MTH 112 Final Exam Study Guide (33 multiple choice questions) Blitzer 7th

Be sure to bring a green Scantron answer form and a #2 pencil!

Chapter 1 Review Exercises, page 213-214

- #49, 50, 51: multiply complex numbers and write in standard form
- #53, 54: divide complex numbers and write in standard form
- #60, 62, 63: solve the quadratic equation by square root method
- #68, 69, 70, 75: solve the quadratic equation

Chapter 2 Review Exercises, page 339-342

- #7, 8: evaluate the function
- #11-15: identify the graph which represents a function
- #17e, 18e, 19e: find the intervals on which a function is increasing, decreasing, or constant
- #9, 10: evaluate the piecewise function (and page 253 #53-55)
- #33, 34: find and simplify the difference quotient
- #41, 42: find the equation of the line in slope-intercept form
- #76, 77, 78: find the domain of the function
- #82, 83: find the sum, difference, product, or quotient of two functions
- #85a&b, 86a&b, 88a: find the composition of two functions
- #93a, 94a: find the inverse of the one-to-one function

Chapter 3 Review Exercises, page 459-461

- #1, 2, 3, 4: find the coordinates of the vertex and the *y*-intercept of the parabola
- #5,6: find the minimum or maximum value and where it occurs
- #10, 11, 12, 13: use the Leading Coefficient test to determine the end behavior of a graph
- #16, 17: find the zeros of the function and determine at each if the graph crosses the *x*-axis or touches the *x*-axis and turns around
- #27, 28, 29: divide the polynomials using long division
- #30, 31: divide the polynomials using synthetic division
- #40, 43, 45: find the zeros of the polynomial function (omit part b)
- #57, 58, 59, 61: find the vertical and horizontal asymptotes of the rational function
- #69, 70: solve the polynomial inequality (and page 442 #5, 19)

Chapter 4 Review Exercises, page 538-539

- #13-18: change the logarithmic expression into exponential form or vise versa
- #19, 20, 22: evaluate the logarithm
- #50, 51, 52: expand the logarithm as much as possible
- #54, 55, 56: write the expression as a single logarithm with coefficient 1
- #58, 59: use the change of base formula to evaluate the logarithm on a calculator
- #64, 70, 71: solve the exponential equation
- #74, 75: solve the logarithmic equation
- #76, 77: solve the logarithmic equation using the properties of logarithms

Chapter 8 Review Exercises, page 904-905

- #25, 26, 27: solve the nonlinear system of equations
- #46, 48: graph the solution set of the system of inequalities (and page 890 #45, 46)

Ch. 1

Chapter 1 Review Exercises, page 213-214

- #49, 50, 51: multiply complex numbers and write in standard form
- #53, 54: divide complex numbers and write in standard form
- #60, 62, 63: solve the quadratic equation by square root method
- #68, 69, 70, 75: solve the quadratic equation

In Exercises 48–57, perform the indicated operations and write the result in standard form.

49. $4i(3i - 2)$

50. $(7 - i)(2 + 3i)$

51. $(3 - 4i)^2$

53. $\dfrac{6}{5 + i}$

54. $\dfrac{3 + 4i}{4 - 2i}$

Solve each equation in Exercises 60–63 by the square root property.

60. $2x^2 - 3 = 125$

62. $(x + 3)^2 = -10$

63. $(3x - 4)^2 = 18$

Solve each equation in Exercises 68–70 using the quadratic formula.

68. $x^2 = 2x + 4$

69. $x^2 - 2x + 19 = 0$

70. $2x^2 = 3 - 4x$

Solve each equation by the method of your choice.

