

## MATH 102 – Sample Final Exam Review

This review is a collection of sample questions used by instructors of this course at Missouri State University. It contains a sampling of problems representing the material covered throughout the semester and may not contain every type of question on the final exam. Any material listed on the lecture schedule and/or the assignment sheet may be on the final exam. Please also be aware that a few questions on the final exam, while requiring knowledge and understanding of the content covered in the course, may be presented in a form different than the problems in the text.

### Problems 1 - 12. Evaluate. Assume all variables are nonzero.

- |                                               |                          |                            |                                                |                                            |
|-----------------------------------------------|--------------------------|----------------------------|------------------------------------------------|--------------------------------------------|
| 1. $\left(\frac{3}{2}\right)^{-3}$            | 2. $-8^0 + 7^2$          | 3. $-(-2)^{-2} + (2)^{-3}$ | 4. $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$ | 5. $7^{\frac{4}{5}} \cdot 7^{\frac{6}{5}}$ |
| 6. $-\sqrt{81}$                               | 7. $-125^{\frac{-2}{3}}$ | 8. $\frac{-3}{4^{-2}}$     | 9. $(-9xy^3)^0$                                | 10. $(-32)^{\frac{2}{5}}$                  |
| 11. $\left(\frac{1}{16}\right)^{\frac{1}{4}}$ | 12. $49^{\frac{-3}{2}}$  |                            |                                                |                                            |

### Problems 13 - 47. Solve.

- |                                                    |                                                                  |                                                        |                                                     |
|----------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------|
| 13. $5(a-3) - 4(a+5) = -33$                        | 14. $ x+2  = 3$                                                  | 15. $x^2 - 7x + 6 = 0$                                 |                                                     |
| 16. $3[3b - 2(b-3)] + 4b = 31 - 7(1-2b)$           | 17. $-2x^3 + 50x = 0$                                            | 18. $ 2x+3  - 3 = 4$                                   |                                                     |
| 19. $(x-7)(x+5) = -20$                             | 20. $\frac{6y}{5y+15} - \frac{y+2}{3y+9} = \frac{16y-1}{15y+45}$ | 21. $4 - 3(m+2) + 8m = 5(m-1) - 7m$                    |                                                     |
| 22. $1 + \frac{2}{x} = \frac{24}{x^2}$             | 23. $\frac{3}{x+1} - \frac{5}{x} = \frac{19}{x^2+x}$             | 24. $\sqrt{2y-3} = 4$                                  | 25. $2\sqrt{x} = \sqrt{x+75}$                       |
| 26. $(2x-5)^2 = 49$                                | 27. $2x^2 - 4x - 5 = 0$                                          | 28. $\sqrt{3x+13} - 3 = x$                             | 29. $y^4 + 6y^2 - 7 = 0$                            |
| 30. $\frac{2q+1}{3} - \frac{q-1}{4} = -2$          | 31. $\sqrt{z^2+5} = z+3$                                         | 32. $\frac{3}{x^2-25} = \frac{1}{x+5} + \frac{2}{x-5}$ | 33. $\left \frac{x+5}{2}\right  + 3 = 18$           |
| 34. $6t^2 = 7 - 19t$                               | 35. $p = \sqrt{p^2 + 3p + 18}$                                   | 36. $(5k-2)^2 + 7 = 31$                                | 37. $\frac{4}{z+2} - \frac{1}{3z+6} = \frac{11}{9}$ |
| 38. Solve by substitution: $(x-1)^2 - 3(x-1) = 28$ | 39. $3(x+3)^2 - 10(x+3) - 8 = 0$                                 |                                                        |                                                     |
| 40. Solve: $4p - 3(y+p) = 2y$ for $y$              | 41. Solve: $\frac{1}{p} = \frac{1}{f} + \frac{1}{q}$ for $q$     | 42. Solve: $4x - 5y = 15$ for $x$                      |                                                     |
| 43. Solve: $a = \frac{3}{4}(b-5)$ for $b$          | 44. Solve: $9x = 3y + bx + 2$ for $x$                            | 45. Solve: $p = px + y$ for $p$                        |                                                     |
| 46. Solve: $\frac{m-x}{n} = y$ for $m$             | 47. $2x^2 + 20x + 48 = 0$ by completing the square               |                                                        |                                                     |
| 48. $x^2 - 6x = -14$ by completing the square.     |                                                                  |                                                        |                                                     |

