The Math Department at Quarry Lane School has a challenging and enriching curriculum. We want to ensure each student is well prepared for the following school year. It's important for our students to keep up with their math skill over for the long summer break. Studies indicate that students lose a huge percentage of what they learned from the prior school year. In order to be proactive, Quarry Lane School Math Department would like to provide you with the following math grade level supplements.

These packets are for your student to practice during the long summer break. Each packet contains practice worksheets. Your student can do the practice worksheets at their own pace. Please encourage your student to complete this work and grade it using the answer keys provided.

Have a safe and fun-filled summer!

Order of Operations

PEMDAS

1. Parentheses (All Grouping symbols) – Brackets, parentheses, curly brackets and groups above and below a fraction bar
2. Exponents
3. Multiplication and Division from left to right
4. Addition and Subtraction from left to right

Simplify

1. $(9 \times 18) + 623 \div 7 \times 19 - (1 + 229)$

2. $432 \div 6 - (3 - 274 \times 46 + 120)$

3. $(8 \times 440) \times 322 + (23 \times 21)$

4. $90 \div 2 \times 238 + 3 - 42$

5. $(5 - 45) + 936 \div 9 - (96 \div 8)$

6. $86 + 29 \times 47 + (147 - 468) - 43$

Fill in the missing operation.

7. $83 \square 5 + 32 \div 8 = 419$

8. $8 \square 308 \times 846 \div 6 = 43{,}436$

Simplify.

9. $(8 \times 291) - 670 \div 5 + 3 \times (2 - 24 + 29) \times 455$

10.

$$\frac{13.9 - 4^2 + \bar{}179.3 \div 11 - \bar{}0.9}{29 + (187.58 \div 11.3 - 3^3)}$$

Fractions

Adding and Subtracting Fractions

1. Determine if the fractions have a common denominator. If so, skip to step 4 .
2. Find the least common denominator (LCD) by factoring each denominator multiple the shared factors by the unshared factors.
3. Find the equivalent fractions with the LCD.
4. Add numerators and place over common denominator.
5. Simplify the resulting fraction.

Example

$$\frac{a}{b}+\frac{c}{d}=\frac{a}{b}\cdot\frac{d}{d}+\frac{c}{d}\cdot\frac{b}{b}=\frac{ad}{bd}+\frac{cb}{bd}=\frac{ad+cb}{bd}$$

$$\frac{1}{5}+\frac{3}{10}=\frac{1}{6}\cdot\frac{5}{5}+\frac{3}{10}\cdot\frac{3}{3}=\frac{5}{30}+\frac{9}{30}=\frac{14}{30}=\frac{7}{15}$$

Multiplying Fractions

1. Multiply across the numerator.
2. Multiply across the denominator.
3. Place resulting numerator over resulting denominator.

Example

$$\frac{a}{b}\cdot\frac{c}{d}=\frac{ac}{bd}$$

Dividing Fractions

Multiply the numerator by the reciprocal of the denominator.

Example

$$\frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\cdot\frac{d}{c}=\frac{ad}{bc}$$

Add or subtract these fractions.

11. $\frac{13}{15}+\frac{1}{3}=$

12. $\frac{3}{4}+\frac{5}{6}=$

13. $\frac{7}{10}+\frac{2}{3}=$

14. $\frac{2}{5}-\frac{1}{5}=$

15. $\frac{17}{18}-\frac{1}{6}=$

16. $\frac{5}{6}-\frac{7}{9}=$

17. $\frac{7}{8}-\frac{5}{12}$

Multiply these fractions. Be sure to cross cancel first if possible, especially for large numbers.

18. $\frac{1}{2}\left(\frac{3}{4}\right)=$

19. $\frac{8}{9}\left(\frac{3}{4}\right)=$

20. $\frac{2}{3}\left(\frac{4}{3}\right)=$

21. $\frac{1}{3}\left(\frac{4}{5}\right)\left(\frac{3}{7}\right)=$

22. $\frac{21}{25}\left(\frac{10}{21}\right)=$

23. $\frac{15}{18}\left(\frac{12}{25}\right)=$

24. $\frac{64}{78}\left(\frac{27}{40}\right)=$

Divide these fractions.

