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TABE **9 & 10 A**

Math Computation

** Calculator use **NOT** allowed; you may use scrap paper. **

Math computation covers adding, subtracting, multiplying, and dividing: decimals, fractions, and integers. This part of the test also covers percentages and algebraic operations. A review and practice of these operations are as follows:

DECIMALS

I. Adding Decimals

1. Line up decimals and digits correctly, one under the other.
2. Add numbers together, starting from right to left.
3. Place the decimal point in the answer. (Bring decimal straight down)

$$\begin{array}{r} 2.5 \\ 16.15 \\ 1.0 \\ \underline{+\quad .256} \\ 19.906 \end{array}$$

II. Subtracting Decimals

1. Line up decimals and digits correctly, one under the other.
2. Subtract the numbers, starting from right to left.
3. Place the decimal point in the answer. (Bring decimal straight down)

$$\begin{array}{r} 21.25 \\ \underline{-\quad 15.05} \\ 6.20 \end{array}$$

III. Multiplying Decimals

1. Multiply numbers in problems

$$\begin{array}{r} 1.25 \\ \underline{\times\quad .05} \\ 625 \end{array}$$

2. Count number of decimal places to the right of the decimal point(s) in the multiplicand and multiplier.
3. Move from right to left in the answer and count as many decimal places in the answer as there are in the problems.

$$\begin{array}{rl} 1.25 & \text{2 decimal places} \\ \underline{\times\ .05} & \text{2 decimal places} \\ 625 & \text{4 decimal places} \end{array}$$

4. Insert the decimal point

$$\begin{array}{r} 1.25 \\ \underline{\times\ \ .05} \\ \uparrow .0625 \end{array}$$

(NOTE: Add zeros in the answer if necessary).

$$\begin{array}{r} .05 \\ \underline{\times\ \ .5} \\ \uparrow .025 \end{array}$$

IV. Dividing Decimals

A. Decimal in the dividend only.

1. Place the decimal point in the quotient directly above; the decimal in the dividend.
2. Divide the numbers.

1) $5\overline{)\,2.5}$ 2) $\overset{.}{5\overline{)\,2.5}}$

3) $$\begin{array}{r} .5 \\ 5\overline{)\,2.5} \\ \underline{2.5} \\ 0 \end{array}$$

B. Decimal in the divisor.

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1. Move the decimal point in the divisor to the right until it is outside the number.

$$2.5\overline{)\,1625}$$

2. Move the decimal point in the dividend to the right the same number of places.

$$2.5\overline{)\,1625.0}$$

(NOTE: There is a decimal point at the end of the last digit in a whole number).

3. Place a zero in the empty space if there is one.
4. Divide and place the decimal point in the quotient directly above the decimal in the dividend.

$$\begin{array}{r} \underline{650.}\ \text{(Quotient)} \\ \text{(Divisor}\quad 2.5\overline{)\,16250.}\ \text{(Dividend)} \\ \underline{150} \\ 125 \\ \underline{125} \\ 0 \end{array}$$

DECIMAL PRACTICE

Add.

1.

.9	3.5	2.08	.8	3.08	.6	3.
.5	2.8	.45	.32	.05	.38	.07
.7	5.9	.07	.056	2.5	.0009	2.9
$\underline{.6}$	$\underline{1.4}$	$\underline{3.70}$	$\underline{.44}$	$\underline{3.34}$	$\underline{.056}$	$\underline{.063}$
2.7						

Subtract.

2.

2.4	.23	2.	5.23	9.04	5.45	7.002	62.0108
$\underline{1.5}$	$\underline{.1}$	$\underline{.43}$	$\underline{2.}$	$\underline{2.4}$	$\underline{2.9}$	$\underline{.84}$	$\underline{29.45}$
.9							

Multiply

3.

.9	.05	.05	15.	.15	3.09	2.008
$\underline{.7}$	$\underline{.9}$	$\underline{.09}$	$\underline{.12}$	$\underline{.12}$	$\underline{4.5}$	$\underline{.19}$
.63						

4. 12.4 X 10 = 124 87.05 X 10 = 1.3 X 100 = .245 X 1000 =

Divide.

5. $\begin{array}{r}\underline{.06}\\ 12\overline{)\,.72}\end{array}$ $.8\overline{)\,9.6}$ $8\overline{)\,9.6}$ $8\overline{)\,.96}$

6. $.6\overline{)\,24}$ = $.6\overline{)\,24.0}$ $.9\overline{)108}$ $.09\overline{)\,108}$ $15\overline{).150}$

7. 125 ÷ 10 = 12.5 25.4 ÷ 10 = 186 ÷ 100 = 45 ÷ 1000 =

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KEY

1. 13.6, 6.3, 1.616, 8.97, 1.0369, 6.033
2. .13, 1.57, 3.23, 6.64, 2.55, 6.162, 32.5608
3. .045, .0045, 1.8, .018, 13.905, .38152
4. 870.5, 130, 245
5. 12, 1.2, .12
6. 40, 120, 1,200, .010
7. 2.54, 1.86, .045

FRACTIONS

I. Reducing fractions to lowest terms.

Note (Hint): Even numbers: Are numbers that can be divided evenly by 2.
(Example) 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, …..
Odd numbers: Are numbers that can not be divided evenly by 2.
(Example) 1, 3, 5, 7, 9, 11, 15, 17, 19, 21, 23, 25, …..
Prime numbers: Can only be divided by itself & 1
(Example) 2,3, 5, 7, 11, 13, 17, 19

1. To reduce a fraction find the largest number that will divide into the numerator and denominator evenly (with no remainder)
2. Repeat this process until the fraction can not be reduced anymore.
3. The end result should be in the lowest term

Example: $\frac{12}{20}$ Both the numerator & denominator can be divided by 4

$\frac{12 \div 4 = 3}{20 \div 4 = 4}$ This is in the lowest terms.

