

## MATH 092

### 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)  $6x^5y^{-2} - 4x^2y^3$       ii)  $\frac{9a^{x-2}}{3a^{2x+2}}$       iii)  $\left(\frac{2x^3y^{-2}}{3y^{-3}}\right)^{-4}$
- iv)  $\frac{4.2 \times 10^{27} \left[ 2.5 \times 10^{-5} \div 5.0 \times 10^{-9} \right]}{3.0 \times 10^8}$       v)  $\left(x + \frac{1}{3}\right) \left(6x^3 - 12x^2 - 5x + \frac{1}{3}\right)$
- vi)  $a+b - a-b$       vii)  $(R-2)(R^2+2R+4)$       viii)  $\frac{3^{T+3} \left[ (-3)^2 3^T \right]}{3 \cdot 3^{T+4}}$

#### 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

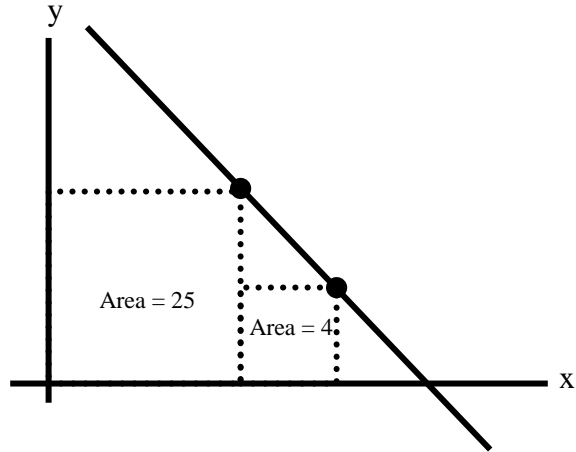
Temperature can be measured using either degrees Fahrenheit ( $^{\circ}\text{F}$ ) or degrees Celsius ( $^{\circ}\text{C}$ ). These two measures are related linearly. Water boils at  $100^{\circ}\text{C}$  or  $212^{\circ}\text{F}$  and freezes at  $0^{\circ}\text{C}$  or  $32^{\circ}\text{F}$ .

- 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  $20^{\circ}\text{C}$ ?
- v) What Celsius temperature corresponds to  $20^{\circ}\text{F}$ ?

- 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.



**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,  $\pi$ , 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.  $N(s) = N(125)$