

8th Grade – Summer Math Packet

Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

7 – Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Objective: Use the distributive property to generate equivalent expressions.

The **distributive property** of multiplication over addition states: $a(b + c) = a \cdot b + a \cdot c$ or $a(b + c) = ab + ac$.

The same is true for subtraction:

$$a(b - c) = a \cdot b - a \cdot c \text{ or } a(b - c) = ab - ac.$$

Examples:

1. $-3(-2x + 5) = (-3) \cdot -2x + (-3) \cdot 5$ Distribute 3 through the parentheses; Multiply -3 by $-2x$ & multiply -3 by 5 .
 $= 6x - 15$ Simplify
2. $4(5a - 9b) = 4 \cdot 5a - 4 \cdot 9b$ Distribute 4 through the parentheses; Multiply 4 by $5a$ and multiply 4 by $9b$.
 $= 20a - 36b$

1. Use the distributive property to write an equivalent expression.

$$-2(n + 7)$$

2. Use the distributive property to write an equivalent expression.

$$-8(3p - 1)$$

3. Use the distributive property to write an equivalent expression.

$$7(-4m + 5)$$

4. Use the distributive property to write an equivalent expression.

$$11(-x - 5)$$

5. Use the distributive property to write an equivalent expression.

$$-(3k - 4)$$

6. Use the distributive property to write an equivalent expression.

$$-6(5z + 12)$$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

7 – Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Objective: Combine like terms.

Definition	Illustration on $2x + 5x - 3y + 1$
Terms are separated by addition or subtraction.	$2x, 5x, 3y$, and 1 are <i>terms</i> .
A <u>coefficient</u> is the number multiplied by a variable in a term.	2, 5, and 3 are <i>coefficients</i> .
Like terms have exactly the same variable.	$2x$ and $5x$ are <i>like terms</i> .
A <u>constant</u> is a numerical term that does not have a variable.	1 is a <i>constant term</i> .
**Like terms can be combined by adding or subtracting their coefficients.	

Examples:

1. Combine like terms: $5x + x - 7y$

$$5x + x - 7y = \text{original problem}$$

$$5x + 1x - 7y = \text{When a coefficient is not visible, it is 1.}$$

$$(5 + 1)x - 7y = 6x - 7y \text{ Add coefficients of like terms (5x and 1x); } -7y \text{ remains unchanged.}$$

2. Combine like terms: $12r + 5 + 3r - 5$

$$12r + 5 + 3r - 5 = \text{original problem}$$

$$12r + 3r + 5 - 5 = \text{reorder terms}$$

$$(12 + 3)r + 5 - 5 = \text{add coefficients of like terms (12r and 3r); add constants (5 and -5)}$$

$$15r + 0 = 15r \text{ simplify}$$

1.) Combine like terms:

$$-2x + 11 + 6x$$

2.) Combine like terms:

$$9a - 6a + 4b$$

3.) Combine like terms:

$$-3x + 15x - 9 + 4$$

4.) Combine like terms:

$$6 - 7n - 2n - 8$$

5.) Combine like terms:

$$7m - 2m + 4n + n$$

6.) Combine like terms:

$$11a + 7b - 15a - 5b$$

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CCRS Standards:

7 – Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Objective: Expand linear expressions with the distributive property and simplify the expressions by combining like terms.

Examples:

1. Distribute and simplify: $-4 + 6(-4x + 3)$

$$\begin{array}{lcl} -4 + 6(-4x + 3) & = & \text{original problem} \\ -4 + 6 \cdot -4x + 6 \cdot 3 & = & \text{distribute 6 through } (-4x + 3) \\ -4 - 24x + 18 & = & \text{multiply 6 by } -4x, \text{ and multiply 6 by 3} \\ -24x - 4 - 18 & = & \text{reorder} \\ -24x - 22 & & \text{combine like terms (add constants } -4 \text{ and } -18) \end{array}$$

2. Distribute and simplify: $-(-3n + 2) - 2n$

$$\begin{array}{lcl} -(-3n + 2) - 2n & & \text{original problem} \\ -1(-3n + 2) - 2n & & \text{the opposite sign before the parentheses represents } -1 \\ -1 \cdot -3n + -1 \cdot 2 - 2n & & \text{distribute } -1 \text{ through } (-3n + 2) \\ 3n - 2 - 2n & & \text{multiply } -1 \text{ by } -3n \text{ and multiply } -1 \cdot 2 \\ 3n - 2n - 2 & & \text{reorder} \\ (3 - 2)n - 2 & & \text{combine like terms} \\ 1n - 2 & & \text{simply} \\ n - 2 & & \text{simplify} \end{array}$$

1.) Combine like terms: $3(7n + 6) - 5n$

2.) Combine like terms: $-5(9x - 4) + 10$

3.) Combine like terms: $7(-2p + 3) + 2p$

4.) Combine like terms: $-2v - (9 - 10v)$

5.) Combine like terms: $-1 + 3(m + 4)$

6.) Combine like terms: $-8(5 - 3x) + 12$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

13 – Write, read, and evaluate expressions in which letters stand for numbers. (6th)

13c – Evaluate expressions at specific values of their variables. (6th)

Objective: Evaluate an algebraic expression.