75. $3x^2 - 7x + 1 = 0$

Ch.1 Answers

49. $-12 - 8i$ **50.** $17 + 19i$ **51.** $-7 - 24i$

53. $\frac{15}{13} - \frac{3}{13}i$ **54.** $\frac{1}{5} + \frac{11}{10}i$

60. $\{-8, 8\}$

62. $\{-3 - i\sqrt{10}, -3 + i\sqrt{10}\}$

63. $\left\{\frac{4 - 3\sqrt{2}}{3}, \frac{4 + 3\sqrt{2}}{3}\right\}$

68. $\{1 + \sqrt{5}, 1 - \sqrt{5}\}$

69. $\{1 + 3i\sqrt{2}, 1 - 3i\sqrt{2}\}$ **70.** $\left\{\frac{-2 + \sqrt{10}}{2}, \frac{-2 - \sqrt{10}}{2}\right\}$

75. $\left\{\frac{7 + \sqrt{37}}{6}, \frac{7 - \sqrt{37}}{6}\right\}$

Ch. 2

Chapter 2 Review Exercises, page 339-342

- #7, 8: evaluate the function
- #11-15: identify the graph which represents a function
- #17e, 18e, 19e: find the intervals on which a function is increasing, decreasing, or constant
- #9, 10: evaluate the piecewise function (and page 253 #53-55)
- #33, 34: find and simplify the difference quotient
- #41, 42: find the equation of the line in slope-intercept form
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- #82, 83: find the sum, difference, product, or quotient of two functions
- #85a&b, 86a&b, 88a: find the composition of two functions
- #93a, 94a: find the inverse of the one-to-one function

In Exercises 7–10, evaluate each function at the given values of the independent variable and simplify.

7. $f(x) = 5 - 7x$

a. $f(4)$ **b.** $f(x + 3)$ **c.** $f(-x)$

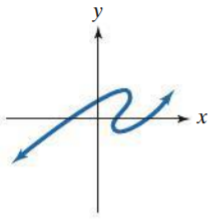
8. $g(x) = 3x^2 - 5x + 2$

a. $g(0)$ **b.** $g(-2)$

c. $g(x - 1)$ **d.** $g(-x)$

In Exercises 11–16, use the vertical line test to identify graphs in which y is a function of x.

11.



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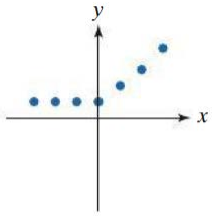

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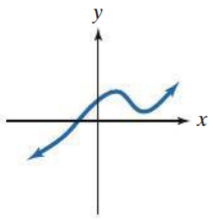

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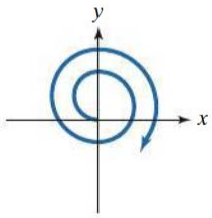

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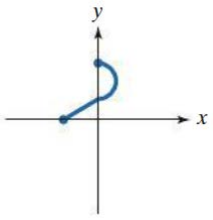


9. $g(x) = \begin{cases} \sqrt{x - 4} & \text{if } x \geq 4 \\ 4 - x & \text{if } x < 4 \end{cases}$

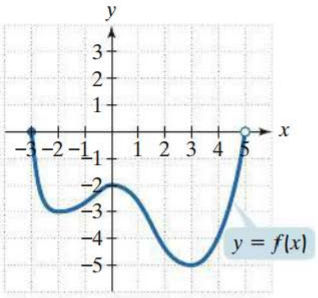
a. $g(13)$ **b.** $g(0)$ **c.** $g(-3)$

10. $f(x) = \begin{cases} \dfrac{x^2 - 1}{x - 1} & \text{if } x \neq 1 \\ 12 & \text{if } x = 1 \end{cases}$

a. $f(-2)$ **b.** $f(1)$ **c.** $f(2)$

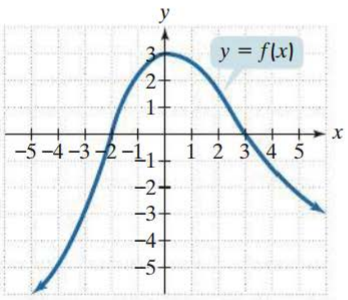
In Exercises 17–19, use the graph to determine **a.** *the function's domain;* **b.** *the function's range;* **c.** *the x-intercepts, if any;* **d.** *the y-intercept, if there is one;* **e.** *intervals on which the function is increasing, decreasing, or constant; and* **f.** *the missing function values, indicated by question marks, below each graph.*

17.



