

Math 120 Final Exam Review

Solve:

1. $2x^2 - x - 28 = 0$

2. $(x + 4)^2 = 81$

3. $4x^2 + 4x = 7$

4. $x^4 - 5x^2 + 6 = 0$

5. $x^4 + 4x^2 = 12$

6. $\frac{6}{x} + \frac{8}{x+5} = 3$

7. $\frac{4}{x+1} - \frac{3}{x+2} = 1$

8. $|3x+2| = 7$

9. $|x-10| = x^2 - 10x$

10. $\sqrt{x} - \sqrt{x-5} = 1$

11. $\sqrt{x+5} = \sqrt{x-5}$

Perform the indicated operation and write the answer in standard form:

12. $(5 + i) + (6 - 2i)$

13. $(8 - i) - (4 + 3i)$

14. $(1 + i)(2 - 3i)$

15. $(6 - 2i)(1 + 2i)$

For 16-19, determine if the following equations represent a function:

16. $y = x^3 + 3$

17. $y^2 + x^2 = 4$

18. $|x| = y - 2$

19. $|y| = x - 1$

20. Find $P(3)$ given $p(x) = \begin{cases} x^2 + 3x + 1 & \text{if } x < 5 \\ x^3 - x + 1 & \text{if } x \geq 5 \end{cases}$

21. Find $f(1)$ given $f(x) = 2x - 3$

22. Find $g(4)$ given $g(x) = 2x^2 + x - 1$

23. Find the domain of $f(x) = \sqrt{x+2} - 1$

24. Find the domain of $g(x) = \frac{3x+2}{x^2+3x-4}$

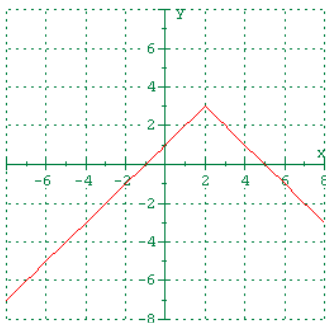
25. Find the domain of $h(x) = x^3 - 2x^2 + 4$

