

CHAPTER 1

PRE - ALGEBRA

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1.1 RULES FOR ADDITION AND SUBTRACTION

1

RULE 1: You cannot add or subtract unless the name is the same.

In algebra we call them like terms. (Combine Like Terms)

Examples:

1. $\frac{2}{3}$ means two of those little thirds

2. $2\sqrt{3}$ means two of those little square roots of threes

3. $2X$ means two of those little X's

The 2 is the number each time and thirds, square roots of three, and X are the names.

Like Names or Like Terms

$$4. \frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$

$$6. \frac{11}{13} - \frac{5}{13} = \frac{6}{13}$$

$$8. 2\sqrt{7} + 3\sqrt{7} = 5\sqrt{7}$$

$$10. 5X + 6X = 11X$$

$$12. 7X^2Y + 8X^2Y = 15X^2Y$$

PRACTICE: (SOLVE)

$$1. \frac{3}{5} + \frac{1}{7} = \frac{26}{35}$$

$$2. \frac{7}{8} - \frac{3}{8} = \frac{1}{2}$$

$$4. 5\sqrt{11} + 7\sqrt{13} = \text{simplest form}$$

$$6. 6X + 7X = 13X$$

$$8. 83MN - 17MN = 66MN$$

Not Like Names or Like Terms

$$5. \frac{3}{8} + \frac{4}{9} = \text{need a common denominator}$$

$$7. \frac{13}{23} - \frac{7}{15} = \text{need a common denominator}$$

$$9. 5\sqrt{3} + 7\sqrt{11} = \text{simplest form}$$

$$11. 5X + 6Y = \text{simplest form}$$

$$13. 3X^2Y + 4XY^2 = \text{simplest form}$$

$$3. 5\frac{11}{13} - 2\frac{5}{13} = 3\frac{6}{13}$$

$$5. 6\sqrt{3} + 8\sqrt{3} = 14\sqrt{3}$$

$$7. 12X^2Y^3 + 15XY^3 = \text{simplest form}$$

$$9. 13X^2Y + 12X^2Y = 25X^2Y$$

RULE 2: To "simplify an expression" put like terms together (commutative property) and then combine the like terms. 2

RULE 3: To carry or borrow ask the question, "How many of these does it take to make one of those."

EXAMPLES:

1. $234.67 + 54.78 =$

$$\begin{array}{r} 234.67 \\ + 54.78 \\ \hline 289.45 \end{array}$$

2. $467.84 - 98.97 =$

$$\begin{array}{r} 467.84 \\ - 98.97 \\ \hline 368.87 \end{array}$$

3. $4\frac{5}{11} + 3\frac{9}{11} =$

$$\begin{array}{r} 4\frac{5}{11} \\ + 3\frac{9}{11} \\ \hline 7\frac{14}{11} \end{array}$$

Handwritten notes: $1\frac{3}{11}$ (circled), $11 \overline{)14} \begin{array}{l} 1 \\ -11 \\ \hline 3 \end{array}$ (circled), and an arrow pointing from the $14/11$ to $1\frac{3}{11}$.

$8\frac{3}{11}$ (circled)

5. $5 \text{ yards } 2 \text{ feet } 8 \text{ inches}$
 $+ 4 \text{ yards } 2 \text{ feet } 7 \text{ inches}$

$$\begin{array}{r} 5\text{ft} \quad 15\text{in} \\ - 3\text{ft} \quad -12\text{in} \\ \hline \end{array}$$

$10\text{yds } 2\text{ft } 3\text{in}$ (circled)

4. $8\frac{2}{7} - 3\frac{6}{7} =$

$$\begin{array}{r} 7\frac{2}{7} + \frac{7}{7} = \frac{9}{7} \\ - 3\frac{6}{7} \\ \hline \end{array}$$

$4\frac{3}{7}$ (circled)