$\frac{24}{36} \div \frac{2}{2} = \frac{12}{18} \div \frac{2}{2} = \frac{6}{9} \div \frac{3}{3} = \frac{2}{3}$ OR $\frac{24}{36} \div \frac{12}{12} = \frac{2}{3}$ Keep reducing (like above) until you can not reduce anymore.

Any numerator and denominator that ends with an even number can be divided by 2.

$\frac{18}{26} \div \frac{2}{2} = \frac{9}{13}$

Any numerator and denominator that ends in a "0" can be divided by 10.

$\frac{30}{50} = \frac{30}{50} \div \frac{10}{10} = \frac{3}{5}$ or $\frac{3\cancel{0}}{5\cancel{0}}$

Any numerator and denominator ending in a 0 and 5 can always be divided by 5.

$\frac{75}{80} \div \frac{5}{5} = \frac{15}{16}$

Any numerator and denominator ending in a prime number can only be reduced if the prime number divides evenly into the numerator and denominator.

$\frac{7}{49} \div \frac{7}{7} = \frac{1}{7}$ $\frac{13}{39} \div \frac{13}{13} = \frac{1}{3}$ $\frac{27}{54} \div \frac{27}{27} = \frac{1}{2}$

$\frac{19}{28}$ Can not be reduced because 19 does not divide evenly into 28.

II. Raising fractions to higher equivalents.

a. Multiply the numerator and denominator by the same number. $\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

b. If there is a denominator given, follow these steps: Raise $\frac{7}{15}$ to 30ths

1. Divide the denominator of the fraction (15) into the given denominator (30). $\begin{array}{r} 2 \\ 15\overline{)30} \end{array}$
2. Multiply the numerator of the fraction (7) by the answer in step 1 (2). $7 \times 2 = 14$
3. Write the answer to step 2 (14) over the given denominator (30). This is the higher equivalent. $\frac{14}{30}$

III. Comparing fractions for highest value.

a. Change the fractions to equivalent fractions that have the same denominator.

$\frac{5}{9}$ or $\frac{13}{18}$ $\qquad \frac{5}{9} = \frac{10}{18}$

b. Compare the numerator. The one with the largest numerator has the largest value.

$\frac{10}{18}$ or $\frac{13}{18}$ $\qquad \frac{13}{18}$

IV. Changing improper fractions and mixed numbers.

$\frac{57}{12} =$

a. To change improper fractions to mixed numbers, divide the numerator by the denominator.

$$\begin{array}{r} 4\ 9/12 \\ 12\overline{)57} \\ \underline{48} \\ \underline{9} \\ 12 \end{array}$$

$\frac{57}{12} = 4\frac{3}{4}$

b. To change mixed numbers to improper fractions: $2\frac{3}{4}$

1. Multiply the denominator by the whole number $2 \times 4 = 8$
2. Add the numerator. $8 + 3 = 11$
3. Write the numerator over the denominator. $\frac{11}{4}$

V. Adding Fractions.

a. With the same denominator: $\frac{4}{11} + \frac{5}{11} =$

1. Add the numerators. $4 + 5 = 9$
2. Write the sum of the numerators over the denominator. $\frac{9}{11}$

B. With an improper fraction as the sum: $\underline{3} + \underline{3} =$

1. Add the numerators. 5 5
2. Write the sum of the numerators over the denominator. $3 + 3 = 6$ $\frac{6}{5}$
3. Change the improper fraction to a mixed number. $5\overline{)6} = 1\frac{1}{5}$

C. With different denominators:

1. Find the smallest common (same) denominator into which all the unlike denominators will divide. $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}=$ 12 common denominator
2. Divide each unlike denominator into the common denominator. $\begin{array}{r}6\\ 2\overline{)12}\end{array}$ $\begin{array}{r}4\\ 3\overline{)12}\end{array}$ $\begin{array}{r}3\\ 4\overline{)12}\end{array}$
3. Multiply each answer by their respective numerator.
   1/2 x 6 = 6
   2/3 x 4 = 8
   3/4 x 3 = 9
   New Numerators
4. Place the new numerators over the common denominator $\frac{6}{12}+\frac{8}{12}+\frac{9}{12}$ Equivalent Fractions
5. Add the top numbers (numerators).
$$\begin{array}{r}\frac{6}{12}\\ +\frac{8}{12}\\ +\frac{9}{12}\\ \frac{23}{12}\end{array}$$
   Answer is an improper fraction
6. Change the improper fraction to a mixed number. $\frac{23}{12} = 1\frac{11}{12}$ answer is a mixed number

