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BASIC MATH

BASIC MATH

A. BASIC ARITHMETIC

- Foundation of modern day life.
- Simplest form of mathematics.

Four Basic Operations :

- Addition **+** plus sign
- Subtraction **-** minus sign
- Multiplication **x** multiplication
sign **÷**
- Division division sign
Equal or Even Values **=** equal sign

1. Beginning Terminology

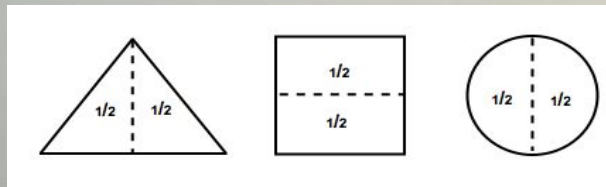
- **Numbers**- Symbol or word used to express value or quantity.
 - Arabic number system - 0,1,2,3,4,5,6,7,8,9
- **Digits**- Name given to place or position of each numeral.

Number Sequence

Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Ones
8	7	6	5	4	3	2

2. Kinds of numbers

- **Whole Numbers**- Complete units , no fractional parts. (43)
 - May be written in form of words. (forty-three)
- **Fraction**- Part of a whole unit or quantity. ($1/2$)



2. Kinds of numbers (con't)

- **Decimal Numbers**- Fraction written on one line as whole no.
 - Position of period determines power of decimal.

.	Tenths 0	Hundredths 0	Thousandths 5
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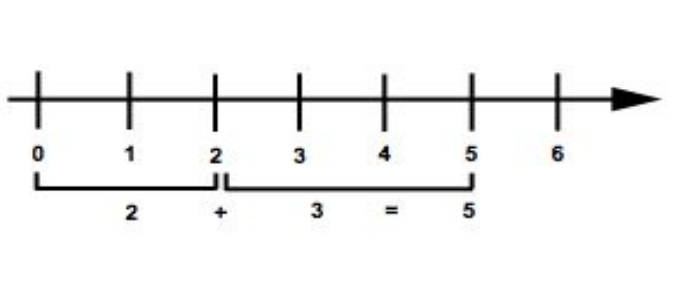
B. WHOLE NUMBERS

1. Addition

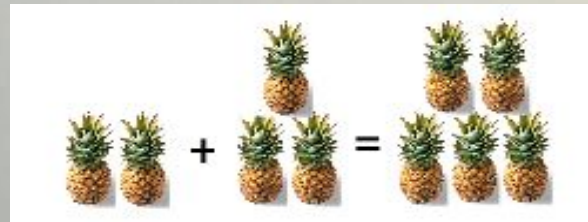
- **Number Line** - Shows numerals in order of value



- **Adding on the Number Line** ($2 + 3 = 5$)



- **Adding with pictures**



1. Addition (con't)

- **Adding in columns**- Uses no equal sign

$$\begin{array}{r} 5 \\ + 5 \\ \hline 10 \end{array}$$

Simple

$$\begin{array}{r} 897 \\ + 368 \\ \hline 1265 \end{array}$$

Complex

Answer is called "sum".

Table of Digits

Millions	Hundred-Thousands	Ten-Thousands	Thousands	Hundreds	Tens	Ones
			2	7	6	5
2765				9	7	2
972				8	5	7
857			1	7	2	4
+ 1724			6	3	1	8
<hr/>						
6318						

ADDITION PRACTICE EXERCISES

1. a.
$$\begin{array}{r} 222 \\ + 222 \\ \hline 444 \end{array}$$

b.
$$\begin{array}{r} 318 \\ + 421 \\ \hline 739 \end{array}$$

c.
$$\begin{array}{r} 611 \\ + 116 \\ \hline 727 \end{array}$$

d.
$$\begin{array}{r} 1021 \\ + 1210 \\ \hline 2231 \end{array}$$

2. a.
$$\begin{array}{r} 813 \\ + 267 \\ \hline 1080 \end{array}$$

b.
$$\begin{array}{r} 924 \\ + 429 \\ \hline 1353 \end{array}$$

c.
$$\begin{array}{r} 618 \\ + 861 \\ \hline 1479 \end{array}$$

d.
$$\begin{array}{r} 411 \\ + 946 \\ \hline 1357 \end{array}$$

3. a.
$$\begin{array}{r} 813 \\ 222 \\ + 318 \\ \hline 1353 \end{array}$$

b.
$$\begin{array}{r} 1021 \\ 611 \\ + 421 \\ \hline 2053 \end{array}$$

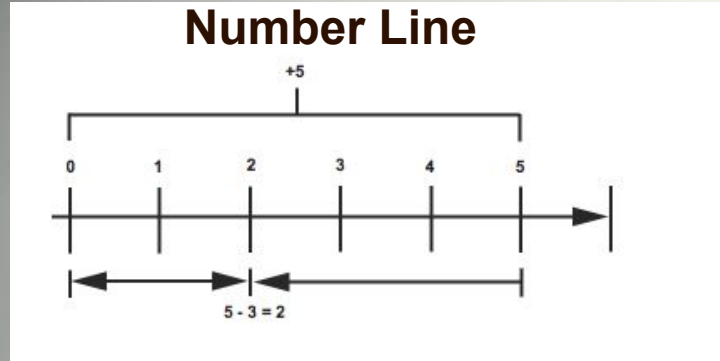
c.
$$\begin{array}{r} 611 \\ 96 \\ + 861 \\ \hline 1568 \end{array}$$

d.
$$\begin{array}{r} 1021 \\ 1621 \\ + 6211 \\ \hline 8853 \end{array}$$

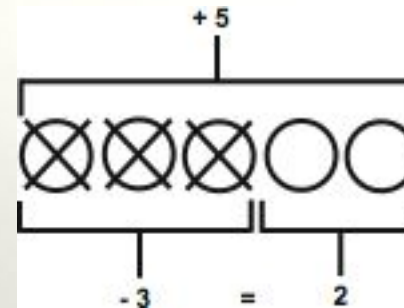
Let's check our answers.

2. Subtraction

- **Number Line** - Can show subtraction.



Subtraction with pictures



Position larger numbers above smaller numbers.

If subtracting larger digits from smaller digits, borrow from next column.

$$\begin{array}{r} 4 \cancel{5} 13 \ 8 \\ - 397 \\ \hline 141 \end{array}$$

SUBTRACTION PRACTICE EXERCISES

1. a.
$$\begin{array}{r} 6 \\ - 3 \\ \hline 3 \end{array}$$
 b.
$$\begin{array}{r} 8 \\ - 4 \\ \hline 4 \end{array}$$
 c.
$$\begin{array}{r} 5 \\ - 2 \\ \hline 3 \end{array}$$
 d.
$$\begin{array}{r} 9 \\ - 5 \\ \hline 4 \end{array}$$
 e.
$$\begin{array}{r} 7 \\ - 3 \\ \hline 4 \end{array}$$

2. a.
$$\begin{array}{r} 11 \\ - 6 \\ \hline 5 \end{array}$$
 b.
$$\begin{array}{r} 12 \\ - 4 \\ \hline 8 \end{array}$$
 c.
$$\begin{array}{r} 28 \\ - 9 \\ \hline 19 \end{array}$$
 d.
$$\begin{array}{r} 33 \\ - 7 \\ \hline 26 \end{array}$$
 e.
$$\begin{array}{r} 41 \\ - 8 \\ \hline 33 \end{array}$$

3. a.
$$\begin{array}{r} 27 \\ - 19 \\ \hline 8 \end{array}$$
 b.
$$\begin{array}{r} 23 \\ - 14 \\ \hline 9 \end{array}$$
 c.
$$\begin{array}{r} 86 \\ - 57 \\ \hline 29 \end{array}$$
 d.
$$\begin{array}{r} 99 \\ - 33 \\ \hline 66 \end{array}$$
 e.
$$\begin{array}{r} 72 \\ - 65 \\ \hline 7 \end{array}$$

Let's check our answers.

SUBTRACTION PRACTICE EXERCISES (con't)

4. a.
$$\begin{array}{r} 387 \\ - 241 \\ \hline 146 \end{array}$$

b.
$$\begin{array}{r} 399 \\ - 299 \\ \hline 100 \end{array}$$

c.
$$\begin{array}{r} 847 \\ - 659 \\ \hline 188 \end{array}$$

d.
$$\begin{array}{r} 732 \\ - 687 \\ \hline 45 \end{array}$$

5. a.
$$\begin{array}{r} 3472 \\ - 495 \\ \hline 2977 \end{array}$$

b.
$$\begin{array}{r} 312 \\ - 186 \\ \hline 126 \end{array}$$

c.
$$\begin{array}{r} 419 \\ - 210 \\ \hline 209 \end{array}$$

d.
$$\begin{array}{r} 3268 \\ - 3168 \\ \hline 100 \end{array}$$

6. a.
$$\begin{array}{r} 47 \\ - 38 \\ \hline 9 \end{array}$$

b.
$$\begin{array}{r} 63 \\ - 8 \\ \hline 55 \end{array}$$

c.
$$\begin{array}{r} 47 \\ - 32 \\ \hline 15 \end{array}$$

d.
$$\begin{array}{r} 59 \\ - 48 \\ \hline 11 \end{array}$$

7. a.
$$\begin{array}{r} 372 \\ - 192 \\ \hline 180 \end{array}$$

b.
$$\begin{array}{r} 385 \\ - 246 \\ \hline 139 \end{array}$$

c.
$$\begin{array}{r} 219 \\ - 191 \\ \hline 28 \end{array}$$

d.
$$\begin{array}{r} 368 \\ - 29 \\ \hline 339 \end{array}$$

Let's check our answers.

