

# Precalculus Honors

## Summer Packet

For all students enrolled in Precalculus Honors for 2009-2010:

Please complete the entire packet and bring it with you on the first day of school. This packet will be collected and graded. To receive credit, you must show ALL work on any problems that require work to find an answer. Show ALL work on a separate piece of paper. WE WILL COLLECT ONLY THE WORK PAPERS (not the packet itself). If you use your calculator, you must explain how you arrived at your answer. If this is not done you will not receive credit for the packet.

You will have a test on the material during the first week of school.

Please note that calculators are not provided for student use. It is recommended that each student have a graphing calculator (TI-83, TI-83 plus, TI-84, or TI-84 plus) of his or her own. Use of a TI-89, TI-92 or comparable is not permitted.

We look forward to having you in class next year.

Mrs. Snyder  
Mrs. Prishack

Use the appropriate procedure(s) to simplify each of the following rational expressions.

1.  $\left(\frac{x^2 + 2x - 3}{x + 2}\right)\left(\frac{x^2 + 2x}{x^2 - 1}\right)$

2.  $\frac{\left(\frac{5t^5}{8}\right)}{\left(\frac{15t^2}{12}\right)}$

3.  $\frac{1 + \frac{1}{t}}{1 - \frac{1}{t}}$

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

5.  $\frac{3}{1-x} - \frac{5}{1+x}$

6.  $\frac{y}{1+z} + \frac{1+z}{y}$

7.  $x^4(-2x)^3(6x^0)^{-2}$

8.  $-8y^4(2y)^{-2}(-3y)^{-5}$

9. Evaluate:  $\frac{8^{-\frac{1}{3}}}{16^{\frac{1}{2}}}$

10. Evaluate:  $\frac{3}{36^{\frac{1}{2}}}$

11. In what interval is the function defined?  $f(x) = \sqrt{x^2 + 5x + 4}$

12. Is this function one-to-one?  $y = |x+7|$

State whether the relation is a function. Write yes or no. State the domain and range of each function.

13.  $\{(-1,2), (3,10), (-2,20), (3,11)\}$

14.  $\{(0,2), (13,6), (2,2), (3,1)\}$

Given that  $x$  is an integer, state the relation representing each of the following by listing a set of ordered pairs. Then state whether the relation is a function. Write yes or no.

15.  $y = 3x^2 - 5$  and  $0 < x < 5$

16.  $|y| = |x|$  and  $0 < x < 2$

Name all values of  $x$  that are in the domain of the given function. Give answer in interval notation.

17.  $f(x) = \frac{x-2}{x+4}$

18.  $f(x) = \frac{1}{|2x+5|}$

19.  $f(x) = \sqrt{x^2 - 25}$

20.  $f(x) = \frac{x^2 + 25}{x^2 - 25}$

21.  $f(x) = \frac{x-10}{\sqrt{x^2-16}}$

22.  $f(x) = \frac{x-7}{x^2-1}$

Given that  $f(x) = |3x - 4| + 5$ , find each value.

23.  $f\left(\frac{1}{3}\right)$

24.  $f(0.5)$

25.  $f(-0.5)$

26.  $f(5d)$

Use the following functions for problems 27-39:

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

$$g(x) = 2x - 2$$

$$h(x) = 0$$

$$m(x) = \frac{4x}{x^2 - 9}$$

Find the domain and range of the following: Give answer in interval notation.

27.  $f(x)$

28.  $h(x)$

29.  $m(x)$

Find each of the following:

30.  $(fg)(x)$

31.  $\left(\frac{f}{h}\right)(x)$

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

33.  $g^{-1}(x)$

34.  $f(-5)$

35.  $g(0)$

36.  $m\left(\frac{1}{2}\right)$

37.  $(f + g)(-3)$

38.  $(m + h)(2)$

39.  $(f \circ g)(2)$

Given  $f(x) = \frac{2}{x+4}$ ,  $g(x) = x^2 - 2$ , find each function:

40.  $(f + g)(x)$

41.  $(f - g)(x)$

42.  $(fg)(x)$

43.  $\left(\frac{f}{g}\right)(x)$

For each of the following, find  $(f \circ g)(x)$  and  $(g \circ f)(x)$

44.  $f(x) = \frac{1}{3}x + 5$ ,  $g(x) = x - 3$

45.  $f(x) = \frac{1}{3x} + 5$ ,  $g(x) = 3x$

46.  $f(x) = 2x^2 - 5x + 1$ ,  $g(x) = 2x - 3$

47.  $f(x) = 3x^2 - 2x + 5$ ,  $g(x) = 2x - 1$

Determine whether the functions are inverses of each other or not. Write yes or no. Show your work.

