

## Math4020 Problem Set 1

Due date: \_\_\_\_\_

Please attach the appropriate cover sheet to your assignment when you turn it in. Remember that it must be stapled and also that you cannot turn this in late! **To get full credit, you must have neat work, show all your work and circle or box all answers!**

- (20 points) List the capital letters of the alphabet which have the indicated symmetry and make the longest word you can using that set of letters.
  - vertical reflection symmetry
  - horizontal reflection symmetry
  - rotational symmetry
- (10 points) Place all letters of the alphabet in a Venn Diagram letting L be the set of all letters (the universal set), V the set of those letters with vertical symmetry, H the set of those letters with horizontal symmetry and R the set of letters with rotational symmetry.
- From the book: (10 points each)
  - 12.1B #3, 5, 16 page 582 #3
  - 12.2B #6, 8, 12 page 594 #2
  - 12.3B #4, 8, 9 page 606 #2
  - Chapter 12 Review (Section 12.3) page 634 #2
- Reflection Question: (**Must be typed.**) (20 points) What misconceptions were cleared up for you with your new knowledge of quadrilaterals? What new vocabulary terms did you learn in this chapter? What were the easiest and hardest concepts for you to learn? What do you think that tells you about your learning style?

### Extra Credit:

For a bonus 15 points, you can choose to do the following fun.

Go to the website

<http://www.c3.lanl.gov/mega-math/workbk/map/mppoor.html>

- Read the story of The Young Map Colorer.
- Read the "A Television Story" and answer the question: What does the problem in this story have in common with the map coloring problem?
- Print out all four town maps and color them according to what you learned in your reading.
- Click on the Next Activity link (at the bottom of the page), read the information about making a 2-color map. Then, create and color your own 2-color map.

This is a fun and simple math activity that young kids really enjoy. The 4-color map coloring theorem was only recently proved mathematically, although it's been used by map colorers for a very long time.

## Math4020 Problem Set 2

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*I. Based on the book "Spaghetti and Meatballs for All" read in class, do the following problems.*

1. (10 points) If Mrs. Comfort had rented six tables but didn't know how many people were coming, show at least 10 different ways she could arrange them so that everyone sits at the same table. (Each table must share an entire side with another table and each person must have a space the length of one side of the small table to sit at, and someone must be at each "sittable" place.) Make sure you get arrangements that seat a varying number of people.

- For each arrangement, tell how many it will seat.
- Which arrangement seats the most?
- Which arrangement seats the least?

2. (10 points) If Mrs. Comfort instead orders 16 chairs because she knows exactly how many people are coming, show one way she can seat her guests at 7 tables, 8 tables, 9 tables, etc. up to 16 tables. Again, everyone must sit at the same table.

3. (10 points) What is the meaning of the above two problems, i.e. what is the lesson and conclusion from the questions above?

*II. Complete the following problems.*

4. (20 points) Make a page (following the instructions below) that illustrates what pi is and how it is used. (Note: This will go directly into your portfolio.)

- Find 15-20 circular objects around your home and measure the diameter and circumference of each circle.
- Make a two-column table to record all the data you've collected. List diameter first and circumference second.
- Place all those points (d, c) on a Cartesian coordinate system where the horizontal axis is the diameter and the vertical axis is the circumference.
- Find the best fit line and calculate the slope of the best fit line. What does the slope have to do with pi? Why?
- List some applications that need to use pi.

5. From the book: (10 points each)

- 12.4 B #3, 5, 7 page 617 #3
- 13.1 B #3, 4, 8, 17 page 658 #3
- 13.2 B #6(a-c), 9, 20, 34 page 679 #1
- Chapter 12 Test (page 637) #22

6. Reflection Question: (**Must be typed.**) (20 points) Discuss the dimensionality of perimeter vs. area for a two-dimensional figure. How could you explain to a child that area has square units and perimeter doesn't? Is there any way to measure something in a 2-d figure that is measured with cubed units? What is your prediction about what type of units will be used to measure three-dimensional objects?