D. With mixed numbers:

1. Add the whole numbers. $8\frac{3}{4} = \frac{6}{8}$
2. Add the fractions. $+ \quad 5\frac{3}{8} = \frac{3}{8}$
   a. Change unlike denominators to a common denominator $+ \quad 4\frac{1}{2} \quad \frac{4}{8}$
   $17 \quad \frac{13}{8}$
   b. Change improper fractions to mixed numbers $\frac{13}{8} = 1\frac{5}{8}$
3. Combine the two answers for a final total. $17 + 1\frac{5}{8} = 18\frac{5}{8}$ answers

VI. Subtracting Fractions.

a. With unlike denominators:

1. Arrange fractions one under another
2. Find the common denominator. Make fractions equivalent.

$$\begin{array}{r} \frac{2}{3} \\ -\ \frac{3}{5} \\ \hline \end{array}$$

3. Subtract the numerators
4. Place the answer over the common denominator

$$\begin{array}{rcl} \frac{2}{3} & = & \frac{10}{15} \\ -\ \frac{3}{5} & & \frac{9}{15} \\ \hline \end{array} \quad = 1/15$$

b. With mixed numbers:

1. Arrange mixed numbers one under another.

$$\begin{array}{r} 13\ \frac{2}{3} \\ -\ \ 6\ \frac{3}{8} \\ \hline \end{array}$$

2. Determine the common denominators. (24).
3. Subtract the fractions first, then subtract the whole numbers

$$\begin{array}{r} 13\ \frac{16}{24} \\ -\ \ 6\ \frac{9}{24} \\ \hline 7\ \frac{7}{24} \end{array}$$

(NOTE: If the fraction in the subtrahend is larger than the fraction in the minuend, borrow one (1) from the whole number in the minuend (7) and add to the fraction (1 $\frac{4}{20}$).

Change the mixed fraction (1 $\frac{4}{20}$) to an improper fraction ($\frac{24}{20}$) and subtract.)

$$\begin{array}{rcl} 7\frac{1}{5} & = & 6\ \frac{4}{20} \quad \text{(minuend)} \\ -\ 3\frac{3}{4} & = & 3\ \frac{15}{20} \quad \text{(subtrahend)} \\ \hline \end{array}$$

$$6\ \frac{24}{20} \qquad 1\ \frac{4}{20} = \frac{24}{20} \quad (1\ 4/20=24/20)$$

$$\begin{array}{r} -\ 3\ \frac{15}{20} \\ \hline 3\ \frac{9}{20} \end{array}$$

VII. Multiplying Fractions.

A. Common fractions: $\frac{1}{5} \times \frac{2}{3} =$

1. Multiplying the numerators. $\frac{1}{5} \times \frac{2}{3} = \frac{2}{15}$
2. Multiplying the denominators.
   (NOTE: If possible, cancel cross factors before multiplying numerators and denominators.)

$$\frac{2}{5} \times \frac{5}{8} = \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{5}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{4}{\cancel{8}}} = \frac{1}{4}$$

3. Reduce product to its lowest terms.

B. Mixed numbers and whole numbers:

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

1. Change the mixed numbers and the whole numbers to improper fractions.
   (NOTE: Cancel cross factors, if possible.

$\frac{2}{1} \times \frac{10}{3} = \frac{20}{3} = 6\frac{2}{3}$

$1\frac{1}{4} \times 2\frac{2}{3} = \frac{5}{4} \times \frac{8}{3} =$

2. Multiply across.

$\frac{5}{\cancel{4}} \times \frac{\cancel{8}}{3} = \frac{10}{3} = 3\frac{1}{3}$

VIII. Dividing Fractions.

A. Common fractions:

$\frac{1}{3} \div \frac{1}{6} =$

1. Change the ÷ symbol to a multiplication symbol and invert the divisor.

$\frac{1}{\underset{1}{\cancel{3}}} \times \frac{\cancel{6}\,2}{1}$

2. Multiply.
   (NOTE: Cancel cross factors if possible.)

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

B. Mixed and whole numbers:

$3 \div 5\frac{1}{4} =$

1. Change whole and mixed numbers to improper fractions.

$\frac{3}{1} \div \frac{21}{4} =$

2. Change the ÷ symbol to a multiplication symbol and invert the divisor.

$\frac{3}{1} \times \frac{4}{21} =$

3. Multiply.
   (NOTE: Cancel cross factors if possible.)

$\frac{\overset{1}{\cancel{3}}}{1} \times \frac{4}{\underset{7}{\cancel{21}}} = \frac{4}{7}$

IX. Simplifying complex fractions

1. Rewrite the fraction as a division problem.

$\frac{\frac{1}{4}}{\frac{3}{8}} = \frac{1}{8} \div \frac{3}{4} = \frac{1}{3} \times \underline{8} =$

2. Change the ÷ symbol to an x symbol and invert the divisor.

3. Multiply.

$\frac{\overset{2}{1}}{\underset{1}{\cancel{4}}} \times \frac{\overset{4}{\cancel{8}}}{3} = \frac{\overset{3}{2}}{3}$

(NOTE: Cancel cross factors if possible)

X. Changing fractions to decimals:

A. Common fractions: ¼

1. Divide the numerator by the denominator.
2. Insert the decimal.

¼ = .25 $\frac{1}{4}$ = 25
4)1.00
8
20
20

B. Mixed numbers: 2 1/4

1. Change the fraction to 2 ¼ = 4)1.00 = 2.25 (quotient .25)
2. Divide the denominator into the numerator. This is your decimal point. If there are whole numbers, write them before your fractional values. 2 ¼ = 2.25

