DEPARTMENT OF MATHEMATICS
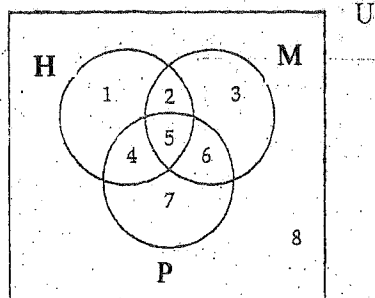### BROOKLYN COLLEGE

Name:_____

FINAL EXAMINATION – SPRING 2015
Mathematics 1401 (1.95)

INSTRUCTIONS: *Answer any TEN questions.* Each problem is worth 10 points.
For **problems #1-9**, *please write all your work and answers in the* **booklet**. *All work must be shown for full credit.*

1. (a) A teacher has 38 students. In a class survey, 22 students said they liked basketball, 17 students said they liked volleyball, and 6 students said they liked neither sport.
   Let U = {all students surveyed}, B = {students who liked basketball}, V = {students who liked volleyball}.

   (i) How many students liked at least one of the two sports?　　(ii) Find $n(\overline{B \cap V})$

   (b) Suppose U = {all Brooklyn College students},
   H = { students who take courses in history},
   M = {students who take courses in mathematics},
   and P={ students who take courses in psychology}.

   The regions of a Venn diagrams are labeled 1-8.

   (i) Describe the following sentence in **set notation** and indicate which **region (regions)** would represent the given set: *The set of all Brooklyn College students who take neither mathematics nor history.*
   (ii) Describe region 2 using set notation.

2. (a) Without converting to base ten, subtract the numbers in base TWELVE : $9T3_{twelve} - 24_{twelve}$
   (b) What base- four number is represented by the base-four blocks shown below?
   Hint: make all possible exchanges to obtain the smallest number of pieces.
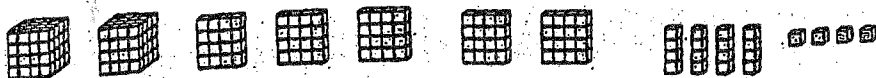
   (c) Convert 438 to a number in base THREE.
   (d) Find the next two numbers in the sequence: $11_{eight},\quad 22_{eight},\quad 44_{eight},\quad 77_{eight},\quad \dots$

3. (a) Convert the repeating decimal 0.405405405405... to a common fraction. Reduce your answer to lowest terms.
   (b) Find 6 rational numbers between $\frac{9}{13}$ and 0.7 . If you think that there aren't any, then write NONE.
   (c) 40 seconds is what fraction of an hour?
   (d) Write the number described in words as a reduced common fraction **and** as a percentage:
   twenty- four thousandths

4. Assume that the pattern continues for the following sequence of matchstick square figures.
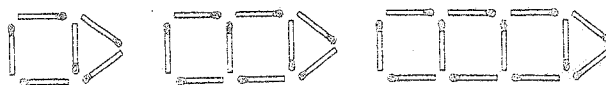
   (a) How many matchsticks are there in the 4th and the 5th figures?
   (b) How many matchsticks does it take to build the nth figure?
   (c) How many matchsticks will it take to build the 65th figure?
   (d) What is the **total** number of matchsticks that is needed for the first 65 figures? (Hint: use Gauss' method.)
   (e) Is there a figure in the sequence that is made up of exactly 591 matchsticks? If so, which one? If no, why not?

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5. (a) Two racing cars leave the starting line at the same time. One car completes a lap every 100 seconds, while the other completes a lap every 105 seconds.

    (i) How long will it take for the two cars to meet again at the starting line for the first time after the race begins? (Express your answer in **minutes**).

    (ii) At that point in time, how many laps will each car have completed?

(b) Let n = 418,230,745,680,429. **Without performing the actual division**, find two *prime* factors of **n**.

6. (a) (i) Maria poured $2\frac{1}{6}$ cups of water into a plastic container and noticed that the water filled one quarter of the container. How many cups of water will it take to fill the whole container?
(Give an **exact** answer using **common fractions or mixed numbers**).

