This tutorial is designed to be a very basic review of some of the subjects that are being tested with the ELM test.

It is not a fully inclusive study of these subjects. It is meant to be a short superficial consolidation of the concepts of math, algebra, and geometry that are involved in the ELM criteria.

It is recommended that, if you have trouble understanding the information provided herein, you conduct a more in-depth study with an appropriate text book or get help from a tutor.

This icon will take you back to the index of subjects.

The index is hyperlinked to the material within the document. This tutorial is a work in progress. If you have any suggestions of other material or corrections please submit them to the CSUSM Math Lab.

Index of Subjects

General notes:

1. When working with fractions it may be helpful to think of the fraction in terms of money or parts of a dollar:

        3/4 = .75 or 3 quarters

        1/2 = .50 or 2 quarters, or 5 dimes

        3/10 = .30 or 3 dimes (1/10 is a dime)

This is one way to convert a fraction to a decimal, or to see relative size more easily.   1.35 is smaller than 1.45

2. Convert a mixed number to an improper fraction:

        2 3/5 = 13/5 = 260/100 = 260%

Since we are dealing in fifths (1/5s), each whole number has 5/5 and we have 2 whole numbers… 5/5 + 5/5 = 10/5 and 10/5 + 3/5 = 13/5

3. To divide a fraction by 2 -- multiply by 1/2:

        1/2 x 5/2 = 5/4 = 4/4 + 1/4 = 1 ¼

4.   Percent: 25% = 25/100 = ¼
   a. Any whole percent can be written as a number over 100.
       i.   13% = 13/100
       ii. 46% = 46/100
       iii. 40% = 40/100 = 4/10 = 2/5
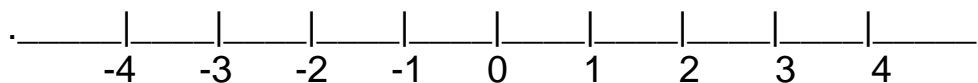   b. Reduce these fractions whenever possible.
   c. A fractional percent can be written over 1000
       i. 25.7% = 275/1000 = 11/40
   d. Any denominator that can be made into 100, will let you convert to %
       i. 3/20 = 15/100 = 15%   [multiply 3/20 by 5/5]

5. Number line: a way to organize and visualize numbers

.——————|——————|——————|——————|——————|——————|——————|——————|——————|——————.
    -4   -3   -2   -1   0   1   2   3   4

    −3 is smaller than −2, because it is further to the left on the number line.

5. Word problem solution steps:
    a. write down the facts on a separate sheet of paper,
    b. draw a picture,
    c. Determine what the question is and fit the facts to the question.
    d. Reread your facts against what is written.
    e. If you are comparing quantities, figure out which one is bigger/smaller just from the reading, then check your extracted facts to see if what you wrote is correct.
    f. If you are choosing variables to represent some value, choose them so they relate to that value: larger = L, Frank = F
    g. Estimate an answer. Estimates are extremely helpful because it is representative of the facts and your understanding. And on the ELM they can eliminate some of the possible answers.

6. Prime Numbers: are numbers that have only two factors that can be divided evenly — **the number itself and 1** and 1 is not a prime.
    a. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47
    b. You cannot take the square root of a prime evenly
    c. If you have prime factors from a number, they will not factor any further
    d. If you have two different primes in both the numerator and denominator of a fraction, it will not reduce and further
    e. 2 is the only even prime, all others are odd.
    f. 2 is the smallest prime
    g. 1 is not considered a prime number because it has only one factor –> 1.
    h. If a number can be divided by a smaller prime, it is not prime: ie= 9, 27, 35, etc
    i. To determine if a number is prime, you need only check if it is divisible by prime number that are smaller than the square root of the number.
        i. Ex: 97, $\sqrt{97} < 10$, need only check 2-9 for divisibility

Order of Operations:

This order helps you to carry out a sequence of math operations correctly.

The acronym for the order is…. **PEMDAS**……
<u>**P**</u>lease <u>**E**</u>xcuse <u>**M**</u>y <u>**D**</u>ear <u>**A**</u>unt <u>**S**</u>ally

P- parentheses	E - exponents
M – multiply	D - divide
A - add	S - subtract

$$3 + 7(4 - 3)^2 \div 6 + 3$$

The correct answer is: $7\frac{1}{6}$ or 7.1667

To conduct the proper order of operations and get the correct answer use PEMDAS.