FRACTION PRACTICE

1. Change as indicated.

$\frac{1}{3} = \frac{\_\_}{12}$ $\frac{1}{2} = \frac{\_\_}{8}$ $\frac{1}{4} = \frac{\_\_}{16}$ $\frac{1}{4} = \frac{\_\_}{12}$ $\frac{1}{3} = \frac{\_\_}{9}$ $\frac{1}{2} = \frac{\_\_}{16}$

2. Reduce to lowest terms.

$\frac{9}{12} =$ $\frac{8}{12} =$ $\frac{9}{15} =$ $\frac{6}{12} =$ $\frac{6}{10} =$ $\frac{6}{9} =$

3. Add.

174 ¾ + 77 ¾

63 1/6 +17 5/8

26 3/8 +14 7/8

201 3/10 + 19 3/10

4. Subtract

21 1/4 = 20 5/4
-12 1/2 = 12 2/4

16 1/6 - 7 1/3

32 1/8 -14 1/4

45 1/10 - 24 1/2

Perform the operation indicated.

5.

$\frac{3}{4} \times \frac{8}{9} =$ $\frac{9}{10} \times \frac{2}{3} =$ $\frac{2}{3} \times \frac{1}{6} =$ $\frac{3}{5} \times \frac{2}{3} =$

6.

$2\frac{2}{3} \times \frac{1}{4} =$ $3\frac{1}{2} \times \frac{1}{2} =$ $\frac{2}{5} \times 6\frac{1}{4} =$ $\frac{3}{10} \times 3\frac{1}{8} =$

7. $8\frac{1}{3} \times 2\frac{2}{5} =$ $2\frac{1}{2} \times 3\frac{1}{5} =$ $4\frac{2}{3} \times 2\frac{1}{7} =$ $5\frac{3}{5} \times 3\frac{3}{4} =$

8. $6 \div \frac{1}{3} =$ $\frac{1}{3} \div 6 =$ $9 \div \frac{1}{3} =$ $\frac{3}{5} \div 6 =$

KEY

1.	1/3=$\underline{4}$/12	1/2=$\underline{4}$/8	1/4=$\underline{4}$/16	1/4=$\underline{3}$/12	1/3=$\underline{3}$/9	1/2=$\underline{8}$/16
2.	3/4	2/3	3/5	1/2	3/5	2/3
3.	252 ½	80 19/24	41 1/4	220 3/5		
4.	8 3/4	8 5/6	17 7/8	20 3/5		
5.	2/3	3/5	1/9	2/5		
6.	2/3	1 ¾	2 ½	15/16		
7.	20	8	10	21		
8.	18	1/8	27	1/10		

INTERGERS

Integers (signed numbers)

Negative numbers such as 7° below zero is written -7° or losing yards in football play can be written – 15.
Positive numbers can be written with a plus sign (+) or without a sign. +8 means a positive 8. A positive 24 can be written +24 or 24.

Adding Integers

When you add integers and the signs are alike, only add the integers and the signs stay the same. Such as:

$$\begin{array}{r} -3 \\ -10 \\ \underline{+\ -13} \\ -26 \end{array} \quad \text{or} \quad \begin{array}{r} +11 \\ +4 \\ \underline{+\ +15} \\ +30 \end{array}$$

When you add and the signs are different, then you actually subtract and use the sign of the bigger number.

$$\begin{array}{r} -30 \\ \underline{+4} \\ -26 \end{array}$$

The difference between 30 and 4 is 26. Since 30 is the largest number, use a (-) sign.

$$\begin{array}{r} +1 \\ \underline{+\ -10} \\ -9 \end{array}$$

The difference between 10 and 1 is 9. Since 10 is the largest number, use a (-) sing.

Subtracting Integers

To subtract integers, change the subtraction sign to addition. Then change the sign of the number being subtracted to the opposite sign (the second number). It is now an addition problem.

Follow addition rules above.

$$\begin{array}{r} +\ 10 \\ \underline{-\ \ +2} \end{array} \quad \text{Becomes} \quad \begin{array}{r} +\ 10 \\ \underline{+\ \ -2} \\ +8 \end{array}$$ Then follow addition rules.

$$\begin{array}{r} -2 \\ \underline{-\ -2} \end{array} \quad \text{Becomes} \quad \begin{array}{r} -2 \\ \underline{+\ +2} \\ 0 \end{array}$$

Multiplying Integers

To multiply integers fist multiply all factors together to get the product (answer)

(-6) (+2) (-3) = 36
(-2) (-2) (-2) = -8
(-16) (-2) = 32

To decide the correct sign in multiplication and division, count the number of negative signs. An even number of negative signs equal a positive answer; an odd number of negative signs equals a negative answer.

Dividing Integers

To divide integers, follow normal division rules.

-42 ÷ 7 = 6 -21 ÷ 7 = -3

If you have an even number of negative signs, your answer is positive; if you have an odd number of negative signs, your answer is negative.

INTEGER PRACTICE

Adding, Subtracting, Multiplying, and Dividing Signed Numbers

Use the rules for adding, subtracting, multiplying, and dividing signed numbers.

