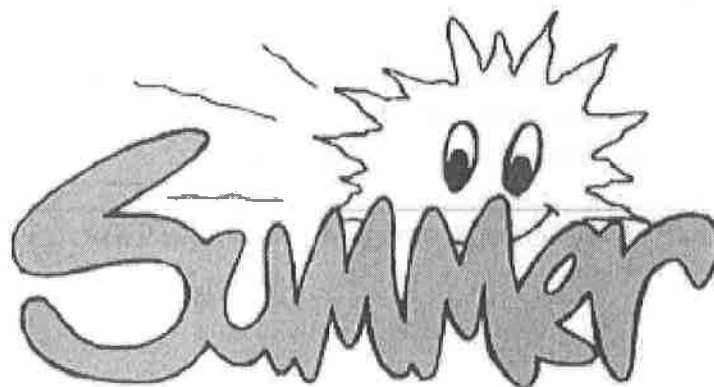


# OCS NINTH GRADE



## Summer

### MATH PACKET



Name: \_\_\_\_\_

**Instructions:** Complete this review packet at your own pace this summer. Show your work when any computation is involved. You must finish the packet in time for the start of 9<sup>th</sup> grade. All of the problems are intended to review mixed skills through eighth grade.

**Due on the first day of 9<sup>th</sup> grade**

## Summer Requirements

We know that summer is often a time for vacations and family; however, it is also important for students to maintain and practice skills learned in school. For this reason, we are asking all incoming ninth graders to complete a math review packet to review basic concepts learned in previous grades. It will be due the first day of school. A time management schedule is suggested throughout the summer so that the student does not rush to complete all of the work in the last week. This is not intended to be a burden, but rather to keep the students' math skills as sharp as they were in the spring come early fall.

If students are unsure of any concepts or would like some extra practice, you can visit the following websites for assistance:

<https://learnzillion.com>

<http://www.ck12.org/>

<https://www.mathabc.com/>

<http://www.ixl.com/math/grade-8>

<https://www.khanacademy.org/math/cc-eighth-grade-math>

[http://www.softschools.com/ccss/8th grade math common core test prep/](http://www.softschools.com/ccss/8th_grade_math_common_core_test_prep/)

Coming to school prepared is essential so that we are ready to jump into more challenging and exciting problem solving when we return to 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. $9n - 8 + 3(2n - 11)$  | 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. $8(h - 4) - h - (h + 7)$ |

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

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

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

$$\boxed{a = 21}$$

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

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

$$10x - 5 = 7x - 1$$
$$-7x \quad -7x$$

$$3x - 5 = -1$$
$$+5 \quad +5$$

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

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

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

Standard Form to Scientific Notation: move the decimal after the first non-zero digit and eliminate 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

0.0000571

Original number < 1, so negative exponent

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

Scientific Notation to Standard Form: 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:  $3.5 \times 10^3$

Positive exponent, so move decimal right

$$3,500 = 3,500$$

## Negative Exponents & Simplifying Monomials

Zero Exponent: Any number raised to the zero power equals 1

$$\text{ex: } y^0 = 1$$

Negative Exponent: Move the base to the opposite side of the fraction line and make the exponent positive

$$\text{ex: } x^{-4} = \frac{1}{x^4}$$

Monomial x Monomial: Multiply the coefficients and add the exponents of like bases

$$\text{ex: } (4x^3)(2x^5) = 8x^8$$

Monomial ÷ Monomial: Divide the coefficients and subtract the exponents of like bases

$$\text{ex: } \frac{a}{a^6} = a^{-5} = \frac{1}{a^5}$$

Power of a Monomial: Raise each base (including the coefficient) to that power. If a base already has an exponent, multiply the two exponents

$$\text{ex: } (-2fg^5)^3 = -8f^3g^{15}$$

Power of a Quotient: Raise each base (including the coefficient) to that power. If a base already has an exponent, multiply the two exponents

$$\text{ex: } \left(\frac{5d^3}{c}\right)^2 = \frac{25d^6}{c^2}$$

Convert each number to Scientific Notation.

|                    |               |                    |                           |
|--------------------|---------------|--------------------|---------------------------|
| 37. 67,000,000,000 | 38. 0.0009213 | 39. 0.000000000004 | 40. 3,201,000,000,000,000 |
|--------------------|---------------|--------------------|---------------------------|

Convert each number to Standard Form.

|                           |                       |                            |                        |
|---------------------------|-----------------------|----------------------------|------------------------|
| 41. $5.92 \times 10^{-5}$ | 42. $1.1 \times 10^7$ | 43. $6.733 \times 10^{-8}$ | 44. $3.27 \times 10^2$ |
|---------------------------|-----------------------|----------------------------|------------------------|

Simplify each expression. Write your answers using only positive exponents.

