STUDY GUIDE
FOR
MATH ADVISING TOOL(MAT)
MATH 1301-MATHEMATICS FOR THE LIBERAL ARTS

1. **Plotting and reading ordered pairs on a graph**

2. **Reading bar graphs and line graphs**

3. **Conversions of fractions, decimals, percentages**

4. **Relationship between different decimals and fractions**

5. **Rules for order of operations**
   - parenthesis, exponents, multiplication and division from left to right, then addition and subtraction

6. **Algebra (solving basic equations)**
   -You will need to review the rules for adding, subtracting, multiplying, and dividing positive and negative numbers

7. **Probability**
   -What is the probability of randomly selecting a specific object from a group of objects?

8. **Number line**
   -finding and placing numbers on a number line

9. **Word problems**
   - using mathematical operations to solve word problems
   -solving with equations

10. **Ratios**
    - writing fractional notations; solving by cross multiplication
    -using unit ratios to solve for miles or hours

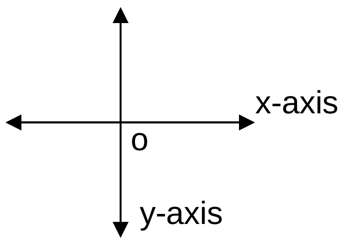
11. **Geometry**
    - volume of a rectangular box (finding length, width, and height when given a value for volume)
    -perimeter of a rectangle (finding length and width when given value for perimeter)

12. **Exponents**
    -adding, subtracting, multiplying, and dividing

13. **Finding approximate values of a number**
    -finding approximate values of rounding

14. **Averaging numbers**

1. Plotting and reading ordered pairs on a graph



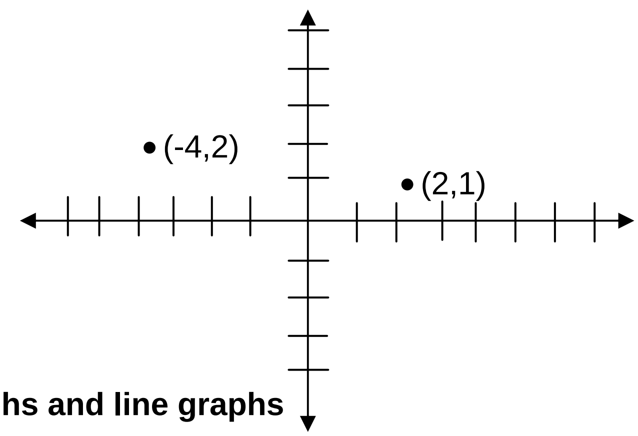
{o = the origin or the point whose coordinates are (0,0)}

All points on the graph are in the form (x, y) where “x” is the distance from the origin to the right or left along the axis.

If the point is to the right of the y-axis “x” is positive. If the point is to the left of the y-axis, then “x” is negative.

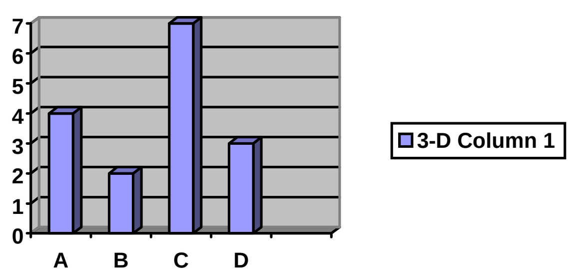
“y” is the distance from the origin up or down along the y-axis. If the point is above the x-axis “y” is positive, but if the point is below the x-axis then “y” is negative.

<u>Examples:</u>



2. Reading bar graphs and line graphs

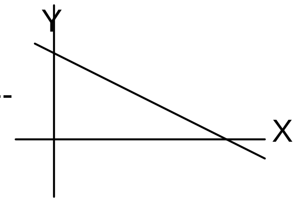
Bar Graphs:



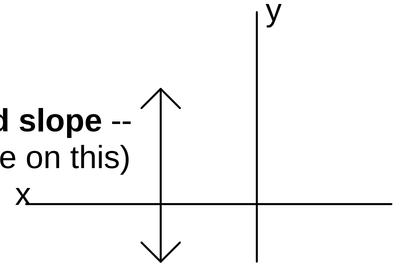
There are: 4 A items
2 B items
7 C items
3 D items