1. Parenthesis:
   a. perform any operations possible <u>within</u> the parenthesis,
   b. <u>then</u> look outside to the right, is there an exponent? If so do step 2
2. Exponents
   a. Carry out the exponential expansion,
   b. then look outside to the left, is there a coefficient? If so do step 3
3. Multiply/Divide
   a. Multiply/divide the coefficient times each term inside (distribute)
   b. remove parens
   c. If there is a choice of both multiply and divide, work from left to right (order **is** important).
4. Once all Mult/Div is finished, then Add/Subtract as needed
5. Add/Subtract
   a. (order is **not** important), it may be easier to add all positives, then all negatives together individually, then add the results.

Reduced prices/amounts/budgets/etc.

Item reduced by 20%:

Strategy: if it is reduced by 20% then the new amount is 80% of the original.

So if the original price is $60 then the sale price is 80% of $60 ==>
.80 x 60 = $48.00

If they tell you the 20% sales price is $48, then $48 is 80% of the original price: ==>   48/.80 = $60 $60 is the original price.

Concepts:
a. the original price will be more than the sale price. So if you are given the original price your answer will be smaller, and if you are given the sale price - the original price will be larger.

b. You know you have to multiply or divide, so if you get the wrong answer, just do the opposite. In figuring what percent to use, you start with 100% and if you reduce it by (subtract) 15%, then you know you have 85% left. So 0.85 (85%) is the number you use to multiply/divide.

c. Dividing by a fraction/decimal (less than 1) makes a number larger.
Multiplying by a fraction/decimal (less than 1) makes a number smaller.

Which number/fraction is bigger:

Which is bigger: 3/4 or 5/8

Strategy: cross multiply the numerators to the denominators.
multiply the 5 x 4 = 20,
and the   3 x 8 = 24
whichever answer is bigger, that is the bigger fraction. So 3/4 is bigger than 5/8 (go by the numerator with the bigger result).

If you are given a decimal number and a fraction, you must convert one of the numbers. Either convert to decimal, or to fractions. It is usually easier to convert the fraction to a decimal. Sometimes estimation will save time.

Which is bigger: 3.74   or $3\frac{4}{5}$

If you initially drop the whole digit of 3, then you have a number between .74 and 4/5.   4/5 converts to 8/10 which is .80 Therefore $3\frac{4}{5}$ is bigger.

Find a number between them: If there is an answer between 3.74 and 3.80 then that is the answer. If they give you the answer in fraction form then remember that .74 is almost .75 which is 3/4.

You need to find a common denominator, if one of the answers is not 3_3/4.

In most cases you should be able to get the answer by inspection, knowing that $3\frac{4}{5}$ = 3.80

A number between .35 and .36:   at first it may seem that there is no number between .35 and .36, but if you consider .350 and .360 are equivalent, now there are several numbers in between. In fact, if you consider fractions as valid answers, then there are an infinite number between them.

3/4 = 15/20 = 75/100 and 4/5 = 16/20 = 80/100 There is at least one number between 3/4 and 4/5 .

Half of an amount or double an amount:

For half -- divide by 2
For double -- multiply by 2

if you have a mixed number like 2 and 1/2:

There are two approaches:

1) convert mixed number to improper fraction and multiply by ½ … 2 ½ = 5/2 --> 1/2 x 5/2 = 5/4 = 1 ¼

2) divide both parts (2 and ½) separately and then add together.

Time Problems:

How many hours elapsed from 3:45 to 7:15:
=> subtract: 7:15 – 3:45
- since 45 is bigger than 15, we need to borrow.
- when you borrow in time… you must borrow 60 min
- so you have 6:75 – 3:45 = 3:30 = 3_1/2 hrs

=> alternate way is to add time to make the minutes equal and then add hours.

