

Lawrence Academy
Mathematics Department
Math 3Honors
Summer Work 2019

Students enrolling in Math 3Honors must complete this summer Math work. These pages are intended to review the topics of linear, absolute value and quadratic functions, complex numbers, and transformations of functions. It also covers domain & range, exponent properties, algebraic properties and rational expressions.

Students enrolling in Math 3Honors must bring this work with them on their first day of classes in September.

If after reviewing the summer work you feel that Math 3Honors is not the correct placement, please contact Theresa Ryan, Mathematics Department Chair, via email at teryan@lacademy.edu

Math 3 Honors Summer Work 2019

Name: _____ Date: _____

Linear Equations

Directions: Solve for x in each equation.

1. $\frac{5}{a} = \frac{b}{x}$

2. $\frac{a+x}{b-x} = c$

3. $\frac{7}{a} = \frac{13}{x} - \frac{4}{b}$

4. $\frac{x-a}{x-b} = \frac{c}{d}$

5. $\frac{a}{bx-c} = \frac{8}{x-a}$

6. $\frac{x}{4} + \frac{a-2}{12} = \frac{a-5}{3}$

7. $5(h+x) = \frac{7-ax}{3}$

8. $(x-c)(x+d) = 0$

9. $(x^2 - 1) = 0$

10. Find a number b such that the three lines in the xy -plane given by the equation $y = 3x + b$, $y = 2x - 5$, and $y = -7x + 6$ have a common intersection point.

11. Find a number t such that the line in the xy -plane containing the points $(t, 4)$ and $(2, -1)$ is perpendicular to the line $y = 8x - 7$.
12. Find a number t such that the line containing the points $(t, -2)$ and $(-3, 5)$ is perpendicular to the line that contains the points $(3, 7)$ and $(5, 11)$.

Absolute Value Equations

Directions: Solve the following equations.

13. $|2x| = 18$
14. $|x| = -6$
15. $|x - 4| = 0.01$
16. $9 - |x - 6| = -2$
17. $\frac{1}{3}|5 - 2x| = \frac{7}{9}$

Directions: For each function

- Write out in words what transformation is occurring
 - Graph and clearly label at least three points
 - Find the domain and range
18. $f(x) = \frac{1}{4}|x + 1|$
19. $f(x) = -3|x - 2| + 2$

Quadratic Equations

Directions: Solve the given equations by factoring or quadratic formula.

20. $x^2 + x - 20 = 0$

21. $x^2 - 7x + 12 = 0$

22. $4x^2 - 4x - 15 = 0$

23. $2x^2 + 7x = -3$

24. $6x(x - 1) = 21 - x$

25. $\frac{x+1}{x-1} = \frac{3x}{3x-6}$

26. $(x + 2)^2 = (x - 4)^2$

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

28. $\frac{4}{x-1} + \frac{2}{x+1} = \frac{35}{x^2-1}$

Completing the Square

Completing the Square

"Completing the Square" is where you ...

... take a [Quadratic Equation](#) like this:

$$ax^2 + bx + c = 0$$



and turn it into this:

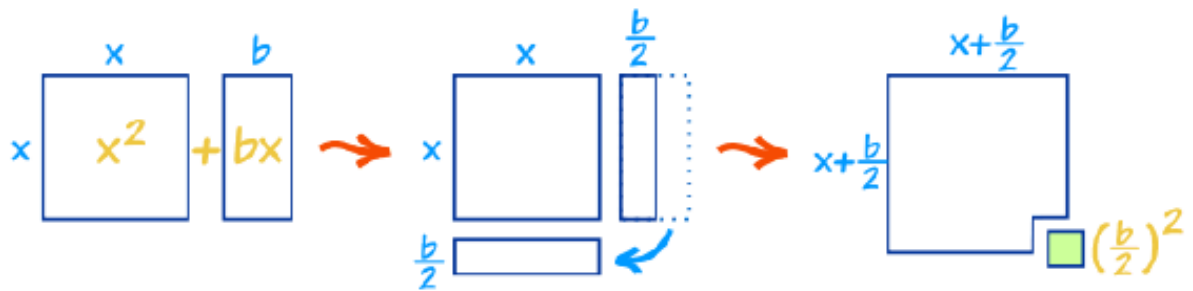
$$a(x+h)^2 + k = 0,$$

where $(-h,k)$ is the vertex of the parabola

Completing the Square

Say we have a simple expression like $x^2 + bx$. Having x twice in the same expression can make life hard. What can we do?

Well, with a little inspiration from Geometry we can convert it, like this:



As you can see $x^2 + bx$ can be rearranged *nearly* into a square ...