- A variable is a symbol, usually a letter, used to represent a number.
- Algebraic expressions are combinations of variables, numbers, and at least one operation.
- Multiplication in algebra can be shown as $8n$ or $8 \times n$
- The variables in an algebraic expression can be replaced with any number.
- Once the variables have been replaced, you can evaluate, or find the value of, the algebraic expression.

Example 1: Evaluate $-7x + 4y - 12$

if $x = -6$ and $y = -1$

$$-7x + 4y - 12 \quad \text{original problem}$$

$-7 \cdot -6 + 4 \cdot -1 - 12$ replace x with -6 and y with -1

$42 - 4 - 12$ multiply -7 by -6 and 4 by -1

$38 - 12$ simplify

26 simplify

Example 2: Evaluate $10a - ab + 3b$

if $a = \frac{1}{5}$ and $b = 15$

$$10a - ab + 3b \quad \text{original problem}$$

$10 \cdot \frac{1}{5} - \frac{1}{5} \cdot 15 + 3 \cdot 15$ replace a with $\frac{1}{5}$ and b with 15

$2 - 3 + 45$ multiply 10 by $\frac{1}{5}$ and $\frac{1}{5}$ by 15

$-1 + 45$ simplify

44 simplify

1.)

Evaluate $12a + 3b$ if $a = -1$ and $b = -7$

2.)

Evaluate $-12g + 5h$ if $g = \frac{1}{3}$ and $h = -2$

3.)

Evaluate $30 - xy + 2$ if $x = 7$ and $y = 3$

4.)

Evaluate $xy + 7 - y$ if $x = -2$ and $y = -6$

5.)

Evaluate $np + n - p$ if $n = 4$ and $p = -5$

6.)

Evaluate $24r - 3s + 6$ if $r = -\frac{1}{4}$ and $s = 5$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

12 – Write and evaluate numerical expressions involving whole-number exponents. (6th)

13c – Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). (6th)

Objective: Evaluate numeric expressions using order of operations.

Example 1: Evaluate $3 \cdot 2^3 - 25 \div 5$

$$\begin{array}{ll} 3 \cdot 2^3 - 25 \div 5 & \text{original expression} \\ 3 \cdot 8 - 25 \div 5 & \text{calculate } 2^3 \\ 24 - 25 \div 5 & \text{multiply 3 by 8} \\ 24 - 5 & \text{divide 25 by 5} \\ 67 & \text{subtract 5 from 24} \end{array}$$

Example 2: Evaluate $(12 - 9) \cdot (15 - 3^3) + 4^2$

$$\begin{array}{ll} (12 - 9) \cdot (15 - 3^3) + 4^2 & \text{original expression} \\ (12 - 9) \cdot (15 - 27) + 16 & \text{calculate } 3^3 \text{ and } 4^2 \\ 3 \cdot -12 + 16 & \text{simply parentheses} \\ -36 + 16 & \text{multiply 3 by } -12 \\ -20 & \text{simplify} \end{array}$$

1.) $12 \cdot 4 - 72 \div 9$

2.) $64 - 4 \cdot 2^3 + 7$

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

4.) $(72 - 16) \div (13 - 6) \cdot 2^3$

5.) $45 \div 9 - 3 + 7 \cdot 3$

6.) $(28 - 10^2) \div 2^3$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

10 – Use variables to represent quantities in real-world or mathematical problems, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

10a – Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Objective: Solve two-step equations.

Example 1:

$$\begin{array}{rcl} 5m + 2 = -13 & \text{original equation} \\ -2 -2 & \text{add } -2 \text{ to both sides} \\ \hline 5m + 0 = -15 & \text{solution} \\ 5m = -15 & \text{simplify} \\ 5 \quad 5 & \text{divide both sides by 5} \\ 1m = -3 & \text{solution} \\ m = -3 & \text{simplify} \end{array}$$

Check Solution:

$$\begin{array}{rcl} 5m + 2 = -13 & \text{original equation} \\ 5 \cdot -3 + 2 = -13 & \text{replace } m \text{ with } -3 \\ -15 + 2 = -13 & \text{simplify} \\ -13 = -13 & \text{simplify} \end{array}$$

