# Incoming Algebra I Summer Packet 2024

Welcome to Algebra I! To keep you prepared for Algebra I in August, you must complete this packet in its entirety. It will be turned in for your first grade the first Friday of school. Prior to each review section, you will see a few example problems as well as a link to a video for additional help. A quiz on this material will be taken the first FULL week of school. Make sure to show all work and you may use a calculator, but steps MUST still be shown. Please reach out via email if I can help in any way. I check email frequently and I am happy to help if you're struggling with any of this work.

Sincerely,
Mrs. McAllister
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## Topic #1 Exponent Rules

Product of Exponents: https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-numbers-operations/cc-8th-exponent-properties/v/exponent-properties-involving-products

Power of Powers: https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-numbers-operations/cc-8th-exponent-properties/v/products-and-exponents-raised-to-an-exponent-propertiesn

Division of Exponents: https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-numbers-operations/cc-8th-exponent-properties/v/exponent-properties-involving-quotients

### Exponent Rules

Zero Exponent: Any base raised to the zero power equals 1.
Ex: $(-9)^0 = \boxed{1}$

Negative Exponent: Move the base to the opposite side of the fraction bar and make the exponent positive.
Ex: $3^{-4} = \frac{1}{3^4} = \boxed{\frac{1}{81}}$

Monomial x Monomial: Multiply the coefficients and add the exponents of like bases.
Ex: $(-2x^3)(8x^{-5}) = -16x^{-2} = \boxed{\frac{-16}{x^2}}$

Monomial ÷ Monomial: Divide the coefficients and subtract the exponents of like bases.
Ex: $\frac{4ab^3}{4a^2b^2} = 1a^{-1}b^1 = \boxed{\frac{b}{a}}$

Power of a Monomial: Raise each base (including the coefficient) to that power. If a base already has an exponent, multiply the two exponents.
Ex: $(3x^3y^2)^3 = 3^3x^9y^6 = \boxed{27x^9y^6}$

Power of a Quotient: Raise each base (including the coefficients) to that power. If a base already has an exponent, multiply the two exponents.
Ex: $\left(\frac{5a^3b}{2c^{-1}}\right)^2 = \frac{5^2a^6b^2}{2^2c^{-2}} = \boxed{\frac{25a^6b^2c^2}{4}}$

| | | |
|---|---|---|
| 1. $x^6 \cdot x^4$ | 2. $(5^3)^2$ | 3. $-6a^2b^{-4}c \cdot 4ab^2$ |

| | | |
|---|---|---|
| 4. $\frac{a^3b^{-6}}{c^{-2}}$ | 5. $(\frac{-2x^6y}{3z^5})^3$ | 6. $(8w^3x^2)^0$ |
| 7. $\frac{24d^5f^{-5}g^8}{36d^{-3}f^9g^2}$ | 8. $(2b^{-3}d^6)^4 \cdot 3b^7d$ | 9. $(\frac{-4a^4b^2c^{-1}}{6a^9})^{-1}$ |

## Topic #2 Algebraic Expressions

(Remember, algebraic expressions do not have an equal sign so we can only simplify them if variables are involved or evaluate them if not variables are included and NOT solve them for a variable!)

### Evaluating Algebraic Expressions

1. Substitute the given values for the variables in the expression
2. Evaluate the expression using the order of operations
   - Parentheses/Brackets (inside to outside)
   - Exponents
   - Multiplication/Division (left to right)
   - Addition/Subtraction (left to right)

ex: $9x^2 - 4(y + 3z)$ for $x = -3, y = 2, z = 5$

$9(-3)^2 - 4(2 + 3 \cdot 5)$

$9(-3)^2 - 4(2 + 15)$

$9(-3)^2 - 4 \cdot 17$

$9 \cdot 9 - 4 \cdot 17$

$81 - 4 \cdot 17$

$81 - 68 = \boxed{13}$

### The Distributive Property

1. Multiply the number outside the parentheses by each term in the parentheses.
2. Keep the addition/subtraction sign between each term.

ex: $5(8x - 3)$

$5(8x - 3)$

$5(8x) - 5(3)$

$\boxed{40x - 15}$

# Simplifying Algebraic Expressions

1. Clear any parentheses using the Distributive Property
2. Add or subtract like terms (use the sign in front of each term to determine whether to add or subtract)

ex: $2(3x - 4) - 12x + 9$

$2(3x - 4) - 12x + 9$

$6x - 8 - 12x + 9$

$\boxed{-6x + 1}$

Helpful links:
https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:foundation-algebra/x2f8bb11595b61c86:intro-variables/v/variables-and-expressions-1

https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:foundation-algebra/x2f8bb11595b61c86:substitute-evaluate-expression/v/evaluating-expressions-in-two-variables-with-decimals-and-fractions