48.  $f(x) = 3x - 5$ ,  $g(x) = \frac{x+5}{3}$

49.  $f(x) = \frac{2x-3}{5}$ ,  $g(x) = \frac{3x-5}{3}$

50.  $f(x) = 3x - 7$ ,  $g(x) = \frac{1}{3}x + 7$

51.  $f(x) = 4(x + 2)$ ,  $g(x) = \frac{x}{4} - 2$

State the inverse of each function. Tell whether the inverse is a function (yes or no).

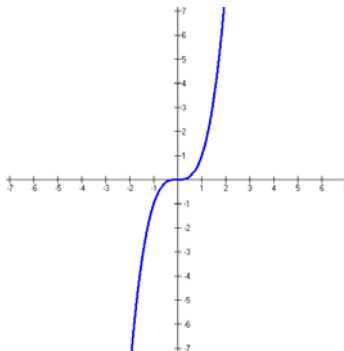
52.  $f(x) = 3x + 7$

53.  $f(x) = x^5$

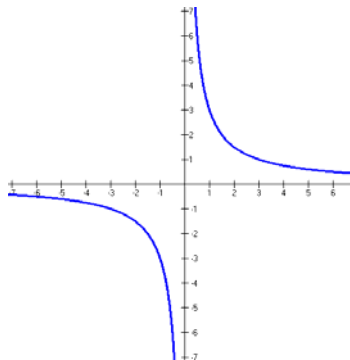
54.  $f(x) = x^2 + 4$

Find the domain and range of the functions:

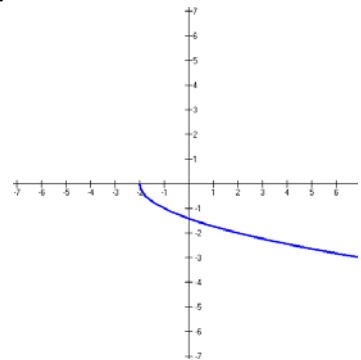
55.



56.



57.



Describe the transformation from the parent function  $g(x) = \sqrt{x}$  to the new function  $f(x)$ .

On graph paper, sketch the graphs of the functions below:

58.  $f(x) = \sqrt{x} - 1$

59.  $f(x) = 2\sqrt{x-2}$

60.  $f(x) = \sqrt{-x} + 2$

61.  $f(x) = \frac{1}{2}\sqrt{x+2}$

62. Given  $f(x) = \frac{1}{2}x - 1$  find  $f^{-1}(x)$ . On graph paper, graph both the function and the inverse on the same set of axes.

63. Given  $f(x) = -2x + \frac{1}{2}$  find  $f^{-1}(x)$ . On graph paper, graph both the function and the inverse on the same set of axes.

Simplify:

64.  $3\sqrt{28}$

65.  $\sqrt{242} \cdot \sqrt{3}$

66.  $3\sqrt{700} + 2\sqrt{7}$

67.  $\frac{1}{\sqrt{3}}$

68.  $\sqrt{\frac{1}{2}}$

69.  $\sqrt{\left(\frac{3}{4}\right)^2 + 1}$

70.  $\sqrt{72} + \sqrt{98}$

71.  $\frac{2}{\sqrt{5}}$

72.  $\frac{4\sqrt{2}}{5} - \frac{3}{\sqrt{2}}$

For questions 84-86, factor completely:

73.  $4x^2 + 5x - 6$

74.  $8x^3 - 27y^6$

75.  $3x^3 - 15x + 2x^2y - 10y$

Solve for  $x$ . Leave answers in terms of  $\pi$ :

76.  $\pi = \frac{5\pi}{6} \div x$

77.  $2\pi - x = \frac{5\pi}{3}$

78.  $\frac{180}{\pi} = \frac{330}{x}$

Solve each equation algebraically. Verify your solution using a graphing utility.