**Problems 49-59. Define the variable, set up an appropriate equation, and solve.**

49. A bookstore sells a college algebra book for \$90. If the bookstore makes a profit of 25% on each sale, what does the bookstore pay the publisher for each book?
50. The perimeter of a garden is 56 meters. The length is 11 meters less than twice the width. Find the length and the width.
51. Ryan can paint a room in 8 hours when working alone. If Stephanie helps him, the total job takes 6 hours. How long would it take Stephanie if she worked alone?
52. Suppose that Boyd's Hardware just announced a 20% decrease in the price of their snowthrower. If one particular snowthrower model sells for \$459.99 after the decrease, find the original price of the snowthrower. (Round to the nearest hundredths).
53. A west-bound jet leaves an airport traveling 600 miles an hour. At the same time, an east-bound plane departs at 350 miles an hour. In how many hours will the planes be 1900 miles apart?
54. An express train and a car leave St. Louis at the same time and head for a town 320 miles away. The speed of the express train is twice the speed of the car. The train arrives 4 hours ahead of the car. Find the speed of the car.
55. The hypotenuse of a right triangle is 1 centimeter more than twice the shorter leg, and the longer leg is 9 centimeters shorter than three times the shorter leg. Find the lengths of the three sides of the triangle.
56. Bob can paint a room in 3 hours working alone. It takes Barbara 5 hours to paint the same room. How long would it take them to paint the room together?
57. Natalie can ride her bike 4 mph faster than her husband, Chuck. If Natalie can ride 48 miles in the same time that Chuck can ride 24 miles, what are their speeds?
58. When Sarah takes the bus to work, the trip takes 30 minutes. When she takes the train to work, the trip takes 20 minutes. The average speed of the train is 15 mph more than the average speed of the bus. Find the distance to work.
59. After  $t$  seconds, the height  $h(t)$  of a model rocket launched from the ground into the air is given by the function  $h(t) = -16t^2 + 80t$ . Find how long it takes the rocket to reach a height of 96 feet.
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**Problems 60- 71. Factor completely. If the expression cannot be factored, write "prime".**

- |                              |                         |                           |                      |
|------------------------------|-------------------------|---------------------------|----------------------|
| 60. $x^2 - 10x + 24$         | 61. $6x^2 + 7x - 3$     | 62. $12y^2 + y - 20$      | 63. $16p^2 - 25$     |
| 64. $125x^3 - 8$             | 65. $p^3 + 10p^2 + 25p$ | 66. $3m^2 - 12m - 63$     | 67. $x^2 + 81$       |
| 68. $12ax + 8ay - 15x - 10y$ | 69. $m^3 + 27n^3$       | 70. $x^3 - 3x^2 + 2x - 6$ | 71. $x^4 - 5x^2 + 6$ |

**Problems 72 - 91. Perform the indicated operation. Simplify your answer.**

$$72. (7y-3)(4y+5) \quad 73. (4z-3)(4z+3) \quad 74. 3x(x-3)(2x+5) \quad 75. \frac{(3x-4)^2}{3x^2} \cdot \frac{15x}{9x^2-16}$$

$$76. \frac{3a-1}{a^2-9} - \frac{2}{a-3} \quad 77. \frac{x^2-x-6}{x^2-8x+15} \div \frac{x^2+5x+6}{x^2-4x-21} \quad 78. \frac{x^3+64}{x^2-16} \div \frac{x^2-4x+16}{x^2-4x} \quad 79. \frac{12}{x} - \frac{5}{4x}$$

$$80. \frac{2}{x-3} + \frac{x}{x+3} \quad 81. (6x-5)^2 \quad 82. (4x-3)(5x^2+3x-4) \quad 83. -xy^4(5x^2y-4xy^2+3x^2y^2)$$

