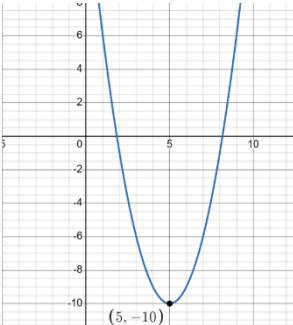


**Math 120**  
**Final Review (Fall 2024)**

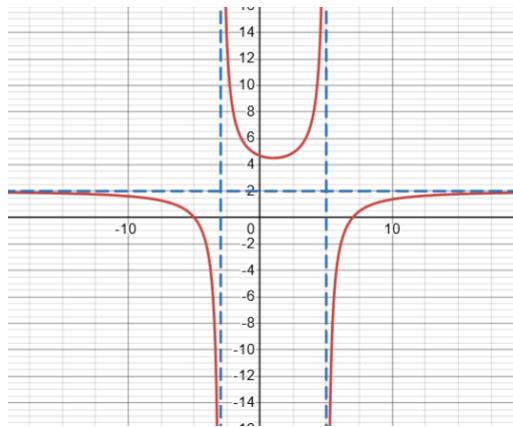
This final review is formatted to be similar to the final exam. The final exam will have 50 questions. You will be able to bring one  $3'' \times 5''$  index card (front and back) and a scientific calculator for the exam.

Multiple Choice: Choose the best possible answer.

1. Find the domain for:  $f(x) = \sqrt{19 - x}$ 
  - a.  $(-\infty, 19]$
  - b.  $[\sqrt{19}, \infty)$
  - c.  $(-\infty, 19] \cup [19, \infty)$
  - d. All real numbers
  
2. Write the following as a product of linear factors, given that 3 and -4 are zeros.
 
$$f(x) = x^4 + x^3 + 13x^2 + 25x - 300$$
  - a.  $(x - 3)(x + 4)(x - 5)(x + 5)$
  - b.  $(x + 3)(x - 4)(x - 5i)(x + 5i)$
  - c.  $(x - 3)(x + 4)(x - 5i)(x + 5i)$
  - d.  $(x + 3)(x - 4)(x - 5)(x + 5)$
  
3. Find the vertical asymptotes for the following rational functions:
 
$$f(x) = \frac{x}{x^2 - 2x - 35}$$
  - a. *none*
  - b.  $x = -7, 5$
  - c.  $x = 0$
  - d.  $x = 7, -5$
  
4. Find the domain for  $f(x) = \ln(-6 - x)$ .
  - a.  $(-6, \infty)$
  - b.  $(6, \infty)$
  - c.  $(-\infty, -6)$
  - d.  $(-\infty, 6)$
  
5. Find the domain and the range for the following function
 
  - a.  $D: [-10, \infty) \quad \& \quad R: (-\infty, \infty)$
  - b.  $D: [2, 8] \quad \& \quad R: [-10, 0]$
  - c.  $D: (-\infty, 2) \cup (8, \infty) \quad \& \quad R: (2, 8)$
  - d.  $D: (-\infty, \infty) \quad \& \quad R: [-10, \infty)$

6. For the function  $f(x) = \sqrt{x - 1} + 3$ , find the domain and range of  $f^{-1}(x)$ .
- a.  $D: (3, \infty)$       b.  $D: [3, \infty)$       c.  $D: [3, \infty)$       d.  $D: [1, \infty)$   
 $R: (1, \infty)$        $R: [1, \infty)$        $R: (-\infty, \infty)$        $R: [3, \infty)$
7. Determine the  $y$ -intercept of the function  $g(x) = x^2 - 3x + 9$
- a.  $(-9, 0)$       b.  $(0, 9)$       c.  $(9, 0)$       d.  $(0, -9)$
8. You deposit \$7550 in an account that pays 7.25% interest, compounded continuously. How long to the nearest year will it take for the money to triple?  
(Hint:  $A = Pe^{rt}$ )
- a. 3 yrs      b. 28 yrs      c. 16 yrs      d. 41 yrs
9. The antler spread  $a$  (in inches) and shoulder height  $h$  (in inches) of an adult male American elk are related by the model  $h = 116 \log(a + 40) - 176$ . Approximate the shoulder height of a male American elk with an antler spread of 55 inches.
- a. 53.4 in      b. 58 in      c. 1.54 in      d. 405.4 in
10. A climber is on a hike. After 3 hours, his altitude is 170 feet. After 7 hours, he is at an altitude of 290 feet. What is his average rate of change during this time?
- a.  $115 \text{ ft/hr}$       b.  $30 \text{ ft/hr}$       c.  $46 \text{ ft/hr}$       d.  $12 \text{ ft/hr}$
11. Solve the polynomial equation  $2x^3 + 24x^2 + 70x = 0$ .
- a.  $x = 2, 0, 1$       b.  $x = 0, 5, -7$       c.  $x = -7, -5, 0$       d.  $x = 0, 5, 7$
12. Solve the equation  $(x - 1)^{1/5} = -2$ .
- a.  $x = -32$       b.  $x = -31$       c.  $x = 33$       d.  $x = -33$
13. Find the equation of the line passing through  $(3, 2)$  and has a slope of  $-\frac{5}{6}$ .
- a.  $y = -\frac{5}{6}x + \frac{9}{2}$       b.  $y = -\frac{5}{6}x - \frac{9}{2}$       c.  $y = -\frac{6}{5}x + \frac{9}{2}$       d.  $y = -\frac{5}{6}x + \frac{2}{9}$

