

May 2026
UPPER SCHOOL SUMMER MATH
Rising to 8th Grade-Algebra 1

Algebra I Readiness Packet

Dear Upper School Students,

This summer, we encourage you to continue to foster a belief in the importance and enjoyment of mathematics at home. Being actively involved in mathematical activities enhances learning.

In preparation for the 2026-2027 school year, each student in middle school is required to complete a summer math review packet. Each packet focuses on the prerequisite concepts and skills necessary for student success in each math class. The topics within this packet are important foundational concepts. READ THE INSTRUCTIONS. Even if it doesn't say "Show Your Work" at the top of the page, **you are expected to show your work on all pages**. If you need extra space, you must use and attach scratch paper to the packet.

Please bring your completed math packet (with scratch work attached) with you on the first day of school in August. Your math teachers will be collecting them, and the packets will be graded for timeliness and thoroughness of completion.

Have a wonderful summer!

The Middle School Mathematics Department

Algebra 1 Savvas enVision Vocabulary List

You are probably familiar with some of these already. Please continue to review and study the words this summer. You will see these throughout the year and well into your math future.

Topic 1: Expressions & Equations

Variable

A letter or symbol that represents an unknown value.

Expression

A mathematical phrase without an equal sign.

Equation

A mathematical sentence with an equal sign.

Inequality

A mathematical statement comparing two expressions using symbols such as $<$, $>$, $\leq$, or $\geq$.

Coefficient

The numerical factor of a term containing a variable.

Example: In $5x$, the coefficient is 5.

Constant

A number without a variable.

Term

A single number, variable, or product of numbers and variables.

Like Terms

Terms that have the same variables raised to the same powers.

Simplify

To combine like terms or rewrite an expression in its simplest form.

Evaluate

To find the value of an expression by replacing variables with numbers.

Distributive Property

A property used to multiply a number across terms inside parentheses.

Example:

$$3(x + 4) = 3x + 12$$

Solution

A value that makes an equation or inequality true.

Topic 2: Linear Equations & Functions**Linear Equation**

An equation whose graph forms a straight line.

Slope

The measure of the steepness of a line.

Rate of Change

The ratio comparing the change in y-values to the change in x-values.

y-intercept

The point where a graph crosses the y-axis.

x-intercept

The point where a graph crosses the x-axis.

Function

A relationship in which each input has exactly one output.

Domain

The set of all possible input values.

Range

The set of all possible output values.

Independent Variable

The input value in a function.

Dependent Variable

The output value that depends on the input.

Scatter Plot

A graph showing the relationship between two variables.

Correlation

A relationship between two sets of data.

Positive Correlation

As one variable increases, the other increases.

Negative Correlation

As one variable increases, the other decreases.

Topic 3: Systems of Equations

System of Equations

A set of two or more equations solved together.

Substitution Method

Solving a system by replacing one variable with an equivalent expression.

Elimination Method

Solving a system by adding or subtracting equations to eliminate a variable.

Ordered Pair

A pair of numbers used to locate a point on a graph.

Example: (4, -2)

No Solution

A system with no point of intersection.

Infinite Solutions

A system where the equations represent the same line.

Topic 4: Exponents & Polynomials

Exponent

Shows how many times a base is multiplied by itself.

Base

The repeated factor in an exponential expression.

Power

An expression containing a base and an exponent.

Monomial

A polynomial with one term.

Binomial

A polynomial with two terms.

Trinomial

A polynomial with three terms.

Polynomial

An expression made of variables, coefficients, and exponents combined using addition or subtraction.

Degree

The greatest exponent of a variable in a polynomial.

Standard Form of a Polynomial

Writing polynomial terms from greatest exponent to least.

Factoring

Rewriting an expression as a product of factors.

Greatest Common Factor (GCF)

The largest factor shared by terms.

Topic 5: Quadratic Functions & Equations**Quadratic Function**

A function with degree 2.

Parabola

The graph of a quadratic function.

Vertex

The highest or lowest point of a parabola.

Axis of Symmetry

A vertical line dividing a parabola into two equal halves.

Factored Form

A quadratic written as a product of binomials.

Zero Product Property

If $ab = 0$, then $a = 0$ or $b = 0$.

Discriminant

The expression under the square root in the quadratic formula.

Roots

The solutions of a quadratic equation.

Topic 6: Radicals & Rational Expressions**Square Root**

A value that multiplied by itself equals a given number.

Radical

An expression containing a root symbol.

Radicand

The number or expression inside a radical.

Rational Expression

A fraction containing a polynomial in the numerator or denominator.

Proportion

An equation stating that two ratios are equal.

Topic 7: Statistics & Probability

Mean

The average of a set of data.

Median

The middle value in a set of data.

Mode

The value occurring most often.

Range

The difference between the greatest and least values.

Probability

The likelihood that an event will occur.

Data Set

A collection of related data values.

Line of Best Fit

A line used to model data on a scatter plot.

Academic Vocabulary

Justify

To explain mathematical reasoning.

Estimate

To find an approximate answer.

Analyze

To examine carefully for patterns or relationships.

Interpret

To explain the meaning of information or data.

Compare

To identify similarities and differences.

Additional Academic Vocabulary

- **Evaluate** — Find the value of an expression.
- **Simplify** — Rewrite an expression in simplest form.
- **Justify** — Explain mathematical reasoning.
- **Estimate** — Find an approximate answer.
- **Ordered Pair** — A pair of numbers used to locate a point on a graph.
- **Coordinate Plane** — A graph formed by the x-axis and y-axis.
- **Origin** — The point (0,0) on the coordinate plane.
- **Quadrant** — One of the four sections of the coordinate plane.



Expressions with Addition and Subtraction

1. Complete to find a pattern in the table.

Total Number of Students (Input)	Number of Students Going to Picnic (Output)
30	25
36	31
42	37
50	45
54	

Think:

$$30 - 5 = 25$$

$$36 - 5 = \underline{\hspace{2cm}}$$

$$42 - \underline{\hspace{2cm}} = 37$$

$$50 \underline{\hspace{2cm}} 5 = 45$$

2. What is the rule for the table above, in words? _____

Let t equal the total number of students. The rule, in symbols, for the table is $t - 5$.