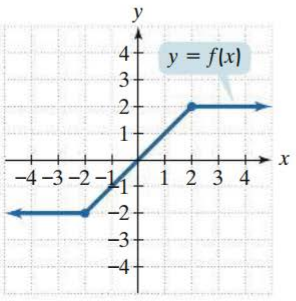
$f(-2) = ?$ $f(3) = ?$

18.



$f(-2) = ?$ $f(6) = ?$

19.



$f(-9) = ?$ $f(14) = ?$

In Exercises 33–34, find and simplify the difference quotient

$$\frac{f(x+h)-f(x)}{h}, \quad h \neq 0$$

for the given function.

33. $f(x) = 8x - 11$

34. $f(x) = -2x^2 + x + 10$

In Exercises 41–44, use the given conditions to write an equation for each line in point-slope form and slope-intercept form.

41. Passing through $(-3, 2)$ with slope -6

42. Passing through $(1, 6)$ and $(-1, 2)$

In Exercises 76–81, find the domain of each function.

76. $f(x) = x^2 + 6x - 3$

77. $g(x) = \dfrac{4}{x-7}$

78. $h(x) = \sqrt{8-2x}$

In Exercises 82–84, find $f+g$, $f-g$, fg, and $\frac{f}{g}$. Determine the domain for each function.

82. $f(x) = 3x - 1, \quad g(x) = x - 5$

83. $f(x) = x^2 + x + 1, \quad g(x) = x^2 - 1$

In Exercises 85–86, find **a.** $(f \circ g)(x)$; **b.** $(g \circ f)(x)$; **c.** $(f \circ g)(3)$.

85. $f(x) = x^2 + 3, \quad g(x) = 4x - 1$

86. $f(x) = \sqrt{x}, \quad g(x) = x + 1$

In Exercises 87–88, find **a.** $(f \circ g)(x)$

88. $f(x) = \sqrt{x-1}, \quad g(x) = x + 3$

The functions in Exercises 93–95 are all one-to-one. For each function,

a. *Find an equation for $f^{-1}(x)$, the inverse function.*

b. *Verify that your equation is correct by showing that $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$.*

93. $f(x) = 4x - 3$

94. $f(x) = 8x^3 + 1$

Ch. 2 Answers

7. a. $f(4) = -23$

b. $f(x + 3) = -7x - 16$ **c.** $f(-x) = 5 + 7x$

8. a. $g(0) = 2$ **b.** $g(-2) = 24$ **c.** $g(x - 1) = 3x^2 - 11x + 10$

d. $g(-x) = 3x^2 + 5x + 2$ **9. a.** $g(13) = 3$ **b.** $g(0) = 4$

c. $g(-3) = 7$ **10. a.** -1 **b.** 12 **c.** 3 **11.** not a function

12. function **13.** function **14.** not a function

15. not a function **17. a.** $[-3, 5)$ **b.** $[-5, 0]$

c. -3 **d.** -2 **e.** increasing: $(-2, 0)$ or $(3, 5)$; decreasing: $(-3, -2)$ or $(0, 3)$ **f.** $f(-2) = -3$ and $f(3) = -5$

18. a. $(-\infty, \infty)$ **b.** $(-\infty, 3]$ **c.** -2 and 3 **d.** 3

e. increasing: $(-\infty, 0)$; decreasing: $(0, \infty)$ **f.** $f(-2) = 0$ and $f(6) = -3$ **19. a.** $(-\infty, \infty)$ **b.** $[-2, 2]$ **c.** 0 **d.** 0

e. increasing: $(-2, 2)$; constant: $(-\infty, -2)$ or $(2, \infty)$

f. $f(-9) = -2$ and $f(14) = 2$

33. 8 **34.** $-4x - 2h + 1$

41. $y - 2 = -6(x + 3); y = -6x - 16$

42. using $(1, 6)$, $y - 6 = 2(x - 1); y = 2x + 4$

76. $(-\infty, \infty)$ **77.** $(-\infty, 7) \cup (7, \infty)$ **78.** $(-\infty, 4]$