79.  $\frac{x+1}{3} + \frac{x+2}{7} = 5$

80.  $z^2 + z - 12 = 0$

$$81. (x+7)(x-1) = (x+1)^2$$

$$82. \sqrt{15-2x} = x$$

$$83. |1-4t| = 5$$

$$84. \left| \frac{x}{3} + \frac{2}{5} \right| = 2$$

Solve for indicated variable. The letters a, b, and c are constants.

$$85. \frac{x}{a} + \frac{x}{b} = c, a \neq 0, b \neq 0, a \neq -b \text{ for } x$$

$$86. S = \frac{a}{1-r} \text{ for } r$$

Find the real solutions, if any, of each equation. Use the quadratic formula. Verify your results using a graphing utility.

$$87. x^2 - 4x + 2 = 0$$

Solve each inequality algebraically. Use interval notation for the solution. Graph the solution set on a number line.

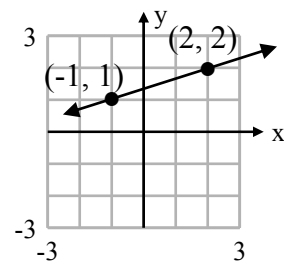
$$88. \frac{1}{2}(x-4) > x+8$$

$$89. -5 \leq 4-3x \leq 2$$

$$90. |1-4x| < 5$$

$$91. x^2 + 3x - 4 < 0$$

92. (a) Find the slope of the line and (b) interpret the slope.



For 93 & 94, find an equation for the line with the given properties. Express your answer using either the general form or the slope-intercept form of the equation of a line, whichever you prefer.

93. x-intercept = 2, y-intercept = -1

94. Parallel to the line  $y = 2x$ ; containing the point  $(-1, 2)$

95. Find the slope and y-intercept of the line:  $2x - 3y = 6$  Graph the line by hand. Check your graph using a graphing calculator.

Find each of the following. Give exact answers.

96. The short leg of a  $30^\circ$ -  $60^\circ$  -  $90^\circ$  triangle is 3 inches. Find the measures of the other two sides.

97. The leg of a  $45^\circ$ -  $45^\circ$ -  $90^\circ$  triangle is 4 centimeters. Find the measures of the other two sides.

98. The long leg of a  $30^\circ$ -  $60^\circ$  -  $90^\circ$  triangle is 3 inches. Find the measures of the other two sides.

99. The hypotenuse of a  $45^\circ$ -  $45^\circ$ -  $90^\circ$  triangle is 4 centimeters. Find the measures of the legs.

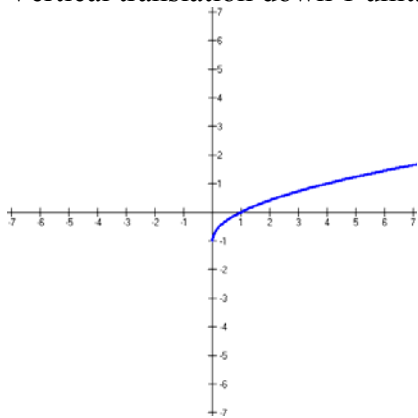
100. The hypotenuse of a  $30^\circ$ -  $60^\circ$  -  $90^\circ$  triangle is 3 inches. Find the measures of the other two sides.

