

Order of Operations and Evaluating Expressions

PEMDAS

1) Parentheses (Grouping Symbols) \rightarrow $[\]$, $()$, $\{ \}$

2) Exponents

3) Multiply / Divide from Left to Right

4) Add / Subtract from Left to Right

Simplify each expression.

$$1) 3[10^2 - (50 - 4 + 20)]$$

$$3[10^2 - (46 + 20)]$$

$$3(10^2 - 66)$$

$$3(100 - 66)$$

$$3(34)$$

$$\boxed{102}$$

$$2) \frac{3^2 + 5^3}{(10 - 8)^2}$$

$$\frac{9 + 125}{2^2}$$

$$\frac{134}{2^2}$$

$$\frac{134}{4} = \boxed{33.5}$$

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Evaluate each expression for $a=5$, $b=10$, and $c=3$.

$$3) 3a^2 - 7b$$

$$3 \cdot 5^2 - 7 \cdot 10$$

$$3 \cdot 25 - 7 \cdot 10$$

$$75 - 70$$

$$\boxed{5}$$

$$4) \frac{5c + 7a}{2b}$$

$$\frac{5 \cdot 3 + 7 \cdot 5}{2 \cdot 10}$$

$$\frac{15 + 35}{2 \cdot 10}$$

$$\frac{50}{20} = \frac{50}{20} = \boxed{2\frac{1}{2}}$$

$$\frac{15 + 35}{20} = \frac{50}{20} = \boxed{2\frac{1}{2}}$$

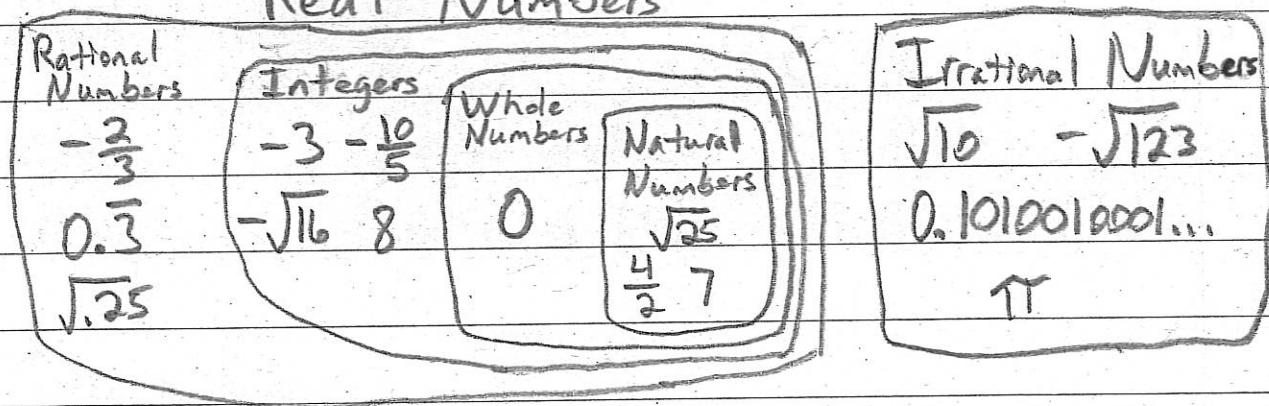
Real Numbers

Simplify each expression.

$$1) \sqrt{144} = \boxed{12}$$

$$2) \sqrt{\frac{16}{225}} = \frac{\sqrt{16}}{\sqrt{225}} = \boxed{\frac{4}{15}}$$

Real Numbers



Inequality Symbols

$<$, less than

\leq , less than or equal to

$>$, greater than

\geq , greater than or equal to

Compare the numbers using an inequality symbol.

$$3) \sqrt{52} \text{ and } 7\frac{1}{4}$$

$$\sqrt{52} = 7.211102551\dots$$

$$7\frac{1}{4} = 7.25$$

$$\boxed{\sqrt{52} < 7\frac{1}{4}}$$

Properties of Real Numbers

Commutative Property

	Algebra	Example
Addition	$a+b = b+a$	$18+54 = 54+18$
Multiplication	$a \cdot b = b \cdot a$	$12 \cdot \frac{1}{2} = \frac{1}{2} \cdot 12$

