x = 0$	1	<i>Touch or Bounce</i>
$x = -1$	2	<i>Cross</i>
$x = 2$	3	<i>Touch or Bounce</i>

31. Find a 3rd degree polynomial with the following x-intercepts and a leading coefficient of 2. X-intercepts: $(-2, 0)$, $(-1, 0)$, $(1, 0)$

a. $p(x) = x^3 + 2x^2 - x - 2$

b. $p(x) = x^3 - 2x^2 - x + 2$

c. $p(x) = 2x^3 + 4x^2 - 2x - 4$

d. $p(x) = 2x^3 - 4x^2 - 2x + 4$

32. V varies directly with the cube of P and inversely with Q. If $V = 2$ when $P = 2$ and $Q = 8$, find V when $P = 1$ and $Q = 2$.

a. 4

b. 2

c. 1

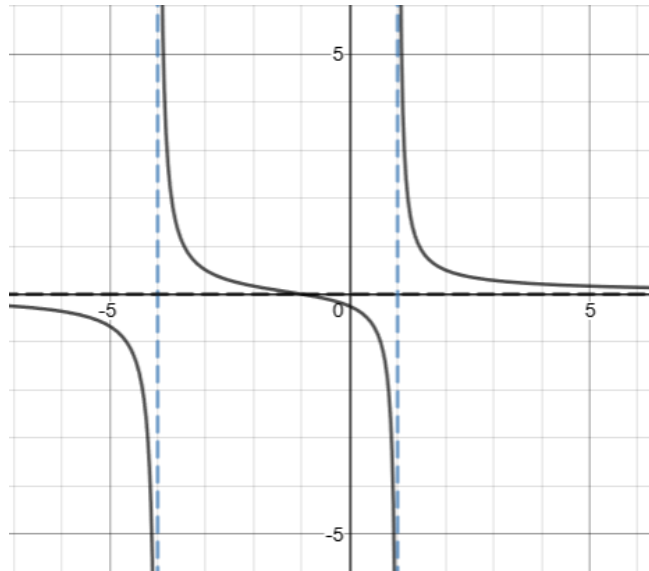
d. $\frac{1}{2}$

33. Find the vertical asymptote(s) and horizontal asymptote(s) of the function:

$$f(x) = \frac{x-3}{x^2-2x-15}$$

- a. VA: $x = -3, x = 3, x = 5$ b. VA: $y = 0$
 HA: $y = 0$ HA: $x = -3, x = 5$
- c. VA: $x = -3, x = 5$ d. VA: $x = -3, x = 5$
 HA: $y = 1$ HA: $y = 0$

34. Which graph below represents the rational function:



- a. $f(x) = \frac{x+2}{x^2-3x+4}$ b. $f(x) = \frac{x^2+1}{x^2+3x-4}$
- c. $f(x) = \frac{x+1}{x^2-5x-4}$ d. $f(x) = \frac{x+1}{x^2+3x-4}$

35. Convert the exponential equation to logarithmic form: $a = b^y$

- a. $b = \log_y a$ b. $y = \log a$ c. $y = \log_b a$ d. $y = \log_a b$

36. Evaluate: $3 \log_3 \sqrt[4]{9}$

- a. 9 b. 1.5 c. 0.75 d. $3\sqrt{3}$

37. Solve for x: $2e^{x+1} - 4 = 10$

- a. $x = \ln 7 - 1$ b. $x = \ln 6$ c. $x = \frac{7}{e} - 1$ d. $x = 6$

38. Solve for x: $3^{x^2} = 81$

- a. $x = 2$ b. $x = \pm 3\sqrt{3}$ c. $x = 4$ d. $x = -2, 2$

39. Find the domain of the function: $f(x) = \frac{1}{2} \log(x + 6) - 4$

- a. $(-\infty, \infty)$ b. $[-6, 0)$ c. $(-6, \infty)$ d. $(6, \infty)$

40. Condense the logarithmic expression to a single quantity:

$$2 \log_3 x + \log_3 y - \frac{1}{3} \log_3 z$$

- a. $\log_3 \left(\frac{2xy}{3z} \right)$ b. $\log_3 \left(\frac{x^2y}{\sqrt[3]{z}} \right)$ c. $\log \left(\frac{x^2y}{\sqrt[3]{z}} \right)$ d. $\log_3 \sqrt[3]{\frac{x^2y}{z}}$

