May 2025
UPPER SCHOOL SUMMER MATH
Rising 7th Grade (7MY and 7MX)

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 2025-2026 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!

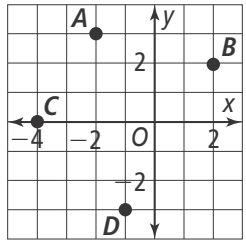
The Middle School Mathematics Department

Name _____

Points on the Coordinate Plane

REVIEW

- Coordinates give the location of a point.
- To locate a point (x, y) on a graph, start at the origin, (0, 0).
- Move x units to the right or left along the x-axis and y units up or down along the y-axis.



Give the coordinates of points *A*, *B*, *C*, and *D*.

Point *A* is 2 units to the left of the origin and 3 units up. The coordinates of *A* are (–2, 3).

Point *B* is 2 units to the right of the origin and 2 units up. The coordinates of *B* are _____.

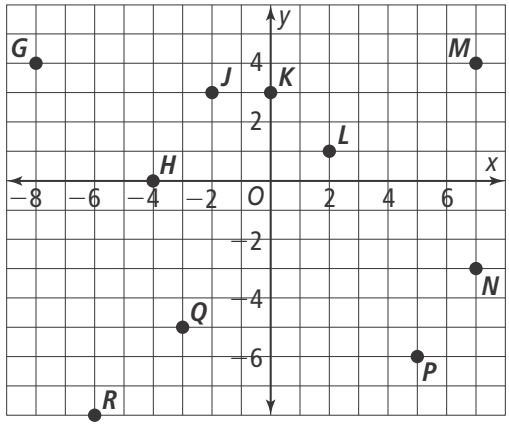
Point *C* is ☐ units to the left of the origin and ☐ units up.

The coordinates of *C* are _____.

Point *D* is ☐ unit to the _____ of the origin and

☐ units down. The coordinates of *D* are _____.

PRACTICE Name the coordinates of each point.



1. *G*

2. *H*

3. *J*

4. *K*

5. *L*

6. *M*

7. *N*

8. *P*

9. *Q*

10. *R*

Graph the points on the same coordinate plane.

11. *S* (3, –5)

12. *T* (0, 0)

13. *U* (–1, –2)

14. *V* (4, 5)

15. *W* (6, 0)

16. *Z* (–5, 0)

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Name _____

Writing Rules for Linear Functions

REVIEW Write a rule for the function.

STEP 1 Calculate the slope.

x	y
–2	12
0	–2
2	8
4	18

$m = \frac{y_2 - y_1}{x_2 - x_1}$ ← **Write the slope formula.**

$m = \frac{12 - (-2)}{-2-0}$ ← **Substitute two pairs of coordinate in corresponding order.**

$m = \frac{14}{-2}$ ← **Simplify.**

$m = \square$

STEP 2 Identify the *y*-intercept.

The *y*-intercept always has an *x*-value of 0.
After analyzing the table, the *y*-intercept is (0, ☐)

STEP 3 Write the equation of the line in slope intercept form.

$y = mx + b$ ← **Write the slope intercept formula.**

$b = -2$ ← **Use the *y*-intercept to identify *b*.**

$y = \square x + \square$ ← **Substitute in the values of *m* and *b*.**

$y =$ _____ ← **Simplify.**

PRACTICE Write a rule for each function.

1.

x	y
–1	–7
0	0
1	7
2	14

2.

x	y
–9	–17
0	–8
9	1
18	10

3.

x	y
0	9
2	5
4	1
6	–3

4.

x	y
–6	7
–3	8
0	9
3	10

5.

x	y
4	0.5
5	1
6	1.5
7	2

6.

x	y
5	3
7	9
9	15
11	21

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Ratio and Proportion

REVIEW

An equation that represents equal ratios is called a proportion. A proportion is true if the unit rates for each ratio are equal.

Does the table represent a proportional relationship?

x	y	Unit Rate, $\frac{x}{y}$
3	4	$\frac{4}{3}$
6	8	$\frac{8}{6}$
9	12	$\frac{12}{9}$

Compare the unit rates. Write $=$ or $\neq$ to complete each statement.

$\frac{4}{3} \square \frac{8}{6}$

$\frac{8}{6} \square \frac{12}{9}$

The unit rates _____ equivalent, so the table shows a proportional relationship.

Maria needs $3\frac{1}{3}$ cups of juice to make 4 quarts of fruit punch. How many cups of juice will she need to make 12 quarts of fruit punch?

$\frac{3\frac{1}{3}}{\square} = \frac{x}{\square}$ ← **Write a proportion.**

$\square \cdot \frac{3\frac{1}{3}}{4} = \frac{x}{12} \cdot \square$ ← **Solve for x.**

$x = \square$ ← **Simplify.**

Maria will need 10 cups of juice.

PRACTICE Find each unit rate and determine if the table represents a proportional relationship.

1.

x	y	Unit Rate, $\frac{x}{y}$
1	5	
3	6	
4	12	

2.

x	y	Unit Rate, $\frac{x}{y}$
1.5	3	
3.5	6	
10	20	

3. Jack records the cost of carpeting for different room areas. Is the relationship between the area of a room and the cost proportional? If so, find the cost of carpeting for a room that is 240 square feet.