6. $17 \text{ hours } 46 \text{ min } + 60 \text{ min} = 106 \text{ min}$
 $18 \text{ hours } 47 \text{ min } 39 \text{ sec } + 60 \text{ sec} = 99 \text{ sec}$
 $- 12 \text{ hours } 52 \text{ min } 47 \text{ sec}$

$5 \text{ hours } 54 \text{ min } 52 \text{ sec}$ (circled)

7. $5XY + 6MN + 7XY + 4MN =$

$12XY + 10MN$ (circled)

8. $3X^2Y + 4XY + -7X^2Y =$

$-4X^2Y + 4XY$ (circled)

PRACTICE: (SIMPLIFY EACH EXPRESSION)

3

1. $345.6 + 24.76 =$

370.36

2. $495.34 - 254.375 =$

240.965

3. $4\frac{5}{6} + 3\frac{5}{6} =$

$8\frac{2}{3}$

4. $7\frac{3}{7} - 4\frac{5}{7} =$

$2\frac{5}{7}$

5. $5\frac{7}{8} + 4\frac{5}{8} =$

$10\frac{1}{2}$

6. $9\frac{3}{11} - 3\frac{9}{11} =$

$5\frac{5}{11}$

7. $9 \text{ yards } 2 \text{ feet } 8 \text{ inches}$
 $+ 8 \text{ yards } 2 \text{ feet } 9 \text{ inches}$

$18 \text{ yards } 2 \text{ feet } 5 \text{ inches}$

8. $19 \text{ hours } 37 \text{ min } 28 \text{ sec}$
 $- 13 \text{ hours } 46 \text{ min } 43 \text{ sec}$

$5 \text{ hours } 50 \text{ min } 45 \text{ sec}$

9. $5 \text{ gallons } 3 \text{ quarts } 1 \text{ pint}$
 $+ 3 \text{ gallons } 2 \text{ quarts } 1 \text{ pint}$

$9 \text{ gallons } 2 \text{ quarts}$

10. $7 \text{ meters } 4 \text{ decimeters } 3 \text{ centimeters}$
 $- 3 \text{ meters } 7 \text{ decimeters } 8 \text{ centimeters}$

$3 \text{ meters } 6 \text{ decimeters } 5 \text{ centimeters}$

11. $5XY + 7DR + 4XY + 3DR =$

$$9XY + 10DR$$

12. $-3XY + 5MN + 8XY = 4$

$$5XY + 5MN$$

13. $6X^2Z + 5YZ^3 + 3X^2Z =$

$$9X^2Z + 5YZ^3$$

14. $8XYZ + 3X + 4XYZ =$

$$12XYZ + 3X$$

15. $5\sqrt{6} + 3\sqrt{7} + 8\sqrt{6} =$

$$13\sqrt{6} + 3\sqrt{7}$$

16. $4\sqrt{3} + -2\sqrt{3} + 5\sqrt{7} =$

$$2\sqrt{3} + 5\sqrt{7}$$

17. $9\sqrt{5} + 7\sqrt{3} + 6\sqrt{5} + 8\sqrt{3} + 8\sqrt{5} + 9\sqrt{3} =$

$$23\sqrt{5} + 24\sqrt{3}$$

18. $7\frac{11}{12} + 9\frac{7}{12} =$ $17\frac{1}{2}$

19. $14\frac{5}{12} - 9\frac{11}{12} =$ $4\frac{1}{2}$

20. Memorize your metric prefixes. (How Many?)

a. Kilo 1000 d. meter 1 length g. deci $\frac{1}{10}$ b. Hecto 100 e. liter 1 volume h. centi $\frac{1}{100}$ c. Deka 10 f. gram 1 weight i. milli $\frac{1}{1000}$

1.2 RULES FOR MULTIPLICATION AND DIVISION

RULE 1: The names do not have to be the same. They do not have to be like terms.