Square Roots (sqrt):

The $\sqrt{45}$ is a number between $\sqrt{36}$ and $\sqrt{49}$ which means the answer is between 6 and 7. For a little closer guess you could estimate that the difference between 36 and 49 = 13 and the difference between 36 and 45 = 9, so the answer is closer to 7 than 6… so maybe 6.6 or 6.7

Strategy: for estimating a square root:
- The $\sqrt{10}$ is a little more than 3, because $\sqrt{9}$ = 3
- The $\sqrt{15}$ is a little less than 4, $\sqrt{16}$ = 4

Median and Average:

Median: is like the median of a highway, it is always in the center of the road, no matter how many cars or lanes there are. So to find the median of a set of numbers:

 1- put them in numerical order
 2- pick the middle number (if there is an odd number of numbers)
 3, 5, 25, 37, 56 ==> 25
 6, 7, 9, 37, 56 ==> 9

 3- if there is an <u>even</u> number of numbers, the median is halfway between the two middle numbers.
 2, 5, 8, 10, 12, 18 ==> 9
 5, 8, 45, 47, 114, 200 ==> 46

Average: is a mathematical calculation (also called the mean).
 1- add all of the numbers
 2- divide the sum by how many numbers you added

 3, 5, 2, 6 ==> sum = 16   avg =   16/4 = 4

 - to have an average of 25 with 5 numbers, multiply 5 x 25 =125; the five numbers must sum to 125

 - find a missing number to get an average of 10
  7,   12,   9,   13 ….. 10
 +3   −2   +1   −3   = −1 [sum up all of the numbers that
                                     will make them equal 10]
  10   10   10   10
  the missing number is 10 - 1 = 9
 - an alternate way is multiply the average times the total number of numbers (10 x 5 = 50), then add the known numbers and subtract the sum from 50.   50 − (7 + 12 + 9 + 13) = 9. If the numbers and the total are small, this may be easier.

Algebra:

Exponents: tell you how many times the base is multiplied: $a^2 = a*a$

$ab = a^1b^1 \rightarrow$ it is understood that there is an exponent of 1 on any letter (or number) unless otherwise stated.

$aabbb = a^2b^3 \rightarrow$ from this you can see that when we multiply letters we add their exponents

$(ab)^2 = a^2b^2 \rightarrow$ every exponent inside the parens is multiplied by the exponent on the parens.
$$(2ab)^3 = 2^3a^3b^3 = 8a^3b^3 .$$

Since we add exponents when we multiply, it seems reasonable that we would subtract them when we divide, and that's true.

$$\frac{8a^3b^3}{2ab^2} = \frac{2ab^2}{2ab^2} * \frac{4a^2b^1}{1a^0b^0} = \frac{4a^2b^1}{1} = 4a^2b .$$ [the blue term is the common value we took out of top/bottom]
(see zero exponents)

Example	Rule	Notes
$2^2 * 2^3 = 2^5$	$b^x * b^y = b^{x+y}$	Multiply same base: add exp
$\frac{2^5}{2^2} = \frac{2^3}{2^0} = \frac{2^3}{1} = 2^3$	$\frac{b^x}{b^y} = b^{x-y}$	Divide same base: subtract exp
$(2^2)^3 = 2^6$	$(b^x)^y = b^{xy}$	Exp to an exp: multiply the exp's
$2^0 = 1$	$b^0 = 1$	Base to zero exp: any non-zero base = 1
$2^1 = 2$	$b^1 = b$	Base to exp = 1: equals the base
$\frac{1}{2^3} = 2^{-3}$	$\frac{1}{b^a} = b^{-a}$	Neg exp: equals 1 over the base
$(2*3)^3 = 2^3 * 3^3$	$(a*b)^C = a^C * b^C$	Product to exp: prod of each base to that exp

Zero Exponent: $8a^0b^0 = 8 \rightarrow$ anything (except 0) to the zero exponent equals 1. One way to think of this is to say that a^0 means there are no 'a's. Just as every letter has an exponent of 1, it also has a coefficient of 1 unless otherwise stated. ($a = 1a^1$). If you take away the "a" you are left with the 1. ($1a^0 = 1$) ... $(4a^2b)^0 = 1$

In the problem: $\dfrac{8a^3b^3}{2ab^2} = \dfrac{4a^2b^1}{1} = 4a^2b$.

We are dividing top and bottom by the same amount ($2a^1b^2$), so you subtract a^1 and b^2 from both top and bottom. We subtract the smaller exponents. In this case the smaller exponents were both in the denominator, but if the smaller were in the numerator or a combination, we would still subtract the smaller exponents.

Strategy: our goal is to make one or more of the letters a zero exponent and by doing so, it equals 1.