3. Checking Addition and Subtraction

- **Check Addition** - Subtract one of added numbers from sum. Result should produce other added number.

$$\begin{array}{r} 2 \\ + 8 \\ \hline 10 \\ - 8 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 5 \\ + 3 \\ \hline 8 \\ - 3 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 73 \\ + 48 \\ \hline 121 \\ - 48 \\ \hline 73 \end{array}$$

- **Check Three or more #'s** - Add from bottom to top.

$$\begin{array}{r} 927 \\ 318 \\ 426 \\ 183 \\ \hline 927 \end{array}$$

To Add ↓ ↑ To Check

- **Check Subtraction** - Add subtracted number back.

$$\begin{array}{r} 5 \\ - 4 \\ \hline 1 \\ + 4 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 62 \\ - 37 \\ \hline 25 \\ + 37 \\ \hline 62 \end{array}$$

$$\begin{array}{r} 103 \\ - 87 \\ \hline 16 \\ + 87 \\ \hline 103 \end{array}$$

CHECKING ADDITION & SUBTRACTION PRACTICE EXERCISES

1. a.
$$\begin{array}{r} 6 \\ + 8 \\ \hline 13 \end{array}$$

b.
$$\begin{array}{r} 9 \\ + 5 \\ \hline 14 \end{array}$$

c.
$$\begin{array}{r} 18 \\ + 18 \\ \hline 26 \end{array}$$

d.
$$\begin{array}{r} 109 \\ + 236 \\ \hline 335 \end{array}$$

2. a.
$$\begin{array}{r} 87 \\ - 87 \\ \hline 1 \end{array}$$

b.
$$\begin{array}{r} 291 \\ - 192 \\ \hline 99 \end{array}$$

c.
$$\begin{array}{r} 367 \\ - 212 \\ \hline 55 \end{array}$$

d.
$$\begin{array}{r} 28 \\ - 5 \\ \hline 24 \end{array}$$

3. a.
$$\begin{array}{r} 34 \\ + 12 \\ \hline 46 \end{array}$$

b.
$$\begin{array}{r} 87 \\ 13 \\ 81 \\ + 14 \\ \hline 195 \end{array}$$

c.
$$\begin{array}{r} 87 \\ 13 \\ 81 \\ + 14 \\ \hline 746 \end{array}$$

d.
$$\begin{array}{r} 21 \\ - 83 \\ \hline 104 \end{array}$$

4. a.
$$\begin{array}{r} 28 \\ - 16 \\ \hline 22 \end{array}$$

b.
$$\begin{array}{r} 361 \\ - 361 \\ \hline 0 \end{array}$$

c.
$$\begin{array}{r} 2793142 \\ - 1361101 \\ \hline 1432141 \end{array}$$

Check these answers using the method discussed.

CHECKING ADDITION & SUBTRACTION PRACTICE EXERCISES

$$\begin{array}{r} 1. \quad a. \quad 6 \\ \quad \quad + 8 \\ \quad \quad \hline \quad \quad 13 \\ \quad \quad - 8 \\ \quad \quad \hline \quad \quad 5 \end{array}$$

$$\begin{array}{r} b. \quad 9 \\ \quad \quad + 5 \\ \quad \quad \hline \quad \quad 14 \\ \quad \quad - 5 \\ \quad \quad \hline \quad \quad 9 \end{array}$$

$$\begin{array}{r} c. \quad 18 \\ \quad \quad + 18 \\ \quad \quad \hline \quad \quad 26 \\ \quad \quad - 18 \\ \quad \quad \hline \quad \quad 8 \end{array}$$

$$\begin{array}{r} d. \quad 109 \\ \quad \quad + 236 \\ \quad \quad \hline \quad \quad 335 \\ \quad \quad - 236 \\ \quad \quad \hline \quad \quad 99 \end{array}$$

$$\begin{array}{r} 2. \quad a. \quad 87 \\ \quad \quad - 87 \\ \quad \quad \hline \quad \quad 1 \\ \quad \quad + 87 \\ \quad \quad \hline \quad \quad 88 \end{array}$$

$$\begin{array}{r} b. \quad 291 \\ \quad \quad - 192 \\ \quad \quad \hline \quad \quad 99 \\ \quad \quad + 192 \\ \quad \quad \hline \quad \quad 291 \end{array}$$

$$\begin{array}{r} c. \quad 367 \\ \quad \quad - 212 \\ \quad \quad \hline \quad \quad 55 \\ \quad \quad + 212 \\ \quad \quad \hline \quad \quad 267 \end{array}$$

$$\begin{array}{r} d. \quad 28 \\ \quad \quad - 5 \\ \quad \quad \hline \quad \quad 24 \\ \quad \quad + 5 \\ \quad \quad \hline \quad \quad 29 \end{array}$$

$$\begin{array}{r} 3. \quad a. \quad 34 \\ \quad \quad + 12 \\ \quad \quad \hline \quad \quad 46 \\ \quad \quad - 12 \\ \quad \quad \hline \quad \quad 34 \end{array}$$

$$\begin{array}{r} b. \quad 195 \\ \quad \quad 87 \\ \quad \quad 13 \\ \quad \quad 81 \\ \quad \quad + 14 \\ \quad \quad \hline \quad \quad 195 \end{array}$$

$$\begin{array}{r} c. \quad 949 \\ \quad \quad 103 \\ \quad \quad 212 \\ \quad \quad 439 \\ \quad \quad + 195 \\ \quad \quad \hline \quad \quad 746 \end{array}$$

$$\begin{array}{r} d. \quad 21 \\ \quad \quad + 83 \\ \quad \quad \hline \quad \quad 104 \\ \quad \quad - 83 \\ \quad \quad \hline \quad \quad 21 \end{array}$$

$$\begin{array}{r} 4. \quad a. \quad 28 \\ \quad \quad - 16 \\ \quad \quad \hline \quad \quad 22 \\ \quad \quad + 16 \\ \quad \quad \hline \quad \quad 38 \end{array}$$

$$\begin{array}{r} b. \quad 361 \\ \quad \quad - 361 \\ \quad \quad \hline \quad \quad 0 \\ \quad \quad + 361 \\ \quad \quad \hline \quad \quad 361 \end{array}$$

$$\begin{array}{r} c. \quad 2793142 \\ \quad \quad - 1361101 \\ \quad \quad \hline \quad \quad 1432141 \\ \quad \quad + 1361101 \\ \quad \quad \hline \quad \quad 2793242 \end{array}$$

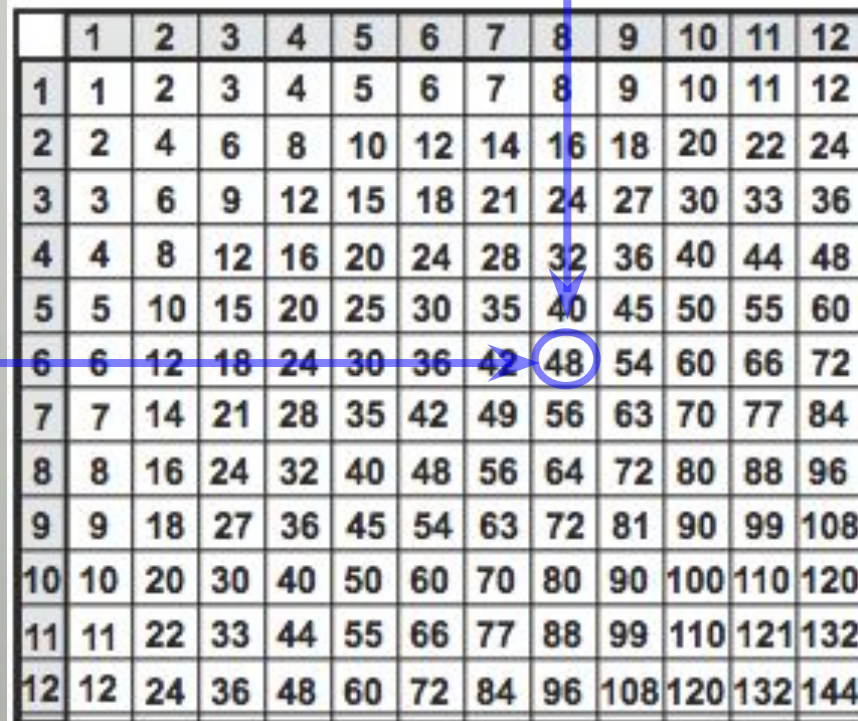
= Right
= Wrong

4. Multiplication

- **In Arithmetic**- Indicated by “times” sign (x).

Learn “Times” Table

$$6 \times 8 = 48$$



	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

4. Multiplication (con't)

- **Complex Multiplication**- Carry result to next column.

Problem: 48×23

$$\begin{array}{r} +2 \\ 48 \\ \times 23 \\ \hline 4 \end{array} \quad \Rightarrow \quad \begin{array}{r} +2 \\ 48 \\ \times 23 \\ \hline 144 \end{array} \quad \Rightarrow \quad \begin{array}{r} +1 \\ 48 \\ \times 23 \\ \hline 144 \\ 6 \end{array} \quad \Rightarrow \quad \begin{array}{r} +1 \\ 48 \\ \times 23 \\ \hline 144 \\ 960 \\ \hline 1104 \end{array}$$

Same process is used when multiplying three or four-digit problems.

MULTIPLICATION PRACTICE EXERCISES

1. a.
$$\begin{array}{r} 21 \\ \times 4 \\ \hline 84 \end{array}$$

b.
$$\begin{array}{r} 81 \\ \times 9 \\ \hline 729 \end{array}$$

c.
$$\begin{array}{r} 64 \\ \times 5 \\ \hline 320 \end{array}$$

d.
$$\begin{array}{r} 36 \\ \times 3 \\ \hline 108 \end{array}$$

2. a.
$$\begin{array}{r} 87 \\ \times 7 \\ \hline 609 \end{array}$$

b.
$$\begin{array}{r} 43 \\ \times 2 \\ \hline 86 \end{array}$$

c.
$$\begin{array}{r} 56 \\ \times 0 \\ \hline 0 \end{array}$$

d.
$$\begin{array}{r} 99 \\ \times 6 \\ \hline 594 \end{array}$$

3. a.
$$\begin{array}{r} 24 \\ \times 13 \\ \hline 312 \end{array}$$

b.
$$\begin{array}{r} 53 \\ \times 15 \\ \hline 795 \end{array}$$

c.
$$\begin{array}{r} 49 \\ \times 26 \\ \hline 1274 \end{array}$$

d.
$$\begin{array}{r} 55 \\ \times 37 \\ \hline 2035 \end{array}$$

Let's check our answers.