RULE 2: Every time you multiply or divide you get a new name. Multiply the numbers and multiply the names and you get a new name. (To mult. with like bases you add the exponents.) To divide use special rules. On a fraction you reduce the numbers and reduce the names. (To divide with like bases you sub. the exp.)

EXAMPLES:

1. $\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$ same name new name

2. $3X \times 4X = 12 X^{(1+1)} = 12 X^2$ HINT: $X+X=2X$ $X \times X = X^2$

3. $5X^2 \times 7X^3 = 35 X^{(2+3)} = 35 X^5$ $X \times X \times X = X^3$

4. $6\sqrt{3} \times 8\sqrt{5} = 48\sqrt{15}$

5. $X^5 \div X^2 =$ same as $\frac{X^5}{X^2} = X^{(5-2)} = X^3$ GCF or Greatest Common Factor

6. $\frac{6X^7Y^5}{8X^3Y^2} = \frac{\overset{GCF}{\cancel{2}} X^{\cancel{4}} Y^{\cancel{3}}}{\cancel{4} X^{\cancel{3}} Y^{\cancel{2}}} = \frac{3X^4Y^3}{4}$

$\begin{array}{r} 2\overline{)6} \\ 2\overline{)8} \\ 2\overline{)4} \\ \hline 3 \\ 2 \\ 2 \end{array}$ $2 \cdot 3 \cdot X \cdot X \cdot X \cdot X \cdot X \cdot X \cdot Y \cdot Y \cdot Y \cdot Y \cdot Y$
 $2 \cdot 2 \cdot 2 \cdot X \cdot X \cdot X \cdot Y \cdot Y$
 $2 \cdot X \cdot X \cdot X \cdot Y \cdot Y$
 $2X^3Y^2$

7. $\frac{12\sqrt{15}}{15\sqrt{3}} \div \frac{3\sqrt{3}}{3\sqrt{3}} = \frac{4\sqrt{5}}{5}$ 8. $0.5 \times 0.12 =$ same as $\frac{5}{10} \times \frac{12}{100} =$

$\frac{60}{1000} \div \frac{20}{20} = \frac{3}{50}$

$\begin{array}{r} 0.12 \\ \times 0.5 \\ \hline \end{array}$ count up the number of decimal places in the factors and put that many in the product

$\frac{060}{1000}$ thousands place (3 decimal places)

PRACTICE : (simplify each expression)

6

$$1. \frac{3}{4} \times \frac{5}{7} = \frac{15}{28}$$

$$2. \frac{5}{6} \times \frac{7}{8} = \frac{35}{48}$$

$$3. 5X \times 6X = 30X^2$$

$$4. 3Y \times 7Y = 21Y^2$$

$$5. 8X^2 \times 7X^3 = 56X^5$$

$$6. 4Z^3 \times 5Z^4 = 20Z^7$$

$$7. \frac{30X^2}{6X} = 5X$$

$$8. \frac{24Z^5}{8Z^3} = 3Z^2$$

$$9. \frac{24X^5Y^7}{36X^3Y^{10}} = \frac{2X^2}{3Y^3}$$

$$10. \frac{6M^3R^5}{8MR^3} = \frac{3M^2R^2}{4}$$

$$11. 5\sqrt{3} \times 7\sqrt{5} = 35\sqrt{15}$$

$$12. 4\sqrt{6} \times 5\sqrt{7} = 20\sqrt{42}$$

$$13. \frac{45\sqrt{21}}{9\sqrt{7}} = 5\sqrt{3}$$

$$14. \frac{25\sqrt{6}}{15\sqrt{3}} = \frac{5\sqrt{2}}{3}$$

$$15. 0.7 \times 0.13 =$$

$$.091$$

$$16. 0.02 \times 0.003 =$$

$$.00006$$

$$17. 0.6 \times 0.6 =$$

$$.36$$

$$18. (0.07)^2 =$$

$$.0049$$

$$19. .7 \overline{) .091} = \text{same as } \frac{91}{1000} \div \frac{7}{10} = \frac{13}{100}$$

SPECIAL RULES FOR DIVISION:

RULE 1: To divide by a decimal move it over enough places in the divisor so that it becomes a whole number then move it the same number of spaces in the dividend.