Area $(ft)^2$, x	Cost, y
100	$175
320	$560
460	$805

4. Simone uses 2 cups of almonds for every 0.5 cups of raisins when she makes trail mix. How many cups of raisins should Simone use for 5 cups of almonds?

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Proportions and Percent Equations

REVIEW

To solve percent problems, you can often represent words with math symbols. This table shows some words and the symbols you can use to represent them.

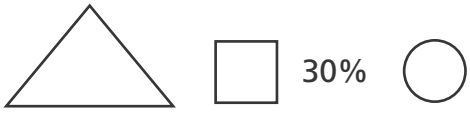
word	What	is	of
symbol	n (or another varible)	$=$	$\times$

What is 30% of 20?

STEP 1 Identify parts of the equation.

← **Draw a triangle around the word that represents the variable. Draw a rectangle around the word that represents =. Circle the word that represents ×.**

STEP 2 Write the equation.



← **Rewrite the equation using just shapes and numbers.**

← **Rewrite percents as decimals and add variables, operations, and equal signs where they belong.**

$n \quad = \quad 0.30 \quad \times \quad 20$

STEP 3 Solve the equation.

$n =$ ☐

30% of 20 is 6.

PRACTICE Rewrite each as an equation, then solve each equation.

1. What is 10% of 50?

2. 8 is 40% of what?

3. 25 is what percent of 100?

4. 7 is what percent of 35?

5. What is 30% of 50?

6. 3 is 25% of what?

7. 0.4 is what percent of 0.8?

8. What is 25% of 25?

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Square Roots and Irrational Numbers

REVIEW Estimate $\sqrt{27}$ to the nearest integer.

27 is not a perfect square, and $\sqrt{27}$ is an irrational number. You can use this table of perfect squares to estimate $\sqrt{27}$.

n	1	2	3	4	5	6	7	8	9	10	11	12
n^2	1	4	9	16	25	36	49	64	81	100	121	144

STEP 1 **Look at the second row of the table, which shows perfect squares. Between which two perfect squares is 27?**

$\square < 27 < \square$

So, $\square < \sqrt{27} < \square$.

STEP 2 **Find the square root using the first row of the table.**

$5 < \sqrt{27} < \square$

STEP 3 **Estimate.**

Since 27 is closer to $\square$ than it is to $\square$, $\sqrt{27}$ is closer to $\square$ than to $\square$.

$\sqrt{27}$ to the nearest integer is $\square$.

PRACTICE Estimate each to the nearest integer.

1. $\sqrt{48}$ **2.** $\sqrt{80}$ **3.** $\sqrt{119}$ **4.** $\sqrt{141}$

5. $\sqrt{67}$ **6.** $\sqrt{95}$ **7.** $\sqrt{6}$ **8.** $\sqrt{20}$

9. $\sqrt{12}$ **10.** $-\sqrt{3}$ **11.** $\sqrt{42}$ **12.** $-\sqrt{22}$

13. $-\sqrt{110}$ **14.** $\sqrt{45}$ **15.** $-\sqrt{31}$ **16.** $-\sqrt{132}$

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Inequalities and Their Graphs

REVIEW

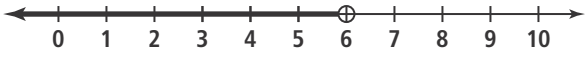
- Solve inequalities in the same way you solve equations, by applying the properties of equality to keep the statement true.
- If you multiply or divide by a negative number, you need to reverse the direction of the inequality symbol.

Solve the inequality $x - 2 < 4$ and graph its solution.

$x - 2 < 4$

$x - 2 + 2 < 4 + \square$ ← Add 2 on each side to isolate x.

$x < \square$



← The inequality uses the < symbol, so 6 is NOT part of the solution. Use an open circle.

Solve the inequality $-3y \leq 9$ and graph its solution.

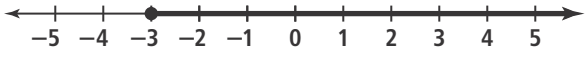
$-3y \leq 9$

$\frac{-3y}{3} \leq \frac{9}{\square}$ ← Divide each side by 3 to isolate y.

$-y \leq 3$

$-y \cdot (-1) \geq 3 \cdot (\square)$ ← Reverse the inequality symbol when multiplying by –1.

$y \geq -3$



← The inequality uses the ≥ symbol, so –3 IS part of the solution. Use a solid circle.

PRACTICE Solve each inequality and graph its solution.