. $\dfrac{8a^3b^2}{2ab^3} \dfrac{(a^{-1}b^{-2})}{(a^{-1}b^{-2})} = \dfrac{4a^2b^0}{a^0b^1} = \dfrac{4a^2}{b}$.

Fractional Exponents: $a^{3/5} = (a)^{3/5} = (a^3)^{1/5} = \sqrt[5]{a^3}$.

Fractional exponents are commonly found in the radical form $\sqrt{}$; the ***denominator*** of the exponent is the index of the radical ($\sqrt[index]{a^{numerator}}$). The ***numerator*** of the exponent goes inside with base.

$(8a^3b^3)^{1/3} = (2^3a^3b^3)^{1/3} = 2ab \rightarrow$ each exponent inside is multiplied by exp outside.

$16^{1/2} = \sqrt{16} = 4 \rightarrow$ think of the exponent (1/2) as being the *square root*. Typically the index of a square root is not written, it is understood.

$x^{1/3} = \sqrt[3]{x}$ $\rightarrow$ consider the exponent (1/3) as being the *cube root*.

Negative Exponents: $a^{-3} = 1/a^3 = (1/a)^3$.

A negative exponent inverts the term.

$8a^3b^{-3} = (8a^3)(b^{-3}) = (8a^3)(1/b^3) = 8a^3/b^3$.

→ the b^{-3} is inverted (goes to the denominator) .

Ex: $\left(\dfrac{2}{3}\right)^{-5} = \left(\dfrac{3}{2}\right)^{5}$

> in this example the fraction inside the parenthesis is inverted to remove the neg (–) from the exponent.

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Adding and subtracting in algebra: to add/subtract terms in algebra you must have the *same letters* and they must have the *same exponents*.

$2ab + 3ab = 5ab$ → if terms are same, add the coefficients

$3a + 2ab = 3a + 2ab$ → the terms are different and cannot be added

$8a^3b^3 + 2a^2b^3$ → cannot be added… different exponents

Factoring: when we factor we are looking for terms that <u>multiply</u> to give us the result.

$2*4 = 8$ so 2 and 4 are factors of 8, so are 1 and 8

$8a^3b^3$ factors are: $1*8, 2*4, a^2b^2 *a^1b^1$, and other combinations of ab.

$(2ab)(4a^2b^2)$, $(2ab)(2ab)(2ab)$.

Factoring out common terms:

Factors are numbers that multiply to give you another number: 1,2,3,6 are factors of 6… 2*3, 1*6

$[8a^3b^3] = (2ab)(4a^2b^2)$ → the common term of (2ab) was factored out (divided out), you can see we could take out another (2ab)

➜ $(2ab)(2ab)(2ab) = (2ab)^3$

$[8a^3b^3 + 8a^2b] = (8a^2b)(ab^2 + 1)$ → factored out a common $(8a^2b)$ from both terms.

** $\underline{(8a^2b)}$ [$\underline{8a^3b^3}$ + $\underline{8a^2b}$] = $\underline{(8a^2b)}$ [$\underline{8a^3b^3}$ + $\underline{8a^2b}$] = $(8a^2b)$ [ab^2 + 1]
$(8a^2b) \longrightarrow 1$ 1 $(8a^2b)$ $(8a^2b)$

** In reality you are multiplying by 1, you distribute the denominator and leave the numerator outside (which is your common factor) and reduce the inside terms.

Factoring a quadratic:

FOIL = First, Outside, Inside, Last:

$(2z - 3)(z + 2) = 2z^2 + z - 6$

Factoring is just unFOILing.

Notes:
1) the middle term is <u>always</u> the sum/diff of the Inside and Outside terms (I/O)
2) the sign of the third term tells you if the two factors have the same or different signs (+ same sign)
3) the sign of the middle term tells you the sign of the factor with the larger I/O.