1. 3 + (-4) 3 + (-4) = -1	7 – (-2)	8 (-5)	$\frac{30}{-2}$
2. -9 – (-9)	-10 + (-8)	$\frac{-24}{6}$	(-12) (3) (-2)
3. $\frac{45}{-9}$	13 (-4)	-5 + (-10)	7 – (+9)
4. (-8) (-3) (-4)	$\frac{-36}{-6}$	19 – (-12)	-21 + (10)
5. 15 + (-12)	1 – (+1)	9 (-6)	$\frac{25}{-5}$
6. -15 (-4)	$\frac{-100}{25}$	-26 – (-13)	16 + (-29)
7. 6 – (+17)	(-3) (-30) (3)	42 + (-19)	$\frac{-81}{9}$
8. 20 ÷-4	-22 – (+33)	-4 (32)	-8 + (-8)

Key

1. -1 , 9, -40, -15
2. 0, -18, -4, 72
3. -5 , -52, -15 , -2
4. -96, 6, 31, -11
5. 3, 0, -54, -5
6. 60, -4, -13, -13
7. -11, 270, 23, -9
8. -5, -55, -128, -16

OPERATIONS ON REAL NUMBERS

1.3 Absolute Value; Adding Integers and Other Signed Numbers

Absolute Value

The **absolute value** of a number is the distance between that number and 0 on the number line *with no regard to direction* (see figure 1.3.1). The symbol for the *absolute value* of a real number x is $|x|$.

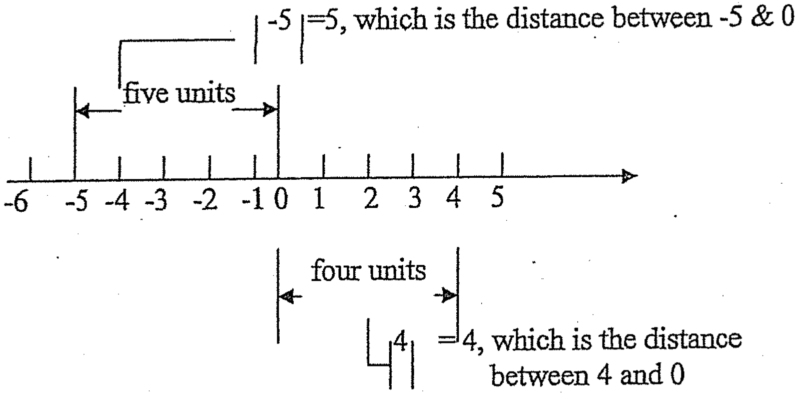


FIGURE 1.3.1- Absolute Value

Example 1 Examples of the absolute value of numbers:

a. $|9| = 9$ A positive number
b. $|0| = 0$ Zero
c. $|-4| = 4$ A positive number

**Note that the absolute value of a number can never be negative

A) $|8 + -2| =$ B) $|-4 + 2| =$ C) $|-10 + 4| =$

D) $|3 + 5| =$ E) $|2 - 7| =$

Answers: A) 6 B) 2 C) 6 D) 8 E) 5

NOTE: The absolute value of a number can never be negative.

Revised 8/20/2009

PERCENTS

I. Changing percents to decimals

- A. Move the decimal two places to the left.

  (NOTE: The decimal is understood to be at the right of a whole number.)

- B. Drop the percent sign

2%

02 = .02

II. Changing decimals to percents

- A. Move the decimal two places to the right.
- B. Add the percent sign.

2.25

2.25

225%

III. Changing percents to fractions

- A. Write the percent as a fraction with a denominator of 100.
- B. Reduce to the lowest term.

25%

$\frac{25}{100}$

$\frac{25}{100} = \frac{1}{4}$

IV. Changing fractions to percents

- A. Divide the numerator by the denominator.
- B. Carry the answer to three places.
- C. Change the decimal answer to a percent.

$$\frac{3}{8} = \begin{array}{r} .375 \\ 8\overline{)3.000} \\ \underline{2\,4} \\ 60 \\ \underline{56} \\ 40 \\ \underline{40} \end{array}$$

.375 = 37.5%

V. Finding a percent of a given amount

- A. Change the percent to a decimal.
- B. Multiply the given amount by the decimal amount.

EXAMPLE 1: Find the amount of the commission on sales of $ 1, 080 if the commission is 5%.

1. 5% = .05
2. $$\begin{array}{r} \$1,080 \\ \underline{\times\ .05} \\ \$54.00 \end{array}$$ Commission

EXAMPLE 2: Find the number of apples sold if 100 apples were purchased and 80% of them were sold.

1. 80%=.80
2. $$\begin{array}{r} 100 \\ \underline{\times\ .80} \end{array}$$ 80 apples were sold

VI. Finding an amount when the percent of it is given.

A. Change the percent to a decimal.
B. Divide the given amount by the decimal amount.
EXAMPLE: If a dress is reduced by 75% to sell for $20
what was the original price?
1. 75% = .75
$80
2. .75) 20.00

3. $80 original price

VII. Finding the percent of decrease or increase.

A. To find the amount of decrease
  1. Subtract the new figure from the original figure.
  2. Write as a fraction.
    a. The amount of decrease as the numerator.
    b. The original figure as the denominator.
  3. Change the fraction to a percent.

EXAMPLE: A dress selling for $80 was reduced to $20
what is the percent of the decrease?
1. $80
- 20
$60

2. 60/80 = ¾

3. .75
4)3.00
28
20
20
4. .75 = 75%, percent of decrease

There are basically 3 rules to solving percent problems.