MULTIPLICATION PRACTICE EXERCISES (con't)

4. a.
$$\begin{array}{r} 94 \\ \times 73 \\ \hline 6862 \end{array}$$

b.
$$\begin{array}{r} 99 \\ \times 27 \\ \hline 2673 \end{array}$$

c.
$$\begin{array}{r} 34 \\ \times 32 \\ \hline 1088 \end{array}$$

d.
$$\begin{array}{r} 83 \\ \times 69 \\ \hline 5727 \end{array}$$

5. a.
$$\begin{array}{r} 347 \\ \times 21 \\ \hline 7287 \end{array}$$

b.
$$\begin{array}{r} 843 \\ \times 34 \\ \hline 28,662 \end{array}$$

c.
$$\begin{array}{r} 966 \\ \times 46 \\ \hline 44,436 \end{array}$$

6. a.
$$\begin{array}{r} 360 \\ \times 37 \\ \hline 13,320 \end{array}$$

b.
$$\begin{array}{r} 884 \\ \times 63 \\ \hline 55,692 \end{array}$$

c.
$$\begin{array}{r} 111 \\ \times 19 \\ \hline 2109 \end{array}$$

7. a.
$$\begin{array}{r} 493 \\ \times 216 \\ \hline 106,488 \end{array}$$

b.
$$\begin{array}{r} 568 \\ \times 432 \\ \hline 245,376 \end{array}$$

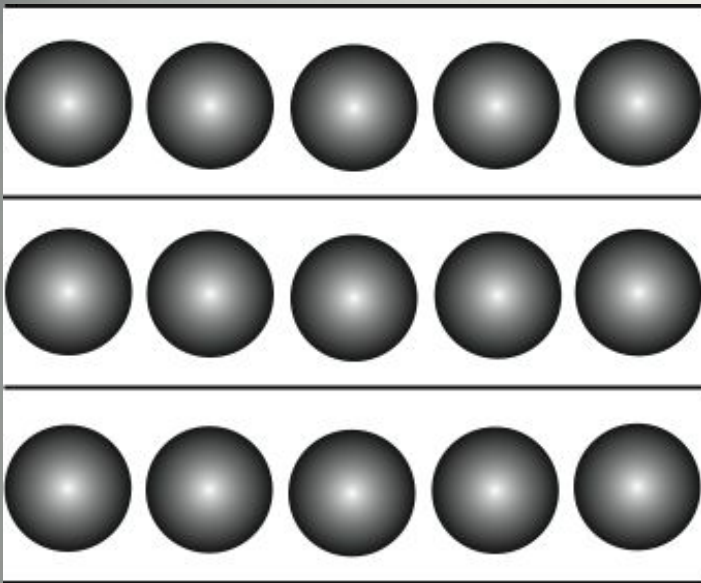
c.
$$\begin{array}{r} 987 \\ \times 654 \\ \hline 645,498 \end{array}$$

Let's check our answers.

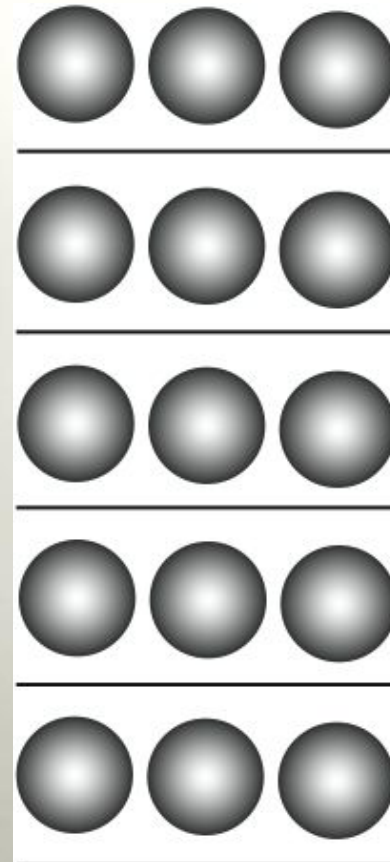
5. Division

- Finding out how many times a divider “goes into” a whole number.

$$15 \div 5 = 3$$



$$15 \div 3 = 5$$



5. Division (con't)

- Shown by using a straight bar “ $\overline{\hspace{1cm}}$ ” or “ $\sqrt{\hspace{1cm}}$ ” sign.

$$\begin{array}{r} 105 \\ 48 \overline{) 5040} \\ \underline{48} \\ 240 \\ \underline{240} \\ 0 \end{array}$$

48 “goes into” 50 one time.
1 times 48 = 48
50 minus 48 = 2 & bring down the 4
48 goes into 24 zero times.
Bring down other 0.
48 goes into 240, five times
5 times 48 = 240
240 minus 240 = 0 remainder

So, 5040 divided by 48 = 105 w/no remainder.

Or it can be stated:

48 “goes into” 5040, “105 times”

DIVISION PRACTICE EXERCISES

1. a. $48 \overline{)5040}^{211}$

b. $7 \overline{)434}^{62}$

c. $9 \overline{)828}^{92}$

2. a. $9 \overline{)117}^{13}$

b. $12 \overline{)3720}^{310}$

c. $10 \overline{)1010}^{101}$

3. a. $23 \overline{)5888}^{256}$

b. $56 \overline{)38472}^{687}$

4. a. $98 \overline{)9604}^{98}$

b. $13 \overline{)871}^{67}$

5. a. $50 \overline{)2500}^{50}$

b. $789 \overline{)97047}^{123}$

Let's check our answers.

DIVISION PRACTICE EXERCISES (con't)

6. a. $21 \overline{)147} \begin{array}{r} 7 \end{array}$

b. $3 \overline{)27000} \begin{array}{r} 9000 \end{array}$

7. a. $32 \overline{)1952} \begin{array}{r} 61 \end{array}$

b. $88 \overline{)8888} \begin{array}{r} 101 \end{array}$

8. a. $87 \overline{)5848} \begin{array}{r} 67 \text{ r } 19 \end{array}$

b. $15 \overline{)12883} \begin{array}{r} 858 \text{ r } 13 \end{array}$

9. a. $994 \overline{)12883} \begin{array}{r} 12 \text{ r } 955 \end{array}$

b. $352 \overline{)8073} \begin{array}{r} 22 \text{ r } 329 \end{array}$

Let's check our answers.

C. FRACTIONS - A smaller part of a whole number.

Written with one number over the other, divided by a line.

$$\frac{3}{8} \quad \frac{11}{16} \quad \text{or} \quad \frac{3}{8} \quad \frac{11}{16}$$

Any number smaller than 1, must be a fraction.

Try thinking of the fraction as “so many of a specified number of parts”.

For example: Think of $\frac{3}{8}$ as “three of eight parts” or...

Think of $\frac{11}{16}$ as “eleven of sixteen parts”.

1. Changing whole numbers to fractions.

Multiply the whole number times the number of parts being considered.

Changing the whole number 4 to “sixths”:

$$4 = \frac{4 \times 6}{6} = \frac{24}{6} \quad \text{or} \quad \frac{24}{6}$$

CHANGING WHOLE NUMBERS TO FRACTIONS EXERCISES

$$1. \quad 49 \text{ to sevenths} = \frac{49 \times 7}{7} = \frac{343}{7} \quad \text{or} \quad \frac{343}{7}$$

$$2. \quad 40 \text{ to eighths} = \frac{40 \times 8}{8} = \frac{320}{8} \quad \text{or} \quad \frac{320}{8}$$

$$3. \quad 54 \text{ to ninths} = \frac{54 \times 9}{9} = \frac{486}{9} \quad \text{or} \quad \frac{486}{9}$$

$$4. \quad 27 \text{ to thirds} = \frac{27 \times 3}{3} = \frac{81}{3} \quad \text{or} \quad \frac{81}{3}$$

$$5. \quad 12 \text{ to fourths} = \frac{12 \times 4}{4} = \frac{48}{4} \quad \text{or} \quad \frac{48}{4}$$

$$6. \quad 130 \text{ to fifths} = \frac{130 \times 5}{5} = \frac{650}{5} \quad \text{or} \quad \frac{650}{5}$$

Let's check our answers.

2. Proper and improper fractions.

Proper Fraction - Numerator is smaller number than denominator.

$$\frac{3}{4}$$

Improper Fraction - Numerator is greater than or equal to denominator.

$$\frac{15}{9}$$

3. Mixed numbers.

Combination of a whole number and a proper fraction.

4. Changing mixed numbers to fractions.

Change $3 \frac{7}{8}$ into an improper fraction.

- Change whole number (3) to match fraction (eighths).

$$3 = \frac{3 \times 8}{8} = \frac{24}{8} \quad \text{or} \quad \frac{24}{8}$$

- Add both fractions together.

$$\frac{24}{8} + \frac{7}{8} = \frac{31}{8}$$

CHANGING MIXED NUMBERS TO FRACTIONS EXERCISES

$$1. \quad 4 \frac{1}{2} = \frac{4 \times 2}{2} = \frac{8}{2} + \frac{1}{2} = \frac{9}{2}$$

$$2. \quad 8 \frac{3}{4} = \frac{8 \times 4}{4} = \frac{24}{4} + \frac{3}{4} = \frac{27}{4}$$

$$3. \quad 19 \frac{7}{16} = \frac{19 \times 16}{16} = \frac{304}{16} + \frac{7}{16} = \frac{311}{16}$$

$$4. \quad 7 \frac{11}{12} = \frac{7 \times 12}{12} = \frac{84}{12} + \frac{11}{12} = \frac{95}{12}$$

$$5. \quad 6 \frac{9}{14} = \frac{6 \times 14}{14} = \frac{84}{14} + \frac{9}{14} = \frac{93}{14}$$

$$6. \quad 5 \frac{1}{64} = \frac{5 \times 64}{64} = \frac{320}{64} + \frac{1}{64} = \frac{321}{64}$$

Let's check our answers.

5. Changing improper fractions to whole/mixed numbers.

Change $19/3$ into whole/mixed number..

$$19/3 = 19 \div 3 = 6, \text{ remainder } 1 = 6 \frac{1}{3} \text{ (a mixed number)}$$

CHANGING IMPROPER FRACTIONS TO WHOLE/MIXED NUMBERS EXERCISES

1. $37/7 = 37 \div 7 = 5, \text{ remainder } 2 = 5 \frac{2}{7}$ (a mixed number)

2. $44/4 = 44 \div 4 = 11, \text{ no remainder} = 11$ (a whole number)

3. $23/5 = 23 \div 5 = 4, \text{ remainder } 3 = 4 \frac{3}{5}$ (a mixed number)

4. $43/9 = 43 \div 9 = 4, \text{ remainder } 7 = 4 \frac{7}{9}$ (a mixed number)

5. $240/8 = 240 \div 8 = 30, \text{ no remainder} = 30$ (a whole number)

6. $191/6 = 191 \div 6 = 31, \text{ remainder } 5 = 31 \frac{5}{6}$ (a mixed number)

Let's check our answers.

6. Reducing Fractions

Reducing - Changing to different terms.

Terms - The name for numerator and denominator of a fraction.

Reducing does not change value of original fraction.

7. Reducing to Lower Terms

Divide both numerator and denominator by same number.

Example: $\frac{3}{9} = \frac{3 \div 3 = 1}{9 \div 3 = 3} \quad \frac{3}{9} \text{ \& } \frac{1}{3} \text{ Have same value.}$

8. Reducing to Lowest Terms

Lowest Terms - 1 is only number which evenly divides both numerator and denominator.