[$8a^2 + 2a - 15$]

By inspection: 3rd term is neg (factors have opposite signs) so we are looking for a difference of I/O terms that equals the middle term, middle term is + (larger I/O is +), the middle term is relatively small so I will begin with factors of 8 and 15 that are fairly close together (ie: 2,4 and 3,5)

$8a^2$ + 2a   − 15
2a   4a   +3 −5
              +12a   (Inside)
           −10a   (Outside)

$(2a + 3) (4a - 5) = 8a^2 + 2a - 15$

[$6x^2 - 13x + 5$]

By inspection; 3rd term is + (factors have same sign), 2nd term is − (both factors are neg), 2nd term somewhat larger so I will start with 2,3 and 1,5; sum of I/O is − 13

$$6x^2 \qquad -13x \qquad +5$$
2x   3x   −1   −5
                    −3x   (Inside)
                    −10x   (Outside)

(2x − 1) (3x − 5) = $6x^2 - 13x + 5$

If: I had tried 1,6 and 1, 5, I would have gotten −11x (or − 31x)

$$6x^2 \qquad -13x \qquad +5$$
1x   6x   −1   −5
                    −6x   (Inside)
                    −5x   (Outside)

Sometimes with inspection you will be able to see the answer right away.

$x^2 - 6x + 5$ →   factors are same sign (−), and the only factor of 5 is 1,5 which add to give 6: so (x − 5)(x − 1) is the answer.

$x^2 - x - 6$ →   factors are diff; factors of 6 are 1,6 and 2,3; the larger is neg; 2,3 give us a diff of 1: so (x + 2)(x − 3)

Difference of two squares:

$$16x^2 - 9$$ **Note**: both coefficients are squares and there is no middle term…. $16x^2$ [+0x] − 9

By inspection: 3rd term is neg, no middle term so both terms have the same coefficients with opposite sign.

$16x^2 \qquad\qquad -9$
4x   4x   3   −3 $(4x - 3)(4x + 3) = 16x^2 - 9$
+12x
−12x

$(4x - 3)(4x + 3)$ are also called the _sum conjugates_ of each other. This will be an extremely useful tool to have in your Math Tool Box, you will see many applications of this idea, because <u>when you multiply sum conjugates</u> the middle term goes away and you get the square of the 1st term minus the square of 2nd. $(a–b)(a+b) = a^2–b^2$

Linear Equations:

Linear equations usually have one or two variables (x and y). Both variables are first degree (ie: y = 3x +2). If you were to plot the equation for various values of x, you would plot a straight line (thus the term linear equation).

Questions that you may be asked:
1) Find the x and y intercepts
2) Solve for x or y given some value of x or y.
3) Solve the equation in terms of one of the variables
4) Find the slope of the line

$3x - 5 = 4$ (solve for x)   x=3
$3a + 4b = 8$ (solve for b) $b = \frac{8-3a}{4}$

Slope of a line (m):

(eq1) $m = \frac{y2-y1}{x2-x1} = \frac{f(x2)-f(x1)}{x2-x1}$ This is one of the forms for the slope of a straight line

(eq2) y = mx + b   In this form the coefficient of the x term is the slope

y=5x +2 …. m=5

Slope through two points: we will use **eq1**. It does not matter which point you choose
a P1 or P2, as long as you are consistent between your x's and y's.

Ex: (4, 3), (2, 5) → $\frac{5-3}{2-4} = \frac{2}{-2} = -1$

Geometry:
1. Terms:
    a. **Length** (L): measure of a line, or along a side or a distance
    b. **Perimeter** (P): the distance/length around an object
        i. Perimeter of a circle is called *circumference*
    c. **Area**: (A) measured in square units
        i. Rectangles: length x width A = L x W
        ii. Circle: A = π * r^2 (π is approximately 3.14)
    d. **Volume** (V): measured in cubic units
        i. V = A$_{base}$ x Heigth   (area of the base times the height)
        ii. Regardless of the shape of the base (square, triangle, circular…etc), if you calculate the area of the base and multiply it times the height, you will get the volume.
    e. **Surface Area**: is the sum of all the areas of all sides
    f. **Diameter** (d): diameter is the measurement across a circle
        i. d = twice the radius = 2r
        ii. radius in measured from the center of a circle to the perimeter
    g. **Triangle**: geometric shape with 3 sides
    h. **Rectangle**: geometric shape with 4 sides
        i. Is a quadrilateral (4 sides)
        ii. Square is a special rectangle with all sides equal
        iii. Adjacent sides are perpendicular to form right angles
   i. **Parallelogram:** Is a quadrilateral with no right angles
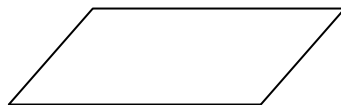
    j. **Angles**: measured in degrees (deg.) or radians