1. $x - 4 < 1$

2. $7 < w + 2$

3. $10 \leq y + 8$

4. $2.5a < 15$

5. $b - 4 \leq -3$

6. $6c < 24$

7. $4t > -14$

8. $-4.2 + g \geq 0.5$

9. $8 - k < 8$

10. $\frac{3p}{5} \geq -9$

11. $0 \leq -m + 6$

12. $-\frac{y}{6} < \frac{2}{3}$

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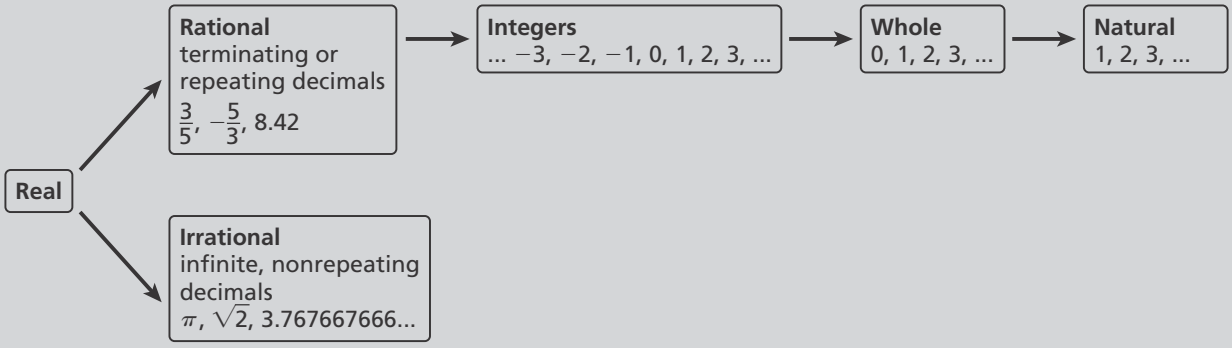
Exploring Real Numbers

REVIEW

Real numbers can be classified using the following system.



Given the numbers -4.4, $\frac{14}{5}$, 0, -9, $1\frac{1}{4}$, $-\pi$, and 32, identify which numbers belong to each set.

_____: 32 ← **numbers used to count**

Whole: _____ ← **natural numbers and zero**

Integers: _____ ← **whole numbers and their opposites**

_____: -9, -4.4, 0, $1\frac{1}{4}$, $\frac{14}{5}$, 32 ← **integers, and terminating and repeating decimals**

Irrational: _____ ← **Infinite, nonrepeating decimals**

Real: -9, -4.4, $-\pi$, 0, $1\frac{1}{4}$, $\frac{14}{5}$, 32 ← **rational and irrational numbers**

PRACTICE Name the set(s) of numbers to which each number belongs.

1. $-\frac{5}{6}$ **2.** 35.99 **3.** 0

4. $4\frac{1}{8}$ **5.** $\sqrt{5}$ **6.** -80

7. $\frac{17}{5}$ **8.** $\frac{12}{3}$ **9.** $\sqrt{100}$

10. $-\sqrt{4}$ **11.** 3.2457946… **12.** 3π

Give an example of each kind of number.

13. irrational number **14.** whole number **15.** negative integer

16. fractional rational number **17.** rational decimal **18.** natural number

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Exponents and Order of Operations

REVIEW Simplify $9 \div 3 + (8 - 5)^2 \cdot 7$.

Order of Operations

1. Operate inside grouping symbols, including parentheses and brackets.
2. Apply any exponents.
3. Multiply and divide from left to right.
4. Add and subtract from left to right.

STEP 1 **Operate inside the parentheses.**

$9 \div 3 + (8 - 5)^2 \cdot 7$

$9 \div 3 + (\square)^2 \cdot 7$

STEP 2 **Apply the exponent.**

$9 \div 3 + (3)^2 \cdot 7$

$9 \div 3 + \square \cdot 7$

STEP 3 **Multiply and divide, from left to right.**

$9 \div 3 + 9 \cdot 7$

$\square + \square$

STEP 4 **Add.**

$3 + 63$

$\square$

$9 \div 3 + (8 - 5)^2 \cdot 7 = \square$

PRACTICE Simplify each expression.

1. $(5 \cdot 3) - 18$

2. $4(6 - 11)$

3. $2(27 - 13.75 \cdot 2)$

4. $2 \cdot 19 + \left(\frac{14}{7}\right)^2$

5. $\frac{18}{9 - 15 \div 5}$

6. $(27 \div 9)^3 - 4 \cdot 6$

7. $2.4 \cdot 8 - (-6)^2$

8. $64 \div (8 - 4)^2$

9. $(3 + 2)^2 \cdot (6 - 4)^2$

10. $2(3 + 4) + 16 \div (9 - 7)^2$

11. $4 \cdot 9 + 8 \div (-2) - 6 \cdot 5$

12. $3[8 - 5 \cdot 2 + 4(5 - 2)]^2$

13. $(1 + 3) \cdot 4^2 - 7 \cdot 2^3$

14. $\frac{6 + 3 \cdot (2 + 8)}{3^2}$

15. $5^3 - [4(1 + 2)^2 + 3(18 \div 6)]$

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Name _____ NS03

The Distributive Property

REVIEW

In the equation $a(b + c) = ab + ac$, the Distributive Property distributes the coefficient outside the parentheses to each term inside the parentheses by multiplying.

Simplify $-\frac{2}{3}(6x - 9)$ by using the Distributive Property.

$-\frac{2}{3}(6x - 9)$ ← **Distribute the coefficient to each term inside the parentheses.**

$-\frac{2}{3}(6x) - \left(-\frac{2}{3}\right)(\square)$

$-\square x + 6$ ← **Simplify. Pay close attention to the signs of the numbers. Change the subtraction of a negative to addition.**

Simplify $\left(4 - \frac{5}{2}x\right)6$ by using the Distributive Property.