$$84. \frac{2}{m^2-4m+4} + \frac{3}{m^2+m-6} \quad 85. \frac{2}{a-2} - \frac{a+2}{a^2-a-2} \quad 86. \frac{\frac{5}{6} - \frac{1}{3}}{\frac{3}{20}} \quad 87. \frac{6}{5a+10} + \frac{7}{6a+12}$$

$$88. \frac{m^2+2mn-m-2n}{m^3-1} \quad 89. \frac{y^2-49}{y+2} \cdot \frac{y}{7-y} \quad 90. \frac{2p^2-7p-4}{6p^2+7p+2} \quad 91. \frac{5x+6}{x^2+x-20} - \frac{-4+3x}{x^2+x-20}$$

**Problems 92 - 107. Simplify. Write answers with only positive exponents. Assume all variables are positive.**

$$92. y^{\frac{3}{2}} \cdot y^{\frac{2}{3}} \quad 93. \sqrt{-75} \quad 94. (-3x)^{-3} \quad 95. \left(\frac{x^2}{x^6}\right)^{\frac{-1}{2}} \quad 96. -\sqrt{-81}$$

$$97. \frac{6\sqrt{3}}{\sqrt{10}} \quad 98. \sqrt{72a^3b^9c^{17}} \quad 99. \sqrt[3]{-135} \quad 100. 2\sqrt{50x^2} - \sqrt{12x^2}$$

$$101. \sqrt[3]{27x^6y^{11}} \quad 102. \left(\frac{8x^3}{y^6}\right)^{\frac{2}{3}} \quad 103. (4m^{-3})^{-2}(m^4)^{-1} \quad 104. \sqrt{45x} - 3\sqrt{20x} + 5\sqrt{80x}$$

$$105. \frac{x^{\frac{5}{4}} \cdot x^{-2}}{x^{\frac{3}{4}}} \quad 106. \frac{-4a^5(a^{-1})^3}{(a^{-2})^{-2}} \quad 107. \left(\frac{-2x^6y^8}{x^{-2}y^{10}}\right)^{-3}$$

**Problems 108 - 110. Express in radical form. Do not leave negative exponents in your answers. Assume all variables represent nonnegative real numbers.**

$$108. (2x-5)^{\frac{-3}{4}} \quad 109. 7y^{\frac{1}{5}} \quad 110. (2w)^{\frac{-5}{2}}$$

**Problems 111 - 126. Solve and graph. Put your answers in interval notation.**

$$111. \frac{3x-2}{-2} < 13 \quad 112. \frac{-2}{3}x+5 \geq 29 \quad 113. -2 \leq \frac{8-x}{3} < 4 \quad 114. x^2-10x+21 < 0$$

$$115. 9-4x^2 \leq 0 \quad 116. |2n-1| \leq 4 \quad 117. -4-(2+3m) \leq 5m+3 \quad 118. |3n-2|+9 \leq 26$$

$$119. |3-8x|-5 > 2 \quad 120. (3m+5)(2m+1)(7m-3) \leq 0 \quad 121. x(x-2) \geq 35$$

122. Find the slope of the line through the points  $(-3, 2)$  and  $(2, 3)$  .  
 123. Find the x and y-intercept of  $3x - 4y = 7$  . (Answers as ordered pairs.)  
 124. Write  $5x + 6y = 12$  in slope-intercept form, then state the slope and y-intercept.  
 125. Find the center and radius of the circle represented by  $x^2 + y^2 - 14x - 6y + 58 = 81$  .  
 126. Find the center and radius of a circle where the endpoints of a diameter are  $(-3, 2)$  and  $(5, -6)$  .