    i. Right Angle: measures 90 degrees, has a square corner

   ii. Acute Angle: measures less than 90 deg.
  iii. Obtuse Angle: measures greater than 90 deg
  iv. Straight Angle: measures 180 deg.
   v. Complementary angles: sum of 2 angles = 90 deg
  vi. Supplementary angles: sum of 2 angles = 180 deg

k. **Congruent Figures**: are figures that have the same shape and size (all angles and lengths are equal)
l. **Similar figures**: have the same angles, and the sides of one figure have the same relative proportions as the sides of the other figure. You can think of similar as being a fraction that is reduced: $\frac{7}{14} = \frac{1}{2}$ the two fractions are similar.

m. All triangles have 180 deg
n. All rectangles have 360 deg, 4 right angles
o. All pentagons have 540 deg
p. Degrees of a polygon = 180(n-2) where n is number of sides
q. Regular polygons have equal sides and vertex angles

2. Rectangles
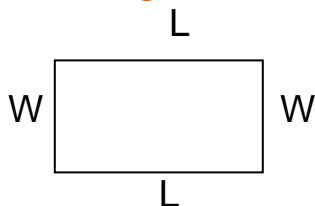
Area = L x W
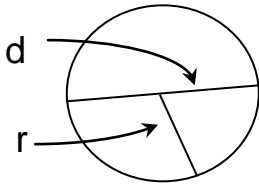Perimeter = 2L + 2W
Length is the longer side

3. Triangles
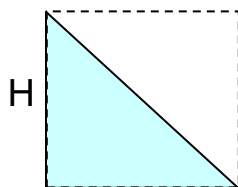
Area = ½ B x H
As you can see the triangle is ½ the area of the rectangle which is L x W

Base

4. Circles

Circumference = $\pi d = 2\pi r$
Area = πr^2 .

estimate of circ ≈ 3d
estimate of area ≈ $3 r^2$ ≈ ¾ d^2 .

5. Similar Triangles
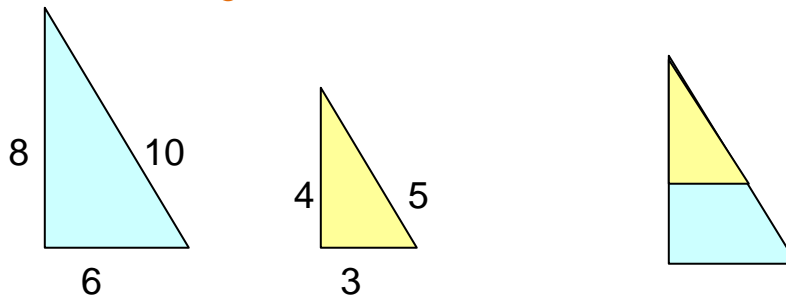
8 to 10 = 4 to 5 or $\frac{8}{10} = \frac{4}{5}$

8 to 6 = 4 to 3

Equivalent sides (same relative position) of similar triangles are proportional. You can think of proportional and similar in terms of fractions:

$\frac{3}{9} = \frac{1}{3}$ these two fractions are proportional or similar. In the below figures you can write your proportions using ratios (fractions) created by two sides of one triangle = the same relative sides of the other triangle.

Ex: $\frac{6}{10} = \frac{4}{x}$ ≫ $\frac{6x}{10} = 4$ ≫ $6x = 40$ ≫ $x = \frac{40}{6} = \frac{20}{3}$
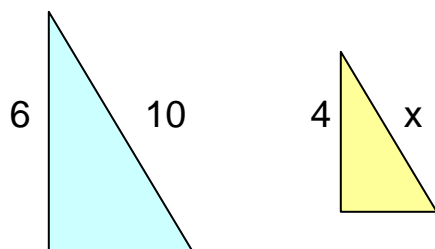
Or $\frac{x}{10} = \frac{4}{6} \gg x = \frac{40}{6} = \frac{20}{3}$ notice that you get the same result whether you relate sides on the same triangle or sides on the other triangle. As long as the sides are the equivalent side in each triangle, you will be ok. If you start with the unknown, it might be quicker.