$\left(4 - \frac{5}{2}x\right)6$

$4(\square) - \frac{5}{2}x\,(\square)$ ← **Distribute the coefficient to each term inside the parentheses.**

$24 - \square x$ ← **Simplify.**

PRACTICE Simplify each expression using the Distributive Property.

1. $2(5x - 4)$

2. $\frac{1}{4}(12x - 8)$

3. $-\frac{2}{5}(3 - x)$

4. $5\left(\frac{x}{5} - 2\right)$

5. $-\left(\frac{2}{3}x + 4\right)$

6. $\frac{1}{10}(30x - 50)$

7. $\left(\frac{2}{7}x + 2\right)14$

8. $(4x - 1)\frac{3}{4}$

9. $-\frac{1}{8}(x + y)$

10. $-6\left(\frac{2}{9}x - y\right)$

11. $(4 + x)\frac{1}{3}$

12. $-\frac{1}{2}(x + 4y)$

13. $\frac{4}{5}(10x - 15y)$

14. $\left(\frac{1}{6}y - \frac{1}{3}x\right)12$

15. $-\frac{1}{11}(33 - 44x)$

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Name _____ NS07

Product of Powers Property

REVIEW

- A *power* is an expression in the form a^n. The variable a represents the *base* and n is the *exponent*.
- **Product of Powers Property** To multiply powers with the same base, add the exponents: $a^m \cdot a^n = a^{m+n}$.

Simplify $4^6 \cdot 4^3$.

$4^6 \cdot 4^3$

$= 4^{6+\square}$ ← **Rewrite with one base and the exponents added.**

$= 4^9$ ← **Add the exponents.**

Simplify $x^3 \cdot x^{-5}$.

$x^3 \cdot x^{-5}$

$= x^{\square+(-5)}$ ← **Rewrite with one base and the exponents added.**

$= x^{-2}$ ← **Add the exponents.**

PRACTICE Complete each equation.

1. $8^2 \cdot 8^3 = 8^{\square}$ **2.** $2^{\square} \cdot 2^6 = 2^9$ **3.** $a^{12} \cdot a^{\square} = a^{15}$

4. $x^{\square} \cdot x^5 = x^6$ **5.** $b^{-4} \cdot b^3 = b^{\square}$ **6.** $6^4 \cdot 6^{\square} = 6^2$

7. $3^4 \cdot 3^8 = 3^{\square}$ **8.** $c^{\square} \cdot c^{-7} = c^{11}$ **9.** $10^{-6} \cdot 10^{-3} = 10^{\square}$

Simplify each expression.

10. $3x^2 \cdot 4x \cdot 2x^3$ **11.** $m^2 \cdot 3m^4 \cdot 6a \cdot a^{-3}$ **12.** $p^3q^{-1} \cdot p^2q^{-8}$

13. $5x^2 \cdot 3x \cdot 8x^4$ **14.** $x^2 \cdot y^5 \cdot 8x^5 \cdot y^{-2}$ **15.** $7y^2 \cdot 3x^2 \cdot 9$

16. $2y^2 \cdot 3y^2 \cdot 4y^5$ **17.** $x^4 \cdot x^{-5} \cdot x^4$ **18.** $x^{12} \cdot x^{-8} \cdot y^{-2} \cdot y^3$

19. $6a^2 \cdot b \cdot 2a^{-1}$ **20.** $r^6 \cdot s^{-3} \cdot r^{-2} \cdot s$ **21.** $3p^{-2} \cdot q^3 \cdot p^3 \cdot q^{-2}$

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Power of a Power Property

REVIEW

- **Power of a Power Property** To raise a power to a power, multiply the exponents: $(a^m)^n = a^{m \cdot n}$.
- A variable or number can be rewritten as a power with an exponent of 1: $b = b^1$.
- Any power with an exponent of 0 is equal to 1.

Simplify $(4x^3)^2$.

$(4x^3)^2$

$= (4^1 \cdot x^3)^2$ ← **Rewrite each term as a power.**

$= 4^{1 \cdot 2} \cdot x^{3 \cdot \square}$ ← **Multiply to distribute the exponent 2.**

$= 4^2 \cdot x^{\square}$ ← **Multiply the exponents.**

$= 16x^6$ ← **Simplify.**

Simplify $3(x^4y^5)^0$.

$3(x^4y^5)^0$

$= 3(x^{4 \cdot 0} \cdot y^{5 \cdot \square})$ ← **Multiply to distribute the exponent 0.**

$= 3(x^0 \cdot y^{\square})$ ← **Multiply the exponents.**

$= 3(1 \cdot \square)$ ← **Simplify.**

$= 3$

PRACTICE Simplify each expression.

1. $(5^2)^4$ **2.** $(a^5)^4$ **3.** $(2^3)^2$ **4.** $(4x)^3$

5. $(7a^4)^2$ **6.** $(3g^2)^3$ **7.** $(g^2h^3)^5$ **8.** $(s^6)^2$

9. $(x^2y^4)^3$ **10.** $(3r^5)^0$ **11.** $(c^4)^7$ **12.** $(8ab^6)^3$

13. $(x^2y^3)^{-2}$ **14.** $(x^7)^2$ **15.** $(3x^2y)^2$ **16.** $(ab^{-3})^{-3}$

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Quotient of Powers Property

REVIEW

- **Quotient of Powers Property** To divide powers with the same base, subtract the exponents: $\frac{a^m}{a^n} = a^{m-n}$.
- A power with a negative exponent is equivalent to its reciprocal with a positive exponent: $b^{-m} = \frac{1}{b^m}$.