Evaluate each expression for $a = 9$, $b = -3$, $c = -2$, $d = 7$. Show your work.

| | | | |
|---|---|---|---|
| 1. $a - cd$ | 2. $2b^3 + c^2$ | 3. $\frac{a + d - c}{b}$ | 4. $(a - b)^2 + d(a + c)$ |
| 5. $4c - (b - a)$ | 6. $\frac{a}{b} - 5a$ | 7. $2bc + d(12 - 5)$ | 8. $b + 0.5[8 - (2c + a)]$ |

Simplify each expression using the Distributive Property.

| | | | |
|---|---|---|---|
| 9. $5(2g - 8)$ | 10. $7(y + 3)$ | 11. $-3(4w - 3)$ | 12. $(6r + 3)2$ |

Simplify each expression, showing all work.

| | | | |
|---|---|---|---|
| 13. $8(x + 1) - 12x$ | 14. $6w - 7 + 12w - 3z$ | 15. $9n - 8 + 3(2n - 11)$ | 16. $3(7x + 4y) - 2(2x + y)$ |
| 17. $(15 + 8d)(-5) - 24d + d$ | 18. $9(b - 1) - c + 3b + c$ | 19. $20f - 4(5f + 4) + 16$ | 20. $8(h - 4) - h - (h + 7)$ |

## Topic #3 Solving one Variable Equations

Helpful Videos: https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:solve-equations-inequalities/x2f8bb11595b61c86:linear-equations-variables-both-sides/v/solving-equations-2

https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:solve-equations-inequalities/x2f8bb11595b61c86:linear-equations-parentheses/v/solving-equations-with-the-distributive-property

### Solving One-Step Equations

1. Cancel out the number on the same side of the equal sign as the variable using inverse operations (addition/subtraction; multiplication/division)
2. Be sure to do the same thing to both sides of the equation!

ex: $-18 = 6j$

$\frac{-18}{6} = \frac{6j}{6}$

$-3 = j \rightarrow \boxed{j = -3}$

### Solving Two-Step Equations

1. Undo operations one at a time with inverse operations, using the order of operations in reverse (i.e. undo addition/subtraction before multiplication/division)
2. Be sure to always do the same thing to both sides of the equation!

ex: $\frac{a}{7} - 12 = -9$

$\frac{a}{7} - 12 = -9$

$+12 \quad +12$

$7 \times \frac{a}{7} = 3 \times 7$

$\boxed{a = 21}$

# Solving Multi-Step Equations

1. Clear any parentheses using the Distributive Property
2. Combine like terms on each side of the equal sign
3. Get the variable terms on the same side of the equation by adding/subtracting a variable term to/from both sides of the equation to cancel it out on one side
4. The equation is now a two-step equation, so finish solving it as described above

ex: $5(2x - 1) = 3x + 4x - 1$

$10x - 5 = 3x + 4x - 1$

$10x - 5 = 7x - 1$

$-7x \quad -7x$

$3x - 5 = -1$

$+5 \quad +5$

$\frac{3x}{3} = \frac{4}{3}$

$\boxed{x = \frac{4}{3}}$

Solve each equation, showing all work.

| | | | |
|---|---|---|---|
| 21. $f - 64 = -23$ | 22. $-7 = 2d$ | 23. $\frac{b}{-12} = -6$ | 24. $13 = m + 21$ |
| 25. $5x - 3 = -28$ | 26. $\frac{w + 8}{-3} = -9$ | 27. $-8 + \frac{h}{4} = 13$ | 28. $22 = 6y + 7$ |

| | | | |
|---|---|---|---|
| 29. $8x - 4 = 3x + 1$ | 30. $-2(5d - 8) = 20$ | 31. $7r + 21 = 49r$ | 32. $-9g - 3 = -3(3g + 2)$ |
| 33. $5(3x - 2) = 5(4x + 1)$ | 34. $3d - 4 + d = 8d - (-12)$ | 35. $f - 6 = -2f + 3(f - 2)$ | 36. $-2(y - 1) = 4y - (y + 2)$ |

## Topic #4 Linear Equations and Slope

https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:linear-equations-graphs/x2f8bb11595b61c86:two-variable-linear-equations-intro/v/2-variable-linear-equations-graphs

https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:linear-equations-graphs/x2f8bb11595b61c86:slope/v/introduction-to-slope

### Finding Slope from 2 Points

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Special Cases:

$\frac{0}{\#}$ → slope = 0 $\frac{\#}{0}$ → slope is undefined

Ex: Find the slope of the line that passes through the points (-9, -3) and (7, -7)

$m = \frac{-7 - (-3)}{7 - (-9)} = \frac{-4}{16} = \boxed{-\frac{1}{4}}$

### Slope-Intercept Form

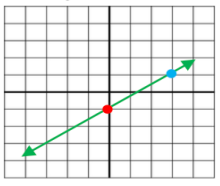
$y = mx + b$

*m = slope & b = y-intercept*

Graphing from Slope-Intercept Form:

1. Make a point at the y-intercept.
2. Use the slope $\left(\frac{\text{rise}}{\text{run}}\right)$ to make more points.
3. Connect the points to form a line.