3. Use the rule to complete the table above.

4. Complete to find a pattern in the table.

Input	Output
12	14
15	17
18	
22	24
26	28

Think:

$$12 + \underline{\hspace{2cm}} = 14$$

$$15 + \underline{\hspace{2cm}} = 17$$

$$22 + \underline{\hspace{2cm}} = 24$$

$$26 + \underline{\hspace{2cm}} = 28$$

5. What is the rule for the table, in words? _____

6. Let b equal the input. What is the rule for the table, in symbols? _____

7. Use the rule to complete the table.

Name _____

Expressions with Addition and Subtraction (continued)



Find a rule for each table. Write the rule in symbols. Let n equal the input. Then use the rule to complete the table.

8.

Input	Output
27	24
20	17
18	15
12	9
9	

9.

Input	Output
7	15
10	18
11	19
15	23
18	

10.

Input	Output
7	5
9	
15	
16	14
20	18
25	23

11.

Input	Output
3	
5	22
7	24
12	29
25	
32	49

12. **Reasoning** How can you tell an addition pattern in an input/output table from a subtraction pattern?

Expressions with Multiplication and Division

1. Complete to find a pattern in the table.

Number of Kittens (Input)	Total Number of Paws (Output)
3	12
4	16
6	
8	32
9	36

Think:

$$3 \times 4 = 12$$

$$4 \times 4 = \underline{\hspace{2cm}}$$

$$4 \times 8 = \underline{\hspace{2cm}}$$

$$4 \times 9 = \underline{\hspace{2cm}}$$

2. What is the rule for the table, in words? _____

Let k equal the number of kittens. The rule, in symbols, for the table is $4 \times k$.

3. Use the rule to complete the table.

4. Complete to find a pattern in the table.

input	Output
6	2
9	3
15	5
18	
24	8

Think:

$$6 \div \underline{\hspace{2cm}} = 2$$

$$9 \div \underline{\hspace{2cm}} = 3$$

$$15 \div \underline{\hspace{2cm}} = 15$$

$$24 \div \underline{\hspace{2cm}} = 8$$

5. What is the rule for the table, in words? _____

6. Let c equal the input. What is the rule for the table, in symbols? _____

7. Use the rule to complete the table.

Name _____



Expressions with Multiplication and Division (continued)

Find a rule for each table. Write the rule in symbols. Let n equal the input. Then use the rule to complete the table.

8.

Input	Output
24	12
20	10
16	8
14	7
10	

9.

Input	Output
2	8
4	16
5	20
7	28
9	

10.

Input	Output
0	0
8	2
12	
20	5
28	
40	10

11.

Input	Output
0	0
1	9
4	
5	45
7	63
10	

12. **Reasoning** How can you tell an addition pattern in an input/output table from a multiplication pattern?

Name _____

Expressions with Parentheses

The pet store had 12 angel fish. Ava bought 4 and her sister, Salma, bought 3. How many angel fish did the store have left after the sisters bought their fish?

- 1.** Fill in the blanks to solve the problem one way.

number of fish Ava bought	number of fish left after Ava	number of fish left after Ava	number of fish Salma bought	number of fish left
↓	↓	↓	↓	↓
12 - _____ = _____		_____ - 3 = _____		

- 2.** Fill in the blanks to solve the problem another way.

number of fish Ava bought	number of fish Salma bought	number of fish sisters bought	number of fish left
↓	↓	↓	↓
$12 - (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 12 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$			

3. The store had _____ fish left after the sisters bought their fish.

To find the value of an expression, do what is in parentheses first.

4. $(15 - 10) - 2 = \underline{\hspace{2cm}} - 2 = \underline{\hspace{2cm}}$
5. $15 - (10 - 2) = 15 - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$
6. Where would you place the parentheses to make the number sentence below true? Use your answers to 4 and 5 above to help.

$$15 - 10 - 2 = 7$$



Name _____

Expressions with Parentheses (continued)

Find the value of each expression.

7. $10 - (4 + 2)$

8. $6 + (12 - 4)$

9. $(5 + 5) - 5$

10. $(13 + 12) + 10$

11. $(15 - 5) + 8$

12. $14 - (9 - 5)$

13. $12 - (10 - 8)$

14. $18 - (12 + 5)$

15. $(10 - 6) - (3 - 1)$

16. $(12 - 6) + (30 - 15)$

17. $(12 + 8) + (15 + 5)$

18. $(18 + 12) - (7 + 13)$

Circle the number sentence that is true.

19. $(16 - 7) + 6 = 3$

OR

$16 - (7 + 6) = 3$

20. $(20 - 8) - 5 = 7$

OR

$20 - (8 - 5) = 7$

21. $(100 - 50) + 15 = 35$

OR

$100 - (50 + 15) = 35$

Place parentheses to make the number sentence true.

22. $32 - 18 - 6 = 20$

23. $20 - 6 + 8 = 6$

24. $75 - 25 + 25 = 25$

25. $30 - 27 - 2 = 1$

26. $24 - 4 + 19 = 39$

27. $15 - 4 + 8 = 3$

28. **Reasoning** Carlos had \$15 before he spent \$4 on lunch and \$5 on a kite.

Write an expression with parentheses.

Use the expression to find how much money Carlos had left.



Order of Operations

To evaluate an expression, you must follow the order of operations.