Simplify $\frac{4^3}{4^5}$.

$\frac{4^3}{4^5} = 4^{3-\square}$ ← **Rewrite to subtract exponents.**

$= 4^{-2}$ ← **Subtract the exponents.**

$= \frac{1}{4^2}$ ← **Write with a positive exponent.**

$= \frac{1}{\square}$ ← **Simplify.**

Simplify $\left(\frac{x^3}{x^5}\right)^4$.

$\left(\frac{x^3}{x^5}\right)^4 = (x^{\square-5})^4$ ← **Rewrite expression in parentheses to subtract exponents.**

$= (x^{-2})^4$ ← **Subtract the exponents.**

$= x^{\square}$ ← **Apply the Power of a Power Property.**

$= \frac{1}{x^8}$ ← **Write with a positive exponent.**

PRACTICE Simplify each expression.

1. $\frac{z^6}{z^3}$
2. $\left(\frac{3^2}{4}\right)^3$
3. $\frac{m^{-3}}{m^{-4}}$
4. $\frac{5^3}{5^4}$
5. $\left(\frac{b^7}{b^5}\right)^3$
6. $\frac{5a^5}{15a^2}$
7. $\frac{2^2}{2^5}$
8. $\frac{d^8}{d^3}$
9. $\frac{x^3}{x^8}$
10. $\left(\frac{10^8}{10^2}\right)^3$
11. $\frac{14x^{11}}{7x^{10}}$
12. $\frac{8x^9}{12x^6}$

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Compare and Order Real Numbers

REVIEW Order the numbers 2.85, $\frac{23}{8}$, and $2\sqrt{2}$ from least to greatest.

STEP 1 **Find the decimal equivalent for $\frac{23}{8}$, and compare it to 2.85.**

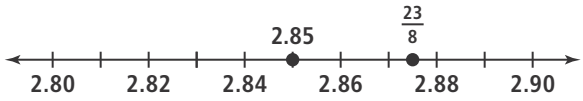
$\frac{23}{8} = 2.875$ ← **The digits are the same until the hundredths place.**

$\updownarrow$

2.85

The 7 in 2.875 is greater than the 5 in 2.85, so $2.875 > 2.85$, or $2.85 < 2.875$.

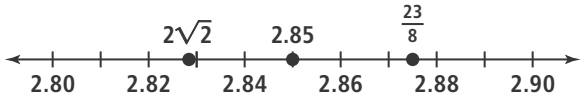
STEP 2 **Plot the numbers on a number line.**



STEP 3 **Repeat the process above by finding the decimal equivalent for $2\sqrt{2}$ and comparing it to one of the other numbers, say, 2.85.**

$2\sqrt{2} \approx$ ☐

Again, the units and tenths digits are the same. The digit in the hundredths place for 2.8284 is _____ than the digit in the hundredths place for 2.85. So, $2\sqrt{2}$ is _____ than 2.85, and lies to the _____ of 2.85 on the number line, as shown below.



On the number line, $2\sqrt{2} < 2.85 < \frac{23}{8}$. From least to greatest, the numbers are $2\sqrt{2}$, 2.85, and $\frac{23}{8}$.

PRACTICE

Compare the numbers. Enter =, <, or > in each box.

1. $\frac{9}{16}$ ☐ $\frac{3}{4}$

2. 0.125 ☐ $\frac{1}{8}$

3. 0.04 ☐ 0.014

4. $\sqrt{\frac{4}{25}}$ ☐ 0.6

5. $2\sqrt{3}$ ☐ $\sqrt{6}$

6. $\frac{\sqrt{3}}{2}$ ☐ $\frac{11}{12}$

Order each set of numbers from least to greatest. Use a number line.

7. $S = \left\{0.85, \frac{5}{6}, 0.800\right\}$

8. $N = \left\{\frac{5}{3}, 1.6, \sqrt{3}\right\}$

9. $P = \left\{\frac{10}{7}, \sqrt{\frac{196}{100}}, \sqrt{2}\right\}$

10. $R = \left\{\frac{\sqrt{2}}{2}, 0.7, \frac{11}{15}\right\}$

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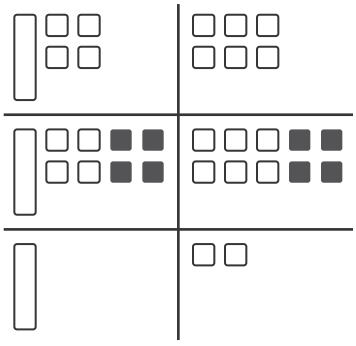
Name _____ **A01**

Solving One-Step Equations

REVIEW Model the equation $x + 4 = 6$ and solve.