25. $\frac{1}{2}\div\frac{2}{3}=$

26. $\frac{4}{8}\div\frac{8}{15}=$

27. $\frac{7}{8}\Big/\frac{21}{16}$

28. $\dfrac{\frac{16}{35}}{\frac{10}{25}}$

29. $\dfrac{\frac{12}{15}}{\frac{18}{20}}$

Algebraic Expressions

like terms – contain the same variables to the same degree
coefficient – the numerical part of a term
simplified – when all like terms have been combined and all parentheses have been removed

Adding and Subtracting Expressions

1. Rearrange and group like terms
2. Simplify by combining like terms

Multiplying and Dividing Expressions

Distributive property – multiplication can be distributed over addition and subtraction

-(4x + 3) = -4x -3 (the negative gets applied to all terms)

Dividing

$$\frac{a+b}{c}=\frac{a}{c}+\frac{b}{c} \text{ and } \frac{a-b}{c}=\frac{a}{c}-\frac{b}{c}$$

Simplify the following expressions.

30. $(6z-3)+(4z-5)$

31. $(12p-3q+5r)-(8p+2q-r)$

32. $-7x\cdot 3$

33. $-7x\cdot 3x$

34. $6x\cdot 5-2x\cdot 3$

35. $-36x\div 6x$

36. $\dfrac{22-4x}{22}$

37. $\dfrac{-15x+10}{5}$

38. Which of the expressions are equivalent?

a. $(-3x+8)/4$ b. $(8-3x)\cdot\frac{1}{4}$ c. $(-8+3x)+1-4$ d. $\frac{1}{4}-(-3x+8)$

39. Which of the expressions are equivalent?

a. $\dfrac{3(2x-1)}{3}$ b. $(2x-1)$ c. $\dfrac{4(2x-1)}{8}$ d. $\dfrac{2(3x-1)}{2}$

Equations

Subtraction Property of Equality – For all real numbers a, b, and c, if $a = b$, then $a - c = b - c$.

Addition Property of Equality - For all real numbers a, b, and c, if $a = b$, then $a + c = b + c$.

Division Property of Equality - For all real numbers a, b, and $c \neq 0$, if $a = b$, then $\frac{a}{c} = \frac{b}{c}$.

Addition Property of Equality - For all real numbers a, b, and c, if $a = b$, then $ac = bc$.

Solve the equation.

40. $-8 - 12q = -7 - 11q$

41. $9w - 4(w - 2) = 3(w + 1) - 9$

42. $7c + 2 - 4(2c + 1) = 3(c - 3)$

Solve each equation for the indicated variable.

43. $\frac{b + k}{j} = t$, for k

44. $\frac{-b}{c} + 5 = d$, for c

Inequalities/ Absolute Value

An **inequality** is a statement that two expressions are not equal.

Addition and Subtraction Properties of Inequality

Let a, b, and c be real numbers.

If $a < b$, then $a + c < b + c$ or if $a > b$, then $a + c > b + c$.

If $a < b$, then $a - c < b - c$ or if $a > b$, then $a - c > b - c$.

Multiplication and Division Properties of Inequalities

For c>0:

If $a < b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$.

If $a > b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$.

For c<0:

If $a < b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$.

If $a > b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$.

Compound Inequalities

AND – intersection of the two inequalities; part where they overlap

OR – union of the two inequalities; total of the two

Absolute value

$|a| = a, \ a \geq 0$

$|a| = -a, \ a \leq 0$

Solve each inequality.

45. $|x + 3| > 8$

46. $|x + 5| \leq 6$

Solve each equation.

47. $|2x - 1| + 3 = 4$

Linear Functions

A **function** is a pairing between two sets of numbers in which each element of the first set is paired with exactly one element of the second set.

Function – $(-2, 5), (-1, 2), (0, 1), (1, 2), (2, 5)$ (notice the second coordinate CAN repeat)

Not a function - $(2, 7), (5, 8), (3, 9), (2, 10), (4, 11)$ (2 repeats as the first coordinate)

Domain – the set of all the first coordinates (In the function above, -2, -1, 0, 1, 2)
Range – the set of all the second coordinates (In the function above, 5, 2, 1)

Slope

$$\frac{rise}{run} = m = \frac{x_2 - x_1}{y_2 - y_1}$$

Slope of a vertical line is undefined. Slope of a horizontal line is 0.