1. Follow the steps to simplify the expression.

$$\begin{aligned} & (21 + 16) - 6 \times 4 \\ & \quad \downarrow \\ & = \underline{\hspace{2cm}} - 6 \times 4 \quad \text{Do parentheses first.} \\ & \quad \quad \downarrow \\ & = 37 - \underline{\hspace{2cm}} \quad \text{Do multiplication before subtraction.} \\ & \quad \quad \downarrow \\ & = \underline{\hspace{2cm}} \quad \text{Subtract.} \end{aligned}$$

$$\text{So, } (21 + 16) - 6 \times 4 = \underline{\hspace{2cm}}.$$

Order of Operations

- Parentheses
- Multiplication and/or Division from left to right
- Addition and/or Subtraction from left to right

2. Follow the steps to find the value of $(15 - c) + 27 \div 9$ when $c = 8$.

$$\begin{aligned} & (15 - c) + 27 \div 9 \\ & \quad \downarrow \\ & = (15 - \underline{\hspace{2cm}}) + 27 \div 9 \quad \text{Put 8 in for c.} \\ & \quad \downarrow \\ & = \underline{\hspace{2cm}} + 27 \div 9 \quad \text{Do parentheses first.} \\ & \quad \quad \downarrow \\ & = 7 + \underline{\hspace{2cm}} \quad \text{Do division before addition.} \\ & \quad \quad \downarrow \\ & = \underline{\hspace{2cm}} \quad \text{Add.} \end{aligned}$$

$$\text{So, when } c = 8, (15 - c) + 27 \div 9 = \underline{\hspace{2cm}}$$

3. What do you do first to simplify $5 \times 8 - (3 + 5) \div 4$?



Name _____

Order of Operations (continued)

Use the order of operations to simplify each expression.

4. $2 \times (1 + 5)$

5. $5 + (6 \div 3)$

6. $(7 - 3) + (4 + 5)$

7. $49 \div (10 - 3)$

8. $(2 \times 3) + (4 \times 2)$

9. $8 + (3 \times 4)$

10. $(6 \times 2) + (8 \div 4)$

11. $15 + (25 \times 4) - 52$

12. $18 - (12 - 9) \times 3$

13. $6 - 2 \times 3 + 12$

14. $(12 \div 3) + (7 \times 2)$

15. $9 + 16 \div (3 + 1)$

Evaluate each expression for $a = 20$.

16. $a + 5 \div 5 - 3$

17. $a - (12 + 3)$

18. $(13 + 6) - (a - 14)$

Find the value of each expression for $g = 4$.

19. $6 + 5 \times 2 + g$

20. $(22 - g) \div (3 \times 2)$

21. $75 + (25 \times g) - 67$

22. William has 3 jars of marbles that he wishes to share equally with his brother. In the first jar there are 12 marbles, in the second jar there are 21 marbles, and in the third jar there are 17 marbles. Write an expression with parentheses to show how many marbles each boy will get. Then simplify the expression.

23. **Reasoning** Eddie simplified the expression $8 - 2 \times 3 + 10$ and got an answer of 28. Is Eddie correct? If not, what did he do wrong?

Name _____

Writing Expressions

Melon is on sale at a store for \$5 each. The store is also offering \$2 off the entire purchase. To write an expression to represent this situation answer 1 and 2.

1. Complete the table.

Number of Melons	Expression	Cost
3	$5 \times 3 - 2$	\$13
4	$5 \times 4 - 2$	
6		
7		

2. Look for a pattern in the expressions in the table above. Write an expression for the cost of m melons.

- 3.** Complete the table.

Words	Symbols
12 more than 5	$5 + 12$
12 more than 38	
12 more than d	
12 more than 3 times 7	$3 \times 7 + 12$
12 more than 3 times d	

4. Complete the table.

Words	Symbols
8 less than the product of 5 and 2	$5 \times 2 - 8$
8 less than the product of 5 and 9	
8 less than the product of 5 and m	
8 less than the product of 10 and m	$10m - 8$



Name _____

Writing Expressions (continued)

Complete the table.

5.	Words	Symbols
	6 more than y	
	10 added to the product of n and 3	
	4 more than s times 15 dollars	
	x less than 10	
	20 less than the product of b and 5.	

Write an algebraic expression for each situation.

6. 8 fewer than x

7. 12 times the distance d

8. 24 divided by b

9. 3 apples added to a apples

10. 5 more than 3 times y

11. 9 fewer than m miles divided by 4

12. 7 less than 10 times h

13. the sum of 9 and n divided by 6

14. Mr. Warren, the physical education teacher, has 7 boxes of helmets. Each box has h helmets. Write an expression to represent the total number of helmets.

15. **Reasoning** The cost of buying a loaded bagel is \$5. The cost of buying a box of juice is \$2. Write an expression for the cost of buying b bagels and j boxes of juice.



Name _____

Identify Parts of Expressions

Materials highlighting markers

Describe parts of the expression.

$$18k - 9 + \frac{k}{3}$$

1. The terms of an expression are separated by plus or minus signs.
Highlight all plus or minus signs in the expression above.
How many terms does the expression have? _____
2. A constant term does not have a variable.
Which term is constant? _____
3. A coefficient is a number that is multiplied by a variable. Which number in the expression is a coefficient? _____
4. A product is the result of multiplying. Which term is a product? _____
5. In the term that is a product, what are the factors? _____ and _____
6. Remember that $\frac{a}{b} = a \div b$ and a quotient is the result of dividing.
Which term is a quotient? _____
7. In $a \div b$, a is the dividend and b is the divisor.
In the term that is a quotient, what is the dividend? _____
8. In the term that is a quotient, what is the divisor? _____
9. A sum is the result of adding. What part of the expression is a sum? _____
10. A difference is the result of subtracting. What part of the expression is a difference? _____



Name _____

Identify Parts of Expressions (continued)

11. Add another term to the expression so that your new expression meets these conditions.

- The new expression has 4 terms.
- The new expression has a term that is a constant product equal to 14.

Use the expression $8x - (3 \cdot 400) + \frac{x}{5} - 2y$. Highlight the + and - signs, if you wish.

12. How many terms does the expression have? _____

13. How many terms are constant? _____

14. What is the coefficient of the variable y ? _____

15. Which terms are products? _____

16. Which term is a quotient? _____

Marcus has \$20. He wants to buy 2 bottles of shampoo. Then he wants to buy as many packages of tennis balls as he can afford. The prices are shown in the table.