14. Which of the following rational functions is represented by the graph?



a.  $m(x) = \frac{x^2 - 2x - 35}{x^2 - 8x + 15}$

b.  $g(x) = \frac{2x^2 - 4x - 70}{x^2 - 2x - 15}$

c.  $f(x) = \frac{x^2 - 2x - 35}{x^2 - 2x - 15}$

d.  $h(x) = \frac{2x^2 - 4x - 70}{x^2 - 8x + 15}$

15. Find the equation of a line perpendicular to  $7x + 8y = 47$ .

a.  $y = -\frac{8}{7}x - \frac{27}{7}$

b.  $y = -\frac{7}{8}x - \frac{33}{8}$

c.  $y = -\frac{7}{8}x - \frac{47}{8}$

d.  $y = \frac{8}{7}x - \frac{43}{7}$

16. Find the horizontal asymptote:  $f(x) = \frac{3x^2 + x}{2x^2 + 1}$

a. 0

b. none

c.  $y = \frac{3}{2}$

d.  $x = \frac{3}{2}$

17. Which of the following functions has a slant (or oblique) asymptote?

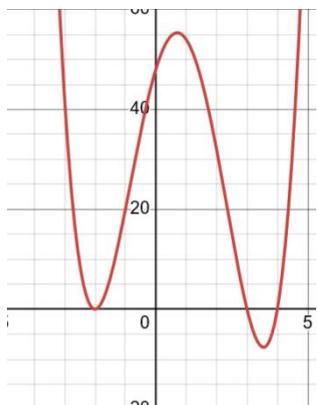
a.  $f(x) = \frac{x^4 + x - 1}{x^3 + x}$

b.  $f(x) = \frac{x^4 + x - 1}{x^2 + x}$

c.  $f(x) = \frac{x - 1}{x^2 + 2}$

d.  $f(x) = \frac{x^2 - x + 1}{x^2 + x}$

18. Select the polynomial function whose graph is shown below.



a.  $f(x) = (x - 4)^2(x + 2)(x - 3)^2$

b.  $f(x) = (x - 4)(x + 2)(x - 3)$

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

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

For problems 19 and 20, use  $f(x) = x^3 - x$  and  $g(x) = \sqrt[3]{x - 12}$ .

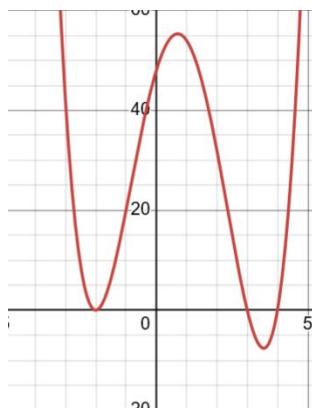
19.  $(f - g)(20)$

a. -7972      b. 7978      c. -8012      d. -7978

20.  $(f \circ g)(x)$

a.  $x - 12 - \sqrt[3]{x - 12}$       b.  $\sqrt[3]{x^3 - x - 12}$   
 c. 0      d.  $x - 12 - \sqrt[3]{x - 12}$

21. Determine the number of local maxima/minima (aka. relative max/min) of the graph:



- a. 1      b. 2      c. 3      d. 4

Solve the following equations:

22.  $|7m + 4| + 9 = 15$

a.  $\frac{2}{7}, -\frac{10}{7}$       b.  $-\frac{2}{7}, \frac{10}{7}$       c.  $\frac{2}{7}$       d. No Solution

23.  $\sqrt{4x - 3} = 2x - 3$

a. 1, 3      b. 3      c. -3      d. No Solution

24.  $2x^2 + 6x = -3$

a.  $\frac{-3 \pm \sqrt{3}}{2}$       b.  $\frac{-3 \pm \sqrt{3}}{4}$       c.  $\frac{-3 \pm \sqrt{15}}{2}$       d.  $\frac{-6 \pm \sqrt{3}}{2}$