**Problems 127- 131. Find an equation of each line. Express final answer in slope-intercept form if possible.**

127.  $m = -3$  , through  $(2, 3)$  .  
 128. Through  $(-1, 3)$  and  $(-3, 2)$  .  
 129.  $m = -\frac{2}{5}$  , y-intercept  $(0, 8)$  .  
 130. Horizontal line, through  $(8, -2)$  .  
 131. Undefined slope, through  $(-3, -4)$

**Problems 132-133. Find an equation of each circle. Express final answer in standard form.**

132. Center  $(0, -5)$  and radius 3.  
 133. Center  $(-4, -3)$  and containing the point  $(-3, 3)$  .

**Problems 134 - 144. Graph each of the following. Label at least 3 key points on the graph.**

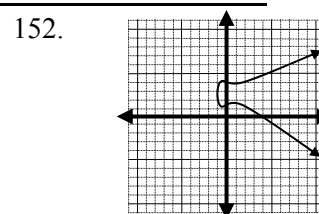
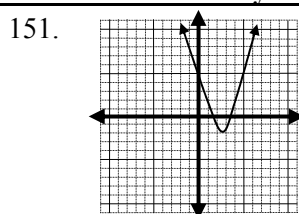
134.  $5x - y = 5$       135.  $2x + 3y = 9$       136.  $x + 2y \geq 6$       137.  $x \leq 4$   
 138.  $y > 1$       139. intersection of  $2x + y \leq 3$  and  $x \leq 2$       140.  $y = x^2 + 7$   
 141.  $y = -(x - 5)^2 + 1$     142.  $y = -\frac{1}{2}(x - 2)^2$       143.  $x^2 + (y - 4)^2 = 9$     144.  $x^2 + y^2 + 2x - 6y = 15$

**Problems 145 – 149. Solve the systems.**

145.  $2x + 5y = 21$       146.  $5x + 3y = 7$       147.  $3x + 2y = 1$   
        $3x - 2y = -16$        $7x - 3y = -19$        $9x + 6y = 1$   
 Solve by substitution.  
 148.  $3x - y = 7$       149.  $x - 5y = 1$   
        $2x + 5y = -1$        $-4x + 20y = -4$

**Problems 150-152. Give the domain and range of each relation. Identify those that define a function.**

150.  $\{(8, 0), (5, 4), (9, 3), (3, 8)\}$



**Problems 153 - 155. Let  $f(x) = 5 + 3x$  and  $g(x) = -x^2 - 5$  find:**

153.  $f(7)$       154.  $g(7)$       155.  $g(-2)$

**Problems 156 - 159. Find where each function is undefined.**

156.  $h(x) = \frac{x+3}{x^2}$       157.  $h(x) = \frac{6-x}{x^2-7x}$       158.  $h(x) = \frac{x+3}{x^2+9}$       159.  $f(x) = \frac{x}{2x-6}$