Slope-Intercept Form
slope of m and y-intercept of b: $y = mx + b$
vertical line: y = b
horizontal line: x = a, where a if the x-intercept

Example: Write an equation in slope-intercept form for the line that contains (-1, 3) and (2, -3).

First, find m. $m = \frac{-3 - 3}{2 - (-1)} = -2$

Substitute for x, y, and m in the equation $y = mx + b$.

$3 = -2(-1) + b$; $b = 1 \rightarrow y = -2x + 1$

Point-Slope Form
The form $y - y_1 = m(x - x_1)$

Parallel Lines

Two different lines with the same slope, the lines are parallel.
Two parallel, vertical lines have undefined slopes.
Two parallel, horizontal lines have a slope of 0.

Perpendicular Lines

If the slopes of two lines are m and $-\frac{1}{m}$, the lines are perpendicular.

48. Determine whether the relation is a function. Then state its domain and range.
(12, 7), (6, 5), (12, -7), (2, 6)

Write an equation in slope-intercept form for the line that is described.

49. Contains (0, -8) and (5, -6)
50. Contains (0, -3) and is parallel to the line y = 5/8x – 2
51. Contains (2, 6) and is perpendicular to the line y = 1/2x +4

Exponents

Exponents

If x is any number and m is an integer exponent greater than 1, then

$$x^m = \underbrace{x \cdot x \cdot x \cdot \ldots \cdot x}_{m \text{ factors}}$$

When $m = 1$, $x^m = x^1 = x$.

Definition of Monomial

A monomial is an algebraic expression that is either a constant, a variable, or a product of a constant and one or more variables. The constant is called the coefficient.

Powers of −1

Even powers of -1 are equal to 1. Odd powers of -1 are equal to -1.

Definition of Negative Exponent

If x is any number except zero and n is any integer, then $x^{-n} = \frac{1}{x^n}$.

Zero as an Exponent

For any nonzero number x, $x^0 = 1$.

Summary of the Properties of Exponents

Let x and y be any numbers and let m and n be integers.

Product of Powers	Quotient of Powers	Power of a Power	Power of a Product	Power of a Fraction
$x^m \cdot x^n = x^{m+n}$	$\frac{x^m}{x^n} = x^{m-n}$	$(x^m)^n = x^{mn}$	$(xy)^n = x^n y^n$	$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$

Simplify each expression. Write each expression with positive exponents only.

52. $x^{-2}y$

53. $x^0 y^5$

54. $\left(3x^2y^5\right)^2$

55. $\left(-5w^2z\right)\left(4wz^4\right)$

56. $\dfrac{52x^8y^5z^6}{-13x^5y^5z}$

57. $\dfrac{a^{-7}b^3c^{-1}}{a^3bc^{-4}}$

58. $\left(\dfrac{3x^4}{y}\right)^{-3}$

59. $\left(\dfrac{4a^{-5}b^3}{12a^3b^{-5}}\right)^0$

Write each number in scientific notation.

60. -5716

61. 0.000083

Simplify, then write the answer in scientific notation.

62. $\left(2 \times 10^4\right)\left(4.1 \times 10^3\right)$

63. $\dfrac{\left(8.4 \times 10^8\right)}{\left(4 \times 10^5\right)}$

Polynomials and Factoring

Special Products

For any real numbers a and b and for any expressions involving real numbers and variables:

$$(a + b)(a - b) = a^2 - b^2$$
$$(a + b)(a + b) = (a + b)^2 = a^2 + 2ab + b^2$$
$$(a - b)(a - b) = (a + b)^2 = a^2 - 2ab + b^2$$

Use the Distributive Property to find the product of a monomial and a binomial.

Find the product $2x(x - 13)$.

$$2x(x - 13) = (2x \cdot x) - (2x \cdot 13) = 2x^2 - 26x$$

Multiply two binomials by using the Distributive Property or the FOIL method.

Use the Distributive Property to find $(x + 10)(x - 3)$.

$$\begin{aligned}(x + 10)(x - 3) &= x(x - 3) + 10(x - 3)\\ &= x^2 - 3x + 10x - 30\\ &= x^2 + 7x - 30\end{aligned}$$

Use the FOIL method to find $(7w - 2)(w + 1)$.

$$\begin{aligned}(7w - 2)(w + 1) &= 7w^2 + 7w - 2w - 2\\ &= 7w^2 + 5w - 2\end{aligned}$$

Simplify and write the answer in standard form.