Ex: Graph $y = \frac{2}{3}x - 1$

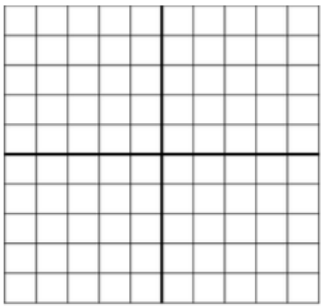
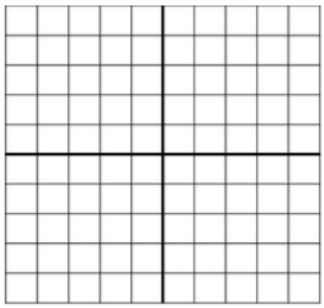
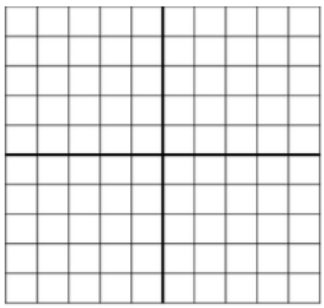


y-intercept is -1
slope = $\frac{2}{3}$, (so from the y-intercept go up 2 & right 3)

Find the slope of the line that passes through the pair of points.

| | | |
|---|---|---|
| 37. $(9,-3) and\ (9,8)$ | 38. $(-8,5) and\ (3,-6)$ | 39. $(7,-1) and\ (15,9)$ |

Graph each line.

| | | |
|---|---|---|
| 40. $y=-\frac{3}{2}x+2$  | 41. $y=x-3$  | 42. $y=\frac{1}{3}x-5$  |

## Standard Form

Ax + By = C

*A, B, & C are integers & A is not negative*

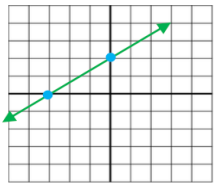
Graphing Using Intercepts:

1. Find the x-intercept by substituting 0 for y.
2. Find the y-intercept by substituting 0 for x.
3. Make a point at each intercept and then connect the points to form a line.

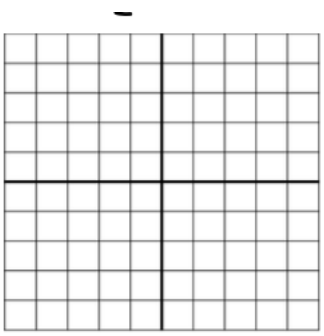
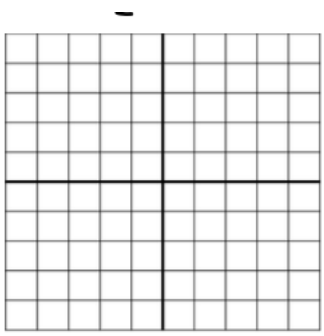
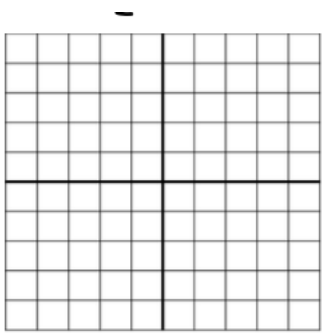
Ex: Graph 2x - 3y = -6

x-intercept: 2x - 3(0) = -6
2x = -6 → x = -3
(-3, 0)

y-intercept: 2(0) - 3y = -6
-3y = -6 → y = 2
(0, 2)



Graph the line by finding the x and y intercepts.

| | | |
|---|---|---|
| 43. $2x-y=-2$  | 44. $x+y=4$  | 45. $3x+4y=-12$  |

# Topic #5 Translating Verbal Phrases

## Hints:

More, sum, plus = addition
Product, time, multiplied = multiplication

is = equal to

Difference, less, minus = subtraction
Quotient, divided by = division

Helpful links:
https://www.youtube.com/watch?v=gb8GDyyMWms
https://www.youtube.com/watch?v=ovT70xTQ000

#46 Translate the following phrases into expressions.

a) The difference of 7 and 10 times a number

b) 11 plus the quotient of a number and 7

c) Two less than the sum of six and a number

d) Half of a given number

e) The sum of 6 and a number

f) 3 less than 4 times a given number

g) The sum of 6 and a number is 18.

h) Sixteen more than a number is 36.

i) 12 more than a number

j) One number decreased by the sum of 10 and the square of another number