r. **Prisms**:   a three dimensional polyhedron which has two parallel faces (usually top and bottom). Regular prisms have a base that is a regular polygon.
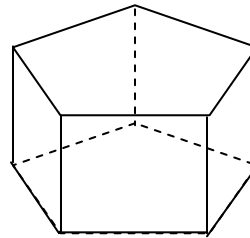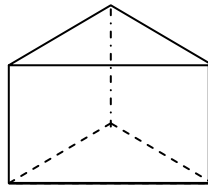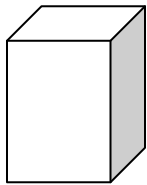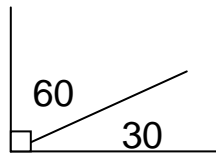
6. Supplementary Angles: angles that add to equal 180 deg
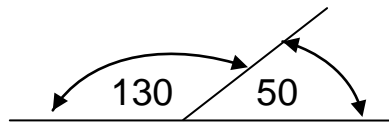
$$150 = 180$$

130   50
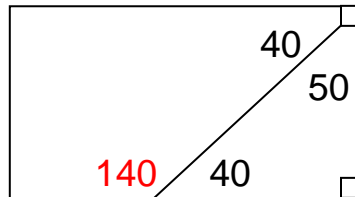
7. Complementary Angles: angles that add to equal 90.
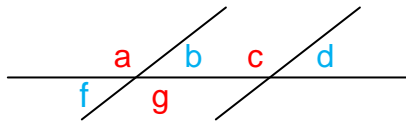
$$90 = 90$$

60
30

Using supplementary and complementary angles

40
50
140   40

All angles can be found by knowing only one of the angles
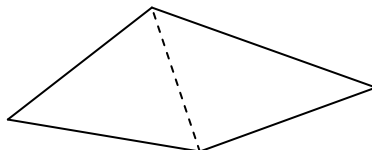
8. Bisector of parallel lines

a   b   c   d
f   g

a = c, b = d,   a + b = 180, a + f = 180 therefore a = g,

9. Quadrilaterals have 360 deg

You can draw a diagonal to form two triangles each of which have 180 deg, therefore the quadrilateral has 360.

10.

Strategies:

A is 15% more than B; B is 8000: find A
1) A is larger than B, or > 8000
2) A = B + 15% of B
3) You can take .15 (8000) then add that amount to 8000 or
4) You can take 1.15(8000), because A = 100% + 15% of B
5) To estimate 10%(8000)=800, 20%(8000)=1600, so answer is beteen 8800 and 9600

List in order smallest to largest: .003, .12,   .035, .105
1) Add zeros so all have the same number of digits
.003
.120
.035
.105
2) Now it is easier to see their comparative size
3) .003, .035, .105, .120

Compare fractions: $\frac{3}{8}, \frac{4}{9}$
1) You can make common denominators and compare
2) Or you can cross multiply 3*9, 4*8 → 27, 32… the larger number is the larger fraction

There are 30 students, there are 6 more female than male: how many male/females are there?
1) Subtract the excess female: 30–6=24, now there are equal male/female, so there are 12 m and 18f

ELM Criteria

NUMBERS AND DATA (approximately 35%)

- ✓ Carry out basic arithmetic calculations
- ✓ Understand and use percent in context
- ✓ Compare and order rational numbers expressed as fractions and/or decimals
- ✓ Solve problems involving fractions and/or decimals in context
- ✓ Interpret and use ratio and proportion in context
- ✓ Use estimation appropriately
- ✓ Evaluate the reasonableness of a solution to a problem
- ✓ Evaluate and estimate square roots
- ✓ Represent and understand data presented graphically (including pie charts, bar and line graphs, histograms, and other formats used in print and electronic media for presenting data visually)
- ✓ Calculate and understand the arithmetic mean
- ✓ Calculate and understand the median
- ✓ Make estimates and predictions based on data
- ✓ Distinguish between reasonable and unreasonable claims based on data

ALGEBRA (approximately 35%)