41. Expand the expression by using the properties of logarithms:

$$\log_2 \left(\frac{4m\sqrt{n}}{p^2} \right)$$

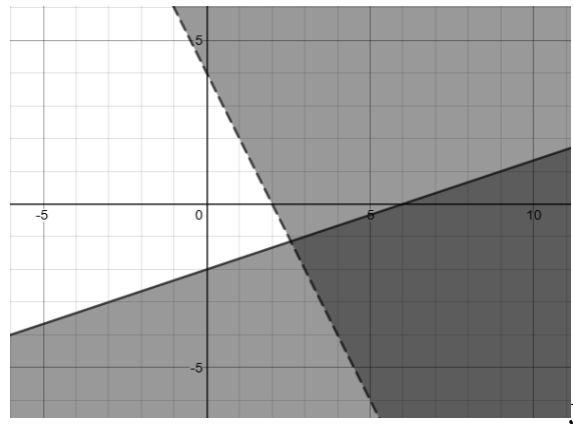
- a. $\log_2 4 + \log_2 m + \frac{1}{2} \log_2 n - 2 \log_2 p$ b. $\log_2 4m + \frac{1}{2} \log_2 n - 2 \log_2 p$
c. $\log_2 4 + \log_2 m + \frac{1}{2} \log_2 n + 2 \log_2 p$ d. $2 + \log_2 m + \frac{1}{2} \log_2 n - 2 \log_2 p$

42. Solve for x: $\ln(x + 5) = \ln(x - 1) - \ln(x + 1)$

- a. $\{-2, -3\}$ b. No Solution c. $\{3\}$ d. $\{2, 3\}$

43. Solve for x : $\log_4 x - \log_4(x - 1) = \frac{1}{2}$
- a. $\{1, 2\}$ b. No Solution c. $\{2\}$ d. $\{-2\}$
44. On the day a grandchild is born, a grandparent deposits \$2500 into a fund that earns 7.5% interest and compounds quarterly. How much money will the fund be worth on the grandchild's 21st birthday?
- a. \$12,076.85 b. \$15,750.00 c. \$11,902.01 d. \$11,416.10
45. The number N of bacteria in a culture is given by the model $N = 175e^{kt}$, where t is given in hours. Given that $N = 420$ when $t = 8$, estimate the time required for the number of bacteria to double.
- a. 2.9 hrs. b. 6.9 hrs. c. 6.3 hrs. d. 14.3 hrs.
46. A total of \$24,000 is invested in two separate corporate bonds that pay 3.5% and 5% simple interest. The investor wants the annual interest income from the investments to be \$930. What amount should be invested in the 5% bond?
- a. \$6,000 b. \$18,000 c. \$1,200 d. \$2,040
47. Find the points of intersection of the graphs of the two equations.
- $$x^2 + y^2 = 9 \qquad x - y = -3$$
- a. $(-3, 0), (0, 3)$ b. $(-9, 0), (9, 0)$
- c. They do not intersect d. $(-3, 0), (3, 0)$
48. Solve the system of equations:
- $$\begin{aligned} -2x + 3y &= -9 \\ 6x - 9y &= -27 \end{aligned}$$
- a. $(-3, 9)$ b. No Solution c. $(0, 0)$ d. $\{(x, y) \mid 2x - 3y = 9\}$

49. Which system of inequalities is represented by the graph below?



a. $-x + 2y > 4$
 $-3x + y \leq -6$

b. $2x + y < 4$
 $-x + 3y \geq -6$

c. $4x + y > 2$
 $x - 6y \leq 3$

d. $2x + y > 4$
 $-x + 3y \leq -6$

50. Find the solution to the system of linear equations that is represented by the following augmented matrix:

$$\left[\begin{array}{ccc|c} 1 & 0 & 3 & -2 \\ 0 & 1 & -4 & 6 \\ 0 & 0 & 0 & 0 \end{array} \right]$$

a. $(-2, 6, 0)$

b. $(3a - 2, -4a + 6, 0)$

c. $(-3a - 2, 4a + 6, a)$

d. No Solution

Answer Key

- | | | | |
|-----|---|-----|---|
| 1. | C | 26. | C |
| 2. | A | 27. | C |
| 3. | A | 28. | A |
| 4. | D | 29. | A |
| 5. | B | 30. | B |
| 6. | C | 31. | C |
| 7. | C | 32. | C |
| 8. | D | 33. | D |
| 9. | C | 34. | D |
| 10. | B | 35. | C |
| 11. | D | 36. | B |
| 12. | D | 37. | A |
| 13. | B | 38. | D |
| 14. | A | 39. | C |
| 15. | B | 40. | B |
| 16. | B | 41. | D |
| 17. | A | 42. | B |
| 18. | C | 43. | C |
| 19. | D | 44. | C |
| 20. | D | 45. | C |
| 21. | B | 46. | A |
| 22. | B | 47. | A |
| 23. | B | 48. | B |
| 24. | D | 49. | D |
| 25. | C | 50. | C |