Example: $\frac{16}{32} =$

a. $\frac{16 \div 2 = 8}{32 \div 2 = 16}$ b. $\frac{8 \div 2 = 4}{16 \div 2 = 8}$ c. $\frac{4 \div 2 = 2}{8 \div 2 = 4}$ d. $\frac{2 \div 2 = 1}{4 \div 2 = 2}$

REDUCING TO LOWER/LOWEST TERMS EXERCISES

1. Reduce the following fractions to LOWER terms:

a. $\frac{15}{20}$ to 4ths = $\frac{15 \div 5 = 3}{20 \div 5 = 4}$

- Divide the original denominator (20) by the desired denominator (4) = 5..
- Then divide both parts of original fraction by that number (5).

b. $\frac{36}{40}$ to 10ths = $\frac{36 \div 4 = 9}{40 \div 4 = 10}$

c. $\frac{24}{36}$ to 6ths = $\frac{24 \div 6 = 4}{36 \div 6 = 6}$

d. $\frac{12}{36}$ to 9ths = $\frac{12 \div 4 = 3}{36 \div 4 = 9}$

e. $\frac{30}{45}$ to 15ths = $\frac{30 \div 3 = 10}{45 \div 3 = 15}$

f. $\frac{16}{76}$ to 19ths = $\frac{16 \div 4 = 4}{76 \div 4 = 19}$

Let's check our answers.

REDUCING TO LOWER/LOWEST TERMS EXERCISES (con't)

2. Reduce the following fractions to **LOWEST** terms:

$$\text{a. } \frac{6}{10} = \text{a. } \frac{6 \div 2 = 3}{10 \div 2 = 5}$$

$$\text{b. } \frac{3}{9} = \text{a. } \frac{3 \div 3 = 1}{9 \div 3 = 3}$$

$$\text{c. } \frac{6}{64} = \text{a. } \frac{6 \div 2 = 3}{64 \div 2 = 32}$$

$$\text{d. } \frac{13}{32} = \text{Cannot be reduced.}$$

$$\text{e. } \frac{32}{48} = \text{a. } \frac{32 \div 2 = 16}{64 \div 2 = 32} \quad \text{b. } \frac{16 \div 2 = 8}{32 \div 2 = 16} \quad \text{c. } \frac{8 \div 8 = 1}{16 \div 8 = 2}$$

$$\text{f. } \frac{16}{76} = \text{a. } \frac{16 \div 2 = 8}{76 \div 2 = 38} \quad \text{b. } \frac{8 \div 2 = 4}{38 \div 2 = 19}$$

Let's check our answers.

9. Common Denominator

Two or more fractions with the same denominator.

$$\frac{1}{8} \quad \frac{2}{8} \quad \frac{6}{8} \quad \frac{7}{8}$$

When denominators are not the same, a common denominator is found by multiplying each denominator together.

$$\frac{1}{6} \quad \frac{3}{8} \quad \frac{2}{9} \quad \frac{5}{12} \quad \frac{5}{18} \quad \frac{7}{24} \quad \frac{1}{36}$$

$$6 \times 8 \times 9 \times 12 \times 18 \times 24 \times 36 = 80,621,568$$

80,621,568 is only one possible common denominator ...
but certainly not the best, or easiest to work with.

10. Least Common Denominator (LCD)

Smallest number into which denominators of a group of two or more fractions will divide evenly.

10. Least Common Denominator (LCD) con't.

To find the LCD, find the “lowest prime factors” of each denominator.

$$\frac{1}{6}$$

$$2 \times 3$$

$$\frac{3}{8}$$

$$2 \times 2 \times 2$$

$$\frac{2}{9}$$

$$3 \times 3$$

$$\frac{5}{12}$$

$$2 \times 3 \times 2$$

$$\frac{5}{18}$$

$$2 \times 3 \times 3$$

$$\frac{7}{24}$$

$$3 \times 2 \times 2 \times 2$$

$$\frac{1}{36}$$

$$2 \times 2 \times 3 \times 3$$

The most number of times any single factors appears in a set is multiplied by the most number of time any other factor appears.

$$(2 \times 2 \times 2) \times (3 \times 3) = 72$$

Remember: If a denominator is a “prime number”, it can't be factored except by itself and 1.

LCD Exercises (Find the LCD's)

$$\frac{1}{6}$$

$$2 \times 3$$

$$\frac{1}{8}$$

$$2 \times 2 \times 2$$

$$\frac{1}{12}$$

$$2 \times 3 \times 2$$

$$2 \times 2 \times 2 \times 3 = 24$$

$$\frac{1}{12}$$

$$2 \times 2 \times 3$$

$$\frac{1}{16}$$

$$2 \times 2 \times 2 \times 2$$

$$2 \times 2 \times 2 \times 2 \times 3 = 48$$

$$\frac{1}{24}$$

$$3 \times 2 \times 2 \times 2$$

$$\frac{3}{10}$$

$$2 \times 5$$

$$\frac{4}{15}$$

$$3 \times 5$$

$$2 \times 2 \times 3 \times 5 = 60$$

$$\frac{7}{20}$$

$$2 \times 2 \times 5$$

Let's check our answers.

11. Reducing to LCD

Reducing to LCD can only be done after the LCD itself is known.

$$\begin{array}{ccccccc} \frac{1}{6} & \frac{3}{8} & \frac{2}{9} & \frac{5}{12} & \frac{5}{18} & \frac{7}{24} & \frac{1}{36} \\ \left(\begin{array}{ccccccc} 2 \times 3 & 2 \times 2 \times 2 & 3 \times 3 & 2 \times 3 \times 2 & 2 \times 3 \times 3 & 3 \times 2 \times 2 \times 2 & 2 \times 2 \times 3 \times 3 \end{array} \right) \\ \rightarrow & & & \text{LCD} = 72 & & & \leftarrow \end{array}$$

Divide the LCD by each of the other denominators, then multiply both the numerator and denominator of the fraction by that result.

$$\begin{array}{cccc} \frac{1}{6} & \frac{3}{8} & \frac{2}{9} & \frac{5}{12} \\ 72 \div 6 = 12 & 72 \div 8 = 9 & 72 \div 9 = 8 & 72 \div 12 = 6 \\ \frac{1 \times 12 = 12}{6 \times 12 = 72} & \frac{3 \times 9 = 27}{8 \times 9 = 72} & \frac{2 \times 8 = 16}{9 \times 8 = 72} & \frac{5 \times 6 = 30}{12 \times 6 = 72} \end{array}$$

Remaining fractions are handled in same way.

Reducing to LCD Exercises

Reduce each set of fractions to their LCD.

$$\frac{1}{6} \quad \frac{1}{8} \quad \frac{1}{12}$$

$2 \times 3 \quad 2 \times 2 \times 2 \quad 2 \times 3 \times 2$

$2 \times 2 \times 2 \times 3 = 24$

$$\frac{1}{6} \left\{ \begin{array}{l} 24 \div 6 = 4 \\ \frac{1 \times 4 = 4}{6 \times 4 = 24} \end{array} \right.$$

$$\frac{1}{8} \left\{ \begin{array}{l} 24 \div 8 = 3 \\ \frac{1 \times 3 = 3}{8 \times 3 = 24} \end{array} \right.$$

$$\frac{1}{12} \left\{ \begin{array}{l} 24 \div 12 = 2 \\ \frac{1 \times 2 = 2}{12 \times 2 = 24} \end{array} \right.$$

$$\frac{1}{12} \quad \frac{1}{16} \quad \frac{1}{24}$$

$2 \times 2 \times 3 \quad 2 \times 2 \times 2 \times 2 \quad 3 \times 2 \times 2 \times 2$

$2 \times 2 \times 2 \times 2 \times 3 = 48$

$$\frac{1}{12} \left\{ \begin{array}{l} 48 \div 12 = 4 \\ \frac{1 \times 4 = 4}{12 \times 4 = 48} \end{array} \right.$$

$$\frac{1}{16} \left\{ \begin{array}{l} 48 \div 16 = 3 \\ \frac{1 \times 3 = 3}{16 \times 3 = 48} \end{array} \right.$$

$$\frac{1}{24} \left\{ \begin{array}{l} 48 \div 24 = 2 \\ \frac{1 \times 2 = 2}{24 \times 2 = 48} \end{array} \right.$$

$$\frac{3}{10} \quad \frac{4}{15} \quad \frac{7}{20}$$

$2 \times 5 \quad 3 \times 5 \quad 2 \times 2 \times 5$

$2 \times 2 \times 3 \times 5 = 60$

$$\frac{3}{10} \left\{ \begin{array}{l} 60 \div 10 = 6 \\ \frac{3 \times 6 = 18}{10 \times 6 = 60} \end{array} \right.$$

$$\frac{4}{15} \left\{ \begin{array}{l} 60 \div 15 = 4 \\ \frac{4 \times 4 = 16}{15 \times 4 = 60} \end{array} \right.$$

$$\frac{7}{20} \left\{ \begin{array}{l} 60 \div 20 = 3 \\ \frac{7 \times 3 = 21}{20 \times 3 = 60} \end{array} \right.$$

Let's check our answers.

12. Addition of Fractions

All fractions must have same denominator.

Determine common denominator according to previous process.

Then add fractions.

$$\frac{1}{4} + \frac{2}{4} + \frac{3}{4} = \frac{6}{4} = 1\frac{1}{2}$$

Always reduce to lowest terms. 

13. Addition of Mixed Numbers

Mixed number consists of a whole number and a fraction. (3 1/3)

- Whole numbers are added together first.
- Then determine LCD for fractions.
- Reduce fractions to their LCD.
- Add numerators together and reduce answer to lowest terms.
- Add sum of fractions to the sum of whole numbers.

Adding Fractions and Mixed Numbers Exercises

Add the following fractions and mixed numbers, reducing answers to lowest terms.

1. $\frac{3}{4} + \frac{3}{4} =$

$$\frac{6}{4} = 1\frac{1}{2}$$

2. $\frac{2}{5} + \frac{7}{10} =$

$$\frac{4}{10} + \frac{7}{10} = \frac{11}{10}$$

$$= 1\frac{1}{10}$$

3. $\frac{9}{32} + \frac{15}{16} =$

$$\frac{9}{32} + \frac{30}{32} = \frac{39}{32}$$

$$= 1\frac{7}{32}$$

4. $5\frac{2}{5} + 1\frac{3}{4} =$

$$5 + 1 = 6$$

$$\frac{8}{20} + \frac{15}{20} = \frac{23}{20}$$

$$= 1\frac{3}{20} + 6 = 7\frac{3}{20}$$

Let's check our answers.