- ✓ Evaluate and interpret algebraic expressions
- ✓ Simplify algebraic expressions
- ✓ Express relationships among quantities using variables
- ✓ Use properties of exponents
- ✓ Perform polynomial arithmetic (add, subtract, multiply, divide, and factor)
- ✓ Perform arithmetic operations involving rational expressions
- ✓ Solve linear equations (with both numerical and literal coefficients)
- ✓ Solve systems of linear equations in two unknowns
- ✓ Solve linear inequalities
- ✓ Solve problems in context that are modeled by linear equations
- ✓ Solve quadratic and rational equations (with both numerical and literal coefficients; real solutions only)
- ✓ Solve problems in context that are modeled by quadratic equations
- ✓ Solve equations involving absolute value (in one variable)
- ✓ Solve inequalities involving absolute value (in one variable)
- ✓ Find and use slopes and intercepts of lines
- ✓ Use constant and average rates to solve problems in context (using appropriate units)

GEOMETRY (approximately 30%)

- ✓ Find the perimeter, area, or volume of geometric figures (including triangles, quadrilaterals, rectangular parallelepipeds, circles, cylinders, and combinations of these figures)
- ✓ Calculate the ratio of corresponding geometric measurements of similar figures (e.g., if the perimeters are in a 3:2 ratio, the areas are in a 9:4 ratio)
- ✓ Use the Pythagorean Theorem
- ✓ Use properties of congruent or similar geometric objects
- ✓ Solve geometric problems using the properties of basic geometric figures (including triangles, quadrilaterals, polygons, and circles)
- ✓ Determine angles in the plane (using properties of intersecting lines, parallel lines, and perpendicular lines)
- ✓ Identify and plot points on the number line
- ✓ Identify and plot points in the coordinate plane
- ✓ Plot points on the graph of a function determined by an algebraic expression
- ✓ Graph linear functions in one variable
- ✓ Graph quadratic functions in one variable
- ✓ Relate basic information about a function to features of its graph (e.g., linearity, positivity or negativity, increasing or decreasing)
- ✓ Find the length or midpoint of a line segment in the coordinate plane

Strategies:
1. **Test Taking**: there are a number of strategies to test taking, the below listed items may or may not be obvious.
    a. **Preparation**: on any test, preparation is the main element
        i.   With respect to the ELM there are sample tests available.
        ii. Test prep assistance is available in the CSUSM Math Lab
        iii. Successful completion of Math 51 at CSUSM is equivalent.
    b. Rest: get a good night's sleep before the exam
    c. Eat: taking a test on an empty stomach can be distracting
    d. Snack: taking nibble food with you can be helpful, it can help you relax.
    e. Skip the Question: If you cannot understand the problem, skip it and come back. Many times the answer will come when you are working another problem.

    f. Review: If you have time at the end, go back and review questions. I have saved many points by catching logic errors. If you have misread the problem, redo it.

2. Word Problems:
    a. Types
        i.   Reduced price
        ii. Comparing two numbers
        iii. Find a number between two numbers
        iv. Half/Double
        v.   Time problems
        vi. Average, Mean, Median
        vii.
3. Study Methods:
    a. Study in short segments, take mental breaks.
    b. Study the problems you do not know how to start. If you look at a problem and you know how to approach it, then move on… the rest is just math.
    c. Outline main ideas of each section.

       d. If you do an outline of each chapter, the final exam will be easier to study for. An outline can be just a few example problems.

       e. Pick a difficult problem representative of a chapter/section and write out the details of how you solved it… save them for review time.

Terminology:

Product	= the result of multiplication
Quotient	= the result of division
Sum	= the result of addition
Difference	= the result of subtraction
[Factor](#)	
Variable	= a letter that represents some value
Constant	= a number
Percent	=
Fraction	= has a numerator, a fraction bar, and a denominator
Numerator	= the top number of a fraction
Denominator	= the bottom number of a fraction
Ratio	= the comparison of two numbers
Rational polynomial	= a polynomial in the form
Nomial	= another word for term
Monomial	= one term
Binomial	= two terms, separated by a + or −
Polynomial	= three or more terms
Common denominator	= the product of two denominators
Angle	= the value in degrees of two rays
Side	= the linear distance of an angle or geometric shape
Area	= measured in square units: ft^2, cm^2
Volume	= measured in cubic units: ft^3, cm^3
Domain	= the valid values of x in an expression/equation
Range	= the values of y in an equation
Intercepts	= the point at which a line crosses the x/y axis
Exponents	= small raised number that indicates the number of times a value is multiplied times itself
Term	=
Circumference	
Pi	

Radius
Diameter
Inequality
Equality
Equation
Expression
Absolute value
Prime numbers
Composite
Divisor
Divide