64. $\left(18x^4 - 2x^3 - 7x + 8\right) - \left(9x^4 - 6x^3 - 5x + 7\right)$

65. $\left(2x - 3\right)\left(5x + 3\right)$

66. $\left(x + 3\right)\left(x - 3\right)$

67. $\left(8x^3 + 3\right)\left(x^2 - 5\right)$

68. $\left(x + 1\right)\left(x^2 - x + 1\right)$

69. $\left(x - 3\right)^2$

Factor a polynomial by using the GCF or by grouping.

Factor $24x^4 - 12x^2 + 18x$ by using the GCF.

The GCF is $6x$. Factor $6x$ from each term.

$$24x^4 - 12x^2 + 18x = 6x(4x^3 - 2x + 3)$$

Factor $3x^2 + 3x + 7x + 7$ by grouping.

Factor and regroup the terms with a common binomial factor. Then use the Distributive Property.

$$\begin{aligned}3x^2 + 3x + 7x + 7 &= (3x^2 + 3x) + (7x + 7)\\ &= 3x(x + 1) + 7(x + 1)\\ &= (3x + 7)(x + 1)\end{aligned}$$

Factor out the greatest common factor.

70. $3x^2 + 6x$

71. $9x^4 - 18x^3 + 27x^2$

72. $x\left(x + 5\right) + 3\left(x + 5\right)$

73. $2y^2 + ay + 4ay + 2a^2$

Rule for Factoring a Perfect-Square Trinomial

For all numbers a and b:

$$a^2 + 2ab + b^2 = (a + b)(a + b) = (a + b)^2, \text{ and}$$
$$a^2 - 2ab + b^2 = (a - b)(a - b) = (a - b)^2$$

Rule for Factoring a Difference of Two Squares

For all numbers a and b:

$$a^2 - b^2 = (a + b)(a - b)$$

The x – factor

1. Multiply the first term by the last. Write at the top of the x.
2. Place the middle term in the bottom of the x.
3. Find two factors of the product at the top of the x that add together to equal the middle term (at the bottom of the x).
   Rewrite the middle term as the sum of the two terms you placed in the two sides of the x.
4. Group and factor.

Factor each polynomial completely.

74. $x^2 + 5x + 6$

75. $49m^2 + 14m + 1$

76. $3x^2 - x - 2$

77. $36x^2 - 49$

78. $49m^2 - 28mn + 4n^2$

Radicals

Definition of Square Root

If a is a number greater than or equal to zero, $\sqrt{a}$ represents the principal, or positive, square root of a and $-\sqrt{a}$ represent the negative square root of a. The square roots of a have the following property:

$$\sqrt{a} \cdot \sqrt{a} = a \qquad (-\sqrt{a})(-\sqrt{a}) = a$$

Multiplication Property of Square Roots

For all numbers a and b, where $a \geq 0$ and $b \geq 0$:

$$\sqrt{ab} = \sqrt{a}\sqrt{b}$$

Division Property of Square Roots

For all numbers $a \geq 0$ and $b > 0$:

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

Simplify radical expressions, and estimate square roots.

To express $\sqrt{45} - 2\sqrt{5}$ in simplest radical form, first use the Multiplication Property of Square Roots.

$$\begin{aligned}\sqrt{45} - 2\sqrt{5} &= \sqrt{9 \cdot 5} - 2\sqrt{5} \\ &= \sqrt{9} \cdot \sqrt{5} - 2\sqrt{5} \\ &= 3\sqrt{5} - 2\sqrt{5} \\ &= \sqrt{5}\end{aligned}$$

Since $4 < 5 < 9$, $2 < \sqrt{5} < 3$. To the nearest hundredth, $\sqrt{5} \approx 2.24$.

Simplify the expression.

79. $\sqrt{36}$

80. $-\sqrt{36}$

81. $\sqrt{-36}$

82. $\sqrt{25-16}$

83. $\sqrt{10x} \cdot \sqrt{8x}$

84. $\sqrt{\dfrac{72x^2}{8x}}$

85. $4\sqrt{27} - 2\sqrt{3}$

86. $\sqrt{50}\sqrt{2}$

87. $\sqrt[3]{-125}$

Rationalize the denominator.