RULE 2: To divide by a fraction you reciprocate it and then multiply. Remember- multiply the numbers then multiply the names and you get a new name.

EXAMPLES:

1.
$$\begin{array}{r} 304 \\ .012 \overline{)3.648} \\ \underline{-36} \\ 048 \\ \underline{-48} \\ 0 \end{array}$$

Handwritten notes: 12 wouldn't go into 4 so put a zero

2.
$$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \cdot \frac{6}{5} = \frac{9}{10}$$

Handwritten note: reciprocate & multiply

PRACTICE:

1.
$$.04 \overline{)3.284}$$

Handwritten note: 82.1

2.
$$.006 \overline{)306}$$

Handwritten note: 51

3.
$$\frac{3}{4} \div \frac{5}{7} = \frac{21}{20} \text{ or } 1\frac{1}{20}$$

4.
$$\frac{5}{8} \div \frac{15}{16} = \frac{2}{3}$$

5. $.24 \overline{)4.896}$

20.4

6. $3.5 \overline{)70.70}$

20.2

7. $.0015 \overline{)450.6}$

300,400

7A

8. $\frac{5}{8} \div \frac{15}{56} = \frac{7}{3} \text{ or } 2\frac{1}{3}$

9. $\frac{3}{4} \div \frac{1}{2} = \frac{3}{2} \text{ or } 1\frac{1}{2}$

10. $\frac{7}{8} \div \frac{7}{8} = 1$

11. $\frac{4}{11} \div \frac{12}{55} = \frac{5}{3} \text{ or } 1\frac{2}{3}$

12. $\frac{3}{4} \div \frac{8}{9} \div \frac{5}{13} \times \frac{15}{39} = \frac{27}{32}$

1.3 ADDING AND SUBTRACTING UNLIKE FRACTIONS 8

RULE: You must get a common name or common denominator. The common denominator will be the least common multiple.

EXAMPLE:

1. Find the least common multiple of 75 and 135.

- Prime Numbers 2, 3, 5, 7, 11, 13, 17, 19, 23, -----
- Do the prime factorization of each number.
- Take the largest power of each prime and multiply them.

$$\begin{array}{r} 3 \overline{)75} \\ 5 \overline{)25} \\ \hline 5 \end{array}$$

$$\begin{array}{r} 3 \overline{)135} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ \hline 5 \end{array}$$

$$\begin{array}{l} 75 \rightarrow 3^1 \cdot 5^2 \\ 135 \rightarrow 3^3 \cdot 5^1 \end{array}$$

$$\begin{array}{c} \text{LCM} \\ 3^3 \cdot 5^2 = 27 \cdot 25 = \boxed{675} \end{array}$$

2. Find the least common multiple of $24X^3Y$ and $90XY^2$.

$$\begin{array}{r} 2 \overline{)24X^3Y} \\ 2 \overline{)12} \\ 2 \overline{)6} \\ \hline 3 \end{array}$$

$$\begin{array}{r} 2 \overline{)90XY^2} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ \hline 5 \end{array}$$

$$\begin{array}{l} 24X^3Y \rightarrow 2^3 \cdot 3^1 \cdot \cancel{X^3} \cdot Y^1 \\ 90XY^2 \rightarrow 2^1 \cdot 3^2 \cdot 5^1 \cdot X^1 \cdot \cancel{Y^2} \end{array}$$

$$\begin{array}{c} \text{LCM} \\ 2^3 \cdot 3^2 \cdot 5^1 \cdot X^3 \cdot Y^2 = 8 \cdot 9 \cdot 5 \cdot X^3 \cdot Y^2 \\ \boxed{360X^3Y^2} \end{array}$$