▯ = x ☐ = 1 ■ = −1



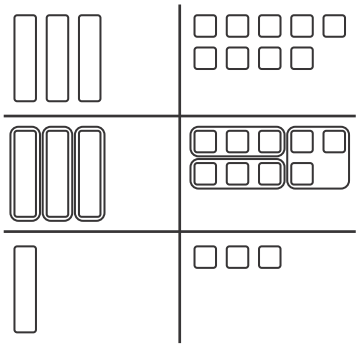
← **Model $x + 4 = 6$ with tiles.**

← **Model subtracting 4 by adding ☐ gray tiles to each side.**

← **Simplify by removing pairs of white and gray tiles.**

$x =$ ☐

Model the equation $3x = 9$ and solve.



← **Model $3x = 9$ with tiles.**

← **Divide each side into ☐ equal groups.**

← **Leave only 1 group on each side.**

$x =$ ☐

PRACTICE Solve each equation.

1. $x + 3 = 10$ **2.** $y - 4 = 2$ **3.** $-6 = 3y$

4. $2x = 6$ **5.** $y + 1 = 4$ **6.** $5y = 10$

7. $x - 5 = 4$ **8.** $12 = 4x$ **9.** $x + 4 = 2$

10. $17 = -8 + x$ **11.** $8d = 16$ **12.** $a - 7 = -11$

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Name _____ **A02**

Solving Two-Step Equations

REVIEW

Steps for Solving Two-Step Equations
- Isolate the term with the variable on one side.
- Isolate the variable on one side.

Solve $3x + 4 = 10$.

$$3x + 4 = 10$$

$$3x + 4 - \square = 10 - \square \quad \leftarrow \textbf{Subtract to isolate } 3x.$$

$$3x = \square$$

$$\frac{3s}{\square} = \frac{6}{\square} \quad \leftarrow \textbf{Divide to isolate } x.$$

$$x = 2$$

Solve $-8 = \frac{s}{6} - 5$.

$$-8 = \frac{s}{6} - 5$$

$$-8 + \square = \frac{s}{6} - 5 + \square \quad \leftarrow \textbf{Add to isolate } \frac{s}{6}.$$

$$\square = \frac{s}{6}$$

$$-3 \cdot \square = \frac{s}{6} \cdot \square \quad \leftarrow \textbf{Multiply to isolate } s.$$

$$\square = s$$

PRACTICE Solve each equation.

1. $3x - 4 = 8$

2. $\frac{z}{4} + 3 = 10$

3. $4y + 5 = -7$

4. $p \div 3 + 9 = 15$

5. $15 = -6 + 3g$

6. $18 = 6 + \frac{t}{3}$

7. $7 - 4d = 43$

8. $12 - \frac{f}{5} = -8$

9. $15z + 6 = 81$

10. $\frac{k}{6} + 4 = 46$

11. $8 + h \div 7 = -4$

12. $25 = m \times 3 - 11$

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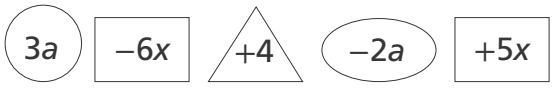
Combining Like Terms

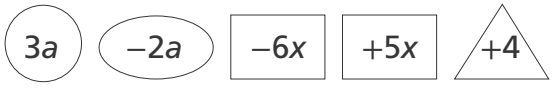
REVIEW Simplify $3a - 6x + 4 - 2a + 5x$ by combining like terms.

STEP 1 Use symbols to show like terms.



← **Circle each term with a variable *a*. Draw a rectangle around each term with a variable *x*, and a triangle around each constant term.**

STEP 2 Group the like terms by reordering the terms so that all matching shapes are together.



STEP 3 Combine like terms by adding coefficients.

$a - x +$ ☐

PRACTICE Draw circles, rectangles, and triangles to help you combine like terms and simplify each expression.

1. $3a + 5 - x + 7x - 2a$

2. $2x - 5 + 3a - 5x + 10a$

3. $7b - b - x + 5 - 2x - 7b$

4. $-6m + 3t + 4 - 4m - 2t$

5. $2r + 3s - \frac{5}{2}r$

6. $4 - p - 2x + 3p - 7x$

7. $3k - 2x + 6k + 5$

8. $3 + 2a - 7x + 2.5 + 5x$

9. $4a + 3 - 2y - 5a - 7 + 4y$

10. $c - 3 + 2x - 6c + 4x$

Simplify each expression.

11. $2b + 2 - x + 4$

12. $-5 - c - 4 + 3c$

13. $\frac{1}{2}a - 5 - \frac{1}{2}a$

14. $1.5y - 1.5 + 0.5y + 0.5z + 1$

15. $6a + 3b - 2a + 4$

16. $\frac{2}{3}a + 5 - \frac{1}{3}a - 7$

17. $-8 + x - 2 + 3x$

18. $x + y - z + 4x - 5y + 2z$

19. $\frac{7}{8}x + 5 - \frac{3}{8}x - 4$

20. $10y - 3x + 5 - 8 - 2y$

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Equations with Variables on Both Sides

REVIEW Solve $5a - 12 = 3a + 7$.

- To solve, rewrite the equation until all terms with variables are combined on one side and all constant terms are combined on the other side.
- When you perform an operation on one side to move terms with variables, you must do the same on the other.