Line Graphs:

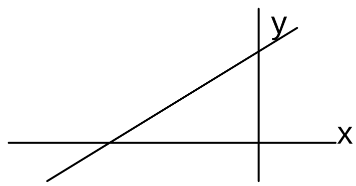
Negative slope --
(car decelerates)



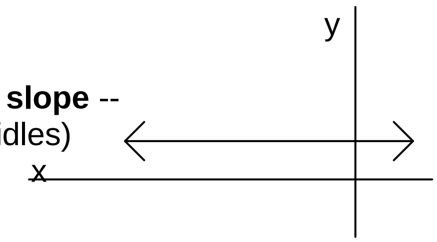
Undefined slope --
(car cannot drive on this)



Positive slope --
(car accelerates)



Zero slope --
(car idles)



3. Conversions of fractions, decimals, and percentage

Fraction → Decimal

Divide

$\frac{1}{3} = 3\overline{)1} \rightarrow \begin{array}{r} .333 \\ 3\overline{)1.000} \end{array}$ (divide numerator by denominator)

Decimal → Fraction

-eliminate the decimal point by dividing the non-decimal number by 10, 100, 1000, etc. depending on the place of the last digit to the right

For example,

.21= twenty-one hundredths = $\frac{21}{100}$

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

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

5.31 = five hundred thirty-one hundredths = $\frac{531}{100}$

Decimal $\rightarrow$ Percent

-multiply by 100(i.e. move the decimal point two places to the right then affix a % sign)

.5 = 50%
.05 = 5%

HELPFUL HINT: Think about the alphabetical order of D and P. To change from D(decimal) to P(percent) move the point to the right. To change from P(percent) to D(decimal) move to the left.

Percent $\rightarrow$ Decimal

-divide by 100(or move the decimal two places to the left and remove the % sign)

50% = .50
21% = .21

4. Relationship between different decimals and fractions.

Example:

Which is larger? $\frac{1}{2} or \frac{1}{3}?$

There are three methods for determining which fraction is larger:

convert to decimal(from previous section)

$\frac{1}{2} = .5$ and has a 5 in the <u>tenths place.</u>

$\frac{1}{3} = .33\bar{3}$ and has a 3 in the <u>tenths place.</u>

Therefore,

.5>.333 since 5>3, then $\frac{1}{2} > \frac{1}{3}$

find a common denominator to determine which is larger

$\left(\frac{1}{2}\right) \bullet \left(\frac{3}{3}\right) = \frac{3}{6}$ $\left(\frac{1}{3}\right) \bullet \left(\frac{2}{2}\right) = \frac{2}{6}$

$$\frac{3}{6} > \frac{2}{6} \Rightarrow \frac{1}{2} > \frac{1}{3}$$

compare cross products

Which is larger $\frac{3}{5} or \frac{5}{7}$?

21 25

$\frac{3}{5}$ $\frac{5}{7}$ $7 \bullet 3 = 21$ $5 \bullet 5 = 25$

since $21 < 25, then \frac{3}{5} < \frac{5}{7}$

5. Rules for order of operations

Start with:

1. Parenthesis
2. Exponents
3. Multiplication and division from left to right
4. Addition and subtraction from left to right

A good way to remember this order is with the sentence-

Please Excuse My Dear Aunt Sally

Parenthesis Exponents Multiplication Division Addition Subtraction

Example:

$3(4 \bullet 2 + 3) - 10 \div 2 - 5$

Step 1: Do everything in the parenthesis

$(4 \bullet 2 + 3)$

Multiplication comes before addition

$4 \bullet 2 = 8$ $8 + 3 = 11$

Step 2: Mult/Div comes before add/sub.

Go from left to right.