26. Find the domain of $f(x) = \ln(3-x)$

27. Find the equation of the line that passes through the point $(6,3)$ and has a slope of $-\frac{2}{3}$.

28. Find the equation of the line that passes through the origin and is parallel to the line $y = 2x - 3$.

29. Match the graph with its equation:



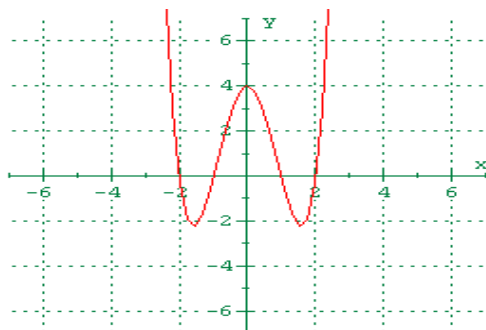
a. $f(x) = -|x+2|+3$

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

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

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

30. From the graph, determine the intervals for which $f(x) > 0$.



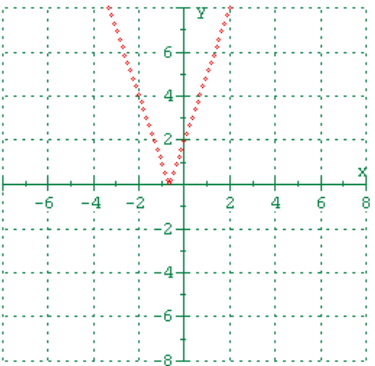
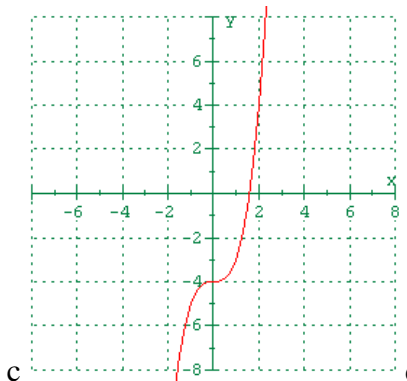
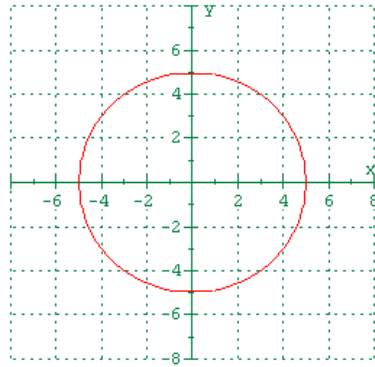
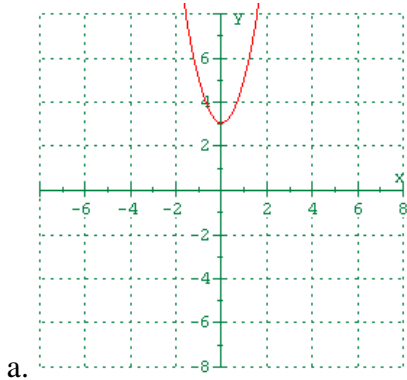
For 31-34, match each graph with its corresponding function.

31. $y = |3x + 2|$

32. $x^2 + y^2 = 25$

33. $y = 2x^2 + 3$

34. $y = x^3 - 4$



35. Find the slope of the line $3x + 2y = 5$.

36. Find the slope of the line $4y - 2x = 9$

For 37-40, determine if the function is even, odd, or neither:

37. $h(x) = x^3 + 5x$

38. $f(x) = 4x^{\frac{2}{3}}$

39. $f(x) = x^2 - 2x - 3$

40. $g(x) = x^2 - x^4$

For 41-43, write the quadratic equations in standard form:

41. $f(x) = -x^2 + 2x + 1$

42. $f(x) = 2x^2 - 3x + 5$

43. $f(x) = x^2 - 4x + 6$

44. Divide: $(4x^3 - 7x^2 - 11x + 5) \div (4x + 5)$

45. Divide: $(6x^3 - 16x^2 + 17x - 6) \div (3x - 2)$

46. Use the Rational Zeros Theorem to list all the possible rational zeros of $f(x) = 3x^3 - 4x^2 + 7x - 10$

47. Use the Rational Zeros Theorem to list all the possible rational zeros of $f(x) = 6x^3 + 10x^2 + x + 8$

48. If the leading coefficient of a 5th degree polynomial with real coefficients is negative, describe the far-left and far-right behavior of the graph.

49. If the leading coefficient of a 4th degree polynomial with real coefficients is positive, describe the far-left and far-right behavior of the graph.

50. If the leading coefficient of a 3rd degree polynomial with real coefficients is positive, describe the far-left and far-right behavior of the graph.