25.  $\frac{x}{2x+2} = \frac{-2x}{4x+4} + \frac{2x-3}{x+1}$
- a.  $x = \frac{3}{2}$       b.  $x = 3$       c.  $x = -\frac{12}{5}$       d.  $x = -3$
26.  $2^{(12-2x)} = 16$
- a.  $x = 2$       b.  $x = 10$       c.  $x = -6 + \frac{\log 16}{\log 2}$       d.  $x = 4$
27.  $\left(\frac{1}{3}\right)^x = 18$
- a.  $x = \ln \frac{1}{6}$       b.  $x = \frac{\ln 18}{\ln 3}$   
 c.  $x = \ln 6$       d.  $x = -\frac{\ln 18}{\ln 3}$
28.  $\ln 2x + \ln 9x = \ln 19$
- a.  $x = 1$       b.  $x = \left(\frac{19}{18}\right)^{\frac{1}{2}}$   
 c.  $x = 0$       d.  $x = \frac{e^{19}}{18}$
29. Identify the vertex of the quadratic equation.
- $$f(x) = x^2 + 5x + 2$$
- a.  $(5, 23)$       b.  $(-5, 23)$       c.  $\left(-\frac{5}{2}, -\frac{17}{4}\right)$       d.  $\left(\frac{5}{2}, -\frac{17}{4}\right)$
30. How can the graph of  $f(x) = (x - 2)^2 - 5$  be obtained from its parent function, the graph  $y = x^2$ ?
- a. Shift the graph 2 units left and 5 units down.  
 b. Shift the graph 5 units right and 2 units down.  
 c. Shift the graph 2 units left and 5 units up.  
 d. Shift the graph 2 units right and 5 units down.
31. Write a quadratic function with x-intercepts  $(-4, 0)$  &  $(2, 0)$  and opens downward.
- a.  $f(x) = -(x - 4)(x + 2)$       b.  $f(x) = (x + 4)(x - 2)$   
 c.  $f(x) = -(x + 4)(x - 2)$       d.  $f(x) = (x - 4)(x + 2)$

32. Graph the quadratic function,  $f(x) = 2x^2 - 7x + 5$  and determine the interval(s) for which  $f(x) \geq 0$ .

a.  $(-\infty, 1] \cup [\frac{5}{2}, \infty)$       b.  $(1, \frac{5}{2})$

c.  $(-\infty, 1) \cup (\frac{5}{2}, \infty)$       d.  $[1, \frac{5}{2}]$

33. Given the function  $f(x)$ , find  $f(7)$  and  $f(-1)$ .

$$f(x) = \begin{cases} \sqrt{x+2} & x \geq 3 \\ x^2 + 3x - 10 & -1 < x < 3 \\ x^5 + 3 & x \leq -1 \end{cases}$$