88. $\frac{1}{\sqrt{7}}$ **89.** $\frac{\sqrt{7}}{\sqrt{3}}$ **90.** $\frac{3}{3+\sqrt{7}}$

Simplify the expression (remember, no calculators!).

91. $81^{\frac{1}{2}}$

92. $125^{\frac{2}{3}}$

93. $\left(7x^{\frac{1}{3}}\right)\left(2x^{\frac{1}{4}}\right)$

Quadratic Functions

Zero Product Property

If a and b are real numbers such that $ab = 0$, then $a = 0$ or $b = 0$.

Solve an equation by factoring.

Solve $x^2 - 7x - 44 = 0$.

Write the equation in factored form.

$$(x - 11)(x + 4) = 0$$

Set each factor equal to 0 and solve for x.

$x - 11 = 0$ $\qquad$ $x + 4 = 0$

$x = 11$ $\qquad$ $x = -4$

The solutions are 11 and -4.

The Quadratic Formula

For $ax^2 + bx + c = 0$, where $a \neq 0$:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The Discriminant

Given the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, the discriminant is defined as $b^2 - 4ac$.

Solving $ax^2 = k$, Where $\frac{k}{a}$ Is Nonnegative

An equation of the form $ax^2 = k$, where $\frac{k}{a} \geq 0$ and $a \neq 0$, has the following solutions

$$x = \sqrt{\frac{k}{a}} \text{ or } x = -\sqrt{\frac{k}{a}}$$

Solve each quadratic equation. You may use any method, but the most appropriate is written next to the problem.

94. $x^2 - 13x + 36 = 0$ (factoring)

95. $x^2 = -11x - 10$ (factoring)

96. $3(x-4)^2 = 27$ (square root)

97. $3x^2 - 3x - 4 = 0$ (quadratic)

98. Solve the radical equation: $\sqrt{6x+1} = x - 1$.

Find the discriminant and tell what it indicates about the number of solutions.

99. $2x^2 - 11x + 3 = 0$

100. $4x^2 - 2x + 3 = 0$

Perform the indicated operation and simplify if possible.

103. $\dfrac{x-2}{3x+9}\cdot\dfrac{2x+6}{2x-4}$

104. $\dfrac{x^2-25}{2x-2}\div\dfrac{x^2+10x+25}{x^2+4x-5}$

105. $\dfrac{3}{x+4}+\dfrac{6}{x+5}$

106. $\dfrac{4}{x}-\dfrac{3}{x+3}$

Graphing

107. Graph the linear function and give its slope and y-intercept: $y-1=-\dfrac{1}{3}x$.

108. Graph the inequality: $f(x)>2x-4$.

109. Graph the linear equations:

a. $x = 1.5$ b. $y = -2$

110. Graph the quadratic function: $f(x)=(x+1)^2-3$

Entering Algebra 2 - Answer Key

1. 1623
2. 12553
3. 1133923
4. 10671
5. 52
6. 1085
7. x
8. +
9. 11749
10. $\frac{-17.5}{18.6} \approx$ -0.94
11. $\frac{6}{5}$
12. $\frac{19}{12}$
13. $\frac{41}{30}$
14. $\frac{1}{5}$
15. $\frac{7}{9}$
16. $\frac{1}{18}$
17. $\frac{11}{24}$
18. $\frac{3}{8}$
19. $\frac{2}{3}$
20. $\frac{8}{9}$
21. $\frac{4}{35}$
22. $\frac{2}{5}$
23. $\frac{2}{5}$
24. $\frac{36}{65}$
25. $\frac{3}{4}$
26. $\frac{15}{16}$
27. $\frac{2}{3}$
28. $\frac{8}{7}$
29. $\frac{8}{9}$
30. 10z – 8
31. 4p-5q+6r
32. $-21x$
33. $-21x^2$
34. $24x$
35. -6
36. 1 - $\frac{2x}{11}$
37. -3x + 2
38. a and b
39. a and b
40. q= -1
41. w= -7
42. c = $\frac{7}{4}$
43. k= jt-b
44. c= $\frac{-b}{d-5}$
45. -11 > x > 5
46. -11 ≤ x ≤ 1
47. x= 1 or 0
48. Not a function