82. $(f + g)(x) = 4x - 6$;
domain: $(-\infty, \infty)$; $(f - g)(x) = 2x + 4$;
domain: $(-\infty, \infty)$; $(fg)(x) = 3x^2 - 16x + 5$;
domain: $(-\infty, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{3x - 1}{x - 5}$;
domain: $(-\infty, 5) \cup (5, \infty)$

83. $(f + g)(x) = 2x^2 + x$;
domain: $(-\infty, \infty)$; $(f - g)(x) = x + 2$;
domain: $(-\infty, \infty)$; $(fg)(x) = x^4 + x^3 - x -$
domain: $(-\infty, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{x^2 + x + 1}{x^2 - 1}$;
domain: $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$

85. a. $(f \circ g)(x) = 16x^2 - 8x + 4$ **b.** $(g \circ f)(x) = 4x^2 + 11$

86. a. $(f \circ g)(x) = \sqrt{x + 1}$

b. $(g \circ f)(x) = \sqrt{x} + 1$

88. a. $(f \circ g)(x) = \sqrt{x + 2}$

93. $f^{-1}(x) = \frac{x + 3}{4}$ **94.** $f^{-1}(x) = \sqrt[3]{\frac{x - 1}{8}}$ or $\frac{\sqrt[3]{x - 1}}{2}$

Chapter 3 Review Exercises, page 459-461

- #1, 2, 3, 4: find the coordinates of the vertex and the y-intercept of the parabola
- #5,6: find the minimum or maximum value and where it occurs
- #10, 11, 12, 13: use the Leading Coefficient test to determine the end behavior of a graph
- #16, 17: find the zeros of the function and determine at each if the graph crosses the x-axis or touches the x-axis and turns around
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Ch. 3

In Exercises 1–4, use the vertex and intercepts to sketch the graph of each quadratic function. Give the equation for the parabola's axis of symmetry. Use the graph to determine the function's domain and range.

1. $f(x) = -(x + 1)^2 + 4$ **2.** $f(x) = (x + 4)^2 - 2$

3. $f(x) = -x^2 + 2x + 3$ **4.** $f(x) = 2x^2 - 4x - 6$

In Exercises 5–6, use the function's equation, and not its graph, to find

a. *the minimum or maximum value and where it occurs.*

b. *the function's domain and its range.*

5. $f(x) = -x^2 + 14x - 106$

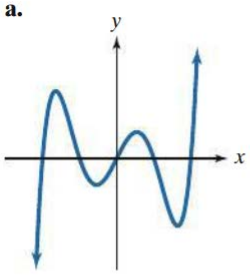
6. $f(x) = 2x^2 + 12x + 703$

In Exercises 10–13, use the Leading Coefficient Test to determine the end behavior of the graph of the given polynomial function. Then use this end behavior to match the polynomial function with its graph. [The graphs are labeled (a) through (d).]

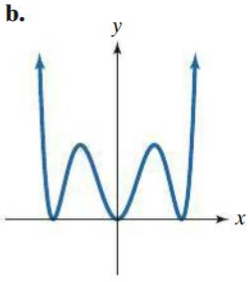
10. $f(x) = -x^3 + x^2 + 2x$ **11.** $f(x) = x^6 - 6x^4 + 9x^2$

12. $f(x) = x^5 - 5x^3 + 4x$ **13.** $f(x) = -x^4 + 1$

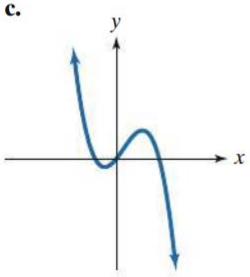
a.



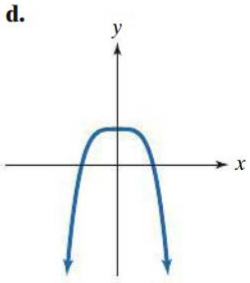
b.



c.



d.