1. Determine if you need a larger or smaller number than the one in the problem.
  (a) If you need a large number, divide the percent into the number given.
  (b) If you need a smaller number multiply the percent by the number in the problem.

2. Percents are based on 100. 30% is equal to 30/100 or .30 as a decimal.

3. If you want to find a percent of one number compared to another, make a fraction of the two numbers and divide the denominator into the numerator.

Revised 8/20/2009

EXAMPLES: 80 is ___ % of 400 = ______

$$\frac{80}{100} = \frac{8}{40} = \frac{1}{5} \quad \div \quad 5\overline{)1.0} \quad = \quad \overset{.20}{5\overline{)1.00}} \quad = \quad 20\%$$

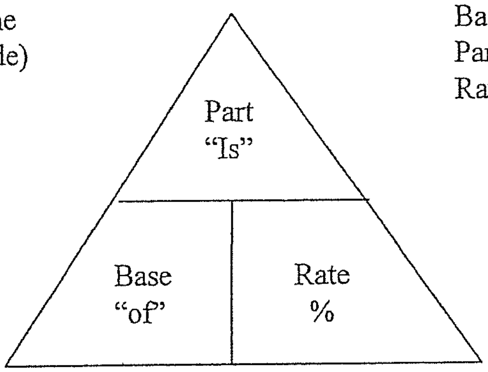
200 people enrolled in a class. 60% showed up. How many were present? (You need a smaller number than 200 so multiply)

$$\begin{array}{r} 200 \\ \underline{\times \quad .60} \\ 120.00 \end{array} = 120 \text{ people}$$

200 people attended church on Sunday. This was 30% of the people that were members. How many people are members of that church? (You need a larger number than 200 so divide)

$$\underline{\;30\uparrow}\overline{)200.} \quad = \quad 30\overline{)20000.} \quad = \quad 600$$

If you know the Base & the Part & want the rate (divide)
P ÷ B = R



Base-amount you start with
Part- piece or amount of the base
Rate= Per Cent

If you know the base & the rate & want the part (multiply)
P=BxR
If you know the rate & the part & want the base (divide)
P ÷ R = B

OF: Clue word for base 10% <u>of</u> 40=?
IS: Clue for part 70 <u>is</u> 50% of what number?

PERCENT PRACTICE

1. 10% of 60 = _______
2. 20% of 16 = _______
3. 5 ½% of _______ = 33
4. What percent of $5.00 is $.40?
5. 8 ½% of ______ = $14.45
6. What percent of 0.48 is 0.12?
7. What percent of 840 is 168?
8. 12.5% of _______ = 4
9. 175% of _______ = 77
10. 80% of _______ = 360

KEY

(1) 6 (2) 3.2 or 3.20 (3) 600 (4) .08 = 8% (5) $170.00

(6) 25% (7) 20% (8) 32 (9) 44 (10) 450

Order of Operations

Sometimes problems will be quite long and have many operations to do (+, -, *, ÷). There could be several ways to work the problem thus getting different answers. So, the order of operations rule came about so everyone works the problem the same way and comes out with the same answer. The phrase: Please Excuse My Dear Aunt Sue will help you remember the order to work the problem.

P = ( ) or [ ]
E = exponents or square roots
M = multiply * ( ) (Neither multiplication or division
D = divide ÷ has priority over the other)
A = add + (Neither addition or subtraction has
S = subtract - priority over the other)

Work left to right completing each part (P, E, M, D, A, S) until you have a final answer. If there is more than one operation alike, do them as they happen left to right. Remember multiplication and division are equal, so do not complete all of the multiplication and then go back and do all of the division. Do the multiplication and division as they happen left to right. The same is true for adding and subtracting, do them as happen left to right. A parenthesis with several operations inside follows the same rules (P, E, M, D, A, S)

WRONG WAY

$$\underbrace{5 * 2} + 14 \div 2$$
$$\underbrace{10 + 14} \div 2$$
$$\underbrace{24 \div 2}$$
$$12$$

RIGHT WAY

$$\underbrace{5 * 2} + \underbrace{14 \div 2}$$
$$10 + \underbrace{14 \div 2}$$
$$\underbrace{10 + 7}$$
$$17$$

Wrong because 14 was added to 10 before 2 was divided into 14. Must complete all multiply and "before" you add or subtract.

Right because 5 was multiplied by 2 first. 14 was divided by 2 next. Last 10 is added to 7.

Evaluate

$$\begin{aligned} & \underbrace{3 * 6} \div 9 - 1 + 4 * 7 \\ = \; & 18 \div 9 - 1 + 4 * 7 \\ = \; & 2 - 1 + \underbrace{4 * 7} \\ = \; & \underbrace{2 - 1} + 28 \\ = \; & \underbrace{1 + 28} \\ = \; & 29 \end{aligned}$$

Example 1: Evaluate (6 + 2) + (8+1) ÷ 9

$$\begin{aligned} & \underbrace{(6 + 2)} + \underbrace{(8+1)} \div 9 && \text{Do the operations in parenthesis first.} \\ = \; & 8 + \underbrace{9 \div 9} && \text{Divide} \\ = \; & \underbrace{8 + 1} && \text{Add} \\ = \; & 9 \end{aligned}$$

