7^{th} to 8^{th} grade Advanced Algebra 1 Summer packer

This packet is made to keep you fresh on your math skills throughout the summer. It is *strongly* recommended not to do this assignment in one sitting. Do a page every so often.

This packet will be graded for accuracy. **Work must be shown. No work means no credit, even if all the answers are right!**

This packet will contain skills and concepts needed to be successful in advanced Algebra 1. **There will be a test (not a quiz, a test) over this material in the first week of school!!**

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

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

$6x - 8 - 12x + 9$

$\boxed{-6x + 1}$

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 – 1)	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)

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: $-18 = 6j$

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

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

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. $-2(y - 1) = 4y - (y + 2)$

Scientific Notation

<u>Standard Form to Scientific Notation</u>: move the decimal after the first non-zero digit and elimnate any trailing zeros. Multiply by 10 to the power equal to the number of places you moved the decimal point. If the original number was greater than 1, the exponent is positive. If the number was less than 1, the exponent is negative.

ex: 0.0000571

0 00005,71

Original number < 1, so negative exponent

= $\boxed{5.71 \times 10^{-5}}$

<u>Scientific Notation to Standard Form</u>: move the decimal point the number of places indicated by the exponent. If the exponent is positive, move the decimal right. If negative, move left.

ex: 3.5×10^{3}

Positive exponent, so move decimal right

3 500. = $\boxed{3{,}500}$

Convert each number to scientific notation.

37. 67,000,000,000	38. 0.0009213	39. 0.00000000004	40. 3,201,000,000,000,000

Convert each number to standard form.

41. 5.92×10^{-5}	42. 1.1×10^{7}	43. 6.733×10^{-8}	44. 3.27×10^{2}

Slope & Rate of Change

<u>Finding the Slope Given Two Points</u>: Use the coordinates from the points in the slope formula:

$$\text{Slope } (m) = \frac{y_2 - y_1}{x_2 - x_1}$$

ex: $(4, -2)$, $(-3, 8)$

$$m = \frac{8-(-2)}{-3-4} = \frac{10}{-7} = \boxed{-\frac{10}{7}}$$

<u>Finding the Rate of Change From a Table</u>: Determine the amount the dependent variable (y) is changing and the amount the independent variable (x) is changing.

$$\text{Rate of Change} = \frac{\text{change in } y}{\text{change in } x}$$

ex:

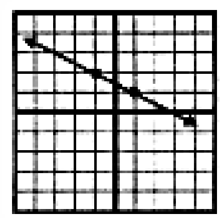
+2 +2 +2

x	# months	3	5	7	9
y	Cost ($)	80	130	180	230

+50 +50 +50

$$m = \frac{50}{2} = \boxed{\text{25 dollars/month}}$$

<u>Finding the Slope From a Graph</u>: Choose 2 points on the graph. Find the vertical change (rise) and horizontal change (run) between the 2 points and write it as a fraction $\frac{\text{rise}}{\text{run}}$. (Up is positive, down is negative, right is positive, and left is negative).



rise = +1
run = -2

$$m = \frac{1}{-2} = \boxed{-\frac{1}{2}}$$

Graphing Linear Equations

<u>Slope-Intercept Form</u>: $y = mx + b$

slope (m), y-intercept (b)

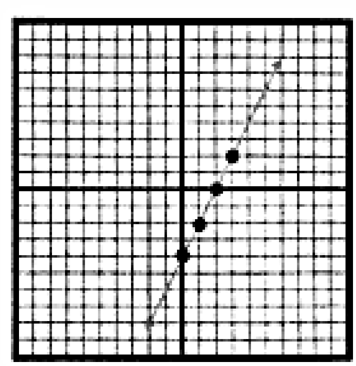
ex: $y = 2x - 4$

y-intercept: -4

slope: $2 = \frac{2}{1}$ ← rise / ← run

<u>How To Graph</u>:

1. Make a point on the y-axis at the y-intercept.
2. Use the slope to determine where to make the next point. The numerator tells you the rise (how far up/down) and the denominator tells you the run (how far right/left) to make the next point.
3. Repeat to make more points and then connect the points with a line.