Associative Property

	Algebra	Example
Addition	$(a+b)+c = a+(b+c)$	$(23+9)+11 = 23+(9+11)$
Multiplication	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$	$(17 \cdot 5) \cdot 2 = 17 \cdot (5 \cdot 2)$

Identity Property

	Algebra	Example
Addition	$a+0 = a$	$7\frac{1}{3}+0 = 7\frac{1}{3}$
Multiplication	$a \cdot 1 = a$	$23 \cdot 1 = 23$

Zero Property of Multiplication

Algebra	Example
$a \cdot 0 = 0$	$21 \cdot 0 = 0$

Multiplication Property of -1

Algebra	Example
$-1 \cdot a = -a$	$-1 \cdot 12 = -12$

Adding and Subtracting Real Numbers

Absolute Value

$$|8| = 8, \quad |-8| = 8$$

Same Sign (SS) \rightarrow Add, Keep Sign

Different Sign (DS) \rightarrow Subtract, Original Sign of Larger Absolute Value

Add or subtract.

1) $-10 + (-15)$ SS 2) $-21 + 10$ DS 3) $18 + (-9)$ DS
 $\textcircled{-25}$ $\textcircled{-11}$ $\textcircled{9}$

4) $-3 - 8$ SS 5) $12 - 15$ DS 6) $-5 \overset{+}{-} (-8)$ DS
 $\textcircled{-11}$ $\textcircled{-3}$ $\textcircled{3}$

7) $9 \overset{+}{-} (-6)$
 $\textcircled{15}$

Multiplying and Dividing Real Numbers

Even Amount of (-), Answer is (+)

Odd Amount of (-), Answer is (-)

Inverse Property of Multiplication
(Multiplicative Inverse or Reciprocal)

Algebra
 $a \cdot \left(\frac{1}{a}\right) = 1$

Example
 $-7\left(-\frac{1}{7}\right) = 1$

Simplify each expression.

1) $-3(-8)$ Even
24

2) $-24 \div 4$ Odd
-6

3) $7(-2)$ Odd
-14

4) $\pm\sqrt{81} = \boxed{\pm 9}$

5) $-\sqrt{\frac{9}{64}} = \boxed{-\frac{3}{8}}$

6) $-8 \div \left(-\frac{16}{5}\right)$

$$-\frac{8}{1} \cdot \left(-\frac{5}{16}\right)$$

$$\boxed{\frac{5}{2} \text{ or } 2\frac{1}{2}}$$

Division Involving 0

Algebra

$$0 \div a = 0$$

$$a \div 0 = \text{Undefined}$$

Example

$$0 \div 9 = 0$$

$$9 \div 0 = \text{Undefined}$$

The Distributive Property

Simplify.

$$\begin{aligned} \textcircled{1} \quad & 5(y-2) \\ & 5(y) - 5(2) \\ & \boxed{5y - 10} \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad & (3m-8)(-4) \\ & (3m)(-4) - 8(-4) \\ & \boxed{-12m + 32} \end{aligned}$$

$$\begin{aligned} \textcircled{3} \quad & -(2c-12) \\ & (-1)(2c-12) \\ & \boxed{-2c + 12} \end{aligned}$$

What sum or difference is equivalent to $\frac{8m-5}{13}$?

$$\begin{aligned} \textcircled{4} \quad \frac{8m-5}{13} &= \frac{1}{13}(8m-5) \quad \text{Write division as multiplication} \\ &= \left(\frac{1}{13}\right)(8m) - \left(\frac{1}{13}\right)(5) \quad \text{Distributive Property} \\ &= \boxed{\frac{8}{13}m - \frac{5}{13}} \quad \text{Simplify} \end{aligned}$$

Simplify. (Combine Like Terms)

$$\textcircled{5} \quad \underline{5m} - \underline{2n} - \underline{7n} - \underline{12} - \underline{8m}$$

$$\boxed{-3m - 9n - 12}$$

$$\textcircled{6} \quad \underline{7x^2} - \underline{8x^2} - \underline{3x} + \underline{8}$$

$$\boxed{-x^2 - 3x + 8}$$

Solving One-Step Equations

Solve each equation.