## SOLUTIONS

1.  $\frac{8}{27}$       2. 48      3.  $-\frac{1}{8}$       4.  $\frac{25}{4}$       5. 49      6. -9
7.  $-\frac{1}{25}$       8. -48      9. 1      10. 4      11.  $\frac{1}{2}$       12.  $\frac{1}{343}$
13.  $a=2$       14.  $x=1,-5$       15.  $x=6,1$       16.  $b=-\frac{6}{7}$       17.  $x=0,\pm 5$       18.  $x=-5,2$
19.  $x=5,-3$       20.  $\emptyset$       21.  $m=-\frac{3}{7}$       22.  $x=-6,4$       23.  $x=-12$       24.  $y=\frac{19}{2}$
25.  $x=25$       26.  $x=6,-1$       27.  $x=\frac{2\pm\sqrt{14}}{2}$       28.  $x=1$       29.  $y=\pm 1,\pm i\sqrt{7}$
30.  $q=\frac{-31}{5}$       31.  $z=-\frac{2}{3}$       32.  $x=\frac{-2}{3}$       33.  $x=25,-35$       34.  $t=\frac{1}{3},\frac{-7}{2}$       35.  $\emptyset$
36.  $k=\frac{2\pm 2\sqrt{6}}{5}$       37.  $z=1$       38.  $x=8,-3$       39.  $x=\frac{-11}{3},1$       40.  $y=\frac{p}{5}$
41.  $q=\frac{pf}{f-p}$       42.  $x=\frac{5y+15}{4}$       43.  $b=\frac{4a+15}{3}$       44.  $x=\frac{3y+2}{9-b}$       45.  $p=\frac{y}{1-x}$
46.  $m=ny+x$       47.  $x=-6,-4$       48.  $x=3\pm i\sqrt{5}$       49. \$72      50. 13 meters, 15 meters
51. 24 hours      52.  $x=\$574.99$       53. 2 hours      54. 40 mph      55. 8 cm, 15 cm, 17 cm
56.  $1\frac{7}{8}$  hours      57. Chuck: 4mph; Natalie: 8 mph      58. 15 miles      59. 2 seconds
60.  $(x-4)(x-6)$       61.  $(3x-1)(2x+3)$       62.  $(4y-5)(3y+4)$       63.  $(4p-5)(4p+5)$
64.  $(5x-2)(25x^2+10x+4)$       65.  $p(p+5)^2$       66.  $3(m-7)(m+3)$       67. Prime
68.  $(4a-5)(3x+2y)$       69.  $(m+3n)(m^2-3mn+9n^2)$       70.  $(x^2+2)(x-3)$       71.  $(x^2-3)(x^2-2)$
72.  $28y^2+23y-15$       73.  $16z^2-9$       74.  $6x^3-3x^2-45x$       75.  $\frac{5(3x-4)}{x(3x+4)}$
76.  $\frac{a-7}{a^2-9}$       77.  $\frac{x-7}{x-5}$       78.  $x$       79.  $\frac{43}{4x}$       80.  $\frac{x^2-x+6}{x^2-9}$
81.  $36x^2-60x+25$       82.  $20x^3-3x^2-25x+12$       83.  $-5x^3y^5+4x^2y^6-3x^3y^6$

84.  $\frac{5m}{(m-2)^2(m+3)}$

85.  $\frac{a}{(a-2)(a+1)}$

86.  $\frac{10}{3}$

87.  $\frac{71}{30(a+2)}$

88.  $\frac{m+2n}{m^2+m+1}$

89.  $\frac{-y(y+7)}{y+2}$

90.  $\frac{p-4}{3p+2}$

91.  $\frac{2}{x-4}$

92.  $y^{\frac{13}{6}}$

93.  $5i\sqrt{3}$

94.  $-\frac{1}{27x^3}$

95.  $x^2$

96.  $-9i$

97.  $\frac{3\sqrt{30}}{5}$

98.  $6ab^4c^8\sqrt{2abc}$

99.  $-3\sqrt[3]{5}$

100.  $(10\sqrt{2}-2\sqrt{3})x$

101.  $3x^2y^3\sqrt[3]{y^2}$

102.  $\frac{4x^2}{y^4}$

103.  $\frac{m^2}{16}$

104.  $17\sqrt{5x}$

105.  $\frac{1}{x^{\frac{3}{2}}}$

106.  $-\frac{4}{a^2}$

107.  $\frac{y^6}{-8x^{24}}$

108.  $\frac{1}{\sqrt[4]{(2x-5)^3}}$

109.  $7\sqrt[5]{y}$

110.  $\frac{1}{\sqrt{(2w)^5}}$

111.  $(-8, \infty)$

112.  $(-\infty, -36]$

113.  $(-4, 14]$

114.  $(3, 7)$

115.  $\left(-\infty, -\frac{3}{2}\right] \cup \left[\frac{3}{2}, \infty\right)$

116.  $\left[\frac{-3}{2}, \frac{5}{2}\right]$

117.  $\left[\frac{-9}{8}, \infty\right)$

118.  $\left[-5, \frac{19}{3}\right]$

119.  $\left(-\infty, \frac{-1}{2}\right) \cup \left(\frac{5}{4}, \infty\right)$

120.  $\left(-\infty, -\frac{5}{3}\right] \cup \left[-\frac{1}{2}, \frac{3}{7}\right]$