$3(11) = 33$

$10 \div 2 = 5$

$33 - 5 - 5$

Step 3: Now add/sub from left to right

$33 - 5 = 28$

$28 - 5 = 23$

The answer is **23.**

6. Algebra(solving basic equations for a variable)

-add and subtract the constant numbers until the variable is on one side and the constant numbers are on the other side. Then divide by the variable's coefficient. *The coefficient is the constant number that stands beside the variable.*

Example:

$$3x+2=x+10$$

Step 1: $3x-x+2=x-x+10$

$$2x+2=10$$

Step 2: $2x+2-2=10-2$

$$2x=8$$

Step 3: $\left(\frac{2x}{2}\right)=\frac{8}{2}$ In this example, the coefficient is the number 2. It is multiplied by the variable, "x". You want to find the value of one "x" so you divide both sides by two.

Step 4: x = 4

7. Probability

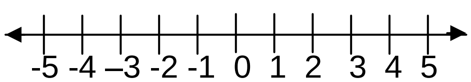
The probability of drawing a blue ball out of a bag that has 2 red, 3 yellow, and 2 blue marbles in it is: $P(Blue)=\frac{part}{whole}$

The total number of marbles in the bag: 7 marbles

The total number of chances to draw a blue marble is 2 because there are 2 blue marbles.

Therefore, the probability of drawing a blue marble is $\frac{2}{7}$ which is expressed as two out of seven.

8. Number Line



9. Word Problems

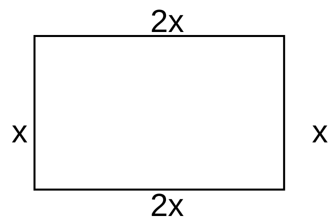
Read the information you are given. It helps to label your unknown as "x". If you have two unknowns then you might consider labeling the smaller of the two items compared as "x".
For instance:

Farmer Joe is building a fence to keep his pigs in. He wants to make the length twice as large as the width for the best comfort of his little friends. He has 42 yd of fencing that he plans to use. What are the dimensions of the fence for his pigs?

First, what is going to be smaller: the length or the width? – the width, because the length is twice as large as the width. So label width "x".

If
Width = x
Then
Length = 2x
Perimeter = distance around

When the problem suggests a geometric figure, make and label a drawing.



HELPFUL HINT: *Think about walking around the perimeter of the building. Where did you walk? If you wanted to know the perimeter of the building, you would add all the sides.*

P = sum of sides

$42 = 2x + x + 2x + x$

$\frac{42}{6} = \frac{6x}{6}$

$x = 7$

Therefore,

x = width = 7
2x = length = 14

10. Ratios

Solve using cross multiplication.

When two fractions are equal, their cross products are equal. For example,

$\frac{2}{3} = \frac{4}{6}$ because 2 • 6 = 3 • 4 = 12

The rule is: If $\frac{a}{b} = \frac{c}{d}$ then $a \bullet d = b \bullet c$

Ratios are unit fractions. An equation of ratios is a proportion.

Proportions are set up according to things that are similar.

For example,

If there are 3 feet in every 1 yard, how many feet are in 36 yards?

$\frac{3ft}{1yd} = \frac{xft}{36yd}$

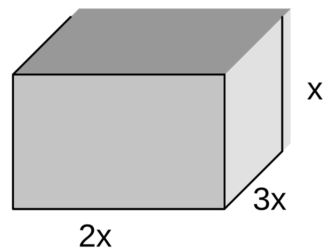
Now you would use the cross multiplication to get…

$$\frac{3}{1} \times \frac{x}{36}$$

$3 \bullet (36) = x$
$x = 108$ft

11. Geometry
For a rectangular prism(example- cracker box)
Volume = length • width • height
Suppose the volume of the box is 162ml, the length is 2 times the height, and the width is 3 times the height. Find the dimensions of the box.
Choose variables (x is smallest)

Figure 2.



For instance,
L = 2x
W = 3x
h = x
V = 162ml
(As seen in Figure 2.)

Draw and label the box. Then fill in the formula, V = L • W • h with the label information. Solve for x.

$162 = (2x) \bullet (3x) \bullet (x)$

$162 = 6x^3$

$\frac{162}{6} = \frac{6x^3}{6}$

$27 = x^3$

What number cubed will give you 27? A number when “cubed” is used as a factor or multiplier three times.
Use trial and error to find the correct number.

$2^3 = 2 \bullet 2 \bullet 2 = 8$ (no) Try another…
$3^3 = 3 \bullet 3 \bullet 3 = 27$ (yes)

x = 3mL Which means:
H = 3*mL*
L = 2x or 2(3) = 6*mL*
W=3x or 3(3) = 9*mL*
This gives the length, width, and height which are the dimensions of the box.