a.  $f(7) = 3$       b.  $f(7) = -3$

$f(-1) = -12$       f.  $f(-1) = -12$

c.  $f(7) = 3$       d.  $f(7) = -3$

$f(-1) = 2$       f.  $f(-1) = 2$

34. Solve the following inequality and write the solution in interval notation:

$$x^2 + 9x + 14 \geq 0$$

a.  $(-\infty, -7] \cup [-2, \infty)$       b.  $(-\infty, -7]$

c.  $[-2, \infty)$       d.  $[-7, -2]$

35. Which symmetry best describes that of an even function?

a. Symmetric about the  $y-axis$       b. Symmetric about the  $x-axis$

c. Symmetric about the origin      d. No Symmetry

36. Which of the following represents an odd function?

a.  $x^2 + 3x$       b.  $\ln x$       c.  $x^3 - 2x$       d.  $e^x$

37. Which of the following equations is not a function of  $y$  with respect to  $x$ .

a.  $2x + 3y = 6$       b.  $x^2 - y = 6x - 5$

c.  $x^2 + y^2 = 16$       d.  $y = 4x^3 - 5x^2 + 3x - 7$

38. Find the inverse function for the following function:  $f(x) = \frac{x}{x+1}$
- a.  $f^{-1}(x) = \frac{x}{x-1}$       b.  $f^{-1}(x) = xy + x$   
c.  $f^{-1}(x) = -x - 1$       d.  $f^{-1}(x) = -\frac{x}{x-1}$
39. Describe the transformations done on the graph of  $f(x) = \ln x$  to form the graph of  $g(x) = -3 \ln(x + 2) - 1$ .
- a. Shift 2 units right, vertical stretch by a factor of 3, reflection about the x-axis, shift down 1 unit  
b. Shift 2 units left, vertical stretch by a factor of 3, reflection about the x-axis, shift down 1 unit  
c. Shift 2 units left, vertical compression by a factor of 3, reflection about the x-axis, shift down 1 unit  
d. Shift 2 units left, vertical stretch by a factor of 3, reflection about the y-axis, shift down 1 unit
40. Solve the system of equations:  $\begin{cases} 2x + y = 4 \\ 3x - y = 16 \end{cases}$
- a.  $(4, -4)$       b.  $(-4, 4)$   
c. *no solution*      d. *infinitely many solutions*
41. Find the point(s) of intersection for the following system of equations:
- $$\begin{cases} y - 2x = 5 \\ x^2 + y^2 = 85 \end{cases}$$
- a.  $(-6, -7) \text{ & } (2, 9)$       b.  $(6, -7) \text{ & } (-2, 9)$   
c. *no solution*      d.  $(6, 7) \text{ & } (-2, -9)$
42. Predict the end behavior of the graph:  $f(x) = 4x - \frac{1}{3}x^3$
- a. Up on both sides      b. Down left & up right  
c. Down on both sides      d. Up left & down right

43. Divide the polynomials and state the quotient and the remainder.

$$(2x^5 - x^4 + 3x^2 - x + 5) \div (x - 1)$$

- a.  $2x^4 + x^3 + 4x^2 + 3x + \frac{8}{x-1}$       b.  $2x^4 + x^3 - x^2 + 2x + 1 + \frac{6}{x-1}$   
c.  $2x^4 - 3x^3 - x + \frac{6}{x-1}$       d.  $2x^4 + x^3 + x^2 + 4x + 3 + \frac{8}{x-1}$

44. Use the rational zero test to find all the possible rational zeros of the function:  $f(x) = 2x^3 + 7x^2 - 17x - 10$

- a.  $\pm\frac{1}{10}, \pm\frac{1}{5}, \pm\frac{2}{5}, \pm\frac{1}{2}, \pm 1, \pm 2$       b.  $\pm\frac{1}{2}, \pm 1, \pm 2, \pm\frac{5}{2}, \pm 5, \pm 10$   
c.  $\pm 1, \pm 2 \pm 5, \pm 10$       d.  $\pm 1, \pm 2$

45. Find  $f(x + h) - f(x)$  for the function  $f(x) = 5x^2 - 6x + 1$ .

- a.  $5x^2 - 10xh + 5h^2 - 6x - 6h + 1$     b.  $5x^2 - 6x + 1$   
c.  $5h^2 - 6h + 1$       d.  $10xh + 5h^2 - 6h$

46. Write the following equation in exponential form:  $\log_7 49 = 2$

- a.  $49^2 = 7$       b.  $2^7 = 49$       c.  $7^2 = 49$       d.  $\sqrt{49} = 7$

47. Evaluate the logarithm:  $9 \ln \sqrt[3]{e}$

- a.  $3 \ln e$       b. 1      c. 27      d. 3

48. Expand the logarithmic expression:  $\log_b \frac{m^5 p^3}{n^2 b^7}$

- a.  $5 \log_b m + 3 \log_b p - 5 \log_b n - 7$   
b.  $5 \log_b m + 3 \log_b p - 5 \log_b n + 7$   
c.  $5 \log_b m + 3 \log_b p - 5 \log_b n - \log_b b^7$   
d.  $m^5 p^3 - n^2 b^7$

49. Condense the logarithmic expression to a single quantity:

$$2 \ln(x - 4) - \frac{1}{3} \ln x^2$$

a.  $\ln\left(\sqrt[3]{x^2}(x^2 - 8x + 16)\right)$

b.  $\ln\left(\frac{x^2 - 8x + 16}{\sqrt[3]{x^2}}\right)$

c.  $\ln\left(\frac{x^2 - 8x + 16}{\sqrt[2]{x^3}}\right)$

d.  $-\ln\left(\frac{2x - 8}{\frac{1}{3}x^2}\right)$

50. Determine the zeros and the multiplicity of each zero for the given function:

$$f(x) = x^5 - 2x^4 - 20x^3 + 8x^2 + 128x + 128$$

a.  $x = 4$  multiplicity: 3      b.  $x = -4$  multiplicity: 3  
 $x = 2$  multiplicity: 2       $x = -2$  multiplicity: 2

c.  $x = 4$  multiplicity: 2      d.  $x = -4$  multiplicity: 2  
 $x = -2$  multiplicity: 3       $x = 2$  multiplicity: 3

## **Answer Key**

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