MATH 0031

END OF YEAR PROJECT
Due: December 1st

You may work with two other members of class on this Project. If you need help use me or the TA. During the week of $11/25 - 11/29$, please bring this to lab and work on it during the specific time the TA instructs you.

Problem A
Expand and simplify each of the following expressions so that there are no negative exponents.

i) $6x^5y^{-2} \quad -4x^2y^3$

ii) $\dfrac{9a^{x-2}}{3a^{2x+2}}$

iii) $\left(\dfrac{2x^3y^{-2}}{3y^{-3}}\right)^{-4}$

iv) $\dfrac{4.2\times10^{27}\left[2.5\times10^{-5} \div 5.0\times10^{-9}\right]}{3.0\times10^8}$

v) $\left(x+\dfrac{1}{3}\right)\left(6x^3-12x^2-5x+\dfrac{1}{3}\right)$

vi) $a+b \quad a-b$

vii) $(R-2)(R^2+2R+4)$

viii) $\dfrac{3^{T+3}\left[(-3)^2 3^T\right]}{3\cdot3^{T+4}}$

Problem B
Answer each of the following questions in scientific notation.

i) A pound of $5 bills is worth $2270. How much is a ton worth? How much is a single $5 bill worth?

ii) According to the April 1996 edition of *Harper's Magazine* there are an average of 79,000,000 bacteria living in each drop of mud in the United States. Using the fact that 1 teaspoon = 6 drops and 6 teaspoons = 1 ounce, determine the average number of bacteria in the average ton of mud in the United States.
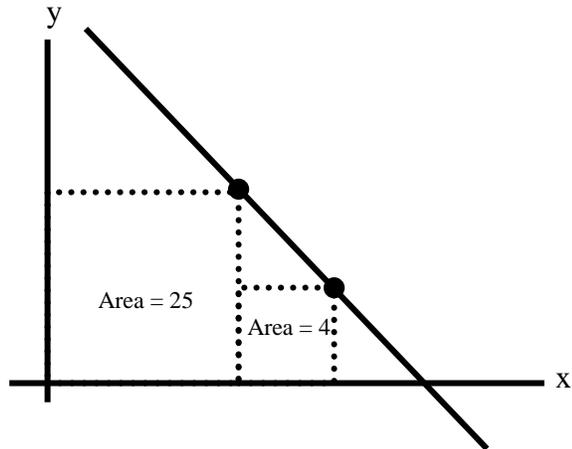
Problem C
Temperature can be measured using either degrees Fahrenheit (°F) or degrees Celsius (°C). These two measures are related linearly. Water boils at 100°C or 212°F and freezes at 0°C or 32°F.

i) Determine a formula for the Fahrenheit temperature (F) as a function of the Celsius temperature (C).

ii) Find and interpret the practical meaning of the slope of your linear function.

iii) Find and interpret the practical meaning of all intercepts of the linear function.

iv) What Fahrenheit temperature corresponds to 20°C?

v) What Celsius temperature corresponds to 20°F?

vi)   Is there any temperature at which the Celsius measure and the Fahrenheit measure are equivalent?

Problem D

Determine an equation of the line drawn on the right. The shapes under the line are squares.

y

Area = 25

Area = 4

x

Problem E

1. The director of a karate school charges each student $275 per MONTH tuition. (Assume all students remain students for the entire year.) She must also pay four types of costs for running the school:

    i)   the school's two karate instructors are paid a $1650 per MONTH salary each

    ii)   it costs $2150 per MONTH to lease the building where the school is located

    iii)   utilities run $195 per WEEK

    iv) $40 ANNUAL miscellaneous expenditures per student

a) Using this information, determine a formula for the school's ANNUAL COSTS, C, as a function of x, the number of students enrolled in the school for the year.

b) Using this information, determine a formula for the school's ANNUAL REVENUE, R, as a function of x, the number of students enrolled in the school for the year.

c) Using this information, determine a formula for the school's ANNUAL PROFIT, π, as a function of x, the number of students enrolled in the karate school for the year.

d) Interpret the practical meaning of the slope and the vertical intercept of the profit function found in part (c). (Hint: If your profit function isn't linear, then you must have made a mistake somewhere.)

e) What is the minimum number of students the school must enroll each year to remain in the black?

Problem F

Generally, the more fertilizer that is used, the better the yield of a crop. However, if too much fertilizer is applied, the crops become poisoned, and the yield goes down rapidly.

Sketch a possible graph of crop yield as a function of the amount of fertilizer used.

Problem G

The number of sections of Economics 101 offered at a local university depends on the number of students who register for the course. The following table gives the relationship.

Number of students, s	50	75	100	125	150	175	200
Number of sections, N	4	4	5	5	6	6	7

Assume that if s is a value between those listed in the table, then N will be the higher number of sections.

i)   Is N a function of s?

ii)   Is s a function of N?

iii)   Evaluate each of the following, and then interpret their practical meanings.

   1. N(150)   2. N(80)   3. N(3.5)

iv)   Evaluate each of the following for all possible values of s, and then interpret their practical meanings.

   1. N(s) = 4   2. N(s) = N(125)