Example 2:

$$\begin{array}{rcl} -7.8x - 5.4 = -78.408 & \text{original equation} \\ +5.4 +5.4 & \text{add } 5.4 \text{ to each side} \\ \hline -7.8x + 0 = -73.008 & \text{solution} \\ -7.8x = -73.008 & \text{simplify} \\ -7.8 \quad -7.8 & \text{divide both sides by } -7.8 \\ 1 \cdot x = 9.36 & \text{solution} \\ x = 9.36 & \text{simplify} \end{array}$$

Check Solution:

$$\begin{array}{rcl} -7.8x - 5.4 & = -78.408 & \text{original equation} \\ -7.8 \cdot (9.36) - 5.4 & = -78.408 & \text{replace } x \text{ with } 9.36 \\ -73.008 - 5.4 & = -78.408 & \text{simplify} \\ -78.408 & = -78.408 & \text{simplify} \end{array}$$

1.) Solve and check.

$$2k + 5 = 29$$

2.) Solve and check.

$$-11x - 7 = 26$$

3.) Solve and check.

$$9x - 7 = -7$$

4.) Solve and check.

$$-3y + 8.25 = 24$$

5.) Solve and check.

$$-5n + 2.75 = -28.75$$

6.) Solve and check.

$$2.43y - 1.21 = -10.94$$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards: 10 – Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

10a – Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Objective: Solve two-step equations with rational numbers.

Example 1:

$$\begin{aligned} \frac{n-10}{2} &= -6 && \text{original equation} \\ 2 \cdot \frac{n-10}{2} &= -6 \cdot 2 && \text{Multiply both sides by the denominator, 2.} \\ 1(n-10) &= -12 && \text{Simplify} \\ n-10 &= -12 && \text{Simplify: } 1(n-10) = n-10 \\ +10 & \quad +10 && \text{Add 10 to each side.} \\ \hline n+0 &= -2 && \text{Solution} \\ n &= -2 && \text{Simplify: } n+0 = -2 \end{aligned}$$

Check Solution

$$\begin{aligned} \frac{n-10}{2} &= -6 && \text{original equation} \\ \frac{-2-10}{2} &= -6 && \text{Replace } n \text{ with } -2. \\ \frac{-12}{2} &= -6 && \text{Simplify numerator.} \\ -6 &= -6 && \text{Simplify} \end{aligned}$$

Example 2:

$$\begin{aligned} \frac{m}{9} - 1 &= -2 && \text{original equation} \\ 9\left(\frac{m}{9} - 1\right) &= 9 \cdot (-2) && \text{Multiply both sides by the denominator, 9.} \\ 9 \cdot \frac{m}{9} + -9 \cdot 1 &= 9 \cdot -2 && \text{Distribute 9 on the left side.} \\ m - 9 &= -18 && \text{Simplify} \\ +9 & \quad +9 && \text{Add 9 to both sides.} \\ m + 0 &= -9 && \text{Solution} \\ m &= -9 && \text{Simplify} \end{aligned}$$

Check Solution

$$\begin{aligned} \frac{m}{9} - 1 &= -2 && \text{original equation} \\ \frac{-9}{9} - 1 &= -2 && \text{Replace } m \text{ with } -9 \\ -1 - 1 &= -2 && \text{Simplify} \\ -2 &= -2 && \text{Simplify} \end{aligned}$$

1.) Solve and check.

$$\frac{v-9}{3} = -8$$

2.) Solve and check.

$$\frac{n+5}{-16} = -1$$

3.) Solve and check.

$$\frac{a}{4} + 2 = -6$$

4.) Solve and check.

$$\frac{x}{20} - 5 = -4$$

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Domain: EXPRESSIONS & EQUATIONS

CCRS Standards:

10 – Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Objective: Write an algebraic expression to represent unknown quantities.

The tables below show phrases written as mathematical expressions.

Phrases	Expression
12 more than a number, x	
the sum of 12 and a number, x	
a number, x , plus 12	
a number, x , increased by 12	
the total of x and 12	
Phrases	Expression
3 multiplied by g	
3 times a number, g	
the product of g and 3	

Phrases	Expression
2 less than a number, n	
a number, n , minus 2	
2 subtracted from number, n	
a number, n , decreased by 4	
the difference of n and 2	
Phrases	Expression
a number divided by 5	
the quotient of m and 5	
divide a number by 5	

1.) 18 less than p	2.) the quotient of a number, n , and 9
3.) 18 years older than Jordan	4.) 5 times as many hits as Paul
5.) Let t = the number of tomatoes Tara planted last year. This year, she planted 3 times as many. Write an algebraic expression to show how many tomatoes Tara planted this year.	6.) Last week, Jack sold x number of hot dogs at the football game. This week he sold twice as many as last week, and then he sold 10 more. Write an expression to show how many hot dogs Jack sold this week.