He knows that tax on \$20 is \$1.20. The expression $2 \cdot 3.98 + 2.58t + 1.20$ can be used to find the total cost if Marcus buys t packages of tennis balls.

Things Marcus Wants to Buy	
Item	Price
Bottle of Shampoo	\$3.98
Package of Tennis Balls	\$2.58

17. How many terms are in the expression? _____

18. Which term is a constant and a product? What does it represent in this problem?

19. Which term has a variable and a coefficient? What does it represent in this problem?

Formulas and Equations

A rectangle with a length of 14 in. and a width of 5 in.

1. The length of the rectangle is _____ inches. So $\ell =$ _____.

2. The width of the rectangle is _____ inches. So $w =$ _____.

3. $A = \begin{matrix} \ell & \times & w \\ \downarrow & & \downarrow \end{matrix}$

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

Put 14 in place of ℓ and 5 in place of w .

A = _____

Multiply.

The area is _____ square inches.

4. Find the temperature in $^{\circ}\text{F}$ when it is 20°C .

Use the formula $F = 1.8C + 32$.

$$F = \underset{\downarrow}{1.8C} + 32$$
$$F = 1.8 \times \underline{\hspace{2cm}} + 32$$

Put 20 in place of C.

$$F = \underline{\hspace{2cm}} + 32$$

Use order of operations. Multiply first.

$$F = \underline{\hspace{2cm}}$$

Add.

The temperature is _____°F.

5. Reasoning Use your answer to 4 above to explain if a temperature of 30°C is warmer or colder than 68°F .

Name _____

Formulas and Equations (continued)

The length and width of rectangles are given.
Use the formula $A = \ell \times w$ for Exercises 6 to 11.

6. $\ell = 10$ in.; $w = 5$ in.; find A.
_____ in.²
8. $\ell = 125$ mi; $w = 4$ mi; find A.
_____ mi²
10. $\ell = 25$ m; $w = 4$ m; find A.
_____ m²
7. $\ell = 6$ m; $w = 1$ m; find A.
_____ m²
9. $\ell = 35$ ft; $w = 6$ ft.; find A.
_____ ft²
11. $\ell = 10$ in.; $w = 10$ in.; find A.
_____ in.²

A math teacher found that students' grades g on an exam are related to the number of hours studied h by the formula $g = 11h + 63$. Use this formula for Exercises 12 to 14.

- 12.** $h = 1$ hour, Find g . **13.** $h = 3$ hours, Find g . **14.** $h = 2$ hours, Find g .

Use the formula $F = 1.8C + 32$ for Exercises 15 to 17.

- 15.** $C = 30^\circ$. Find F **16.** $C = 15^\circ$. Find F . **17.** $C = 4^\circ$. Find F .

Feliz has 5 weeks to save money for vacation. The formula $s = 5d$ gives the total amount he will save, s , if he saves d dollars a week. Use the formula for Exercises 18 to 20.

- 18.** $d = 8$, Find s . **19.** $d = 10$, Find s . **20.** $d = 4$, Find s .

- 21. Reasoning** The length of a rectangle is 12 meters. Which would give a greater area, if $w = 4$ or $w = 6$? Explain.



Name _____

Writing Addition and Subtraction Equations

One of Jorge's puppies, Max, got sick and lost 2 ounces. After the loss, Max weighed 15 ounces. Answer 1 to 4 below to find how much Max weighed before he got sick.

1. What are you trying to find?

Let w equal what you are trying to find.

- 2.** Describe the problem and translate words to symbols.

Weight Before - _____ = Weight After

↓ ↓

w - _____ = _____

- 3.** Solve the equation.

$$w - 2 = 15$$

$$w - 2 + \underline{\hspace{2cm}} = 15 + \underline{\hspace{2cm}}$$

$$W = \underline{\hspace{2cm}}$$

- How much did Max weigh before he got sick? _____ ounces
- What if Max lost 2.5 ounces and his weight dropped to 14.8 ounces? Write and solve an equation to find how much Max weighed before he got sick.

Max gained 8 ounces during March. He weighed 36 ounces at the end of March. Answer 6 to 9 to find how much Max weighed at the beginning of March.

- 6.** What are you trying to find?



Name _____

Writing Addition and Subtraction Equations (continued)

Let w equal what you are trying to find.

7. Describe the problem and translate words to symbols.

8. Solve the equation you wrote in Exercise 7 above.

9. What did Max weigh at the beginning of March? _____

10. What if Max gained 7.6 ounces and weighed 35.2 ounces at the end of March? Write and solve an equation to find how much Max weighed at the beginning of March.

Write an equation for each sentence.

11. 5 more than n is 12.

12. 8 less than k is 9.

13. t minus 3.6 equals 7

14. 15 plus m equals 19.6

15. Ben started the day with \$25.75. After a trip to the park and lunch, he had \$8.17. Let n be the amount he spent. Write an equation to find n .

16. A cold front moved in at noon and in 5 hours, the temperature had dropped 23° . The temperature at 5:00 P.M. was 14° . Let x be the temperature at noon. Write an equation to find x .



Name _____

Writing Multiplication and Division Equations

Earthquakes occur along faults. The San Andreas Fault in California moves about 25 millimeters a year. Answer the questions below to find how many years it would take the San Andreas Fault to move 150 millimeters.

1. What are you trying to find?

Let y equal what you are trying to find.

- 2.** Describe the problem and translate words to symbols.

$$\begin{array}{ccccc} \text{mm per year} & \times & \underline{\hspace{2cm}} & = & \text{total mm} \\ \downarrow & & & & \downarrow \\ \underline{\hspace{1cm}} & \times & y & = & \underline{\hspace{1cm}} \end{array}$$

- 3.** Solve the equation.

$$25y = 150$$

$$\frac{25y}{\square} = \frac{150}{\square}$$

$$y = \underline{\hspace{2cm}}$$

4. How many years would it take the San Andreas fault to move 150 mm?

A geologist divided the total number of acres she needs to map in 5 days by 5. She found she needs to map 635 acres each day. Answer the questions below to find how many total acres she needs to map.

