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" × 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. $D: [-10, \infty)$ & $R: (-\infty, \infty)$

   b. $D: [2, 8]$ & $R: [-10, 0]$

   c. $D: (-\infty, 2) \cup (8, \infty)$ & $R: (2, 8)$

   d. $D: (-\infty, \infty)$ & $R: [-10, \infty)$

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.   15 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. $115 \, ft/hr$ b. $30 \, ft/hr$ c. $46 \, ft/hr$ d. $12 \, ft/hr$

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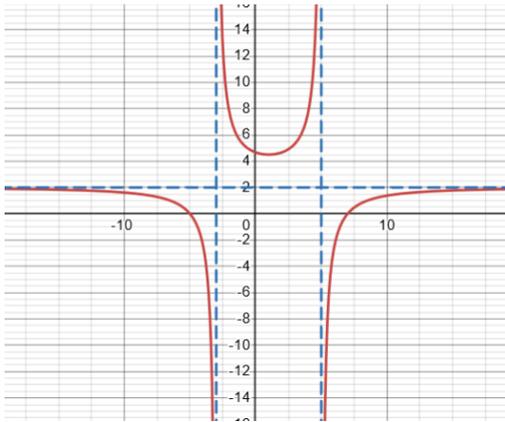
a. $m(x) = \dfrac{x^2-2x-35}{x^2-8x+15}$

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

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

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

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

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

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

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

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

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

a. 0 b. none   c. $y = \dfrac{3}{2}$ d. $x = \dfrac{3}{2}$

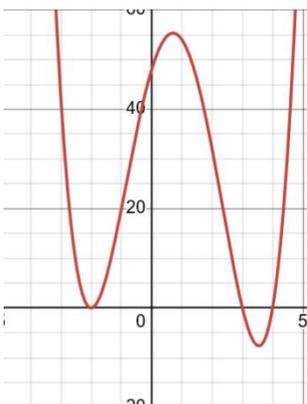17. Which of the following functions has a slant (or oblique) asymptote?

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

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

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

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

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

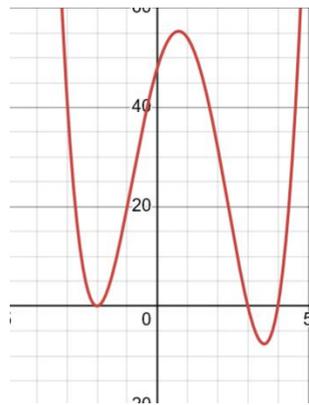For problems 19 and 20, use $f(x) = x^3 - x$ and $g(x) = \sqrt[3]{x - 12}$.

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

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

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

    a. $x - 12 - \sqrt{x - 12}$ 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. $\dfrac{x}{2x+2} = \dfrac{-2x}{4x+4} + \dfrac{2x-3}{x+1}$

  a. $x = \dfrac{3}{2}$ b. $x = 3$ c. $x = -\dfrac{12}{5}$ d. $x = -3$

26. $2^{(12-2x)} = 16$

  a. $x = 2$ b. $x = 10$ c. $x = -6 + \dfrac{\log 16}{\log 2}$ d. $x = 4$

27. $\left(\dfrac{1}{3}\right)^x = 18$

  a. $x = \ln\dfrac{1}{6}$ b. $x = \dfrac{\ln 18}{\ln 3}$

  c. $x = \ln 6$ d. $x = -\dfrac{\ln 18}{\ln 3}$

28. $\ln 2x + \ln 9x = \ln 19$

  a. $x = 1$ b. $x = \left(\dfrac{19}{18}\right)^{\frac{1}{2}}$

  c. $x = 0$ d. $x = \dfrac{e^{19}}{18}$

29. Identify the vertex of the quadratic equation.

$$f(x) = x^2 + 5x + 2$$

  a. $(5,23)$ b. $(-5,23)$ c. $\left(-\dfrac{5}{2},-\dfrac{17}{4}\right)$ d. $\left(\dfrac{5}{2},-\dfrac{17}{4}\right)$

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

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

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. $f(7) = -3$

     $f(-1) = -12$ $f(-1) = -12$

c. $f(7) = 3$ d. $f(7) = -3$

     $f(-1) = 2$ $f(-1) = 2$

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. $(-6, -7)$ & $(2, 9)$ b. $(6, -7)$ & $(-2, 9)$

    c.   *no solution*   d. $(6, 7)$ & $(-2, -9)$

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. $\pm\frac{1}{10}, \pm\frac{1}{5}, \pm\frac{2}{5}, \pm\frac{1}{2}, \pm1, \pm2$ b. $\pm\frac{1}{2}, \pm1, \pm2, \pm\frac{5}{2}, \pm5, \pm10$

c. $\pm1, \pm2 \pm 5, \pm10$ d. $\pm1, \pm2$

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. 9   b. 1   c. 27   d. 3

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

a. $5\log_b m + 3\log_b p - 2\log_b n - 7$

b. $5\log_b m + 3\log_b p - 2\log_b n + 7$

c. $5\log_b m + 3\log_b p - 2\log_b n$

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.	C		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.	B
20.	D		45.	D
21.	C		46.	C
22.	A		47.	D
23.	B		48.	A
24.	A		49.	B
25.	B		50.	C