Solve $5a - 12 = 3a + 7$

$(5a) - 12 = (3a) + 7$ ← Circle all the terms with variables.

$5a \boxed{-12} = 3a \boxed{+7}$ ← Draw rectangles around the constants. Plan to collect variables on one side and constants on the other.

$5a - 12 - 3a = 3a + 7 - 3a$ ← To get variables on the same side, subtract $\square$ from each side.

$2a - 12 = \square$ ← Combine like terms.

$2a - 12 + \square = 7 + 12$ ← To get constants on the other side, add 12 to each side.

$2a = 19$ ← Combine like terms.

$a = \square$ ← To undo multiplication by 2, divide each side by 2.

Check $5(9.5) - 12 \stackrel{?}{=} 3(9.5) + 7$

$47.5 - 12 \stackrel{?}{=} 28.5 + 7$

$35.5 \stackrel{?}{=} 35.5$ ✓

PRACTICE Fill in the blanks to show a plan to solve each equation.

1. $9x + 4 = 6x - 11$ _____ $6x$ _____ each side; subtract $\square$ from each side.

2. $4b - 13 = 7b - 28$ Subtract $\square$ from each side; _____ 28 _____ each side.

Use circles and rectangles to mark the variables and constants. Write a plan that tells the steps you would use and then solve each equation.

3. $7c - 4 = 9c - 11$

4. $3 - 4d = 6d - 17$

5. $5e + 13 = 7e - 21$

Solve and check each equation.

6. $8f - 12 = 5f + 12$

7. $3k + 5 = 2(k + 1)$

8. $9 - x = 3x + 1$

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Solving Linear Equation Problems

REVIEW Paige has lunch with 3 friends. Two friends order the special for $9 and the other 2 friends order flatbreads. Each friend orders a lemonade for $1.50. They add a 20% tip to the bill and evenly split the total cost. Each friend pays $14.40. How much does each flatbread cost?

STEP 1 Write an equation using words to represent the situation.

$$\frac{\text{Total cost with tip}}{\text{Number of friends}} = \text{How much each pays}$$

STEP 2 Translate the words into numbers and variables.

Total cost with tip = 1.2 · (Cost of food + Cost of drinks)

Cost of food = $2 \cdot 9 + \square \cdot f$ Cost of drinks = $\square \cdot 1.5$

How much each pays = $\square$ Number of friends = $\square$

STEP 3 Write and solve the equation.

$$\frac{1.2 \cdot (2 \cdot 9 + 2f + 4 \cdot 1.5)}{4} = 14.4$$

$1.2(2 \cdot 9 + 2f + 4 \cdot 1.5) = 14.4 \cdot \square$ ← **Multiply each side by the denominator.**

$1.2(24 + 2f) = 57.6$ ← **Simplify inside the parentheses.**

$28.8 + 2.4f = 57.6$ ← **Apply the Distributive Property.**

$2.4f = 28.8$ ← **Subtract the constant from each side.**

$f = 12$ ← **Divide to isolate the variable.**

The flatbreads cost $12 each.

PRACTICE Solve.

1. The Drama Club sells 76 adult tickets for $8 each, plus 54 student tickets. If the club makes a total of $770 in ticket sales, how much does each student ticket cost?

2. Lily is driving 360 miles. After 4 hours of driving, she is halfway to her destination. What speed does she need to average the rest of the way to make the total drive in 7 hours?

3. The sum of 3 consecutive integers is 96. What are the 3 integers?

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Solving Inequalities

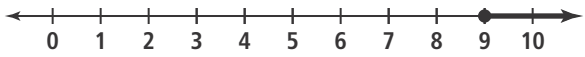
REVIEW

Solve and graph the inequality $2x - 5 \geq 13$.

$2x - 5 \geq 13$

$2x \geq 18$ ← _____ 5 to each side.

$x \geq$ ☐ ← Divide each side by ☐.



Solve and graph the inequality $4 + 3(1 - 2x) > 37$.

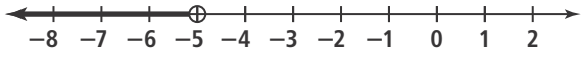
$4 + 3(1 - 2x) > 37$

$4 + 3 -$ ☐ $x > 37$ ← Use the Distributive Property.

☐ $-$ ☐ $x > 37$ ← Simplify.

$-$ ☐ $x >$ ☐

$x <$ ☐ ← Divide. Because each side is divided by a negative number, reverse the inequality.



PRACTICE Solve each inequality. Graph the solutions.

1. $3(y - 5) \leq 6$

2. $-4t > 2$

3. $3 - 4m < 11$

4. $7d \leq 2(d + 5)$

5. $-2(3 - h) + 2h \geq 0$

6. $3k - (1 - 2k) > 1$

7. $5p + 12 \leq 9p - 20$

8. $3 - 2r < 7 - r$

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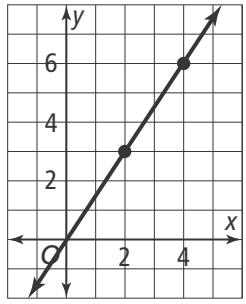
Constant of Proportionality (Direct Variation)

REVIEW Does the equation of the line through the points (2, 3) and (4, 6) represent a proportional relationship? If so, write the equation.