In Exercises 16–17, find the zeros for each polynomial function and give the multiplicity of each zero. State whether the graph crosses the x-axis, or touches the x-axis and turns around, at each zero.

16. $f(x) = -2(x - 1)(x + 2)^2(x + 5)^3$

17. $f(x) = x^3 - 5x^2 - 25x + 125$

In Exercises 27–29, divide using long division.

27. $(4x^3 - 3x^2 - 2x + 1) \div (x + 1)$

28. $(10x^3 - 26x^2 + 17x - 13) \div (5x - 3)$

29. $(4x^4 + 6x^3 + 3x - 1) \div (2x^2 + 1)$

In Exercises 30–31, divide using synthetic division.

30. $(3x^4 + 11x^3 - 20x^2 + 7x + 35) \div (x + 5)$

31. $(3x^4 - 2x^2 - 10x) \div (x - 2)$

For Exercises 40–46,

- ***a.*** *List all possible rational roots or rational zeros.*
- ***b.*** *Use Descartes's Rule of Signs to determine the possible number of positive and negative real roots or real zeros.*
- ***c.*** *Use synthetic division to test the possible rational roots or zeros and find an actual root or zero.*
- ***d.*** *Use the quotient from part (c) to find all the remaining roots or zeros.*

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

43. $2x^3 + 9x^2 - 7x + 1 = 0$

45. $4x^4 + 7x^2 - 2 = 0$

In Exercises 57–64, find the vertical asymptotes, if any, the horizontal asymptote, if one exists, and the slant asymptote, if there is one, of the graph of each rational function. Then graph the rational function.

57. $f(x) = \dfrac{2x}{x^2 - 9}$

58. $g(x) = \dfrac{2x - 4}{x + 3}$

59. $h(x) = \dfrac{x^2 - 3x - 4}{x^2 - x - 6}$

61. $y = \dfrac{x^2}{x + 1}$

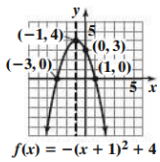
In Exercises 69–74, solve each inequality and graph the solution set on a real number line.

69. $2x^2 + 5x - 3 < 0$

70. $2x^2 + 9x + 4 \geq 0$

Ch. 3 Answers

1.

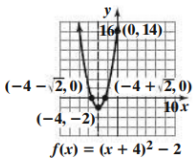


$f(x) = -(x + 1)^2 + 4$

axis of symmetry: $x = -1$

domain: $(-\infty, \infty)$; range: $(-\infty, 4]$

2.

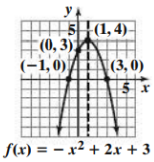


$f(x) = (x + 4)^2 - 2$

axis of symmetry: $x = -4$

domain: $(-\infty, \infty)$; range: $[-2, \infty)$

3.

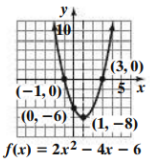


$f(x) = -x^2 + 2x + 3$

axis of symmetry: $x = 1$

domain: $(-\infty, \infty)$; range: $(-\infty, 4]$

4.



$f(x) = 2x^2 - 4x - 6$

axis of symmetry: $x = 1$

domain: $(-\infty, \infty)$; range: $[-8, \infty)$

5. a. maximum is -57 at $x = 7$ **b.** domain: $(-\infty, \infty)$; range: $(-\infty, -57]$

6. a. minimum is 685 at $x = -3$ **b.** domain: $(-\infty, \infty)$; range: $[685, \infty)$

10. c

11. b **12.** a **13.** d

16. $x = 1$, multiplicity 1, crosses; $x = -2$, multiplicity 2, touches; $x = -5$, multiplicity 3, crosses

17. $x = -5$, multiplicity 1, crosses; $x = 5$, multiplicity 2, touches

27. $4x^2 - 7x + 5 - \dfrac{4}{x + 1}$ **28.** $2x^2 - 4x + 1 - \dfrac{10}{5x - 3}$