51. Factor to find all the zeros of $f(x) = 4x^3 - 25x^2 + 6x$

52. Z varies jointly with x and y. If $z = 24$ when $x = 4$ and $y = 8$, find z when $x = 7$ and $y = 3$.

53. Y is varies inversely as x. If $y = 3$ when $x = 25$, find y when $x = 20$.

54. X varies directly as y. If $x = 9$ when $y = 2$, find x when $y = 7$.

55. Find the vertical asymptotes of $R(x) = \frac{3x^2 - 12x + 3}{6x^2 - 5x - 11}$

56. Solve: $6x^2 - 7x - 24 \leq 0$

57. Find the equation of a quadratic function that opens up and has x-intercepts at (4,0) and (8,0).

58. Write in exponent form: $\log_3 x = 6$.

59. Write as a single log: $\log_5(3x+1) - 2\log_5(2x+11)$

60. Write as a single log: $2[2\ln x - \ln(x+1) - \ln(x-1)]$

61. Solve: $\log_2 x + \log_2(x - 4) = 2$

62. Solve: $5^{2x+1} = 48$

63. Simplify: $\log_2(4^2 \cdot 3^2)$

64. Simplify: $\ln \frac{6}{e^2}$

65. Simplify: $\log_{10} \frac{9}{300}$

66. Solve: $\log_2 x + \log_2(x + 2) = \log_2(x + 6)$

67. Solve: $8^x = 4$

68. Solve: $\log_5 x = -3$

69. Solve: $\left(\frac{1}{2}\right)^x = 32$

70. Find $f^{-1}(x)$ if $f(x) = 2x + 5$

71. Find $f^{-1}(x)$ if $f(x) = \frac{3x-1}{2}$

72. Write $\log_b \frac{x^2 \sqrt{y}}{z}$ in terms of separate logs of x , y , and z . Assume $x > 0$, $y > 0$, $z > 0$.

73. Write as a single log: $\ln x - 4[\ln(x + 2) + \ln(x - 2)]$

74. Write as separate logs: $\ln \frac{6}{\sqrt{x^2 + 1}}$

75. Write as a single log: $\ln x - 3\ln(x + 1)$.

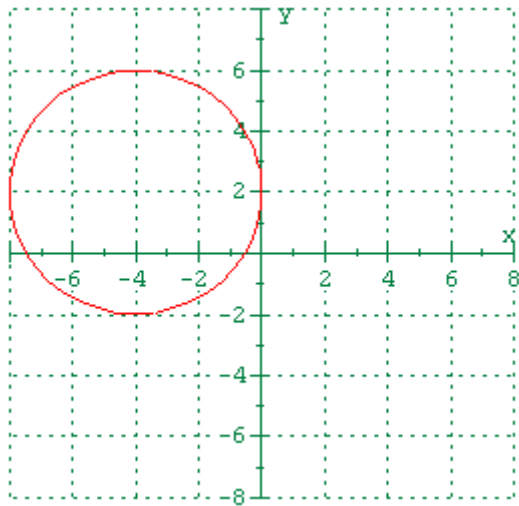
76. The number N of bacteria in a culture is modeled by $N = 250e^{kt}$ where t is the time in hours. If $N = 280$ when $t = 10$, estimate the time required for the population to double in size.

77. The half-life of radioactive radium (^{226}Ra) is 1620 years. What percent of a present amount of radioactive radium will remain after 100 years?

78. A deposit of \$5000 is made in a trust fund that pays 7.5% interest, compounded continuously. It is specified that the balance will be given to the college from which the donor graduated after the money has earned interest for 50 years. How much will the college receive?

79. Given $x^2 + y^2 - 2x + 6y + 9 = 0$, find the center and radius of the circle.

80. From the graph, find the center and radius of the circle.



81. Solve:
$$\begin{cases} x - 2y = 0 \\ 3x - y^2 = 0 \end{cases}$$

82. Solve
$$\begin{cases} x^2 + y^2 = 25 \\ 3x^2 - 16y = 0 \end{cases}$$

83. The system
$$\begin{cases} x - 2y + 5z = 2 \\ 4x \quad \quad - z = 0 \end{cases}$$
 had the following row echelon form solution

matrix:
$$\begin{bmatrix} 1 & 0 & -0.25 & \vdots & 0 \\ 0 & 1 & -2.625 & \vdots & -1 \end{bmatrix}$$
. Determine the solution for the system, and state the type of solution.

84. The system
$$\begin{cases} 2x - 2y - 6z = -4 \\ -3x + 2y + 6z = 1 \\ x - y - 5z = -3 \end{cases}$$
 has the following row echelon form solution matrix:

$$\left[\begin{array}{ccc|c} 1 & -\frac{2}{3} & -2 & -\frac{1}{3} \\ 0 & 1 & 3 & 5 \\ 0 & 0 & 1 & \frac{1}{2} \end{array} \right]. \text{ Determine the solution for the system, and state the type of solution.}$$

85. The system
$$\begin{cases} 2x + y - z = 7 \\ x - 2y + 2z = -9 \\ 3x - y + z = 5 \end{cases}$$
 has the following row echelon form solution matrix:

$$\left[\begin{array}{ccc|c} 1 & -\frac{2}{3} & -\frac{2}{3} & 1\frac{2}{3} \\ 0 & 1 & -1 & 6\frac{2}{5} \\ 0 & 0 & 0 & 1 \end{array} \right]. \text{ Determine the solution for the system, and state the type of solution.}$$