- 5.** What are you trying to find?



Name _____

Writing Multiplication and Division Equations (continued)

Let a equal what you are trying to find.

6. Describe the problem and translate words to symbols.

$$\begin{array}{ccccccc} \underline{\hspace{2cm}} & \div & \text{Number of days} & = & \underline{\hspace{2cm}} \\ \downarrow & & \downarrow & & \downarrow \\ \underline{\hspace{1cm}} & \div & \underline{\hspace{1cm}} & = & \underline{\hspace{1cm}} \end{array}$$

7. Solve the equation in Exercise 6 above.

8. How many total acres does the geologist need to map? _____

Write an equation for each sentence.

9. 8 times k is 144.

10. x divided by 14 is 322.

11. d dollars shared equally by 4 friends equals 8 dollars each.

12. 5 friends giving d dollars each equals \$75.

Write an equation and solve each problem.

13. The North Anatolian Fault in Turkey moves about 24 millimeters a year. The total 8-year movement, m , along the fault divided by 8 equals 24. How far does the fault move in 8 years?

14. A classroom has 5 rows of desks, and each row has the same number of desks. There are 35 desks altogether. How many desks, d , are in each row?

Factoring Numbers



Materials color tiles or counters, 24 for each student

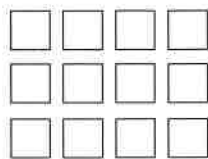
The arrays below show all of the factors of 12.



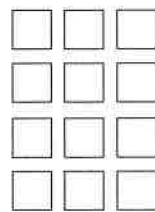
$$1 \times 12$$



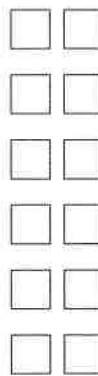
$$2 \times 6$$



$$3 \times 4$$



$$4 \times 3$$



$$6 \times 2$$

1. What are all the factors of 12?

_____, _____, _____, _____, _____, _____

2. Create all the possible arrays you can with 17 color tiles.

3. What are the factors of 17? _____, _____

Numbers which have only 2 possible arrays and exactly 2 factors are prime numbers.

4. Is 17 a prime number? _____

5. Is 12 a prime number? _____

Numbers which have more than 2 possible arrays and more than 2 factors are composite numbers.

6. Is 17 a composite number? _____

7. Is 12 a composite number? _____

8. What are all the factors of 24? _____

9. Is 24 a prime number or a composite number? _____



$$12 \times 1$$

Name _____



Factoring Numbers (continued)

Find all the factors of each number. Tell whether each is prime or composite.

10. 7

11. 8

12. 21

13. 48

14. 51

15. 9

16. 13

17. 26

18. 40

19. 55

20. 70

21. 83

22. Mr. Lee has 18 desks in his room. He would like them arranged in a rectangular array. Draw all the different possible arrays and write a multiplication sentence for each.

23. **Reasoning** Lee says 53 is a prime number because it is an odd number. Is Lee's reasoning correct? Give an example to prove your reasoning.

Exponents

Scott is planning to run in a race and asked 2 friends to sponsor him. The following week, each friend asked 2 more friends to sponsor Scott. If this continued, how many sponsors did Scott have after seven weeks?

1. Complete the table.

Week	Number of Sponsors (Expanded Form)	Number of Sponsors (Exponential Form)	Number of Sponsors (Standard Form)
1	2	2^1	2
2	2×2	2^2	4
3	$2 \times 2 \times 2$	2^3	8
4	$2 \times 2 \times 2 \times 2$	2^4	
5	$2 \times 2 \times 2 \times 2 \times 2$		
6			
7			

2. How many sponsors will Scott have on the 10th week?

Expanded form: _____

Exponential form: _____ Standard form: _____

3. If Scott started by asking 3 friends to sponsor him and each of those friends asked three friends, how many sponsors would he have on the 4th week?

Expanded form: _____

Exponential form: _____ Standard form: _____

4. Use the table above to complete the following patterns. $16, 8, 4, 2, \underline{\hspace{2cm}}$

$2^4, 2^3, 2^2, 2^1, \underline{\hspace{2cm}}$

$2^0 = 1$. Any number, except zero, to the zero power is 1.

5. What is 5^0 ? _____

Name _____

Exponents (continued)



Write each expression in exponential form.

6. $4 \times 4 \times 4$

7. $7 \times 7 \times 7 \times 7 \times 7$

8. $6 \times 6 \times 6$

9. $10 \times 10 \times 10 \times 10$

10. 5×5

11. $3 \times 3 \times 3 \times 3$

Write each expression in standard form.

12. 2^7

13. 1^7

14. 6^3

15. 83^1

16. 4^3

17. 11^2

18. 2^8

19. 10^4

20. 7^2

21. 0^5

22. 3^3

23. 12^0

Write each expression in expanded form.

24. 12^4

25. 8^3

26. 4^4

27. 32^5

28. 3^4

29. 200^2

30. **Reasoning** Is 2^5 the same as 5^{2^2} ? Check by writing both numbers in standard form.



Perfect Squares

Emma asks her friend Manny to choose a number between 10 and 40. Emma will then find out whether the number Manny chooses is a perfect square. Manny chooses the number 20. Is 20 a perfect square?

Use this information to answer 1 to 6.

1. What is a perfect square?
2. What are two ways that you find whether a number is a perfect square?
3. What is a perfect square close to 20? _____
How do you know that this number is a perfect square?
4. What is another perfect square close to 20? _____
How do you know that this number is a perfect square?
5. Is 20 a perfect square? Explain.
6. Explain how you found the two perfect squares closest to 20.

Name _____

Perfect Squares (continued)

Use the figure at the right to answer 7 through 9.