    (ii) A recipe calls for $2\frac{1}{6}$ cups of flour. You want to make one quarter of the recipe. How many cups of flour should you use?
(Give an *exact* answer using *common fractions or mixed numbers*).

    (iii) Which of the two problems above can be solved by calculating $2\frac{1}{6} \div 4$?

(b) Find the Greatest Common Factor and The Least Common Multiple of the numbers 2537 and 989.

7. (a) A girl has $35\frac{5}{6}$ in. of cloth to make doll costumes. Each costume requires $3\frac{1}{8}$ in. of cloth.
    (i) How many costumes can she make?
    (ii) How much material will be left over? (Give an **exact** answer **in inches** using **common fractions or mixed numbers**).

(b) Place parentheses, if needed, to make the following statement true: $216 \div 24 \times 2 + 6 = 4$

8. (a) There are 11,250 students at Brooklyn College. About 1350 of them are in the Elementary Education program. Suppose one student will be picked at random and given a full scholarship. What is the probability that the winner will NOT be in the Elementary Education program? (Express your final answer as a percent).

(b) The salaries of the ten employees at a small business were:
    $10,000 $30,000 $30,000 $22,000 $24,000 $30,000 $24,000 $140,000 $12,000 $320,000
- Find the mean, median, and mode of the given salaries.
- Which measure is most appropriate for this set of data?

9. Answer TRUE or FALSE to the following statements. Give a brief **reason or a counterexample to** justify each answer.

(a) The sequence given below is *geometric*.
    7, 97, 997, 9997, 99997 ...

(b) Let K = {a, b, c, d, e} and L={1, 2, 3, 4, 5}. If *d* must correspond to 2 in each one-to-one correspondence, then there will be 120 one-to-one correspondences between the sets K and L.

(c) The number 851 is prime, because it is not divisible by 2, 3, 5, 7, and 11.

(d) $\frac{1}{6}$ *of* 7 = $7 \div 6$

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**For problems #10-11,** *PLEASE SHOW ALL YOUR WORK AND ANSWERS IN THE SPACES PROVIDED.*

10. In the figure on the right, assume that the distance between two adjacent dots in a row or a column is 1cm.

   (a) Is the figure *convex*?
   (b) Draw all lines of symmetry of the figure.
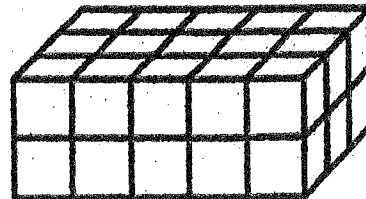   (c) Determine the area of the figure.
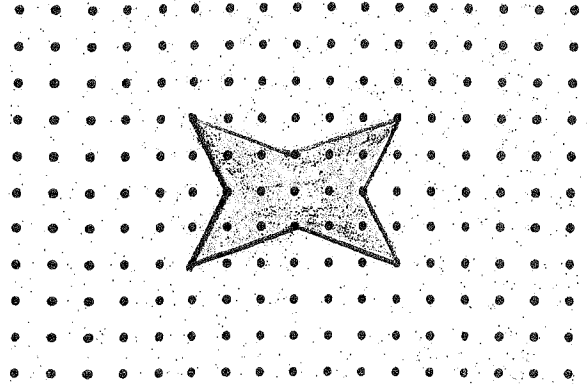
11. (a) A right triangular prism is drawn to the right.
   - How many faces, vertices, and edges does this solid have?
   - Which edges are parallel to CM?
   - Which edges are <u>skew</u> to CM?
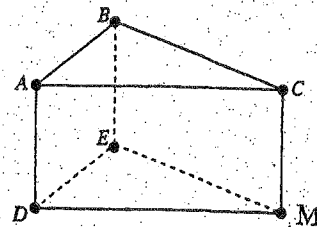
(b) The solid in the figure to the right is made out of identical cubes.
   Each cube has sides with a length of 1 cm.

Find the surface area of the solid .

Find the volume of the solid .