... and we can **complete the square**, but there is a missing $(b/2)^2$

In Algebra it looks like this:

$$x^2 + bx = (x + b/2)^2 - (b/2)^2$$

Directions: Covert each of the equations below to vertex form, state the vertex of the parabola, then solve for x if $y = 0$.

29. $x^2 + 6x + 10 = y$

30. $5x^2 + 15x + 3 = y$

31. $x^2 + 5x - 9 = y$

32. $2x^2 + 7x + 1 = y$

Complex Numbers

Directions: Simplify as much as possible

33. $\sqrt{-25}$

34. $-\sqrt{-4}$

35. $-\sqrt{36}$

36. $\sqrt{-225}i^8$

37. $-i^{111}$

38. i^{75}

39. $-(-i)^{26}$

40. $(10 + 2i) - (3 + 7i)$

41. $(3 - 5i) - (-11 - 6i)$

42. $-2(6 + 3i)$

43. $(6 - 5i)(6 + 5i)$

44. $(2 + 7i)(-4 + 3i)$

45. $(2 - i)^2$

46. $(-2 + 4i)^2$

47. $\frac{-3}{1-i}$

48. $\frac{-2-2i}{5+2i}$

49. $\frac{2+6i}{-4+3i}$

Domain and Range of Functions

Directions: State the domain of each of the following functions.

50. $g(x) = \frac{x}{5-x}$

51. $m(x) = \frac{1}{\sqrt{9-x}}$

52. $f(x) = \frac{\sqrt{x+23}}{x^2-9}$

$$53. \quad h(x) = \frac{x-8}{\sqrt{3x-12}-3}$$

$$54. \quad n(x) = \sqrt{121 - x^2}$$

$$55. \quad b(x) = \sqrt[3]{x + 8}$$

Transformations of Parent Functions:

Directions: Given the equation, it may help to draw the parent function first

a. State in words the transformation occurring

b. Graph each function

c. Label at least 3 points

d. State the domain and range

$$56. \quad f(x) = -x^2 + 3$$

$$57. \quad f(x) = (x + 4)^3 - 2$$

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

$$59. \quad f(x) = -\frac{1}{(x+3)} + 5$$

$$60. \quad f(x) = \frac{1}{(x-7)^2}$$

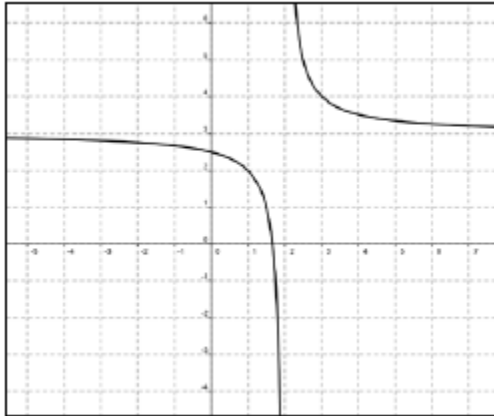
$$61. \quad f(x) = -\sqrt[3]{x} + 4$$

Directions: Given the graph

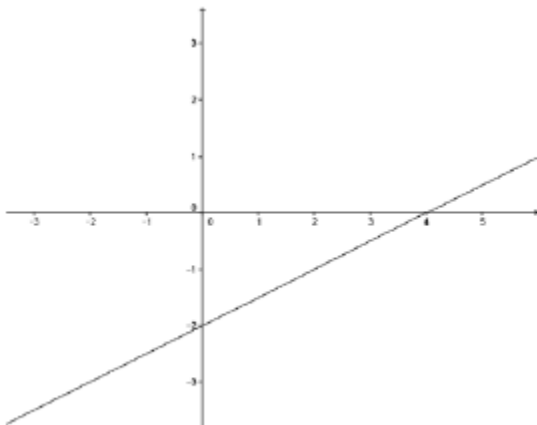
a. State the domain and range

b. Write the equation

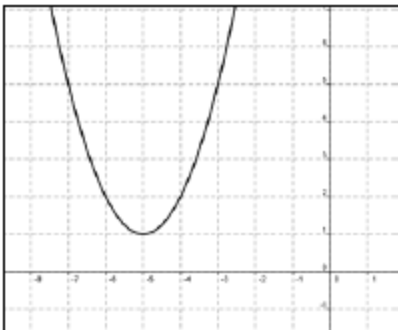
62.