## Answers

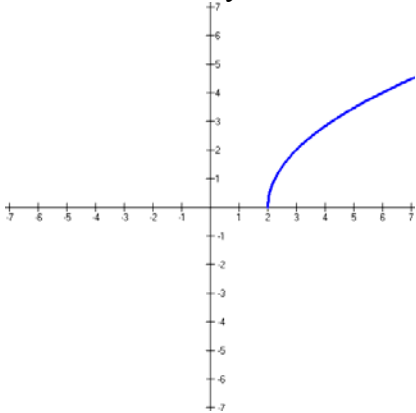
- $\frac{x(x+3)}{(x+1)}$
- $\frac{t^3}{2}$
- $\frac{t+1}{t-1}$
- $\frac{x^2+4x-6}{2x^2}$
- $\frac{2(4x-1)}{(1-x)(1+x)}$
- $\frac{y^2+1+2z+z^2}{y(1+z)}$  or  $\frac{y^2+(1+z)^2}{y(1+z)}$
- $-\frac{2}{9}x^7$
- $\frac{2}{243y^3}$
- $\frac{1}{8}$
- $\frac{1}{2}$
- $(-\infty, -4] \cup [-1, \infty)$
- No.
- No. Domain  $\{-2, -1, 3\}$  Range  $\{2, 10, 11, 20\}$
- Yes. Domain  $\{0, 2, 3, 13\}$ . Range  $\{1, 2, 6\}$
- $\{(1, -2), (2, 7), (3, 22), (4, 43)\}$ . Yes.
- $\{(1, 1), (1, -1)\}$ . No.
- $(-\infty, -4) \cup (-4, \infty)$
- $(-\infty, -\frac{5}{2}) \cup (-\frac{5}{2}, \infty)$
- $(-\infty, -5] \cup [5, \infty)$
- $(-\infty, -5) \cup (-5, 5) \cup (5, \infty)$

21.  $(-\infty, -4) \cup (4, \infty)$
22.  $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$
23. 8
24. 7.5
25. 10.5
26.  $|15d - 4| + 5$
27. Domain:  $(-\infty, \infty)$  Range:  $[2, \infty)$
28. Domain:  $(-\infty, \infty)$  Range:  $\{0\}$
29. Domain:  $(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$  Range:  $(-\infty, \infty)$
30.  $8x^3 - 16x^2 + 14x - 6$
31. Undefined.
32.  $16x^2 - 40x + 27$
33.  $g^{-1}(x) = \frac{x}{2} + 1$
34. 123
35. -2
36.  $\frac{-8}{35}$
37. 43
38.  $\frac{-8}{5}$
39. 11
40.  $\frac{x^3 + 4x^2 - 2x - 6}{x + 4}$
41.  $\frac{-x^3 - 4x^2 + 2x + 10}{x + 4}$
42.  $\frac{2x^2 - 4}{x + 4}$
43.  $\frac{2}{(x + 4)(x^2 - 2)}$
44.  $(f \circ g)(x) = \frac{1}{3}x + 4,$   
 $(g \circ f)(x) = \frac{1}{3}x + 2$

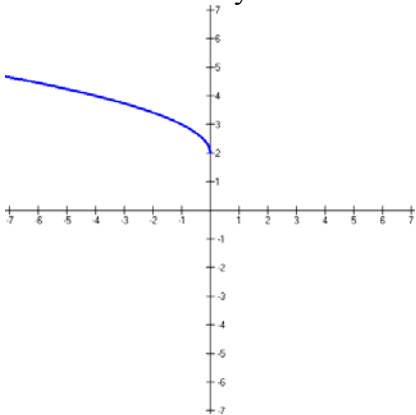
45.  $(f \circ g)(x) = \frac{1}{9x} + 5$   $(g \circ f)(x) = \frac{1}{x} + 15$
46.  $(f \circ g)(x) = 8x^2 - 34x + 34$ ,  $(g \circ f)(x) = 4x^2 - 10x - 1$
47.  $(f \circ g)(x) = 12x^2 - 16x + 10$   $(g \circ f)(x) = 6x^2 - 4x + 9$
48. Yes.
49. No.
50. No.
51. Yes.
52.  $f^{-1}(x) = \frac{1}{3}x - \frac{7}{3}$ , Yes.
53.  $f^{-1}(x) = \sqrt[3]{x}$ , Yes.
54.  $f^{-1}(x) = \pm\sqrt{x-4}$ , No.
55. Domain:  $(-\infty, \infty)$   
Range:  $(-\infty, \infty)$
56. Domain:  $(-\infty, 0) \cup (0, \infty)$       Range:  $(-\infty, 0) \cup (0, \infty)$
57. Domain:  $[-2, \infty)$  Range:  $(\infty, 0]$
58. Vertical translation down 1 unit.