14. Subtraction of Fractions

Similar to adding, in that a common denominator must be found first. Then subtract one numerator from the other.

$$\frac{20}{24} - \frac{14}{24} = \frac{6}{24}$$

To subtract fractions with different denominators: $(\frac{5}{16} - \frac{1}{4})$

- Find the LCD...

$$\frac{5}{16} - \frac{1}{4}$$

$2 \times 2 \times 2 \times 2$ 2×2
 $2 \times 2 \times 2 \times 2 = 16$

- Change the fractions to the LCD...

$$\frac{5}{16} - \frac{4}{16}$$

- Subtract the numerators...

$$\frac{5}{16} - \frac{4}{16} = \frac{1}{16}$$

15. Subtraction of Mixed Numbers

- Subtract the fractions first. (Determine

LCD)
 $10\frac{2}{3} - 4\frac{1}{2}$

$$3 \times 2 = 6 \text{ (LCD)}$$

- Divide the LCD by denominator of each fraction.

$$6 \div 3 = 2$$

$$6 \div 2 = 3$$

- Multiply numerator and denominator by their respective numbers.

$$\frac{2}{3} \times \frac{2}{2} = \frac{4}{6}$$

$$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$$

- Subtract the fractions.

$$\frac{4}{6} - \frac{3}{6} = \frac{1}{6}$$

- Subtract the whole numbers.

$$10 - 4 = 6$$

- Add whole number and fraction together to form complete

answer.
 $6 + \frac{1}{6} = 6\frac{1}{6}$

15. Subtraction of Mixed Numbers (con't)

Borrowing

- Subtract the fractions first. (Determine

LCD) $5 \frac{1}{16} - 3 \frac{3}{8}$ becomes $5 \frac{1}{16} - 3 \frac{6}{16}$
(LCD) = 16

- Six-sixteenths cannot be subtracted from one-sixteenth, so

1 unit ($\frac{16}{16}$) is borrowed from the 5 units, leaving 4.

- Add $\frac{16}{16}$ to $\frac{1}{16}$ and problem becomes:

$$4 \frac{17}{16} - 3 \frac{6}{16}$$

- Subtract the fractions. $\frac{17}{16} - \frac{6}{16} = \frac{11}{16}$

- Subtract the whole numbers. $4 - 3 = 1$

- Add whole number and fraction together to form complete answer. $1 + \frac{11}{16} = 1 \frac{11}{16}$

Subtracting Fractions and Mixed Numbers Exercises

Subtract the following fractions and mixed numbers, reducing answers to lowest terms.

1. $\frac{2}{5} - \frac{1}{3} =$

$$\frac{6}{15} - \frac{5}{15} = \frac{1}{15}$$

4. $33\frac{1}{3} - 15\frac{2}{5} =$

$$33\frac{5}{15} - 15\frac{6}{15} =$$

$$32\frac{20}{15} - 15\frac{6}{15} = 17\frac{14}{15}$$

2. $\frac{5}{8} - \frac{3}{12} =$

$$\frac{15}{24} - \frac{6}{24} = \frac{9}{24} = \frac{3}{8}$$

5. $101\frac{1}{4} - 57\frac{15}{16} =$

$$101\frac{4}{16} - 57\frac{15}{16} =$$

$$100\frac{20}{16} - 57\frac{15}{16} = 43\frac{5}{16}$$

3. $47\frac{2}{5} - 28\frac{1}{3} =$

$$47\frac{6}{15} - 28\frac{5}{15} = 19\frac{1}{15}$$

6. $14\frac{3}{4} - 10\frac{5}{12} =$

$$14\frac{9}{12} - 10\frac{5}{12} = 4\frac{4}{12} = 4\frac{1}{3}$$

Let's check our answers.

16. MULTIPLYING FRACTIONS

- Common denominator not required for multiplication.

$$\frac{3}{4} \times \frac{4}{16}$$

1. First, multiply the numerators.

$$\frac{3}{4} \times \frac{4}{16} = \frac{12}{64} =$$

2. Then, multiply the denominators.

$$\frac{3}{4} \times \frac{4}{16} = \frac{12}{64} =$$

3. Reduce answer to its lowest terms.

$$\frac{12}{64} \div \frac{4}{4} = \frac{3}{16}$$

17. Multiplying Fractions & Whole/Mixed Numbers

- Change to an improper fraction before multiplication.

$$\frac{3}{4} \times 4$$

1. First, the whole number (4) is changed to improper fraction.

$$\frac{4}{1}$$

2. Then, multiply the numerators and denominators.

$$\frac{3}{4} \times \frac{4}{1} = \frac{12}{4}$$

3. Reduce answer to its lowest terms.

$$\frac{12}{4} \div \frac{4}{4} = \frac{3}{1} = 3$$

18. Cancellation

- Makes multiplying fractions easier.
- If numerator of one of fractions and denominator of other fraction can be evenly divided by the same number, they can be reduced, or cancelled.

Example:

$$\frac{8}{3} \times \frac{5}{16} = \frac{1\cancel{8}}{3} \times \frac{5}{\cancel{16}_2} =$$

$$\frac{1}{3} \times \frac{5}{2} = \frac{5}{6}$$

Cancellation can be done on both parts of a fraction.

$$\frac{1\cancel{12}}{\cancel{21}_7} \times \frac{\cancel{3}_1}{\cancel{24}_2} = \frac{1}{7} \times \frac{1}{2} = \frac{1}{14}$$

Multiplying Fractions and Mixed Numbers Exercises

Multiply the following fraction, whole & mixed numbers.
Reduce to lowest terms.

1. $\frac{3}{4} \times \frac{4}{16} = \frac{3}{16}$

2. $26 \times \frac{1}{26} = 1$

3. $\frac{4}{5} \times 3 = 2 \frac{2}{5}$

4. $\frac{9}{5} \times \frac{2}{3} = 1 \frac{1}{5}$

5. $\frac{35}{4} \times \frac{4}{35} = 1$

6. $\frac{9}{10} \times \frac{3}{5} = \frac{27}{50}$

7. $\frac{1}{6} \times \frac{7}{12} = \frac{7}{72}$

8. $\frac{2}{3} \times \frac{5}{11} = \frac{10}{33}$

9. $5 \times \frac{77}{15} = 25 \frac{2}{3}$

Let's check our answers.

19. Division of Fractions

- Actually done by multiplication, by inverting divisors.
- The sign “ \div ” means “divided by” and the fraction to the right of the sign is always the divisor.

Example:

$$\frac{3}{4} \div \frac{1}{5} \text{ becomes } \frac{3}{4} \times \frac{5}{1} = \frac{15}{4} = 3 \frac{3}{4}$$

20. Division of Fractions and Whole/Mixed Numbers

- Whole and mixed numbers must be changed to improper fractions.

Example:

$$3 \frac{3}{16} \div 2 \frac{1}{8} \text{ becomes } 16 \times 3 + \frac{3}{16} = \frac{51}{16} \text{ and } 2 \times 8 + \frac{1}{8} = \frac{17}{8}$$

$$\frac{51}{16} \div \frac{17}{8} \text{ Inverts to } \frac{51}{16} \times \frac{8}{17} = \frac{\cancel{51}^3}{2 \times \cancel{16}^{16}} \times \frac{\cancel{8}^1}{\cancel{17}^{17}} = \frac{3}{2} \times \frac{1}{1}$$

$$\frac{3}{2} \times \frac{1}{1} = \frac{3}{2} = 1 \frac{1}{2}$$

Double
Cancellation

Dividing Fractions, Whole/Mixed Numbers Exercises

Divide the following fraction, whole & mixed numbers. Reduce to lowest terms.

1. $\frac{5}{8} \div \frac{3}{6} = 1\frac{1}{4}$

2. $\frac{51}{16} \div \frac{3}{8} = 8\frac{1}{2}$

3. $18 \div \frac{1}{8} = 144$

4. $15 \div \frac{7}{12} = 25\frac{5}{7}$

5. $\frac{14}{3} \div \frac{7}{4} = 2\frac{2}{3}$

D. DECIMAL NUMBERS

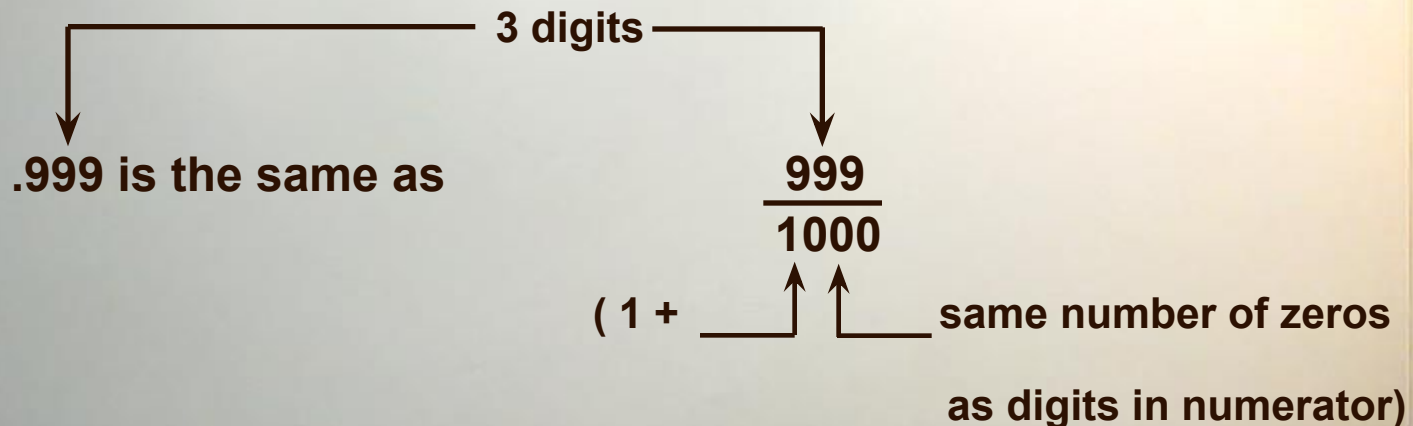
1. Decimal System

- System of numbers based on ten (10).
- Decimal fraction has a denominator of 10, 100, 1000, etc. **Written on one line as a whole number, with a period (decimal point) in front.**

$$\frac{5}{10} = .5$$

$$\frac{5}{100} = .05$$

$$\frac{5}{1000} = .005$$



2. Reading and Writing Decimals

$5\frac{7}{10}$ is written **5.7**

Whole Number _____ ↑ ↑ _____ Decimal Fraction (Tenths)

$55\frac{7}{100}$ is written **55.07**

Whole Number _____ ↑ ↑ ↑ _____ Decimal Fraction (Hundredths)
_____ Decimal Fraction (Tenths)

$555\frac{77}{1000}$ is written **555.077**

Whole Number _____ ↑ ↑ ↑ _____ Decimal Fraction (Thousandths)
_____ Decimal Fraction (Hundredths)
_____ Decimal Fraction (Tenths)

2. Reading and Writing Decimals (con't)

- Decimals are read to the right of the decimal point.

.63 is read as “sixty-three hundredths.”

.136 is read as “one hundred thirty-six thousandths.”

.5625 is read as “five thousand six hundred twenty-five ten-thousandths.”

3.5 is read “three and five tenths.”

- Whole numbers and decimals are abbreviated.

6.625 is spoken as “six, point six two five.”