|                               |   |   |  |
|-------------------------------|---|---|--|
| 45. $w^{-9}$                  | 46. $\frac{m^5}{m^2}$                           | 47. $f^5 \cdot f^3$                     | 48. $\left(\frac{h^2}{g}\right)^3$             |
| 49. $(a^5)^2$                 | 50. $\frac{1}{b^{-3}}$                          | 51. $z^0$                               | 52. $4r^6 \cdot 3r \cdot 2r^2$                 |
| 53. $\frac{qp^{-2}}{3q^{-3}}$ | 54. $\frac{8d^3}{2cd^{-2}}$                     | 55. $(g^4h)^2 \cdot (2g^3h^{-1})^2$     | 56. $(6a)^0$                                   |
| 57. $(-3n^2k^4)^2$            | 58. $\left(\frac{w^5x^{-2}y}{w^2xy^4}\right)^3$ | 59. $\frac{6 \cdot 10^7}{2 \cdot 10^3}$ | 60. $(1.5 \cdot 10^{-6}) \cdot (4 \cdot 10^9)$ |





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

61.  $(-5, 3), (2, 1)$

62.  $(8, 4), (11, 6)$

63.  $(9, 3), (9, -1)$

64.  $(-4, -2), (-6, 4)$

Find the rate of change. Show your work.

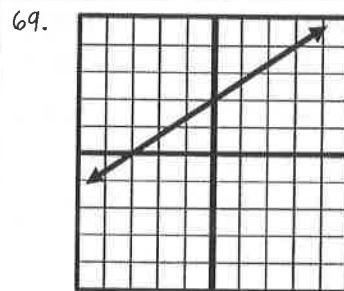
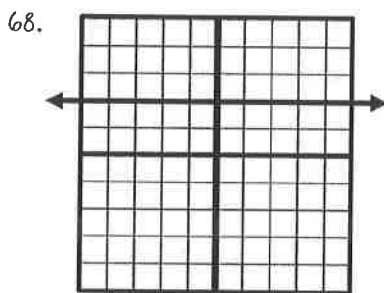
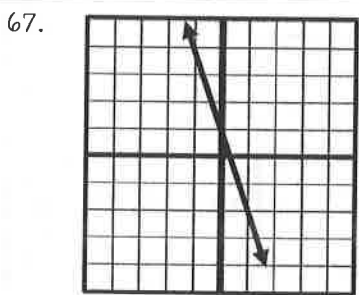
65.

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

66.

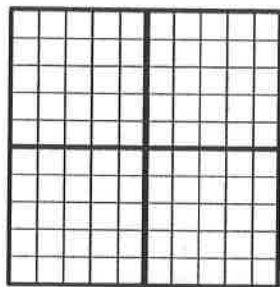
|                 |     |     |     |     |
|-----------------|-----|-----|-----|-----|
| Number of Weeks | 1   | 3   | 5   | 7   |
| Pounds          | 173 | 169 | 165 | 161 |

Find the slope of the line.

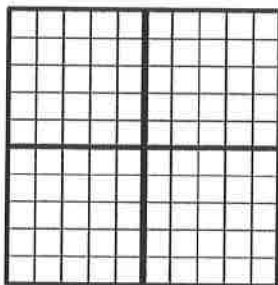


Graph the line.