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10a – Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Objective: Write linear equations.

The table below shows sentences written as an equation.

Sentences	Equation
Seventy less than 5 times a number is 25. Five times the amount decreased by 70 is equal to 25. 25 is equal to the difference of 5 times a number and 70. The product of 5 and a number less 70 equals 25.	$5n - 70 = 25$

1.) Write an equation for the problem. Do not solve.

4 less than 3 times a number is 14.

2.) Write an equation for the problem. Do not solve.

There are 5 people in Johnny's rock band. They made x dollars playing at a dance hall. After dividing the money 5 ways, each person got \$67. Write a division equation that you could use to find the amount of money the band was paid.

3.) Write an equation for the problem. Do not solve.

Twice the sum of a number and 7 is equal to 44.

4.) Write an equation for the problem. Do not solve.

The lifespan of a zebra is 15 years. The lifespan of a black bear is 3 years longer than the lifespan of a zebra. Write an addition equation that you could use to find the lifespan of a bear.

5.) Write an equation for the problem. Do not solve.

A gardening expert recommends that flower bulbs be planted to a depth of three times their height. Suppose Jenna determines that a certain bulb should be planted at a depth of 4.5 inches. Write an equation to find the height of the bulb.

6.) Write an equation for the problem. Do not solve.

The electric company charges \$0.06 per kilowatt hour of electricity used. Write a multiplication equation to find the number of kilowatt hours of electricity for which the Estevez family was charged if their electric bill was \$45.84.

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CCRS Standards:

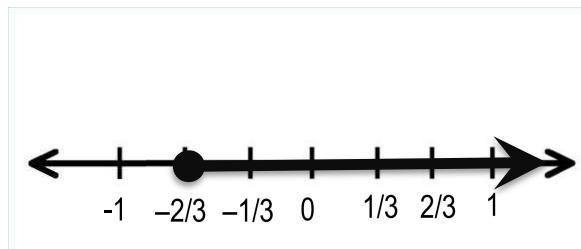
10 – Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

10a – Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem.

Objective: Solve and graph linear inequalities.

Example: Solve and graph $-3x + 2 \leq 4$.

$$\begin{array}{ll} -3x + 2 \leq 4 & \text{original problem} \\ -2 -2 & \text{add } -2 \text{ to both sides} \\ -3x + 0 \leq 2 & \text{simplify} \\ \underline{-3x} \leq 2 & \text{simplify} \\ -3 & \text{divide by } -3 \\ x \geq \frac{2}{-3} & \text{solution} \\ x \geq -\frac{2}{3} & \text{simplify} \end{array}$$



1.) Solve and graph.

$$x - 5 \leq -3$$



2.) Solve and graph.

$$1.3y > 4.42$$



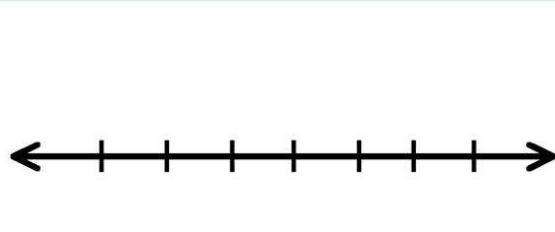
3.) Solve and graph.

$$9 - x \geq -10$$



4.) Solve and graph.

$$2y - 1 < -7$$



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10 – Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

10a – Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem.

Objective: Write and solve linear inequalities.

Example: One-half of a number, x , minus 3 is at least 4. What are the possible values of the number?

Write the inequality:

One-half • a number – 3 ≤ 4 Reason the problem with the correct operations.

$\frac{1}{2} \cdot n - 3 \leq 4$ Replace items with variables and values

$2\left(\frac{1}{2}n - 3\right) \leq 2(4)$ Multiply both sides by 2

$2 \cdot \frac{1}{2}n - 2 \cdot 3 \leq 8$ distribute 2 through parentheses; multiply 2 and 4

$n - 6 \leq 8$ Simplify

$\begin{array}{r} +6 \\ \hline n + 0 \end{array} \leq 14$ add 6 to both sides

$n \leq 14$ Solution

$n \leq 14$ Simplify

1. Write the inequality and solve.

A certain minivan has a maximum carrying capacity of 1100 pounds. If the luggage weighs 120 pounds, what is the maximum weight, w , allowable for passengers?

2. Write the inequality and solve.

Nicole swims 40 meters per minute, and she wants to swim at least 2000 meters this morning. How many minutes, t , should she swim?

3. Write the inequality and solve.

The sum of twice a number, n , and 5 is at most 15. What are the possible values for the number?

4. Write the inequality and solve.

Two-thirds of a number, n , plus 5 is greater than 12. What are the possible values for the number?

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