One place	.0	tenths	
Two places	.00	hundredths	
Three places	.000	thousandths	
Four places	.0000	ten-thousandths	
Five places	.00000	hundred-thousandths	

3. Addition of Decimals

- Addition of decimals is same as addition of whole numbers except for the location of the decimal point.

Add $.865 + 1.3 + 375.006 + 71.1357 + 735$

- Align numbers so all decimal points are in a vertical column.
- Add each column same as regular addition of whole numbers.
- Place decimal point in same column as it appears with each number.

$$\begin{array}{r} .8650 \\ 1.3000 \\ 375.0060 \\ 71.1357 \\ + 735.0000 \\ \hline 1183.3067 \end{array}$$

“Add zeros to help eliminate errors.”

“Then, add each column.”

4. Subtraction of Decimals

- Subtraction of decimals is same as subtraction of whole numbers except for the location of the decimal point.

Solve: $62.1251 - 24.102$

- Write the numbers so the decimal points are under each other.
- Subtract each column same as regular subtraction of whole numbers.
- Place decimal point in same column as it appears with each number.

$$\begin{array}{r} 62.1251 \\ - 24.1020 \\ \hline 38.0231 \end{array}$$

“Add zeros to help eliminate errors.”

“Then, subtract each column.”

5. Multiplication of Decimals

Rules For Multiplying Decimals

- Multiply the same as whole numbers.
- Count the number of decimal places to the right of the decimal point in both numbers.
- Position the decimal point in the answer by starting at the extreme right digit and counting as many places to the left as there are in the total number of decimal places found in both numbers.

Solve: 38.639 X 2.08

$$\begin{array}{r} 38.639 \\ \times 2.08 \\ \hline 306952 \\ 7727800 \\ \hline 80.34752 \end{array}$$

Decimal point 3 places over.

Decimal point 2 places over.

“Add zeros to help eliminate errors.”

“Then, add the numbers.”

Place decimal point 5 places over from right.

6. Division of Decimals

Rules For Dividing Decimals

- Place number to be divided (dividend) inside the division box.
- Place divisor outside.
- Move decimal point in divisor to extreme right. (Becomes whole number)
- Move decimal point same number of places in dividend. (NOTE: zeros are added in dividend if it has fewer digits than divisor).
- Mark position of decimal point in answer (quotient) directly above decimal point in dividend.
- Divide as whole numbers - place each figure in quotient directly above digit involved in dividend.
- Add zeros after the decimal point in the dividend if it cannot be divided evenly by the divisor.
- Continue division until quotient has as many places as required for the answer.

Solve: $123.573 \div 137.4$

6. Division of Decimals

$$\begin{array}{r} .8993 \\ 137.4 \overline{) 123.57300} \\ \underline{10992} \\ 13653 \\ \underline{12366} \\ 12870 \\ \underline{12366} \\ 5040 \\ \underline{4122} \\ 918 \text{ remainder} \end{array}$$

Decimal Number Practice Exercises

“WORK ALL 4 SECTIONS (+, −, X, ÷)

1. Add the following decimals.

a. $.6 + 1.3 + 2.8 = 4.7$

a. $72.8 + 164.02 + 174.01 = 410.83$

a. $185.7 + 83.02 + 9.013 = 277.733$

a. $0.93006 + 0.00850 + 3315.06 + 2.0875 = 3318.08606$

2. Subtract the following decimals.

a. $2.0666 - 1.3981 = 0.6685$

a. $18.16 - 9.104 = 9.056$

a. $1.0224 - .9428 = 0.0796$

a. $1.22 - 1.01 = 0.21$

g. $1347.008 - 108.134 = 1238.874$

a. $0.6 - .124 = 0.467$

g. $111.010 - 12.163 = 98.847$

a. $18.4 - 18.1 = 0.3$

g. $64.7 - 24.0 = 40.7$

Let's check our answers.

Decimal Number Practice Exercises

3. Multiply the following decimals.

$$\begin{array}{r} \text{a. } 3.01 \\ \times 6.20 \\ \hline 18.662 \end{array}$$

$$\begin{array}{r} \text{b. } 21.3 \\ \times 1.2 \\ \hline 25.56 \end{array}$$

$$\begin{array}{r} \text{c. } 1.6 \\ \times 1.6 \\ \hline 2.56 \end{array}$$

$$\begin{array}{r} \text{d. } 83.061 \\ \times 2.4 \\ \hline 199.3464 \end{array}$$

$$\begin{array}{r} \text{e. } 1.64 \\ \times 1.2 \\ \hline 1.968 \end{array}$$

$$\begin{array}{r} \text{f. } 44.02 \\ \times 6.01 \\ \hline 264.5602 \end{array}$$

$$\begin{array}{r} \text{g. } 63.12 \\ \times 1.12 \\ \hline 70.6944 \end{array}$$

$$\begin{array}{r} \text{h. } 183.1 \\ \times .23 \\ \hline 42.113 \end{array}$$

$$\begin{array}{r} \text{i. } 68.14 \\ \times 23.6 \\ \hline 1608.104 \end{array}$$

Let's check our answers.

Decimal Number Practice Exercises

4. Divide the following decimals.

$$\text{a. } 1.4 \overline{) 42.70} \quad \begin{array}{r} 30.5 \\ \hline \end{array}$$

$$\text{b. } .8 \overline{) 4.63000} \quad \begin{array}{r} 5.7875 \\ \hline \end{array}$$

$$\text{c. } 1.2 \overline{) 620.4} \quad \begin{array}{r} 517 \\ \hline \end{array}$$

$$\text{d. } 6 \overline{) 66786} \quad \begin{array}{r} 11131 \\ \hline \end{array}$$

$$\text{e. } 1.1 \overline{) 110.0} \quad \begin{array}{r} 100 \\ \hline \end{array}$$

Let's check our answers.

E. CHANGING FRACTIONS TO DECIMALS

A fraction can be changed to a decimal by dividing the numerator by the denominator.

Change $\frac{3}{4}$ to a decimal. $4 \overline{)3.0} \begin{array}{r} .75 \\ \end{array}$

Decimal Number Practice Exercises

Write the following fractions and mixed numbers as decimals.

a. $\frac{6}{10}$
.6

b. $\frac{3}{5}$
.6

c. $\frac{4}{5}$
.8

d. $1\frac{1}{5}$
.2

e. $\frac{1}{2}$
.5

f. $\frac{8}{20}$
.4

g. $\frac{7}{20}$
.35

h. $\frac{15}{20}$
.75

i. $\frac{7}{25}$
.28

j. $\frac{12}{25}$
.48

k. $\frac{17}{20}$
.85

l. $\frac{49}{50}$
.98

m. $1\frac{9}{10}$
1.9

n. $1\frac{1}{25}$
1.04

o. $6\frac{15}{25}$
6.6

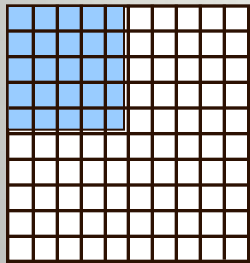
Let's check our answers.

F. PERCENTAGES

1. Percents

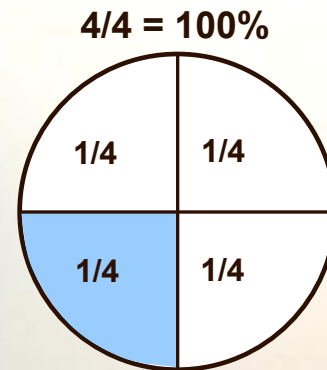
- Used to show how many parts of a total are taken out.
- Short way of saying “by the hundred or hundredths part of the whole”.
- The symbol % is used to indicate percent.
- Often displayed as diagrams.

100 Equal Squares = 100%



25% or 25/100

or



$25/100 = 25\%$

To change a decimal to a %, move decimal point two places to right and write percent sign.

$$.15 = 15\%$$

$$.55 = 55\%$$

$$.853 = 85.3\%$$

$$1.02 = 102\%$$

“Zeros may be needed to hold place”.

$$.8 = 80\%$$

Percents Practice Exercises

Write as a decimal.

1. $35\% = \underline{.35}$

1. $14\% = \underline{.14}$

1. $58.5\% = \underline{.585}$

1. $17.45\% = \underline{.1745}$

1. $5\% = \underline{.05}$

Write as a percent.

6. $.75 = \underline{75}\%$

6. $0.40 = \underline{40}\%$

6. $0.4 = \underline{40}\%$

6. $.4 = \underline{40}\%$

Let's check our answers.

Rules For Any Equivalent

To convert a number to its decimal equivalent, multiply by 0.01

Change 6 1/4% to its decimal equivalent.

- Change the mixed number to an improper fraction, then divide the numerator by the denominator.

$$6 \frac{1}{4} = \frac{25}{4} = 6.25$$

- Now multiply the answer (6.25) times 0.01

$$6.25 \times 0.01 = 0.0625$$

Rules For Finding Any Percent of Any Number

- Convert the percent into its decimal equivalent.
- Multiply the given number by this equivalent.
- Point off the same number of spaces in answer as in both numbers multiplied.
- Label answer with appropriate unit measure if applicable.

Find 16% of 1028 square inches.

$$16 \times .01 = .16$$

$$1028 \times 0.16 = 164.48$$

Label answer: 164.48 square inches

2. Percentage

- Refers to value of any percent of a given number.
- First number is called “base”.
- Second number called “rate”... Refers to percent taken from base.

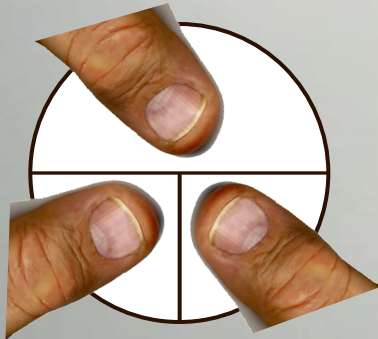
Rule: The product of the base, times the rate, equals the percentage.

Percentage = Base x Rate or $P=B \times R$

NOTE: Rate must always be in decimal form.

To find the formula for a desired quantity, cover it and the remaining factors indicate the correct operation.

Only three types of percent problems exist.



1. Find the amount or rate. $R=P \times B$

2. Find the percentage. $P= \frac{R}{B}$

3. Find the base. $B= \frac{R}{P}$

Percents Practice Exercises

1. Determine the rate or amount for each problem A through E for the values given.

	A.	B.	C.	D.	E.
BASE	2400 lbs	1875 gallons	148 feet	3268.5 Square inches	\$ 875.00
PERCENT-AGE	80%	45%	15%	4 1/2%	19.5%
	<u>1920 lbs.</u>	<u>843.75 Gal.</u>	<u>22.2 feet</u>	<u>147.08 sq.in.</u>	<u>\$170.63</u>
	A.	B.	C.	D.	E.