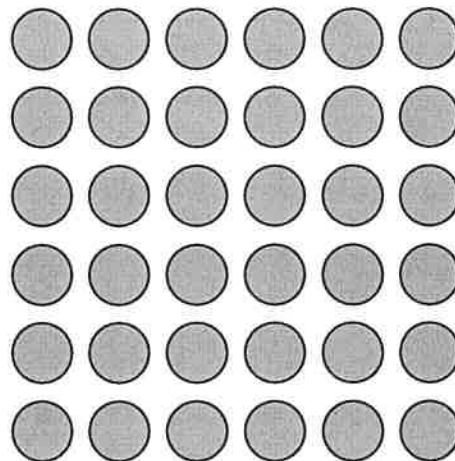
- 7.** How many rows are in the array?

How many columns are in the array?

- 8.** How many counters total are in the array?

9. Complete the equation for the square number.

_____ × _____ = _____



In 10 through 15, write *yes* if the number is a perfect square. Write *no* if it is not a perfect square.

10. 24 _____

11. 50 _____

- 12.** 10 _____

- 13.** 144 _____

14. 49 _____

- 15.** 78 _____

For 16 and 17, draw a square array for each perfect square number.

16. 9

17. 64

Name _____

Properties of Operations

1. Fill in the blanks to complete the table and summarize the properties of addition and multiplication.

Property	Example	Generalization for Any Numbers a , b , and c
Commutative Property of Addition	$12 + 4 = 4 + \underline{\hspace{2cm}}$	$a + b = b + \underline{\hspace{2cm}}$
Associative Property of Addition	$(7 + 3) + 8 = 7 + (3 + \underline{\hspace{2cm}})$ $\underline{\hspace{2cm}} + 8 = 7 + \underline{\hspace{2cm}}$	$(a + b) + c =$ $a + (b + \underline{\hspace{2cm}})$
Identity Property of Addition	$5 + 0 = \underline{\hspace{2cm}}$ $0 + 71 = \underline{\hspace{2cm}}$	$a + 0 = \underline{\hspace{2cm}}$ and $0 + a = \underline{\hspace{2cm}}$
Commutative Property of Multiplication	$5 \times 8 = 8 \times \underline{\hspace{2cm}}$	$a \times b = b \times \underline{\hspace{2cm}}$
Associative Property of Multiplication	$(6 \times 2) \times 4 = 6 \times (\underline{\hspace{2cm}} \times 4)$ $\underline{\hspace{2cm}} \times 4 = 6 \times \underline{\hspace{2cm}}$	$(a \times b) \times c =$ $a \times (b \times \underline{\hspace{2cm}})$
Identity Property of Multiplication	$17 \times 1 = \underline{\hspace{2cm}}$ $1 \times 6 = \underline{\hspace{2cm}}$	$a \times 1 = \underline{\hspace{2cm}}$ and $1 \times a = \underline{\hspace{2cm}}$
Zero Property of Multiplication	$34 \times 0 = \underline{\hspace{2cm}}$ $0 \times 98 = \underline{\hspace{2cm}}$	$a \times 0 = \underline{\hspace{2cm}}$ and $0 \times a = \underline{\hspace{2cm}}$

- 2.** Tell which property is used.

$$(5 \times 7) \times 20 = (7 \times 5) \times 20$$

Property of _____

$$(7 \times 5) \times 20 = 7 \times (5 \times 20)$$

Property of _____



Name _____

Properties of Operations (continued)

Find each n . Name the property that you used.

3. $3 \times 6 = 6 \times n$

4. $n \times 5 = 0$

5. $365 \times n = 365$

6. $(3 \times 2) \times n = 3 \times (2 \times 10)$

7. $5 \times 6 \times 4 \times 0 = n$

8. $n + 45 = 45$

9. $17 + 62 = 62 + n$

10. $21 + (n + 14) = (21 + 50) + 14$

11. $3 \times (14 - 14) = n$

12. $6 + (9 - n) = 6$

13. **Reasoning** Katie says she is thinking of two numbers whose product is 0. John claims that he knows one number for certain. Is he right? How does he know?

Use the Properties of Operations to Complete.

14. $10 + \underline{\hspace{2cm}} = 10$

15. $(10 \times 6) \times 2 = \underline{\hspace{2cm}} \times (6 \times 2)$

16. $(8 + 2) + 6 = (2 + \underline{\hspace{2cm}}) + 6$

17. $14 + 16 = \underline{\hspace{2cm}} + 14$

18. $c \times d = d \times \underline{\hspace{2cm}}$

19. $(q \times r) \times s = q \times (\underline{\hspace{2cm}} \times s)$

Name _____

Variables and Expressions



1. Complete the table.

Number	Number + 5
2	$2 + 5 = \underline{\hspace{2cm}}$
8	$8 + 5 = \underline{\hspace{2cm}}$
10	$\underline{\hspace{2cm}} + 5 = \underline{\hspace{2cm}}$
15	$\underline{\hspace{2cm}} + 5 = \underline{\hspace{2cm}}$
21	$\underline{\hspace{2cm}} + 5 = \underline{\hspace{2cm}}$

You can use n for the number and $n + 5$ as the rule.
The n is called a variable, because it varies to represent different numbers.

2. To find $n + 5$, when $n = 4$, put 4 in place of n and then add.

$$\begin{array}{c} n + 5 \\ \downarrow \\ \underline{\hspace{2cm}} + 5 = \underline{\hspace{2cm}} \end{array}$$

3. Find $3 \times n$, when $n = 7$.

$$\begin{array}{c} 3 \times n \\ \downarrow \\ 3 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \end{array}$$

4. Find $30 - 6 + q$, when $q = 8$.

$$\begin{array}{c} 30 - 6 + q \\ \downarrow \\ 30 - 6 + \underline{\hspace{2cm}} \\ = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} \\ = \underline{\hspace{2cm}} \end{array}$$

Name _____



Variables and Expressions (continued)

Evaluate each expression for $b = 6$.

5. $b - 4$

6. $3 + b$

7. $8 - b$

8. $13 + b - 1$

Evaluate each expression for $c = 11$.

9. $c + 10$

10. $14 - 5 + c$

11. $11 - c$

12. $15 - c$

Evaluate each expression for $x = 3$.

13. $2x$

14. $\frac{x}{6}$

15. $7x$

16. $\frac{18}{x}$

Complete each table.