Example 2: Evaluate 30 ÷ 3 * 2 + 3(6 – 21 ÷ 7)

$30 \div 3 * 2 + 3(6 - \underbrace{21 \div 7})$ Do the operations in parenthesis

$= 30 \div 3 * 2 + 3(\underbrace{6 - 3})$

$= \underbrace{30 \div 3} * 2 + 3(3)$ Divide

$= \underbrace{10 * 2} + \underbrace{3(3)}$ Multiply

$= \underbrace{20 + 9}$ Add

$= 29$

Parts of expressions separated by + or – signs can be simplified Separately for easier evaluation.

$$\underbrace{30 \div 3} * 2 + 3(6 - \underbrace{21 \div 7})$$

$$= \underbrace{10 * 2} + 3(\underbrace{6 - 3})$$

$$= 20 + \underbrace{3(3)}$$

$$= \underbrace{20 + 9}$$

$$= 29$$

Example 3: Evaluate $2 * 9 + 18 \div 9$

$$\underbrace{2 * 9} + \underbrace{18 \div 9}$$

$$= \underbrace{\underline{\qquad} + \underline{\qquad}}$$

$$= \underline{\qquad}$$

Completion Example Answers

$= \underbrace{2 * 9} + \underbrace{18 \div 9}$

$= \underbrace{18 + 2}$

$= 20$

$3 * 8 - 12 - 3 * 4$

Example 4: Evaluate $3 * 8 - 12 - 3 * 4$

$$\underbrace{3 * 8} - 12 - \underbrace{3 * 4}$$

$$= \underline{\qquad} - \underbrace{12 - \underline{\qquad}}$$

$$= \underbrace{\underline{\qquad} - \underline{\qquad}}$$

$$= \underline{\qquad}$$

$= 24 - 12 - 12$

$= 12 - 12$

$= 0$

Revised 8/20/2009

Order of Operations

1. $2 + -3 + -5 =$
2. $8 + (4 + 5)^2 =$
3. $6 \div 2 * 3 - 3$
4. $(10 - {}^{-}4)$ x ${}^{-}2 =$
5. $4 + 3^2 * 7 =$
6. $(3^2 + 2) * 3 =$
7. $(12 - 4)^2 \div 4 =$
8. $(5 *{}^{-}3) + {}^{-}2 =$
9. $22 - 3\ (9 - 2) =$
10. $(2^3 + 4) \div 2 + 8 \div 2 =$

KEY

1\. - 6　2. 89　3. 6　4. -28　5. 67
6\. 33　7. 16　8. -17　9. 1　10. 10

ALGEBRAIC OPERATIONS

Exponents

(* means you multiply)

This is a shorthand way of telling how many times a number is multiplied by itself. 2^4 means 2*2*2*2. The 4 is the exponent. A shorthand way to write 3*3*3*3*3*3 is 3^6.

4 squared means $4^2 = 4*4 = 16$
2 cubed means $2^3 = 2*2*2 = 8$
$2^3 * 4^2$ means $2*2*2 * 4*4 =$
$8 * 16 = 128$

$10^3 * 10^2 = 10*10*10* 10*10 = 10^5$
$8^4 * 8^7 = 8^{11}$

To multiply exponents-just add the exponents.
$(3^2)(3^3) = 3^5$ (The power of 2 plus the power of 3 = the power of 5)
$8^3 * 8^4 = 8^7$ (The power of 3 plus the power of 4 = the power of 7)
$m * m^2 * m * m^3 = m^7$ (The understood power of 1 plus the
plus the power of 2 plus the power of 1 plus the power of 3 = the power of 8, so $= m^8$.)

To divide exponents – just subtract the exponent.
$4^8 \div 4^2 = 4^6$ (The power of 8 minus the power of 2 = the power of 6)
$15^9 \div 15^3 = 15^6$ (The power of 9 minus the power of 3 = the power of 6)

ALGEBRAIC OPERATIONS PRACTICE

1. $72 \div 8 + 3 * 4 - 105 \div 5$
2. $6(14 - 6 \div 2 - 11)$
3. $48 \div 12 \div 4 - 1 + 6$
4. $5 - 1 * 2 + 4\ (6 - 18 \div 3)$

5. 8 – 1 * 5 + 6(13 – 39 ÷ 3)

6. (21 ÷ 7 – 3) 42 + 6

7. 16 – 16 ÷ 2 – 2 + 7 * 3

8. (135 ÷ 3 + 21 ÷ 7) ÷ 12 – 4

9. (13 – 5) ÷ 4 + 12 * 4 ÷ 3 – 72 ÷ 18 * 2 + 16

10. 15 ÷ 3 + 2 – 6 + (3)(2)(18)(0)(5)

11. 100 ÷ 10 ÷ 10 + 1000 ÷ 10 ÷ 10 ÷ 10 – 2

12. [(85 + 5) ÷ 3 * 2 + 15] ÷ 15

13. 2 * 25 – 4 ÷ 2 + 3 * 7

14. 16 ÷ 16 – 9 ÷ 9

15. (16 – 7) 8 – 8 * 5 ÷ 10

KEY (1) 0 (2) 0 (3) 6 (4) 3 (5) 3 (6) 6
(7) 27 (8) 0 (9) 26 (10) 1 (11) 0 (12) 5
(13) 69 (14) 0 (15) 68

Simplifying Equations

Often in algebra a numerical answer can not be found without additional information. Many times the answer is just to make a problem more simple by putting like things (called terms) together.