29. $2x^2 + 3x - 1$ **30.** $3x^3 - 4x^2 + 7$

31. $3x^3 + 6x^2 + 10x + 10 + \dfrac{20}{x - 2}$

40. a. $\pm 1, \pm 2, \pm 4$ **b.** 1 positive real zero; 2 or no negative real zeros

c. -2 or 1 **d.** $-2, 1$

43. a. $\pm 1, \pm \dfrac{1}{2}$

b. 2 or 0 positive real solutions; 1 negative solution

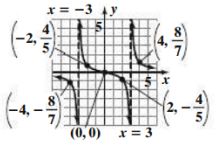
c. $\dfrac{1}{2}$ **d.** $\left\{\dfrac{1}{2}, \dfrac{-5 - \sqrt{29}}{2}, \dfrac{-5 + \sqrt{29}}{2}\right\}$

45. a. $\pm 1, \pm 2, \pm \dfrac{1}{2}, \pm \dfrac{1}{4}$ **b.** 1 positive real root; 1 negative real root

c. $-\dfrac{1}{2}$ or $\dfrac{1}{2}$ **d.** $\left\{-\dfrac{1}{2}, \dfrac{1}{2}, i\sqrt{2}, -i\sqrt{2}\right\}$

57. Vertical asymptotes: $x = 3$ and $x = -3$

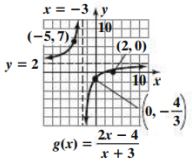
horizontal asymptote: $y = 0$



$f(x) = \dfrac{2x}{x^2 - 9}$

58. Vertical asymptote: $x = -3$

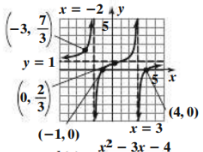
horizontal asymptote: $y = 2$



$g(x) = \dfrac{2x - 4}{x + 3}$

59. Vertical asymptotes: $x = 3$ and $x = -2$

horizontal asymptote: $y = 1$

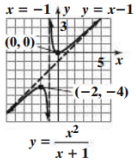


$h(x) = \dfrac{x^2 - 3x - 4}{x^2 - x - 6}$

61. Vertical asymptote: $x = -1$

no horizontal asymptote

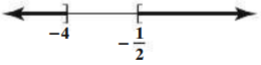
slant asymptote: $y = x - 1$



$y = \dfrac{x^2}{x + 1}$

69. $\left(-3, \dfrac{1}{2}\right)$

70. $(-\infty, -4] \cup \left[-\dfrac{1}{2}, \infty\right)$



Ch. 4

Chapter 4 Review Exercises, page 538-539

- #13-18: change the logarithmic expression into exponential form or vise versa
- #19, 20, 22: evaluate the logarithm
- #50, 51, 52: expand the logarithm as much as possible
- #54, 55, 56: write the expression as a single logarithm with coefficient 1
- #58, 59: use the change of base formula to evaluate the logarithm on a calculator
- #64, 70, 71: solve the exponential equation
- #74, 75: solve the logarithmic equation
- #76, 77: solve the logarithmic equation using the properties of logarithms

In Exercises 13–15, write each equation in its equivalent exponential form.

13. $\frac{1}{2} = \log_{49} 7$ **14.** $3 = \log_4 x$ **15.** $\log_3 81 = y$

In Exercises 16–18, write each equation in its equivalent logarithmic form.

16. $6^3 = 216$ **17.** $b^4 = 625$ **18.** $13^y = 874$

In Exercises 19–29, evaluate each expression without using a calculator. If evaluation is not possible, state the reason.

19. $\log_4 64$ **20.** $\log_5 \frac{1}{25}$

22. $\log_{16} 4$

In Exercises 50–53, use properties of logarithms to expand each logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

50. $\log_6(36x^3)$ **51.** $\log_4\left(\frac{\sqrt{x}}{64}\right)$

52. $\log_2\left(\frac{xy^2}{64}\right)$

In Exercises 54–57, use properties of logarithms to condense each logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.

54. $\log_b 7 + \log_b 3$ **55.** $\log 3 - 3 \log x$

56. $3 \ln x + 4 \ln y$

In Exercises 58–59, use common logarithms or natural logarithms and a calculator to evaluate to four decimal places.