2. The labor and material for renovating a building totaled \$25,475. Of this amount, 70% went for labor and the balance for materials. Determine: (a) the labor cost, and (b) the material cost.
a. \$17,832.50 (labor) b. \$ 7642.50 (materials)
3. 35% of 82 = **28.7** 4. 14% of 28 = **4.32**
5. Sales tax is 9%. Your purchase is \$4.50. How much do you owe? **\$4.91**
5. You have 165 seconds to finish your task. At what point are you 70% finished? **115.5 seconds**
5. You make \$14.00 per hour. You receive a 5% cost of living raise. How much raise per hour did you get? How much per hour are you making now? **\$.70 /hr raise Making \$14.70 /hr**

Let's check our answers.

G. APPLYING MATH TO THE REAL WORLD

1. $18 \times 12 = 216$

1. $240 \times 8 = 30$

1. $3.5 + 8.5 + 12 + 2.5 + 15 = 41.5$
 $55 - 41.5 = 13.5$ gallons more

4. $1.5 \times 0.8 = 1.2$ mm

4. $5 \times .20 = 1$ inch

4. 2400 divided by 6 = 400 per person
400 divided by 5 days = 80 per day per person

7. $6 \times 200 = 1200$ sq. ft. divided by 400 = 3 cans of dye

7. $2\text{mm} \times .97 = 1.94$ min $2\text{mm} \times 1.03 = 2.06$ max

Let's check our answers.

H. METRICS

1. Metrication

- Denotes process of changing from English weights and measures to the Metric system.
- U.S. is only major country not using metrics as standard system.
- Many industries use metrics and others are changing.

Metric Prefixes:

Kilo = 1000 units

Hecto = 100 units

Deka = 10 units

deci = 0.1 unit (one-tenth of the unit)

centi = 0.01 (one-hundredth of the unit)

milli = 0.001 (one thousandth of the unit)

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	← Place Value
Kilo	Hecto	Deka	base unit	deci	centi	milli	← Prefix

Most commonly used prefixes are Kilo, centi, and milli.

A. Advantages of Metric System

- Based on decimal system.
- No fractions or mixed numbers
- Easier to teach.

Example 1:

Using three pieces of masking tape of the following English measurement lengths: $4 \frac{1}{8}$ inches, $7 \frac{6}{16}$ inches, and $2 \frac{3}{4}$ inches, determine the total length of the tape.

Step 1: Find the least common denominator (16). This is done because unequal fractions can't be added.

Step 2: Convert all fractions to the least common denominator.

$$\begin{array}{r} 4 \frac{1}{8} = 4 \frac{2}{16} \\ 7 \frac{6}{16} = 7 \frac{9}{16} \\ 2 \frac{3}{4} = 2 \frac{12}{16} \end{array}$$

Step 3: Add to find the sum.

$$13 \frac{23}{16}$$

Step 4: Change sum to nearest whole number.

$$14 \frac{7}{16}$$

“Now, compare with Example 2 using Metrics”.

b. Advantages of Metric System

Example 2:

Using three pieces of masking tape of the following lengths: 85 mm, 19.4 cm, and 57 mm, determine the total length of the tape.

Step 1: Millimeters and centimeters cannot be added, so convert to all mm or cm.

Step 2: Add to find the sum.

$$\begin{aligned} 85\text{mm} &= 85\text{mm} \\ 19.4\text{cm} &= 194\text{mm} \\ 57\text{mm} &= \underline{57\text{mm}} \end{aligned}$$

336 mm

or

$$\begin{aligned} 85\text{mm} &= 8.5\text{cm} \\ 19.4\text{cm} &= 19.4\text{cm} \\ 57\text{mm} &= \underline{5.7\text{cm}} \end{aligned}$$

33.6 cm

“MUCH EASIER”

2. Metric Abbreviations

- Drawings must contain dimensions.
- Words like “inches, feet, millimeters, & centimeters take too much space.

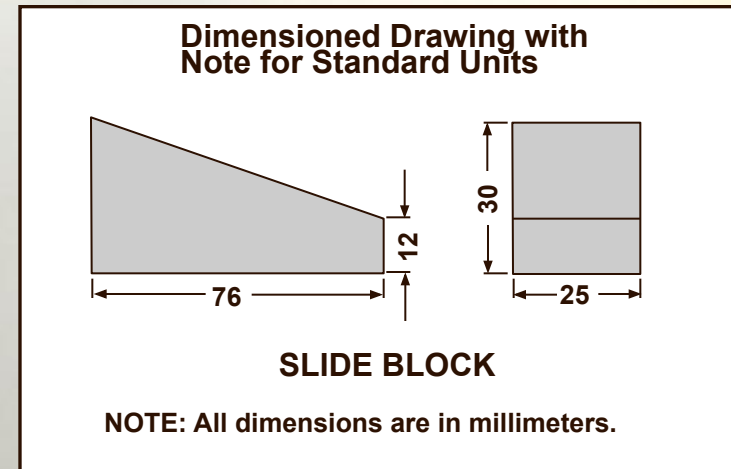
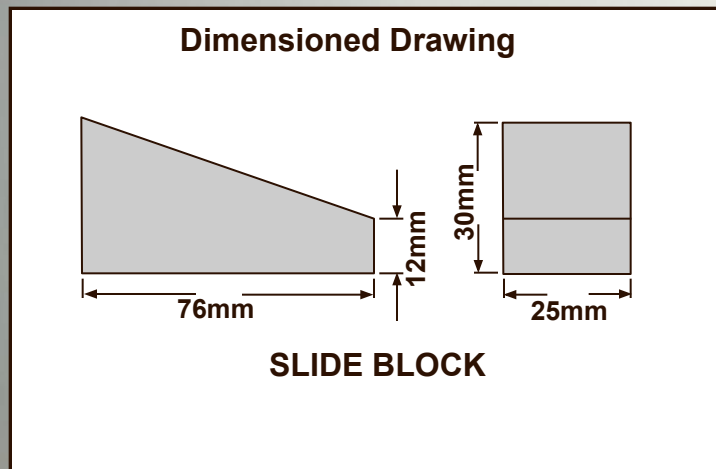
- Abbreviations are necessary.

Metric Abbreviations:

mm = millimeter = one-thousandth of a meter

cm = centimeter = one-hundredth of a meter

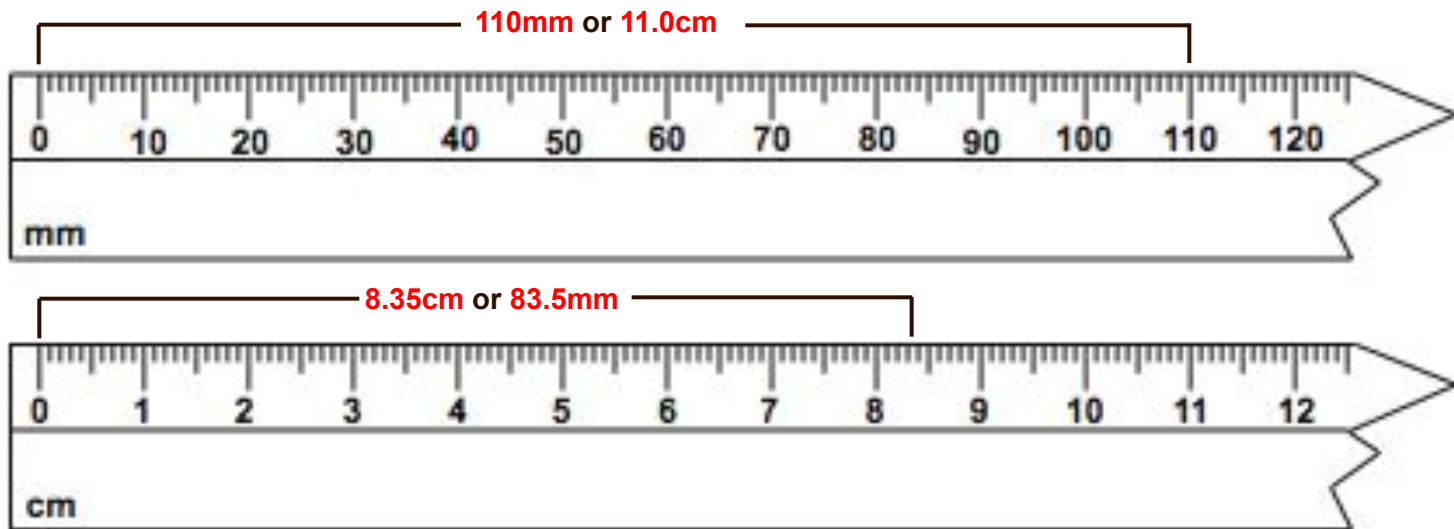
Km = Kilometer = one thousand meters



3. The Metric Scale

- Based on decimal system. Easy to read.
- Graduated in millimeters and centimeters.

Metric Scales



- Both scales graduated the same... Numbering is different.
- Always look for the abbreviation when using metric scales.
- Always place “0” at the starting point and read to end point.

Metric Measurement Practice Exercises

Using a metric scale, measure the lines and record their length.

- a. 109 mm
- b. 81.5 mm
- c. 3.1 cm
- d. 103 mm
- e. 6.3 cm
- f. 80.5 mm
- g. 10.85 cm
- h. 23 mm
- i. 91.5 mm
- j. 4.25 cm

Let's check our answers.

4. Comparisons and Conversions

- Manufacturing is global business.
- Metrics are everywhere.
- Useful to be able to convert.

Compare the following:

One Yard: About the length between your nose and the end of your right hand with your arm extended.

One Meter: About the length between your left ear and the end of your right hand with your arm extended.

One Centimeter: About the width of the fingernail on your pinky finger.

One Inch: About the length between the knuckle and the end of your index finger.

U.S. Customary and Metric Comparisons

Length:

A Kilometer is a little over 1/2 mile - .62 miles to be more precise.



A centimeter is about 3/8 inch.



Weight:

A paper clip weighs about one gram.



A nickel weighs about five grams.



A Kilogram is 2.2 pounds. - Two packs of butter plus about 1 stick.



U.S. Customary and Metric Comparisons

Capacity:

One liter and one quart are approximately the same.

There are about 5 milliliters in a teaspoon.



Pressure is measured in newton meters instead of foot pounds.



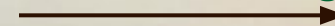
Equivalent Units:

Kilo	Thousands
Hecto	Hundreds
Deka	Tens
base unit	Ones
deci	Tenths
centi	Hundredths
milli	Thousandths

← Place Value

← Prefix

To change to a smaller unit,
move decimal to right.



To change to a larger unit,
move decimal to left.