STEP 1 **Graph the points and connect them with a line.**

STEP 2 **Verify that the line passes through the origin.**

Proportional relationships must pass through (0, 0).

STEP 3 **Find the constant of proportionality.**

$y = kx$ ← **Write the general equation.**

$3 = k(\square)$ ← **Substitute the coordinates of one point.**

$k = \frac{3}{2}$ ← **Solve for *k*.**

The equation for the proportional relationship is $y = \square x$.

Catalina is making a snack mix with $\frac{1}{2}$ cup of raisins and $1\frac{3}{4}$ cups of almonds. Write an equation that relates the amounts of raisins and almonds in the snack mix.

- The ratio of raisins to almonds is $\frac{\frac{1}{2}}{1\frac{3}{4}} = \frac{\frac{1}{2}}{\frac{7}{4}}$. This simplifies to $\frac{2}{\square}$ and represents the constant of proportionality.
- If y = cups of almonds and x = cups of _____, the equation is $y = \frac{2}{\square}x$.

PRACTICE Determine if the line through the given points represents a poportional relationship. If so, write the equation.

1. (−1, 3), (1, −3) **2.** (0, 3), (−1, 1) **3.** (1, −2), (4, −8)

For each situation, write an equation that relates the proportional quantities.

4. Darnell bought 5 tickets at an arcade for $2.50, and then he bought 8 tickets for $4. Let y = cost and x = tickets purchased.

5. Renata makes bracelets and uses 8 red beads for every $2\frac{1}{2}$ inches of cord. Let y = inches of cord and x = number of red beads.

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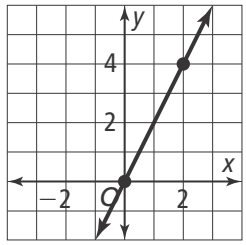
Name _____

Slope

REVIEW Calculate the slope of the line shown in the graph.



STEP 1 **Pick any two points on the line and write their coordinates.**

Underline the *x*-coordinates and circle the *y*-coordinates.

(0 , 0) and (2 , 4)

STEP 2 **Find the vertical change or *rise* of the line by subtracting the *y*-coordinates.**

rise: $4 - 0 = 4$

STEP 3 **Find the horizontal change or *run* of the line by subtracting the *x*-coordinates.**

Be sure to subtract the *x*-coordinates in the same order as the *y*-coordinates.

run: $\square - \square = \square$

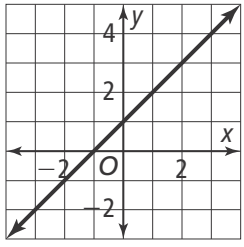
STEP 4 **Find the slope of the line through the two points.**

Find the slope by forming the ratio of rise to run.

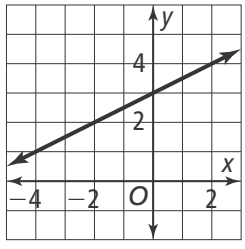
$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\square}{\square} = \square$$

PRACTICE Find the slope of each line.

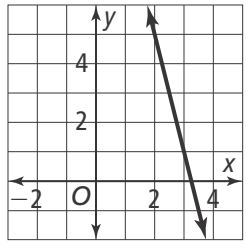
1.



2.

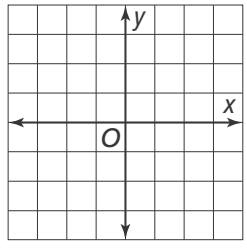


3.



4. Draw a horizontal line on the coordinate grid at the right. Find the slope of the line.

5. Draw a vertical line on the same grid. Find the slope of the line.



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Slope-Intercept Form

REVIEW Graph $y = 2x - 4$.

- The slope-intercept form of a linear equation is $y = mx + b$, where m is the slope of the line and b is the y-coordinate of the y-intercept of the line.

slope	***y*-intercept**
$m = \frac{\text{vertical change}}{\text{horizontal change}}$	$(0, b)$

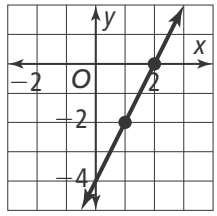
STEP 1 Identify the slope and *y*-intercept.

$y = 2x - 4$

$m =$ ☐ $b =$ ☐

STEP 2 Plot a point at the *y*-intercept.

Plot a point at the y-intercept (☐ , ☐).



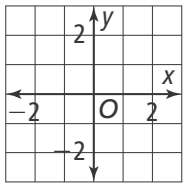
STEP 3 Plot at least one other point using the *y*-intercept and the slope.

Plot points so that the y-value increases by ☐ each time the x-value increases by 1.

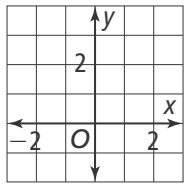
STEP 3 Draw a line through the points.

PRACTICE Graph each line.

1. $y = 3x + 1$

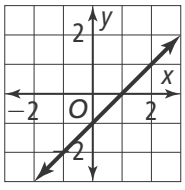


2. $y = -2x + 3$

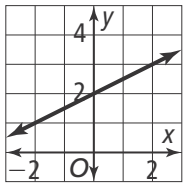


Write an equation for each line using the slope and y-intercept.

3.



4.



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