Find the slope of the line that passes through the points. Show your work.

45. (-5, 3) and (2,1)	46. (8,4) and (11,6)	47. (9,3) and (9,-1)	48. (-4,-2) and (-6,4)

Find the rate of change. Show your work.

49.

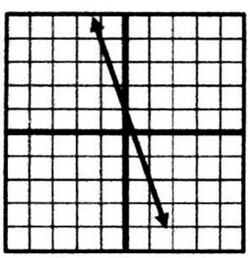
Number of Hours	3	6	9	12
Distance (in miles)	135	270	405	540

50.

Number of Weeks	1	3	5	7
Pounds	173	169	165	161

Find the slope of the line.

51.



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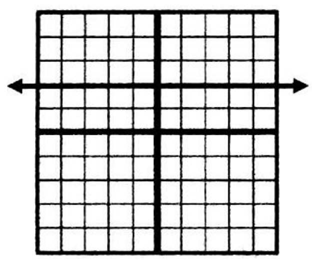

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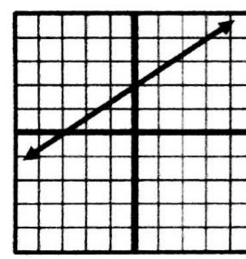
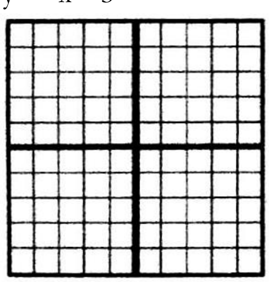
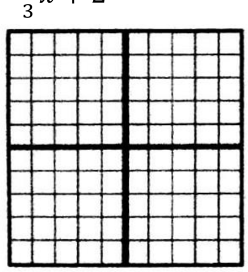


Graph the line.

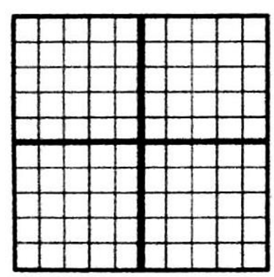
54. y = -x – 3



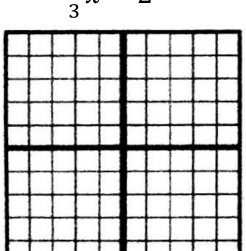
55. $y = \frac{1}{3}x + 2$



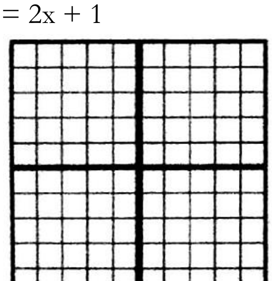
56. y = -3x – 1



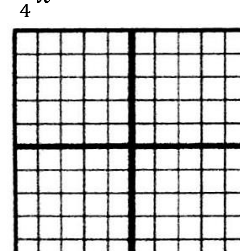
57. $y = -\frac{2}{3}x - 2$



58. y = 2x + 1



59. $y = \frac{1}{4}x$



Solving Proportions

1. Set the two cross-products equal to each other
2. Solve the equation for the variable

ex: $\frac{m}{4} = \frac{3}{5}$

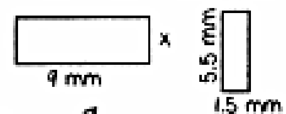
$\frac{\cancel{5}m}{\cancel{5}} = \frac{12}{5}$

$\boxed{m = 2.4}$

Similar Figures

1. To find a missing side length, set up a proportion, matching up corresponding sides.
2. Solve the proportion using the steps above.

ex:



$\frac{x}{1.5} = \frac{9}{5.5}$

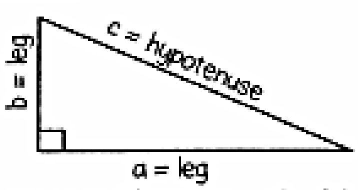
$\boxed{x = 2.\overline{45}\text{ mm}}$

The Pythagorean Theorem

*** The Pythagorean Theorem applies to right triangles only **

The sides next to the right angle (a & b) are legs

The side across from the right angle (c) is the hypotenuse

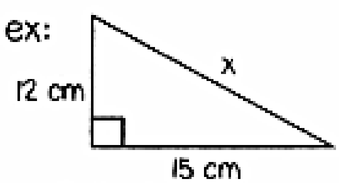


Pythagorean Theorem: $a^2 + b^2 = c^2$

To find the hypotenuse: add the squares of the legs and then find the square root of the sum

To find a leg: subtract the square of the given leg from the square of the hypotenuse and then find the square root of the difference

ex:



x is the hypotenuse

$12^2 + 15^2 = x^2$

$144 + 225 = x^2$

$369 = x^2$

$x = \sqrt{369}$ $\boxed{\approx 19.2\text{ cm}}$

ex: $a = ?,\ b = 3,\ c = 6$

a is a leg

$a^2 + 3^2 = 6^2$

$a^2 + 9 = 36$

$a^2 = 36 - 9 = 27$

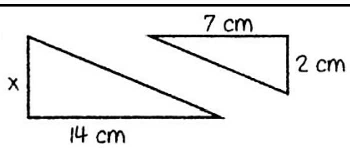
$a = \sqrt{27}$ $\boxed{\approx 5.2}$

Solve each proportion. Show all work.

60. $\frac{6}{7} = \frac{4}{m}$	61. $\frac{12}{5} = \frac{k}{3}$	62. $\frac{h}{7} = \frac{8}{2}$	63. $\frac{22}{n} = \frac{9}{36}$	64. $\frac{4}{21} = \frac{3}{c}$

Assume each pair of figures is similar. Find the missing side length. Show all work.

65.



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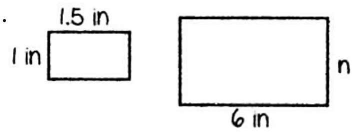

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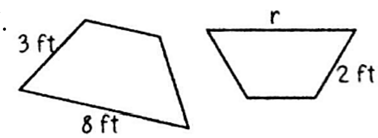

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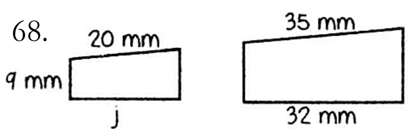

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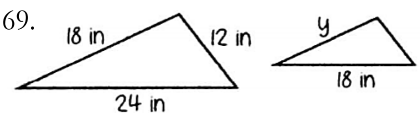

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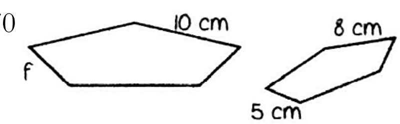
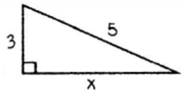


Find the missing side length in each right triangle, to the nearest tenth. Show all work.

71. a = 6, b = 8, c = ?	72. a = ? b = 9, c = 13	73. a = 7, b = ? c = 14	74. a = 14, b = 14, c = ?

75.



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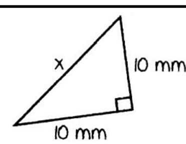

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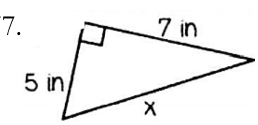

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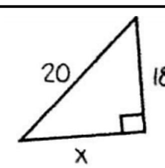

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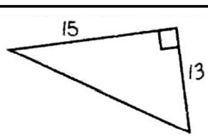

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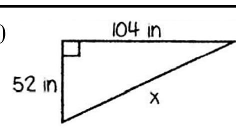

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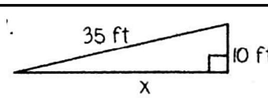

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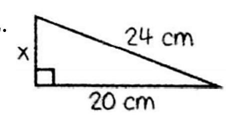

Determine whether or not you can form a right triangle from the given side lengths. Explain.

83. 18, 22, 26	84. 5, 12, 13