17.

x	$x - 4$
4	0
9	5
15	
	17

18.

n	$7 + n$
6	
15	22
20	27
50	

19.

x	$5x$
3	
7	
12	
20	

20.

y	$\frac{56}{y}$
2	
7	
14	
56	

21. Jeff is three years younger than Steve. Complete the table to show Jeff's age.

Steve's age	n	10	15	21	35
Jeff's age	$n - 3$				

22. **Reasoning** Using the table in Exercise 21, if Jeff is 45, how old is Steve?



More Variables and Expressions (continued)

Evaluate each expression for $x = 3$.

5. $\left(\frac{x}{3}\right) + 15$

6. $24 - (2x)$

7. $(3x) + 5$

8. $(4x) - 12$

9. $(5x) - \left(\frac{15}{x}\right)$

10. $35 + \left(\frac{21}{x}\right)$

11. $(19 + x) \div 11$

12. $(6x) + x - 12$

13. $5x \div 3$

Evaluate each expression for $a = 9$, $b = 2$, and $c = 0$.

14. $(a + 7b) + c$

15. $13c + a$

16. $(a + b) \times 3$

17. $12b - 14c$

18. $(a + b + c) \times 2$

19. $(11 + a) \div b$

20. $c \times (b + c)$

21. $4a - 5b$

22. $(a - b - c) \times 4$

23. $7b - 12c$

24. $(2a + b) \div 5$

25. $a \times (b - c)$

Use the data at the right to answer Exercises 26–28.

26. The cost of x small pizzas with y small beverages is given by the expression $5x + y$. How much do 3 small pizzas and 2 small beverages cost? _____

27. The cost of x large pizzas with y large beverages is given by the expression $8x + 2y$. How much do 2 large pizzas with 3 large beverages cost? _____

28. **Reasoning** Micka purchases 4 small veggie pizzas and 3 large beverages. Romano purchases 3 large pizzas and 4 small beverages. Who spent more money? Explain.

Veggie Pizza House		
Size	Pizza	Beverages
small	\$5.00	\$1
large	\$8.00	\$2



Name _____

Solving Addition and Subtraction Equations (continued)

Solve each equation.

10. $w + 5 = 10$

11. $n - 17 = 5$

12. $77 = m + 8$

13. $49 = a - 21$

14. $y - 27 = 27$

15. $0 = w - 10$

16. $m + 41 = 52$

17. $x - 74 = 100$

18. $323 = a + 11$

19. $12 = n - 14$

20. $y + 54 = 98$

21. $k - 40 = 51$

22. $159 = n - 12$

23. $a - 159 = 12$

24. $205 = a + 148$

25. $w + 37 = 98$

26. $35 = x - 149$

27. $y - 84 = 31$

28. $178 = a + 167$

29. $19 = n - 67$

30. $m - 248 = 16$

31. $w + 156 = 208$

32. $n - 110 = 400$

33. $177 = x - 45$

34. **Reasoning** To solve the equation $x + 14 = 30$, Guido added 14 to both sides of the equation and got a solution of $x = 44$. Do you agree with Guido? If not, why?
- _____



Name _____

Solving Multiplication and Division Equations (continued)

7. Does the value of n you found in Exercise 6 make the equation $\frac{n}{7} = 3$ true? _____

Fill in the blanks to solve each equation.

8. $5b = 400$

$$\frac{5b}{\square} = \frac{400}{\square}$$

$b = \underline{\hspace{2cm}}$

9. $\frac{c}{4} = 19$

$$\underline{\hspace{2cm}} \times \frac{c}{4} = \underline{\hspace{2cm}} \times 19$$

$c = \underline{\hspace{2cm}}$

10. **Reasoning** Why can you multiply both sides of $\frac{h}{7} = 3$ by 7 and still have a true equation?

Solve each equation.

11. $4a = 16$

12. $\frac{m}{15} = 2$

13. $7x = 56$

14. $16b = 32$

15. $10y = 40$

16. $\frac{z}{24} = 3$

17. $15n = 90$

18. $\frac{c}{12} = 7$

19. $\frac{t}{9} = 20$

20. $19r = 38$

21. $35s = 140$

22. $\frac{v}{72} = 4$

23. **Reasoning** To solve an equation like $\frac{d}{5} = 7$, you multiply both sides of the equation by 5. Why do you multiply instead of divide?



Name _____

Constant of Proportionality

Rosa is filling her swimming pool with a garden hose. After 3 hours, there are 1,620 gallons of water in the pool. After 5 hours, there are 2,700 gallons of water in the pool.

Use the information about Rosa's swimming pool to answer Exercises 1–4.

1. If 1,620 gallons of water are in the pool in 3 hours and 2,700 gallons of water are in the pool in 5 hours, you can divide the number of gallons of water, y , by the number of hours, x , to find the unit rate of the number of gallons of water per hour.

$$\frac{y}{x} = \frac{\boxed{}}{3} = \underline{\hspace{2cm}}$$

$$\frac{y}{x} = \frac{\boxed{}}{\boxed{}} = \underline{\hspace{2cm}}$$

2. The table shows some other ratios for the relationship of numbers of gallons of water, y , to number of hours, x . Is the number of gallons per hour the same for each entry in the table? How do you know?

y	1,080	2,160	3,240	3,780	4,320
x	2	4	6	7	8

3. The number 540 is the constant of proportionality, k , that relates the x and y terms of each of these ratios. Express k in terms of x and y .

$$k = \frac{\boxed{}}{\boxed{}}$$

4. Write an equation that uses the value of k to represent the relationship between the number of hours, x , and the number of gallons of water, y .

$$y = \underline{\hspace{2cm}} \cdot x$$



Name _____

Constant of Proportionality (continued)

Tori read that the average cost of 64 ounces of milk was \$1.12.
Suppose that the cost of a bottle of milk is proportionate to the number of ounces in the bottle.