Adding 4 ab + c + 3 ab + 2 c = 7 ab + 3 c
4 ab and 3 ab are like terms so they can be added together 4ab + 3ab = 7ab.
So c and 2 c can be added together since they are like terms c + 2c = 3c.
The final answer then is 7ab + 3c. Since these terms are not alike they cannot be added together.

Subtracting – The same thing is true of subtraction. You can subtract like terms, but you cannot combine unlike terms.

3x + 4y – 2y – 2x = x + 2y

3x and 2x are like terms. So 3x – 2x = 1x which is written just x. 4y – 2y = 2y
Final answer is x + 2y.

Multiplication – When one term is multiplied by another term, multiply the numbers in front of the terms together and follow the multiplication rule for exponents with the letters.

4 (3a + 2b) = 12a + 8b 4 * 3 = 12 4 * 2 = 8, so this now becomes 12a + 8b
2 (r + s) = 2r + 2s
$-4c\,(2c^2 + d) = +\,8c^3 - 4cd$
-4 (-2) = + 8 (Integers rule) -4 (+d) = -4d c times $c^2 = c^3$ (exponent rule). So the final answer of $-4c\,(2c^2 + d) = +\,8c^3 - 4cd$

Division – These rules follow the same idea. Divide numbers of a term into numbers of another Term. Follow exponent rule for exponents with your letters, so $\frac{12x^4 - 8x^3}{4x} = 3x^3 - 2x^2$

$12 \div 4 = 3$
$8 \div 4 = 2$
$x^4 - x = x^3$
$x^3 - x = x^2$

So, the final answer is $3x^3 - 2x^2$

(A) $3ab + b + 5ab + 3b =$
(B) $4x + 2y + 8x + 3y =$
(C) $10a + 3b - 2a - b =$
(G) $\frac{10ab^5 + 4ab^3}{2ab} =$

(D) $14r - 7t + 10t - 4r =$
(E) $4y\ (2y^4 + 2x) =$
(F) $-3\ (x+y) - 3xy =$
(H) $\frac{15x^7 - 5x^3}{5x} =$

KEY
(A) $8ab + 4b$ (B) $12x + 5y$ (C) $8a + 2b$ (D) $10r + 3t$ (E) $8y^5 + 8xy$ (F) $-3x - 3y - 3xy$
(G) $5ab^4 + 2ab^2$ (H) $3x^6 - x^2$.

PRACTICE
(A) $9^3 * 9^4 =$
(B) $xy^5 * xy^5 =$
(C) $5^7 * 5^3$
(D) $10^4 * 10^2 =$
(E) $t^3 * t^8 =$

(F) $x^5 \div x =$
(G) $ab^8 \div ab^2 =$
(H) $r^4 \div r =$
(I) $8^6 * 8^2 =$
(J) $4^{10} \div 4^2 =$

KEY
A) 9^7 B) $2xy^{10}$ C) 5^{10} D) 10^6 E)t^{11} F)x^4 G)ab^6 H)r^3 I)8^4 J) 4^8

<u>Simplifying, Adding, and Subtracting x's</u>

$$\begin{array}{r} 4x^2 \\ \underline{+3x^2} \\ +7x^2 \end{array} \qquad \begin{array}{r} 10x^2 \\ \underline{-2x^2} \\ 8x^2 \end{array} \qquad 12x + x = 13x$$

You cannot add or subtract x's with different <u>exponents.</u>

$$\begin{array}{l} 3x^3 \\ \underline{-2x^2} \\ \text{Cannot do} \end{array} \qquad \begin{array}{l} 2x^2 \\ \underline{+5x^4} \\ \text{Cannot do} \end{array}$$

<u>SQUARE ROOTS</u>

Means what number times itself is the answer under the $\sqrt{\ }$ sign.

$\sqrt{100} = 10$ since $10 \times 10 = 100$

$\sqrt{64} = 8$ since $8 \times 8 = 64$

$\sqrt{169} = 13$ since $13 \times 13 = 169$

$\sqrt{361} = 19$ since $19 \times 19 = 361$

$\sqrt{25} + \sqrt{16} = 5 + 4 = 9$

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

$3\sqrt{25} = 3\sqrt{5.5}$ (Break down the number under the square root sign to prime factors. When you have doubles, take out the doubles.)

$3\sqrt{25} = 3\sqrt{5.5} =$ (Remove one of the 5's, Take one 5x the number in front of the √ sign. So 3 x 5 = 15)

$3\sqrt{28} = 3\sqrt{2.2.7}$ (Remove the pair of 2's0).
Take one 2 times 3 = 6. Your problem now looks like $6\sqrt{7.}$

Solve for the unknown

$x + 8 = 8$
Since $0 + 8 = 8$ $\quad$ $x = 0$

$40 - x = 15$ $\quad$ Since $40 - 25 = 15$
$x = 25$

Find the values when $x = 5$ and $y = 4$

$3xy =$	$4x - 3y =$	$12x / y =$
$x + 7y =$	$2(x + y) =$	

Key (above):

3*5*4=60	4(5)-3(4)=8	12(5)÷4=15
5+7(4)=33	2(5+4)=18	