1. Find $f(-1)$ when $f(x) = -2x^2 + x - 1$.
2. Find $f(-3)$ when $f(x) = 3x^2 + 2x + 1$.
3. Determine if the following is a function of $x$: $y = \pm \sqrt{1 - 2x}$.
4. Determine if the following is a function of $x$: $y = \frac{3x - 1}{x + 2}$.
5. Find the domain of the following function: $f(x) = \sqrt{3x - 12}$.
6. Find the domain of the following function: $f(x) = \frac{2x}{x^2 - 4}$.
7. If $f(x) = 1 + \frac{1}{x}$ and $g(x) = \frac{1}{x}$, find $(fg)(x)$ and state its domain.
8. If $f(x) = 1 + \frac{1}{x}$ and $g(x) = \frac{1}{x}$, find $(f - g)(x)$ and state its domain.
9. Determine if the following function is symmetric with respect to the origin, $y$–axis, or $x$–axis:
   $$f(x) = \frac{3x}{x^2 + 9}.$$ 
10. Determine if the following function is symmetric with respect to the origin, $y$–axis, or $x$–axis:
    $$f(x) = x^4 - 1.$$ 
11. For the graph of $f(x) = -3x^2 + 5x$,
    a) Is the point $(-1, 2)$ on the graph of $f$?
    b) If $x = -2$, what is $f(x)$? What point is on the graph of $f(x)$?
    c) If $f(x) = -2$, what is $x$? What point is on the graph of $f(x)$?
    d) What is the domain of $f$?
    e) List the $x$–intercepts, if any, of the graph of $f$.
    f) List the $y$–intercept, if there is one, of the graph of $f$.
    g) What are the zeros of $f$?
12. Use your calculator to determine the intervals on which the following function is increasing, decreasing, or constant: $f(x) = x^5 - x^3$.
    $$\begin{cases} x^5 & x < 0 \\ 2 & x = 0 \\ 2x + 1 & x > 0 \end{cases}$$
13. If $f(x) = \begin{cases} 2 & x = 0 \\ 2x + 1 & x > 0 \end{cases}$, find $f(-2), f(2)$, and $f(0)$.
14. The graph of $y = x^3$ is shifted left by 3 units, reflected across the $x$–axis, and shifted down 5 units. Write the resulting equation.
15. The graph of $y = x^2$ is shifted right by 3 units, reflected across the $y$–axis, and shifted up 5 units. Write the resulting equation.
16. Beth has 3000 feet of fencing available to enclose a rectangular field. One side of the field lies along a river, so only three sides require fencing. Express the area $A$ of the rectangle as a function of $x$, where $x$ is the length of the side parallel to the river. For what value of $x$ is the area largest?
17. Find the equation in slope–intercept form of the line containing the points $(1, 3)$ and $(-1, 2)$.
18. Find an equation of the line perpendicular to the line $x - 2y = -5$ and containing the point $(0, 4)$.
19. Find an equation of the line parallel to the line $2x - y = -2$ and containing the point $(0, 0)$. 
20. The monthly cost $C$, in dollars, of a car rental agency is a weekly rate of $300 for a car and an additional charge of 10 cent for each mile driven.
a) What is the cost if you drive 100 miles?  
b) How many miles can you travel in a week for $1000? 

21. Solve the following system of linear equations: 
   \[
   \begin{align*}
   5x - y & = 13 \\
   2x + 3y & = 12 
   \end{align*}
   \]

22. The height, in feet, from the ground of a ball dropped from a 100-foot building $t$ seconds after it is dropped is given by the formula $h(t) = -16t^2 + 100$. At what time will the ball hit the ground? 

23. John sold 300 tickets for the vet dinner. Dog tickets cost $10.50 per ticket, and cat tickets cost $8.25 per ticket. If John collected $2972.25 for all the tickets he sold, how many dog tickets did John sell? 

24. A bank loaned out $12,000, part of it at the rate of 8% per year and the rest at the rate of 18% per year. If the interest received totaled $1000, how much was loaned at 8%? 

25. Find the standard form of the equation of the circle with center at $(1, 0)$ and containing the point $(-3, 2)$. 

26. Find the standard form of the equation of the circle endpoints of a diameter at $(4, 3)$ and $(0, 1)$. 

27. The length of a rectangle is 6 feet greater than its width. The area $A$ of the opening of a rectangular window is 40 square feet. Find the length of the rectangle. 

28. Solve $x^2 + 6x + 3 = 3$. 

29. An object is propelled vertically upward with an initial velocity of 20 meters per second. The distance $s$ (in meters) of the object from the ground after $t$ seconds is $s(t) = -4.9t^2 + 20t$. 
   a) When will the object be 15 meters above the ground?  
   b) When will it strike the ground?  
   c) Will the object reach a height of 100 meters? 