### Math4020 Problem Set 3

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*I. Complete these exercises about Pythagoras and his famous theorem. (Note: This work can be put directly into your portfolio after this, if done neatly and well.)*

1. (10 points) Type a brief history of Pythagoras and his work. Include at least three interesting facts.
2. (10 points) Make a page of his famous theorem written in words, in symbols and illustrated geometrically.
3. (20 points) Present three different proofs (at least one algebraic). (You're welcome to look online for some interesting proofs, but your assignment must be written in your own words and it must be presented in a manner that clearly demonstrates your understanding of what you've written.)
4. (10 points) Create two word problems solved by the Pythagorean Theorem and then show how to solve them (stating the answers). Be sure each problem asks for a different part of the triangle.

*II. Complete the following problems.*

5. From the book: (10 points each—except 13.3 & 13.4 #1 and 2 are each worth 20 points)  
12.5 B #14, 16 page 631 #3  
13.3 B #1, 2, 8, 12, 13  
13.4 B #1, 2, 11, 15, 18, 25 Problems for Writing/Discussion page 704 #1
6. Reflection Question: (**Must be typed.**) Write a one to two page report on the insights you gained while doing your practicum observations. What did you see that you'd like to incorporate into your classroom some day? Why? What strategies did you see that didn't work so well? How would you improve them?

## Math4020 Problem Set 4

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- Use the “Data on Us” table to complete the following. Please show all of your work (neatly).
  - (20 points) For the variable *# hours study per week*, calculate the mean, median, mode, standard deviation, and the z-scores for each of the entries.
  - (10 points) Make a bar graph for the variable *favorite color*.
  - (10 points) Create a line plot for the *# of siblings*.
  - (10 points) Create a histogram for the *time it takes to get ready* times for the class.
  - (10 points) Make a circle graph (a.k.a. pie chart) for the *grade you want to teach*.
  - (10 points) Calculate the lower and upper quartile and then make a box and whisker plot for the \$ spent on fun per month.
  - (20 points) To investigate the possible relationship between the *height* and *shoe size* variables, make a scatter plot (with height on the vertical axis and length of middle finger on horizontal axis).
    - Are there any outliers? If so, label them.
    - Indicate whether there seems to be a correlation or not. If there is, then draw the line that seems a best fit.
    - If you drew a best fit line for part (ii), then find the equation of that line.
- (20 points) Suppose that the average teacher salary in a given state is \$34,000 with a standard deviation of \$2,700.
  - What percent of teachers will make more than \$39,000?
  - 68% of the teachers will have a salary on what interval centered about the mean?
  - 85% of the teachers have salaries below what amount?
  - What percent of teachers will make less than \$30,500?
- (10 points) Suppose there are four third-grade classes in your school containing 25, 28, 30, and 27 students. These classes have average test scores of 71, 79, 76, and 80, respectively. What is the overall third-grade average for this test?
- (10 points) Make up a set of data values (no more than ten values in each data set) to illustrate each of the following conditions, or explain why it is impossible.
  - A data set that satisfies  $\text{mean} < \text{median} < \text{mode}$ .
  - A data set that has a mean of 8.0 and the sum of the data values is 67.
  - A set of at least four values that has a mean of 20, but all the data values except one are greater than 20.
- (30 points) The object of sampling is to make predictions about large populations. Samples are small when compared to the size of the population. The following activity is designed to show how a sample can represent a given population.
  - Have a friend put one of the following three populations of M&Ms in a container without you knowing the numbers of the two colors of M&Ms. Don't look at the contents of the jar until you have completed all parts of this problem. (Note: You don't have to use M&Ms for this

activity. You can simply use different colored marbles, dice, paper clips, skittles, or any other things that are the same shape.)

- (i) Population 1: 25 red M&Ms, 5 green M&Ms
- (ii) Population 2: 20 red M&Ms, 10 green M&Ms
- (iii) Population 3: 10 red M&Ms, 20 green M&Ms

b. Draw an M&M from the container and check off its color in the following table. Return the M&M to the container and repeat this process. After every five draws, make a prediction as to which population you think is in the container.