    domain: [2,12]

    range: [-7, 7]
49. y = $\frac{2}{5}$ x – 8
50. y = $\frac{5}{8}$x – 3
51. y = $\frac{1}{2}$x - 5
52. $\frac{y}{x^2}$
53. y^5
54. $9x^4y^{10}$
55. $-20w^3z^5$
56. $-4x^3z^5$
57. $\frac{b^2c^3}{a^{10}}$
58. $\frac{y^3}{27x^{12}}$
59. 1
60. -5.716 x 10^3
61. -8.3 x 10^5
62. -8.2 x 10^7
63. 21 x 10^3
64. $9x^4 + 4x^3 – 2x + 1$
65. $10x^2 – 9x – 9$
66. x^2 - 9
67. $8x^5 - 40x^3 + 3x^2 - 15$
68. $x^3 - 1$
69. $x^2 - 6x + 9$
70. 3x (x+2)
71. $9x^2(9x^2 - 2x + 3)$
72. (x + 5)(x+3)
73. (2y + a)(2a+y)
74. (x + 2)(x + 3)
75. $(7m + 1)^2$

76. (3x + 2)(x – 1)

77. (6x – 7)(6x + 7)

78. $(7\mathrm{m} + 2\mathrm{n})^2$

79. 6

80. -6

81. 6i

82. 3

83. 4 |x| $\sqrt{5}$

84. $3\sqrt{x}$

85. $10\sqrt{3}$

86. 10

87. -5

88. $\frac{\sqrt{7}}{7}$

89. $\frac{\sqrt{21}}{3}$

90. $\frac{9-3\sqrt{7}}{2}$

91. 9

92. 25

93. $14x^{\frac{7}{12}}$

94. 4, 9

95. -10, -1

96. 1, 7

97. $\frac{3\pm\sqrt{57}}{6}$

98. 8

99. 97, two distinct real solutions

100. -44, two distinct imaginary solutions

101. $x \neq \pm 5$

102. $x \neq 3$

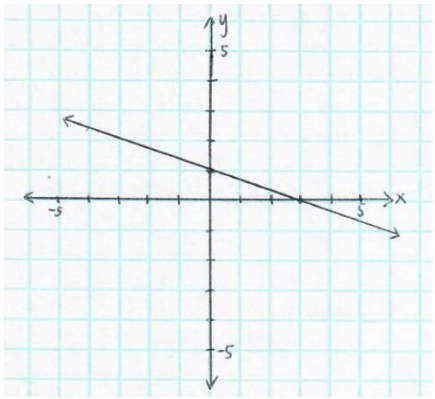
103. $\frac{1}{3}$

104. $\frac{x-5}{2}$

105. $\frac{9x+39}{(x+4)(x+5)}$

106. $\frac{x+12}{x(x+3)}$

107. Slope: m= $-\frac{1}{3}$
y-intercept: (0,1)



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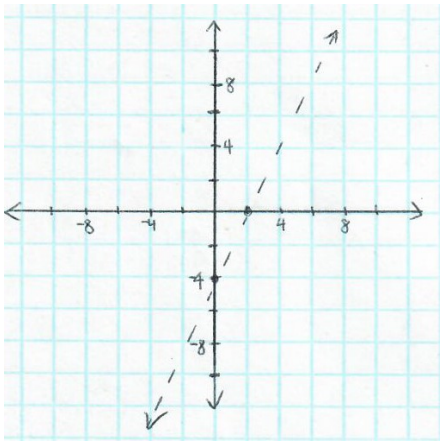

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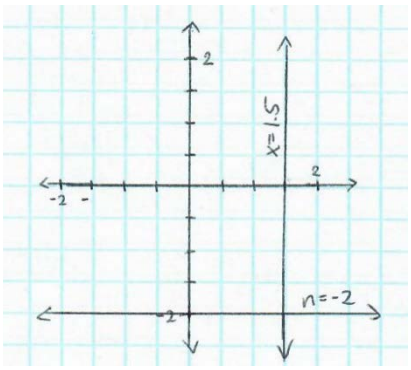

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