58. $\log_6 72{,}348$

59. $\log_4 0.863$

In Exercises 64–73, solve each exponential equation. Where necessary, express the solution set in terms of natural or common logarithms and use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

64. $2^{4x-2} = 64$

70. $e^{12-5x} - 7 = 123$

71. $5^{4x+2} = 37{,}500$

In Exercises 74–79, solve each logarithmic equation.

74. $\log_4(3x - 5) = 3$

75. $3 + 4 \ln(2x) = 15$

76. $\log_2(x + 3) + \log_2(x - 3) = 4$

77. $\log_3(x - 1) - \log_3(x + 2) = 2$

Ch. 4 Answers

13. $49^{1/2} = 7$ **14.** $4^3 = x$ **15.** $3^y = 81$

16. $\log_6 216 = 3$ **17.** $\log_b 625 = 4$ **18.** $\log_{13} 874 = y$ **19.** 3

20. -2

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

50. $2 + 3\log_6 x$ **51.** $\frac{1}{2}\log_4 x - 3$

52. $\log_2 x + 2\log_2 y - 6$ **54.** $\log_b 21$ **55.** $\log\frac{3}{x^3}$

56. $\ln(x^3y^4)$ **58.** 6.2448 **59.** -0.1063

64. $\{2\}$

70. $\left\{\frac{12 - \ln 130}{5}\right\}$; ≈ 1.43 **71.** $\left\{\frac{\ln 37{,}500 - 2\ln 5}{4\ln 5}\right\}$; ≈ 1.14

74. $\{23\}$

75. $\left\{\frac{e^-}{2}\right\}$; ≈ 10.04 **76.** $\{5\}$ **77.** $\varnothing$

Ch. 8

Chapter 8 Review Exercises, page 904-905

- #25, 26, 27: solve the nonlinear system of equations
- #46, 48: graph the solution set of the system of inequalities (and page 890 #45, 46)

8.4

In Exercises 25–35, solve each system by the method of your choice.

25. $\begin{cases} 5y = x^2 - 1 \\ x - y = 1 \end{cases}$

26. $\begin{cases} y = x^2 + 2x + 1 \\ x + y = 1 \end{cases}$

27. $\begin{cases} x^2 + y^2 = 2 \\ x + y = 0 \end{cases}$

28. $\begin{cases} 2x^2 + y^2 = 24 \\ x^2 + y^2 = 15 \end{cases}$

In Exercises 46–55, graph the solution set of each system of inequalities or indicate that the system has no solution.

46. $\begin{cases} 3x + 2y \geq 6 \\ 2x + y \geq 6 \end{cases}$

47. $\begin{cases} 2x - y \geq 4 \\ x + 2y < 2 \end{cases}$

48. $\begin{cases} y < x \\ y \leq 2 \end{cases}$

49. $\begin{cases} x + y \leq 6 \\ y \geq 2x - 3 \end{cases}$

In Exercises 27–62, graph the solution set of each system of inequalities or indicate that the system has no solution.

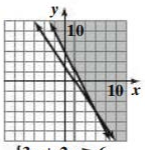
45. $\begin{cases} y \geq x^2 - 1 \\ x - y \geq -1 \end{cases}$

46. $\begin{cases} y \geq x^2 - 4 \\ x - y \geq 2 \end{cases}$

Ch. 8 Answers

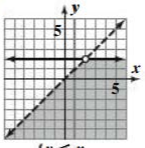
25. $\{(4, 3), (1, 0)\}$ **26.** $\{(0, 1), (-3, 4)\}$ **27.** $\{(1, -1), (-1, 1)\}$

46.



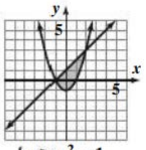
$\begin{cases} 3x + 2y \geq 6 \\ 2x + y \geq 6 \end{cases}$

48.



$\begin{cases} y < x \\ y \leq 2 \end{cases}$

45.



$\begin{cases} y \geq x^2 - 1 \\ x - y \geq -1 \end{cases}$