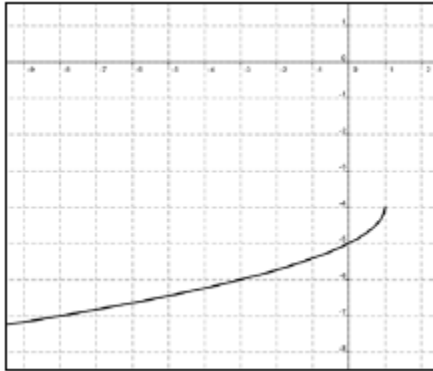
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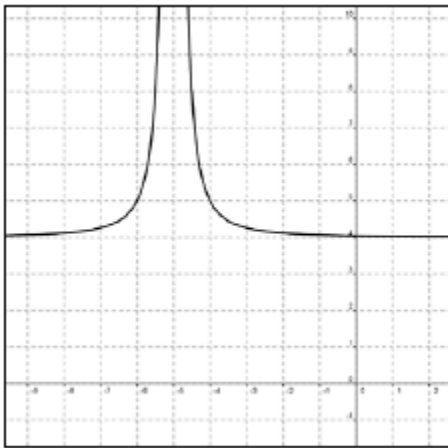
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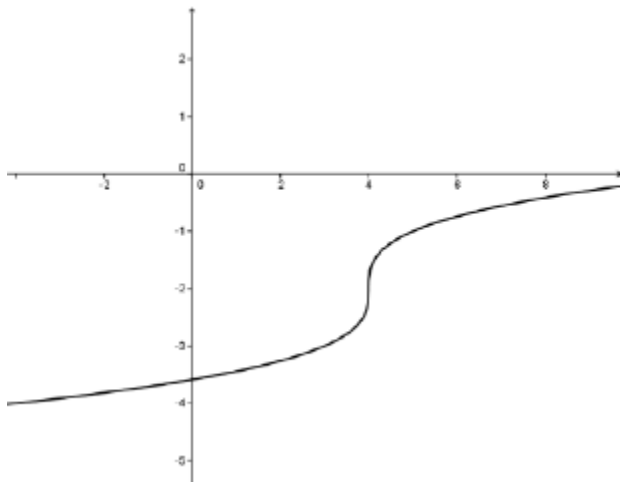
65.



66.



67.



Algebraic Properties

Directions: Expand the given expression.

68. $(x - y)(a + b - c)$

69. $(3x - 5)^2$

70. $(x + 7)(x - 2)(x + 6)$

71. $a^2x(x - a)\left(\frac{1}{x} - \frac{1}{a}\right)$

Directions: Simplify the given expression as much as possible

72. $-3(2x - 4(y + 5z)) + 9y$

73. $\frac{3}{5} + \frac{7}{8}$

74. $\frac{x+3}{5} + \frac{7}{y}$

75. $\frac{2}{7} \cdot \frac{6}{5} + \frac{3}{4} \cdot 2$

76. $\frac{2}{5} \cdot \frac{x+3}{9} - \frac{3}{2}$

77. $\frac{1}{x-y}\left(\frac{x}{y} - \frac{y}{x}\right)$

78. $\frac{(x+a)^2 - x^2}{a}$

$$79. \quad \frac{\frac{x-8}{y}}{\frac{z}{x+8}}$$

Exponent Properties

Directions: Fully simplify each expression by applying the properties of exponents

$$80. \quad \frac{5^{-2} \cdot 5^{-4}}{5^{-6}}$$

$$81. \quad \frac{30(x^4 y^3)^4}{4(xy^3)^3}$$

$$82. \quad \frac{x^0 - 4x^0}{3x^0}$$

$$83. \quad \left(\frac{14x^{-2}y^4z^{-2}}{7x^3y^{-1}} \right)^{-2}$$

$$84. \quad \frac{18(x^{-2}yz)^{-2}}{(2x^{-3}z^0)^3}$$

$$85. \quad 5 \cdot 4m^{\frac{3}{2}} \cdot 3m^{-2}$$

$$86. \quad 8b^{\frac{1}{2}} \cdot b^{\frac{4}{3}}$$

$$87. \quad \frac{2y^{\frac{1}{4}}}{4x^{-\frac{2}{3}}y^{\frac{3}{2}} \cdot 3y^{\frac{1}{2}}}$$

$$88. \quad \left(\frac{x^{\frac{1}{2}}y^{-2}}{yx^{-\frac{7}{4}}} \right)^6$$

Directions: Write each expression in radical form

89. $8^{\frac{4}{3}}$

90. $(81x)^{\frac{3}{2}}$

91. $(5x)^{-\frac{1}{2}}$

92. $(5x)^{-\frac{5}{4}}$

Directions: Write each expression in exponential form

93. $\frac{1}{(\sqrt{3k})^5}$

94. $\frac{1}{\sqrt{6p}}$

Solving Rational Equations

Directions: Solve each of the following equations

95. $x = \frac{3}{x-5}$

96. $7 = \frac{5}{x+2} + x$

97. $\frac{x^2-1}{x-3} = \frac{8}{x-3}$

98. $\sqrt{x+5} - 2x = 1$

99. $\sqrt{3x+6} = \sqrt{x^2+2}$