Perimeter = (2 $\bullet$ length) + (2 $\bullet$ width) This is the distance around a rectangle.

Perimeter = 36ft

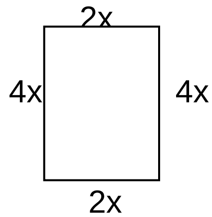


Figure 3.

Therefore, if

Perimeter = 36ft

Length = 2x

Width = 4x

(As seen in Figure 3.)

Then

$36 = (2 \cdot 2x) + (2 \cdot 4x)$

$36 = 4x + 8x$

$36 = 12x$

$x = 3ft$

Now we know that

Length = $2 \bullet 3 = 6\,ft$

Width = $4 \bullet 3 = 12\,ft$

12. Exponents

(Exponents tell how many times the base is a factor or multiplier.)

Exponents are sometimes powers. 3^5 can be called 3 to the power 5.

-If two bases are the same and are being multiplied together then you add the exponents to find how many times the base is a factor.

$3^5 = 3 \bullet 3 \bullet 3 \bullet 3 \bullet 3$

For instance,

$$x^1 \bullet x^1 = x^2$$

$$x^3 \bullet x^5 = (x \bullet x \bullet x) \bullet (x \bullet x \bullet x \bullet x \bullet x) = x^8$$

-If dividing these same variables then exponents are subtracted.

$$\frac{x^9}{x^6} = x^3 \qquad \frac{(x \bullet x \bullet x \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x})}{(\cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x} \bullet \cancel{x})} = x^3$$

-If you raise a number to an exponent that is raised to an exponent, then you multiply the exponents.

$$(x^2)^3 = (x \cdot x \cdot x)^2 = (x \cdot x \cdot x)(x \cdot x \cdot x) = x \cdot x \cdot x \cdot x \cdot x \cdot x = x^6$$

-If you are taking a root then you divide the exponents.

$(\sqrt[n]{a})^m = \sqrt[n]{a^m} = a^{\frac{m}{n}}$ $\qquad (\sqrt[3]{x})^{12} = \sqrt[3]{x^{12}} = x^{\frac{12}{3}} = x^4$ Remember: a fractional exponent means $\frac{power}{root}$ $\qquad [8^{\frac{2}{3}} = (\sqrt[3]{8})^2]$

13. Finding approximate values of a number

For example,

Find the largest whole number whose cube is less than 200.

Use trial and error.

Guess: 10

$10 \times 10 \times 10 = 1000$ (no)

Guess lower: 5

$5 \times 5 \times 5 = 125$ (yes, this number works—but check a number higher than 5)

Guess higher: 8

$8 \times 8 \times 8 = 512$ (no)

Guess lower: 6

$6 \times 6 \times 6 = 216$ (no)

Our answer is 5 because it is the largest whole number whose cube is less than 200.

Rounding

-If you are rounding a given number to the nearest place value, then the decision number is found in the place to the right of the place to where you are rounding.

-If the decision number is a 5 or higher, then round the given number up to the next number (add one to it).

-If the decision number is less than five then the given number stays the same.

For example,

Round to the nearest:

Thousandth $\quad 15.00\underline{2}6 \approx 15.003$ (given number "2" underlined; decision number "6" is greater than or equal to 5)

One $\quad \underline{6}.7 \approx 7$ (round up because $7 \geq 5$)

Tenth $\quad 5.\underline{5}2 \approx 5.5$ (the number in the tenths place stays the same because $2 < 5$)

Hundredth $\quad 1.0\underline{0}1 \approx 1.00$ (then number in the hundredths place stays the same because $1 < 5$)

14. Averaging(finding the mean)

1. Add the numbers together(find their sum)
2. Divide by the number of numbers you added.

For instance,

$$\begin{array}{r} 3 \\ 2 \\ 5 \\ 1 \\ 9 \\ 2 \\ 8 \\ \underline{+2} \\ 32 \end{array}$$

The sum of the numbers is 32 and
There 8 numbers being added, so...
$32 \div 8 = 4$, therefore the average or mean is 4.