$$\begin{array}{r} 1) \quad x + 12 = -5 \\ \quad -12 \quad -12 \\ \hline \quad \quad \quad x = -17 \end{array}$$

$$\begin{array}{r} 2) \quad -8 = y - 4 \\ \quad +4 \quad +4 \\ \hline \quad \quad \quad -4 = y \end{array}$$

$$\begin{array}{r} 3) \quad \frac{3c}{3} = \frac{-13.5}{3} \\ \hline \quad \quad \quad c = -4.5 \end{array}$$

$$\begin{array}{r} 4) \quad -7 = \frac{m}{3} \\ \quad \quad \quad 3(-7) = \frac{m}{3} \cdot 3 \\ \hline \quad \quad \quad -21 = m \end{array}$$

$$5) \quad \frac{2}{3}n = -\frac{8}{9}$$

$$\frac{3}{2} \cdot \frac{2}{3}n = -\frac{48}{3 \cdot 9} \cdot \frac{3}{2}$$

$$n = -\frac{4}{3} = -1\frac{1}{3}$$

Solving Two-Step Equations

Solve each equation.

$$1) \quad 12 - 3x = -15$$

$$\quad \underline{-12 \quad \quad -12}$$

$$\quad \underline{-3x = -27}$$

$$\quad \underline{-3 \quad \quad -3}$$

$$\quad \underline{x = 9}$$

$$2) \quad -13 = \frac{m}{5} - 3$$

$$\quad \underline{+3 \quad \quad +3}$$

$$(5)(-10) = \frac{m}{5}(5)$$

$$\underline{-50 = m}$$

$$3) \quad \frac{c-8}{4} = -5$$

$$4 \left(\frac{c-8}{4} \right) = -5(4)$$

$$c - 8 = -20$$

$$\quad \underline{+8 \quad \quad +8}$$

$$\underline{c = -12}$$

$$4) \quad -y + 3 = -8$$

$$\quad \underline{-3 \quad \quad -3}$$

$$-y = -11$$

$$\underline{\Rightarrow y = -11}$$

$$\underline{\Rightarrow y = -11}$$

$$\underline{y = 11}$$

Solving Multi-Step Equations

Solve each equation.

$$1) -12 - 2 = 4c + 6 + c$$

$$-14 = 5c + 6$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

$$\begin{array}{r} -20 = 5c \\ \hline 5 \quad 5 \end{array}$$

$$\boxed{-4 = c}$$

$$2) -7(3m - 7) = 7$$

$$-21m + 49 = 7$$

$$\begin{array}{r} -49 \quad -49 \\ \hline \end{array}$$

$$\begin{array}{r} -21m = -42 \\ \hline -21 \quad -21 \end{array}$$

$$\boxed{m = 2}$$

$$3) \frac{3y}{4} - \frac{2y}{5} = -7$$

$$20 \left(\frac{3y}{4} - \frac{2y}{5} \right) = (-7)(20)$$

$$15y - 8y = -140$$

$$\begin{array}{r} 7y = -140 \\ \hline 7 \end{array}$$

$$\boxed{y = -20}$$

Solving Equations with Variables on Both Sides

Solve each equation.

$$1) 6b - 4 = -2b - 28$$

$$\begin{array}{r} +2b \\ \hline 8b - 4 = -28 \end{array}$$

$$8b - 4 = -28$$

$$\begin{array}{r} +4 \quad +4 \\ \hline 8b = -24 \end{array}$$

$$8b = -24$$

$$\frac{8}{8} \quad \frac{-24}{8}$$

$$b = -3$$

$$2) -3(2y - 8) = 4(y - 4)$$

$$-6y + 24 = 4y - 16$$

$$\begin{array}{r} +6y \quad +6y \\ \hline 24 = 10y - 16 \end{array}$$

$$24 = 10y - 16$$

$$\begin{array}{r} +16 \quad +16 \\ \hline 40 = 10y \end{array}$$

$$40 = 10y$$

$$\frac{40}{10} = \frac{10y}{10}$$

$$4 = y$$

$$3) -3m + 18 = -3(m - 6)$$

$$-3m + 18 = -3m + 18$$

Answer: All Real Numbers

$$4) 5(x - 2) = 8x + 2 - 3x$$

$$5x - 10 = 5x + 2$$

$$\begin{array}{r} -5x \quad -5x \\ \hline -10 = 2x \end{array}$$

$$-10 = 2x$$

Since $-10 \neq 2$, No Solution