30. Determine, without graphing, whether the following function has a maximum or minimum value, then find that value: $f(x) = -x^2 + 10x - 4$. 

31. Determine, without graphing, whether the following function has a maximum or minimum value, then find that value: $f(x) = 4x^2 - 8x + 3$. 

32. Find the vertex for the following parabola: $f(x) = x^2 - 2x - 3$. 

33. How do you to tell whether a relation is a function or one-to-one function? 

34. Find the complex zeros of the function $f(x) = x^2 + x + 1$. 

35. Determine the character of the zeros of the equation $2x^2 + 3x - 4 = 0$. 

36. Form a polynomial of degree 3 with zeros: $-2$ of multiplicity 2, and 4 of multiplicity 1. 

37. Use the Factor Theorem to determine whether $x + 3$ is a factor of $f(x) = -4x^3 + 5x^2 + 8$. 

38. Use the Factor Theorem to determine whether $x - 2$ is a factor of $f(x) = 3x^4 - 6x^3 - 5x + 10$. 

39. Find all real zeros of $f(x) = x^4 - x^3 - 6x^2 + 4x + 8$, then use the real zeros to factor $f(x)$ completely. 

40. Find the complex zeros of the function $f(x) = x^4 + 2x^3 + 22x^2 + 50x - 75$. 

41. Solve for $x$: $x = \sqrt{3x + 4}$ 

42. Locate any vertical, horizontal, and/or oblique asymptotes of the following function: $f(x) = \frac{3x}{x + 4}$. 

43. Locate any vertical, horizontal, and/or oblique asymptotes of the following function: 
   \[ f(x) = \frac{x^3 - 8}{x^2 - 5x + 6} \]

44. Locate any vertical, horizontal, and/or oblique asymptotes of the following function: 
   \[ f(x) = \frac{5 - x^2}{3x^4} \]

45. Locate any vertical, horizontal, and/or oblique asymptotes of the following function: 
   \[ f(x) = \frac{4x^5}{x^3 - 1} \]

46. Identify the intercepts of the following function: 
   \[ f(x) = \frac{x^2 + x - 12}{x^2 - 4} \]

47. Identify the intercepts of the following function: 
   \[ f(x) = \frac{3x + 3}{2x + 4} \]

48. Solve the linear inequality: 
   \[ \frac{1}{4} + x \leq 7x + \frac{2}{3} \]

49. Solve the quadratic inequality: 
   \[ 6x^2 < 6 + 5x \]

50. Solve the rational inequality: 
   \[ \frac{2x + 5}{x + 1} \leq 0 \]

51. Solve the polynomial inequality: 
   \[ x^3 - 9x \leq 0 \]

52. If \( f(x) = 2x^2 - 1 \) and \( g(x) = 3x \), find the composite function \( (f \circ g)(x) \).

53. If \( f(x) = \frac{x}{2x + 3} \) and \( g(x) = \frac{3}{4x - 2} \), find the composite function \( (f \circ g)(x) \).

54. Find the inverse of the function: 
   \[ f(x) = \sqrt[3]{x + 8} \]

55. Find the inverse of the function: 
   \[ f(x) = \frac{3x + 1}{-x} \]

56. Determine if the following function is one–to–one: \( f(x) = |x + 5| \).

57. Determine if the following function is one–to–one: \( f(x) = x^3 - 7 \).

58. Solve for \( x \): 
   \[ 2^{2x-1} = 4 \]

59. Solve for \( x \): 
   \[ 9^x \cdot 27^{-1} = 3^{-1} \]

60. Write the exponential equation: 
   \[ 3^x = 4.6 \] in logarithmic form.

61. Write the logarithmic equation: 
   \[ \ln x = 4 \] in exponential form.

62. Use the change of base formula to evaluate \( \log_3 8 \) correct to four decimal places.

63. Expand \( \ln \left[ \frac{5x^2 \sqrt[3]{1 - x}}{4(x + 1)^2} \right] \), \( 0 < x < 1 \).

64. Condense \( 2 \log(x + 1) - \log(x + 3) - \log(x - 1) \).

65. Solve for \( x \): 
   \[ \log_3(x + 12) + \log_3(x + 4) = 2 \]

66. Solve for \( x \): 
   \[ \ln(x - 2) + \ln(2) = \ln(x + 3) \]

67. Find the amount that results from an investment of $100 invested at 4% compounded quarterly after a period of 2 years.