Changing to a Smaller Unit

Kilo	Thousands
Hecto	Hundreds
Deka	Tens
base unit	Ones
deci	Tenths
centi	Hundredths
milli	Thousandths

$$15 \text{ liters} = \underline{15000} \text{ milliliters (ml)}$$


- Count the number of places from the base unit to “milli”. There are 3 places.
- Move the decimal 3 places to the right.

$$15 \text{ liters} = 15.000 \text{ liters} = 15000 \text{ ml}$$


Changing to a Larger Unit

$$150 \text{ grams (g)} = \underline{.150} \text{ Kilograms (Kg)}$$

- Count the number of places from the base unit to “Kilo”. There are 3 places.
- Move the decimal 3 places to the left.

$$150 \text{ grams} = 150.00 \text{ grams} = 0.150 \text{ Kg}$$


Comparison and Conversion Practice Exercises

1. 1 liter = 1000 ml
2. 6000 ml = 6 liters
3. 10 cm = 100 mm
4. 500 cm = 5.0 m
5. 4 Kg = 4000 g
6. 55 ml = .055 liters
7. 8.5 Km = 8500 m
8. 6.2 cm = 62 mm
9. 0.562 mm = .0562 cm
10. 75 cm = 750 mm

Let's check our answers.

5. Conversion Factors

Conversion Table for Length

	mm	cm	meter	Km	inch	feet
1 millimeter =	1	.01	.001	.000001	25.4	.0394
1 centimeter =	10	1	10^{-2}	10^{-5}	.394	3.28×10^{-2}
1 meter =	1000	100	1	10^{-3}	39.4	3.28
1 Kilometer =	10^6	10^5	1000	1	3.94×10^3	3280
1 inch =	25.4	2.54	2.54×10^{-2}	2.54×10^{-5}	1	8.33×10^{-2}
1 foot =	305	30.5	.305	3.05×10^{-4}	12	1

Conversion Table for Area

	meter ²	cm ²	inch ²	feet ²
sq. meter =	1	10^4	10.8	1550
sq. centimeter =	10^{-4}	1	1.08×10^{-3}	0.155
sq. foot =	9.29×10^2	929	144	1
sq. inch =	6.45×10^{-4}	6.45	1	6.94×10^{-3}

5. Conversion Factors

Conversion of Volume

- Volume measures the total space occupied by three-dimensional objects or substances.
- Volume of six-sided spaces is calculated as “length x width x height”.
- Volume of spheres and cylinders is more complicated.
- Term “cubic” is used because it is a math function involving 3 factors.

$$2\text{ft} \times 4\text{ft} \times 3\text{ft} = 24 \text{ Cubic Feet}$$

English

1 cubic inch = 1 cubic inch

1 cubic foot = 1728 cubic inches (12 x 12 x 12)

1 cubic yard = 27 cubic feet (3 x 3 x 3)

Metric

1 cubic meter = 1,000,000 cubic centimeters (100 x 100 x 100)

1 foot = .305 meters

and

1 meter = 3.28 feet

Factors can be converted before or after initial calculation.

5. Conversion Factors (con't)

Conversion Table for Pressure

	Nt./meter ²	lb./in. ²	lb./ft. ²
1 Newton per meter	1	1.45×10^{-4}	2.09×10^{-2}
1 pound per inch	6.90×10^3	1	144
1 pound per foot	47.9	6.94×10^{-3}	1

Conversion Table for Weight

TO CONVERT	MULTIPLY BY	TO CONVERT	MULTIPLY BY
Grams to ounces	0.353	Ounces to grams	28.35
Grams to pounds	0.0022	Pounds to grams	453.592
Kilograms to pounds	2.2046	Pounds to kilograms	0.4536
Kilograms to tons	0.00098	Tons to kilograms	1016.05
Tonnes to tons	0.9842	Tons to tonnes	1.016

5. Conversion Factors (con't)

To convert between Celsius and Fahrenheit:

Fahrenheit to Celsius $(^{\circ}\text{F}-32) \times 5/9 = ^{\circ}\text{C}$

Celsius to Fahrenheit $(^{\circ}\text{C} \times 9/5) + 32 = ^{\circ}\text{F}$

Conversion Table for Temperature

CELSIUS $^{\circ}\text{C}$	FARENHEIT $^{\circ}\text{F}$
-30	-22
-20	-4.0
-10	14
0	32.0
1	33.8
2	35.6
3	37.4
4	39.2
5	41.0
6	42.8
7	44.6
8	46.4
9	48.2

Metric System Practice Exercises

1. Which one of the following is **not** a metric measurement?

- a. millimeter
- b. centimeter
- c. square feet
- d. cm

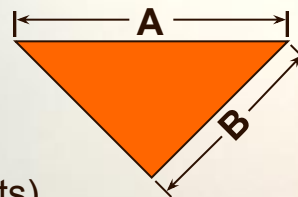
2. Milli - is the prefix for which one of the following?

- a. 100 ones
- b. 0.001 unit
- c. 0.0001 unit
- d. 0.00001 unit

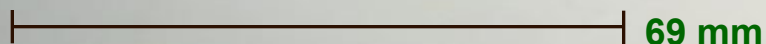
3. How long are lines A and B in this figure?

A = 53 mm, or 5.3 cm

B = 38 mm, or 3.8 cm



4. How long is the line below? (Express in metric units).



5. Convert the following:

- a. 1 meter = 1000 millimeters
- b. 5 cm = 50 millimeters
- c. 12 mm = 1.2 centimeters
- d. 7m = 700 centimeters

Let's check our answers.

H. THE CALCULATOR



- Functions vary from one manufacturer to the next.
- Most have same basic functions.
- More advanced scientific models have complicated applications.
- Solar models powered by sunlight or normal indoor light.

1. Basic Keys:

On/Off Key: Turns calculator on or off. Solar unit will not have “off” key..

C/AC: Press once (C) to clear last entry - Press twice (AC) to clear all functions.

÷ Key: Controls the division function.

X Key: Controls the multiplication function.

- Key: Controls the subtraction function.

+ Key: Controls the addition function.

√ Key: Controls the square root function.

M+ Key: Adds a number or function to the memory register, to be recalled later.

M- Key: Subtracts number or function from memory register.

MR Key: Memory Recall recalls function stored in register.

MC Key: Memory Clear clears or erases all contents from memory.

% Key: Controls the percentage functions

2. Calculator Functions:

- Cannot give correct answer if given the wrong information or command.
- Decimals must be placed properly when entering numbers.
- Wrong entries can be cleared by using the C/AC button.
- Calculators usually provide a running total.

ADDITION

Add 3, 8, 9, and 14.

- Step 1:** Press “3” key - number 3 appears on screen..
- Step 2:** Press “+” key - number 3 remains on screen.
- Step 3:** Press “8” key - number 8 appears on screen.
- Step 4:** Press “+” key - running total of “11” appears on screen.
- Step 5:** Press the “9” key - number 9 appears on screen.
- Step 6:** Press “+” key - running total of “20” appears on screen.
- Step 7:** Press “1 & 4” keys - number 14 appears on screen.
- Step 8:** Press the = key - number 34 appears. This is the answer.

In step 8, pressing the + key would have displayed the total. Pressing the = key stops the running total function and ends the overall calculation.

Calculator Addition Exercise

Use the calculator to add the following.

$$\begin{array}{r} 1. \quad .06783 \\ \quad .49160 \\ \quad .76841 \\ \quad .02134 \\ + \quad .87013 \\ \hline \end{array}$$

2.21931

$$\begin{array}{r} 2. \quad 154758 \\ \quad \quad 3906 \\ \quad \quad 4123 \\ \quad \quad 5434 \\ + \quad \quad 76 \\ \hline \end{array}$$

168297

$$3. \quad 12.54 + 932.67 + 13.4$$

= 958.61

Let's check our answers.

SUBTRACTION

SUBTRACT 25 FROM 187.

- Step 1:** Press 1, 8, and 7 keys - number 187 appears on screen..
- Step 2:** Press “-” key - number 187 remains on screen.
- Step 3:** Press 2 & 5 keys- number 25 appears on screen.
- Step 4:** Press “=” key - number 162 appears on screen. This is the answer.

In step 4, pressing the - key would have displayed the total.

Calculator Subtraction Exercise

Use the calculator to subtract the following.

$$\begin{array}{r} 1. \quad .0543 \\ - .0532 \\ \hline \end{array}$$

0.0011

$$\begin{array}{r} 2. \quad .0578 \\ - .0463 \\ \hline \end{array}$$

0.0115

$$\begin{array}{r} 3. \quad 179853 - 4327 \\ \hline \end{array}$$

= 175526

Let's check our answers.

MULTIPLICATION

MULIPLY 342 BY 174.

- Step 1: Press 3, 4, and 2 keys - number 342 appears on screen..
Step 2: Press "X" key - number 342 remains on screen.
Step 3: Press 1, 7 & 4 keys- number 174 appears on screen.
Step 4: Press "=" key - number 59508 appears on screen. This is the answer.

Calculator Multiplication Exercise

Use the calculator to multiply the following.

1.
$$\begin{array}{r} 2.45 \\ \times 16 \\ \hline \end{array}$$
40.64

2.
$$\begin{array}{r} 60.8 \\ \times 19 \\ \hline \end{array}$$
1155.2

3. $12.8976 \times 43.7 \times 12.01$
= 6769.1376912

Let's check our answers.

DIVISION

DIVIDE 66 BY 12.3

- Step 1: Press the 6 key twice - number 66 appears on screen..
- Step 2: Press “ \div ” key - number 66 remains on screen.
- Step 3: Press 1, 2, . (decimal), & 3 keys- number 12.3 appears on screen.
- Step 4: Press “=” key - number 5.3659 appears on screen. This is the answer.

Calculator Division Exercise

Use the calculator to divide the following.

1. $.2961 \div 5$

= 0.05922

2. $13.5678 \div 11.1$

= 1.22232

3. $.1765 \div .5$

= 0.353

Let's check our answers.

PERCENTAGES

FIND 1.3% OF 50

- Step 1:** Press the 5 and 0 keys - number 50 appears on screen..
Step 2: Press “ x ” key - number 50 remains on screen.
Step 3: Press 1, . (decimal), & 3 keys- number 1.3 appears on screen.
Step 4: Press “%” key - number .065 appears on screen. This is the answer.

Calculator Percentages Exercise

Use the calculator to find the following percentages.

- | | | |
|----------------|-----------------|------------------|
| 1. Find 5% of: | 2. Find 10% of: | 3. Find 26% of |
| a. 150 = 7.5 | a. 1250 = 125 | a. 260 = 67.6 |
| b. 675 = 33.75 | b. 871 = 87.1 | b. 212 = 55.12 |
| c. 100 = 5 | c. 202 = 20.2 | c. 1817 = 472.42 |

Let's check our answers.

That concludes the Basic Math portion of your training.