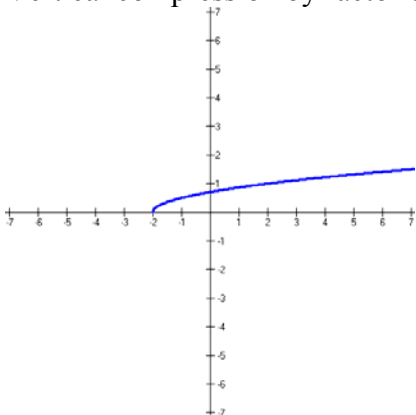
59. Horizontal translation 2 to the right.  
Vertical stretch by a factor of 2.



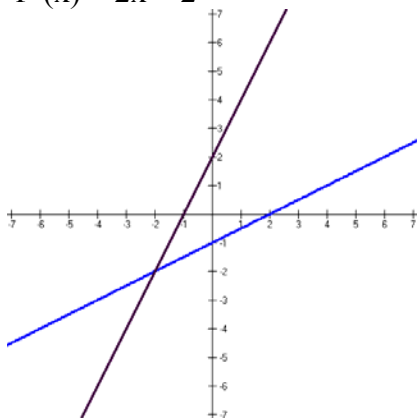
60. Vertical translation up 2 units.  
Reflection across y-axis.



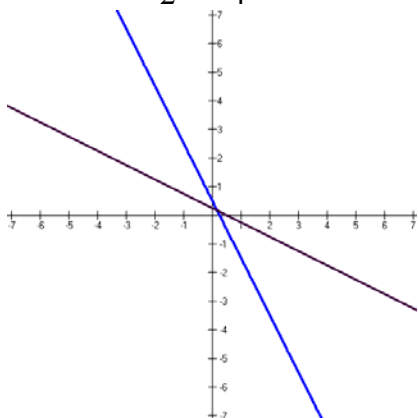
61. Horizontal translation 2 units to the left.  
Vertical compression by factor of  $\frac{1}{2}$ .



62.  $f^{-1}(x) = 2x + 2$



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



64.  $6\sqrt{7}$

65.  $11\sqrt{6}$

66.  $32\sqrt{7}$

67.  $\frac{\sqrt{3}}{3}$

68.  $\frac{\sqrt{2}}{2}$

69.  $\frac{5}{4}$

70.  $13\sqrt{2}$

71.  $\frac{2\sqrt{5}}{5}$

72.  $\frac{-7\sqrt{2}}{10}$
73.  $(4x - 3)(x + 2)$
74.  $(2x - 3y^2)(4x^2 + 6xy^2 + 9y^4)$
75.  $(3x + 2y)(x^2 - 5)$
76.  $\frac{5}{6}$
77.  $\frac{\pi}{3}$
78.  $\frac{11\pi}{6}$
79.  $\frac{46}{5}$
80.  $z = -4, z = 3$
81.  $x = 2$
82.  $x = 3$
83.  $t = \frac{3}{2}, t = -1$
84.  $x = \frac{24}{5}, x = \frac{-36}{5}$
85.  $x = \frac{abc}{a+b}$
86.  $r = \frac{a-S}{-S}$  or  $r = \frac{S-a}{S}$
87.  $x = 2 \pm \sqrt{2}$
88.  $(-\infty, -20)$
89.  $\left[\frac{2}{3}, 3\right]$
90.  $\left(-1, \frac{3}{2}\right)$
91.  $(-4, 1)$
92. a)  $\frac{1}{3}$       b) up one, right 3

93.  $y = \frac{1}{2}x - 1$

94.  $y = 2x + 4$

95.  $y = \frac{2}{3}x - 2$

96. Hypotenuse = 6in., Long Leg =  $3\sqrt{3}$  in.

97. Leg = 4cm., Hypotenuse =  $4\sqrt{2}$  in.

98. Hypotenuse =  $2\sqrt{3}$  in., Short Leg =  $\sqrt{3}$  in.

99. Leg =  $2\sqrt{2}$  cm.

100. Long Leg =  $\frac{3\sqrt{3}}{2}$  in., Short Leg =  $\frac{3}{2}$  in.