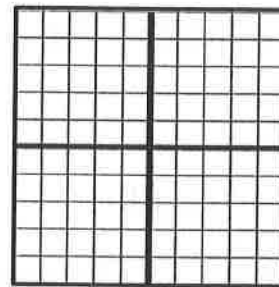
70.  $y = -x - 3$



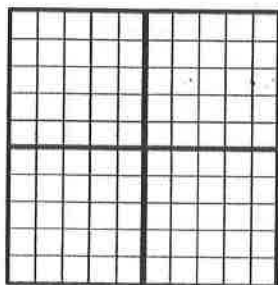
71.  $y = \frac{1}{3}x + 2$



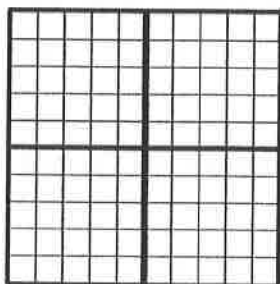
72.  $y = -3x - 1$



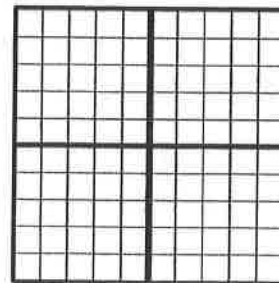
73.  $y = -\frac{3}{2}x - 2$



74.  $y = 2x + 1$



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



# Solving Proportions

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

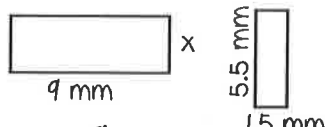
ex:  $\frac{m}{4} = \frac{3}{5}$

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

$m = 2.4$

# 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: 

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

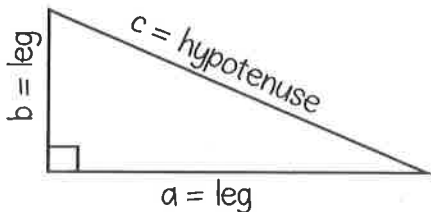
$x = 2.45 \text{ mm}$

# The Pythagorean Theorem

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

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

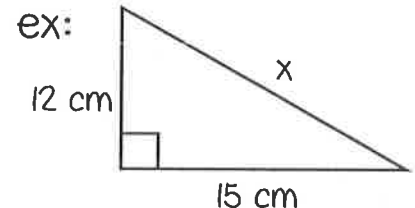
The side across from the right angle (c) is the hypotenuse



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



x is the hypotenuse

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

$$144 + 225 = x^2$$

$$369 = x^2$$

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

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

a is a leg

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

$$a^2 + 9 = 36$$

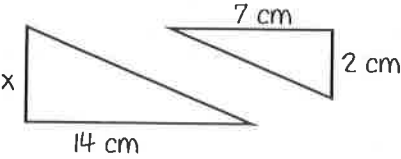
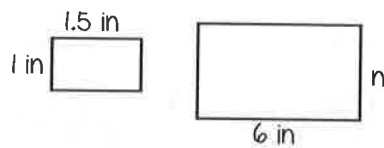
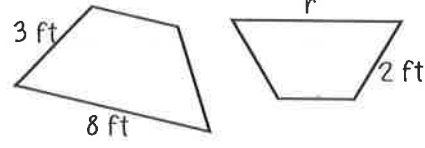
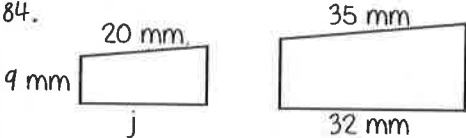
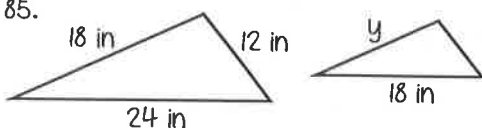
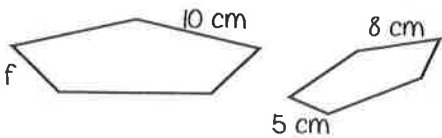
$$a^2 = 36 - 9 = 27$$

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

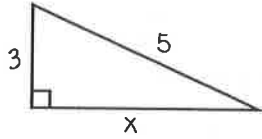
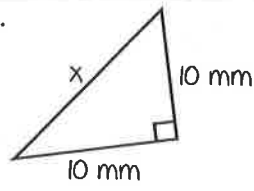
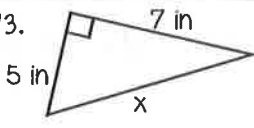
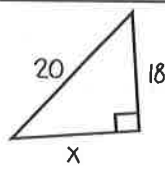
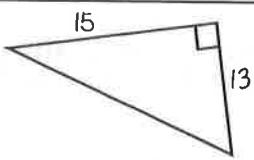
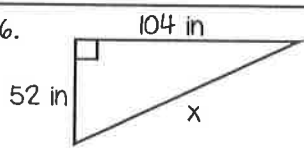
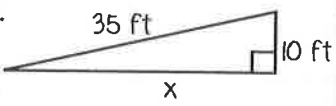
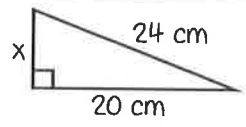
Solve each proportion, showing all work.

|                                 |                                  |                                 |                                   |                                  |
|---------------------------------|----------------------------------|---------------------------------|-----------------------------------|----------------------------------|
| 76. $\frac{6}{7} = \frac{4}{m}$ | 77. $\frac{12}{5} = \frac{k}{3}$ | 78. $\frac{h}{7} = \frac{8}{2}$ | 79. $\frac{22}{n} = \frac{9}{36}$ | 80. $\frac{4}{21} = \frac{3}{c}$ |
|---------------------------------|----------------------------------|---------------------------------|-----------------------------------|----------------------------------|

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

|  |  |   |
|--|--|---|
| 81.  | 82.   | 83.  |
| 84.  | 85.  | 86.  |

Find the missing side length in each right triangle to the nearest tenth. Show your work!

|   |   |  |   |
|---|---|--|---|
| 87. $a = 6, b = 8, c = ?$   | 88. $a = ?, b = 9 \text{ cm}, c = 13 \text{ cm}$  | 89. $a = 7, b = ?, c = 14$   | 90. $a = 14 \text{ in}, b = 14 \text{ in}, c = ?$   |
| 91.   | 92.  | 93.  | 94.  |
| 95.  | 96.  | 97.  | 98.  |

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

|                |                |
|----------------|----------------|
| 99. 18, 22, 26 | 100. 5, 12, 13 |
|----------------|----------------|