5. Write an equation that relates the cost of a bottle of milk, y , to the number of ounces of milk, x , in the bottle.

$$y = \underline{\hspace{2cm}} \cdot x$$

6. At this rate, what would be the cost of 8 ounces of milk?

$$\underline{\hspace{2cm}} \cdot \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

For Exercises 7–9, write the constant of proportionality in each of the equations.

7. $160 = kx$

8. $y = 30x$

9. $8 = \frac{y}{x}$

For Exercises 10–11, determine whether the x - and y -values represent a proportional relationship. If the relationship is proportional, identify the constant of proportionality.

10.

x	5	6	7	8	9
y	\$0.30	\$0.36	\$0.49	\$0.56	\$0.63

11.

x	15	16	17	18	19
y	\$90	\$96	\$102	\$108	\$114

12. A recipe calls for $\frac{1}{2}$ cup of yogurt for every cup of sour cream.
Write an equation that relates the amount of yogurt, y , to the amount of sour cream, x .



Recognizing Proportional Relationships

The table shows examples of the number of cups of banana related to the number of cups of vanilla yogurt for a smoothie recipe.

Cups of vanilla yogurt	$2\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{3}{4}$
Cups of banana	9	6	5	3

1. How is the number of cups of yogurt related to the number of cups of banana?

$$2\frac{1}{4} \div 9 = \underline{\hspace{2cm}} \qquad 1\frac{1}{2} \div 6 = \underline{\hspace{2cm}}$$

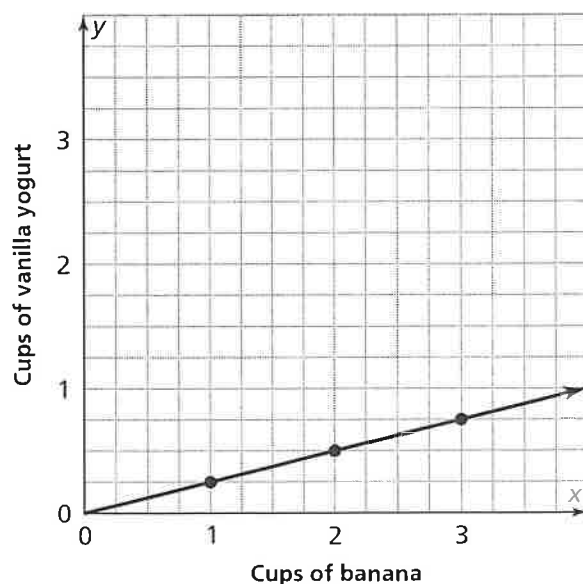
$$1\frac{1}{4} \div 5 = \underline{\hspace{2cm}} \qquad \frac{3}{4} \div 3 = \underline{\hspace{2cm}}$$

2. What is the unit rate for this relationship?

_____ cup of vanilla yogurt to _____ cup of banana

3. Is the relationship proportional? Why or why not?

4. A proportional relationship can be graphed as a straight line that passes through (0,0) on the coordinate plane.



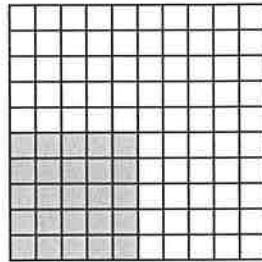
Which ordered pair represents 1 cup of banana as its x-coordinate?

Which ordered pair represents $\frac{3}{4}$ cup of yogurt as its y-coordinate?

Name _____

Relating Percents, Decimals, and Fractions

The hundred grid below represents the number of students out of 100 surveyed that ride the bus to school. Write this number as a percent, a decimal, and a fraction in simplest form by answering 1 to 7.



1. How many students were surveyed? _____
2. How many students ride the bus out of 100? _____
3. What percent of the students surveyed ride the bus? _____
4. Write a decimal to represent the shaded part of the hundred grid. _____
5. What fraction of the hundred grid is shaded? _____
6. Write the fraction from item 5 in simplest form. _____
7. The percent, decimal, and fraction forms are all equal. Use one of each form to fill in the blanks. _____ = _____ = _____

The same survey of 100 students found that 32% walk to school. Write this percent as a decimal and a fraction in simplest form by answering 8 to 10.

8. To change a percent to a decimal, remove the percent sign and move the decimal point two places to the left.
What decimal is equal to 32%? _____
9. To change a percent to a fraction, remove the percent sign and write the number over a denominator of 100.
What fraction is equal to 32%? _____
10. Write the fraction from item 9 in simplest form. _____



Relating Percents, Decimals, and Fractions (continued)

Write each expression in two other ways.

11. 19%

12. $\frac{23}{100}$

13. 0.7

14. 11%

15. 2%

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16. $\frac{9}{100}$

Year	Percentage of Respondents (%)
1994	65
1996	75
1998	70
2000	85
2002	90
2004	95

17. 0.13

18. 25%

Write each percent as a decimal and as a fraction in simplest form.

19. 60%

20. 5%

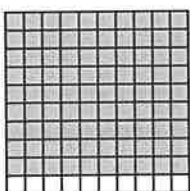
21. 16%

Fig. 3. *Phragmites* and *Spartina* coverages in the marshes of the San Francisco Estuary, 1990–2000. The map shows the distribution of *Phragmites* and *Spartina* coverages in the marshes of the San Francisco Estuary, 1990–2000. The map shows the distribution of *Phragmites* and *Spartina* coverages in the marshes of the San Francisco Estuary, 1990–2000.

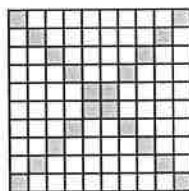
22. 45%

Express each shaded part as a decimal, as a percent, and as a fraction in simplest form.

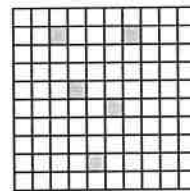
23.



24.



25.



- 26.** In Mrs. Hughes's class $\frac{3}{5}$ of the students voted to have tacos at their end of the year party. What percentage of students voted for tacos?

- 27. Reasoning** When dividing a number by 100, the decimal point is moved two places to the left. How does this relate to the conversion of a percent into a decimal?