68. Find the amount that results from an investment of $100 invested at 12% compounded continuously after a period of 3.75 years.

69. The size \( P \) of a certain insect population at time \( t \) (in days) obeys the function \( P(t) = 500e^{0.02t} \).
   a) Determine the number of insects at \( t = 0 \) days.
   b) What is the growth rate of the insect population?
   c) What is the population after 10 days?
   d) When will the insect population reach 800?
   e) When will the insect population double?
MATH 1111 College Algebra
Practice Final Exam

1.  -4  2.  22  3.  No  4.  Yes
5.  \( D = [4, \infty) \)  6.  \( D = (-\infty, -2) \cup (-2, 2) \cup (2, \infty) \)
7.  \((fg)(x) = \frac{1}{x} + \frac{1}{x^2}, \quad D = (-\infty, 0) \cup (0, \infty) \)
8.  \((f - g)(x) = 1, \quad D = (-\infty, 0) \cup (0, \infty) \)
9.  Origin symmetry
10.  \( y \)-axis symmetry
11.  a. No  b. \(-22; (-2, -22) \)  c. \(-\frac{1}{3}, 2; (2, -2) \) and \([-\frac{1}{3}, -2) \)
    d. \( D = (-\infty, \infty) \)  e. \((0, 0) \) and \((\frac{5}{3}, 0) \)  f. \((0, 0) \)  g. \( x = 0, \frac{5}{3} \)
12.  Increasing \((-\infty, -0.77) \cup (0.77, \infty) \); decreasing \((-0.77, 0.77) \)
13.  4; 5; 2  14.  \( y = -(x + 3)^3 - 5 \)
15.  \( y = -(x - 3)^2 + 5 \)
16.  \( A(x) = 1500x - \frac{1}{2}x^2; \; x = 1500 \) maximizes area
17.  \( y = -\frac{1}{2}x + \frac{5}{2} \)
18.  \( 2x + y = 4 \)  19.  \( y = 2x \)
20.  a. \$310  b. 7000 miles
21.  \((3, 2) \)
22.  2.5 seconds  23.  221 tickets
24.  \$11,600  25.  \((x - 1)^2 + y^2 = 20 \)  26.  \((x - 2)^2 + (y - 2)^2 = 5 \)
27.  10 feet
28.  \( x = 0, -6 \)
29.  a. \( t = 0.99 \) seconds, and \( t = 3.09 \) seconds  b. \( t = 4.08 \) seconds  c. No
30.  Maximum; 21
31.  Minimum; -1
32.  \((1, -4) \)
33.  \( \text{VLT or HLT} \)  34.  \( x = -1 \pm i\sqrt{3} \)
35.  Two distinct real zeros
36.  \( f(x) = x^3 - 12x - 16 \)  37.  No  38.  Yes
39.  The real zeros are \(-2, -1, \) and \(2. \) \( f(x) = (x + 2)(x + 1)(x - 2) \)
40.  \(-3, 1, \pm 5i \)
41.  4
42.  \( x = -4, y = 3 \)
43.  \( x = 3, y = x + 5 \)
44.  \( x = 0, y = 0 \)
45.  \( x = 1, \) no horizontal or oblique
46.  \((-3, 0), (4, 0), \) and \((0, 3) \)
47.  \((-1, 0) \) and \((0, \frac{3}{4}) \)
48.  \([-\frac{5}{72}, \infty) \)
49.  \((-\frac{2}{3}, \frac{3}{2}) \)
50.  \((-\infty, -\frac{5}{2}) \cup (-1, \infty) \)
51.  \((-\infty, -3) \cup [0, 3] \).
52.  \((f \circ g)(x) = 18x^2 - 1 \)
53.  \((f \circ g)(x) = \frac{1}{4x} \)
54.  \( f^{-1}(x) = x^3 - 8 \)
55.  \( f^{-1}(x) = -\frac{1}{x + 3} \)
56.  No  57.  Yes  58.  \( x = \frac{3}{2} \)
59.  \( x = -1, -\frac{1}{3} \)
60.  \( \log_3 4.6 = x \)
61.  \( e^x = 4 \)
62.  2.5841
63.  \( \ln 5 + 2 \ln x + \frac{1}{3} \ln (1 - x) - \ln 4 - 2 \ln (x + 1) \)
64.  \( \log \left( \frac{(x + 1)^2}{(x + 3)(x - 1)} \right) \)
65.  \( x = -3 \)
66.  \( x = 7 \)
67.  \$108.29
68.  \$156.83
69.  a. 500 insects  b. 2%  c. 611 insects  d. 23.5 days  e. 34.7 days