Twenty five samples of M&Ms

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
R																									
G																									

- Predictions:
- After 5 draws \_\_\_\_\_
  - After 10 draws \_\_\_\_\_
  - After 15 draws \_\_\_\_\_
  - After 20 draws \_\_\_\_\_
  - After 25 draws \_\_\_\_\_

- c. Compute the percentage of red M&Ms in each of the following groups.
- (i) First 5 draws \_\_\_\_\_
  - (ii) First 10 draws \_\_\_\_\_
  - (iii) First 15 draws \_\_\_\_\_
  - (iv) First 20 draws \_\_\_\_\_
  - (v) All 25 draws \_\_\_\_\_

As the size of the sample increases, the likelihood that it represents the population becomes greater. Notice that your prediction most likely changed as you gathered more information. You can now finally look at the container to see if your prediction was correct...and also to eat the M&Ms. :)

6. From the book: (10 points each)

10.2 B #18, 19

Chapter 10 Review, Problems for Writing/Discussion (page 498) #10

7. Reflection Question: (**Must be typed.**) (10 points) Why is calculating and tabulating data important to teach children? Did you struggle with or had never heard of any of the types of data graphs? If so, how has your understanding and/or interest changed?

## Math4020 Problem Set 5

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- (40 points) You will do a probability experiment with coins, as follows.
    - Toss a coin four consecutive times, recording each toss. Repeat this process 100 times. Keep a tabular record of all the toss results, and turn that log in with this homework. (For example, your first 4 results might be TTTH, TTHT, HTHT, HHHT.) Compute the *experimental probability* of each of the following events (out of your 100 recorded results).
      - There are exactly 2 tails
      - There's an even number of tails
      - There are no tails at all
      - There is either exactly 1 head or exactly 4 heads
    - Write up the sample space for four coin tosses (either in a set/list form or in a tree— for theoretical probability). Compute the *theoretical probability* of the events A-D listed above.
    - Use Pascal's Triangle to determine the theoretical probability of events A-D listed above. (Note: If done correctly, your results for (b) and (c) should match.)
    - Make a table that compares the probabilities for events A-D. List your experimental probability in one column and the theoretical probability in another column. Discuss how the experimental probability compared to the theoretical probability for each event and what might account for the differences, if there are any.
  - (20 points) In a class of 33 people, 14 people have blue eyes (B), 12 people have blond hair (H) and 7 people have both blue eyes and blond hair.
    - Draw a Venn diagram representing this data.
    - Use the Venn diagram to help you determine the following probabilities.
      - $P(H \cup B)$
      - $P(H \cap B)$
      - $P(\overline{H \cup B})$
      - $P(\overline{H \cap B})$
  - From the book: (10 points each)
    - 11.1 B #2, 12, 14, 16
    - 11.2 B #7, 10, 17 page 534 #2
    - 11.3 B #6, 7, 16, 22 page 544 #1
    - 11.4 B #11, 16, 17
  - Reflection Question: (Must be typed.)** (10 points) What was the most difficult concept you learned in this chapter? Why was it so difficult? What was the easiest concept to learn? What made it easy for you? How has your understanding of probability changed from what we've covered in class?
- Extra Credit: (10 points) 11.2 B #20

## Math4020 Problem Set 6

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1. On the four congruent triangles (copied with this assignment), perform these constructions.
  - (a) (10 points) On one triangle, in red pen, construct the three angle bisectors. Label the center point I. Draw the inscribed circle with center I.
  - (b) (10 points) On the second triangle, in green pen, construct the three perpendicular bisectors. Label the center C. Draw the circumscribed circle with center C.
  - (c) (10 points) On the third triangle, in blue pen, construct the three altitudes (a.k.a. Heights). Label this center O.
  - (d) (10 points) On the fourth triangle, in purple pen, construct the three medians. Label the center G.
  - (e) (5 points) Name each of these centers.
    - I is called the \_\_\_\_\_
    - C is called the \_\_\_\_\_
    - O is called the \_\_\_\_\_
    - G is called the \_\_\_\_\_
  - (f) (5 points) Trace the triangle on patty paper and mark each of the four centers on that traced triangle.
  - (g) (10 points) Three of the above centers are collinear on a line segment called Euler's Line. Which three centers are collinear?
  - (h) (10 points) Draw Euler's line in black on your patty paper triangle. Find the ratio of lengths of the two pieces of the line segment, i.e. the bigger piece to the smaller piece.

2. From the book: (10 points each)
  - 14.1 B #4, 7 page 724 #2
  - 14.2 B #5, 11 page 736 #1
  - 14.3 B #7, 10 page 747 #3
  - 14.4 B #12 page 758 #3
  - 15.1 B #2, 3, 4, 13
  - 15.2 B #12, 20 page 802 #3