Answer Key

1. $x = 4, -\frac{7}{2}$
2. $x = -13, 5$
3. $x = \frac{-1 \pm 2\sqrt{2}}{2}$
4. $x = \pm\sqrt{2}, \pm\sqrt{3}$
5. $x = \pm\sqrt{2}, \pm i\sqrt{6}$
6. $x = 3, -\frac{10}{3}$
7. $x = 1, -3$
8. $x = -3, \frac{5}{3}$
9. $x = -1, 10$
10. $x = 9$
11. no solution
12. $11 - i$
13. $4 - 4i$
14. $5 - i$
15. $10 + 10i$
16. yes
17. no
18. yes
19. no
20. $P(3) = 19$
21. $f(1) = -1$
22. $g(4) = 35$
23. $\mathbf{D}: \{x \mid x \geq -2\}$
24. $\mathbf{D}: \{x \mid x \neq -4, 1\}$
25. $\mathbf{D}: \mathbf{R}$
26. $\mathbf{D}: \{x \mid x < 3\}$
27. $y = -\frac{2}{3}x + 7$
28. $y = 2x$
29. d
30. $(-\infty, -2) \cup (-1, 1) \cup (2, \infty)$
31. d
32. b
33. a
34. c
35. $m = -\frac{3}{2}$
36. $m = \frac{1}{2}$
37. odd
38. even
39. neither
40. even
41. $f(x) = -(x-1)^2 + 2$
42. $f(x) = 2(x-\frac{3}{4})^2 + \frac{31}{8}$
43. $f(x) = (x-2)^2 + 2$
44. $x^2 - 3x + 1$
45. $2x^2 - 4x + 3$
46. $\pm 1, \pm \frac{1}{3}, \pm 2, \pm \frac{2}{3}, \pm 5, \pm \frac{5}{3}, \pm 10, \pm \frac{10}{3}$
47. $\pm 1, \pm \frac{1}{2}, \pm \frac{1}{3}, \pm \frac{1}{6}, \pm 2, \pm \frac{2}{3}, \pm 4, \pm \frac{4}{3},$
 $\pm 8, \pm \frac{8}{3}$
48. far-left: up, far-right: down
49. far-left: up, far-right: up
50. far-left: down, far-right: up
51. $x = 0, \frac{1}{4}, 6$
52. $z = 15.75$ or $\frac{63}{4}$
53. $y = \frac{15}{4}$
54. $x = 31\frac{1}{2}$
55. $x = -1$ $x = \frac{11}{6}$
56. $\left[-\frac{3}{2}, \frac{8}{3}\right]$
57. $f(x) = a(x^2 - 12x + 32)$ where $a > 0$
58. $3^6 = x$
59. $\log_5 \frac{3x+1}{(2x+11)^2}$
60. $\ln \left(\frac{x^2}{(x+1)(x-1)} \right)^2$
61. $2 + 2\sqrt{2}$
62. $x \approx 0.703$
63. $4 + 2\log_2 3$
64. $\ln 6 - 2$
65. $\log_{10} 3 - 2$
66. $x = 2$
67. $x = \frac{2}{3}$

68. $x = \frac{1}{125}$

69. $x = -5$

70. $f^{-1}(x) = \frac{1}{2}x - \frac{5}{2}$

71. $f^{-1}(x) = \frac{2}{3}x + \frac{1}{3}$

72. $2\log_b x + \frac{1}{2}\log_b y - \log_b z$

73. $\ln \frac{x}{[(x+2)(x-2)]^4}$

74. $\ln 6 - \frac{1}{2}\ln(x^2 + 1)$

75. $\ln \frac{x}{(x+1)^3}$

76. $t \approx 61.16$ hours

77. 95.8%

78. \$212,605.41

79. center: (1,-3); radius: 1

80. center: (-4,2); radius: 4

81. (0,0) and (12,6)

82. (4,3) and (-4,3)

83. (.25a, -1 + 2.625a, a), solution is consistent, dependent

84. $\left(3, 3\frac{1}{2}, \frac{1}{2}\right)$, solution is consistent, independent

85. no solution, inconsistent