121.  $(-\infty, -5] \cup [7, \infty)$

122.  $m = \frac{1}{5}$

123. y-intercept  $\left(0, \frac{-7}{4}\right)$  x-intercept  $\left(\frac{7}{3}, 0\right)$

124.  $y = -\frac{5}{6}x + 2$ ,  $m = -\frac{5}{6}$ , y-intercept  $(0, 2)$

125. center  $(7, 3)$ ; radius = 9

126. center  $(1, -2)$ ; radius =  $4\sqrt{2}$

127.  $y = -3x + 9$

128.  $y = \frac{1}{2}x + \frac{7}{2}$

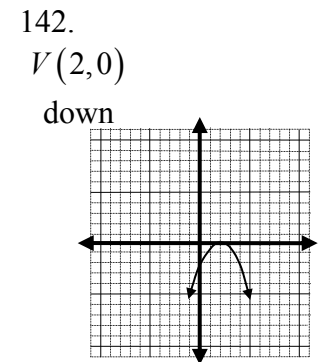
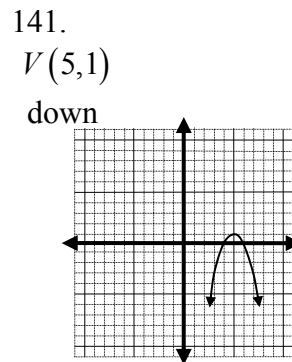
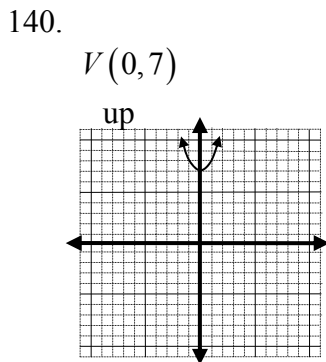
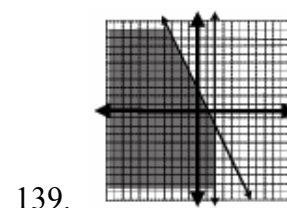
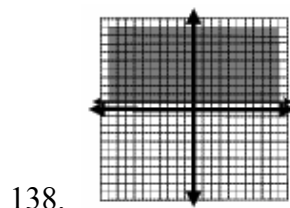
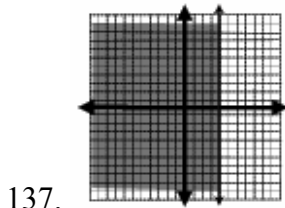
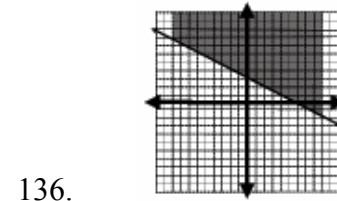
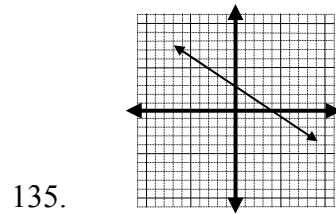
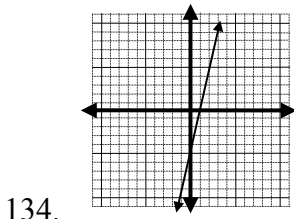
129.  $y = \frac{-2}{5}x + 8$

130.  $y = -2$

131.  $x = -3$

132.  $x^2 + (y+5)^2 = 9$

133.  $(x+4)^2 + (y+3)^2 = 37$



143.  $C(0,4); r=3$

144.  $C(-1,3); r=-5$

145.  $(-2,5)$

146.  $(-1,4)$

147.  $\emptyset$

148.  $(2,-1)$

149.  $\{(x,y) \mid x-5y=1\}$

150. Domain  $\{3,5,8,9\}$   
Range  $\{0,3,4,8\}$   
function

151. Domain  $(-\infty, \infty)$   
Range  $[-2, \infty)$   
function

152. Domain  $[-1, \infty)$   
Range  $(-\infty, \infty)$   
not a function

153. 26

154. -54

155. -9

156.  $x=0$

157.  $x=0,7$

158. *nowhere*

159.  $x=3$