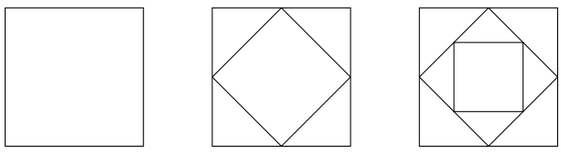
Math 123
Fall 2022
Dr. Lily Yen

Test 1

Show all your work

Name: _____
Number: _____
Signature: _____
Score: ___/35

Problem 1: Beginning with a square, Anjali draws another square by joining midpoints of each side to produce the second picture. Continuing in this pattern, she draws the third picture.



a. Draw the fourth picture in the sequence.

b. Count the total number of squares of all sizes in the fourth picture.

c. Count the total number of triangles of all sizes in the fourth picture.

d. Establish a formula $T(n)$ for the total number of triangles in the nth picture.

Score: /2

Problem 2: Signing up with Shaw Home Internet, Mei's family was given six free cell-phone numbers with unlimited domestic calls and texts. If their six numbers all have the same area code (778) and the same first three digits (843), how many different choices do they have to fill the last four digits? What if the last 4 digits must be distinct and also distinct from what's already used in the previous 6 spots?

Score: /2

Problem 3: Katharina organized a bag of Haribo's gummy bears according to colour. If Katharina had five times as many red gummy bears as blue ones, and the red and blue gummy bears together equalled the rest of the gummy bears, list all the possible total numbers of gummy bears organized by Katharina, starting with the smallest possible number.

Score: /2

Problem 4: Order the following 5 numerals in ascending order, that is, from smallest to largest. One mark is given for each correct conversion into Hindu-Arabic numeral.

a. 

b. 

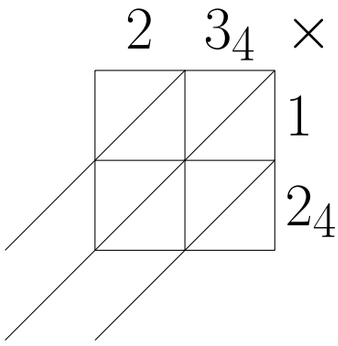
c. MMMCDLXIV

d. 

e. $D54_{16}$

Score: /6

Problem 5: Use the Galley Method to multiply $23_4 \times 12_4$ in base-4 leaving the answer in base-4.

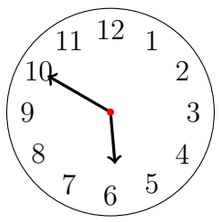


Score: /3

Problem 6: When Anjali went to a pumpkin patch with a group of international students, she noticed that when she organized all the pumpkins her group picked into rows of 5 or rows of 7 each, she had 3 left. However, when she organized them 6 in a row, she had 4 left. Find the smallest possible number of pumpkins satisfying the conditions of her arrangements.

Score: /3

Problem 7: Find the smaller angle formed by the hour and minute hands at ten to six on a twelve-hour analogue clock.

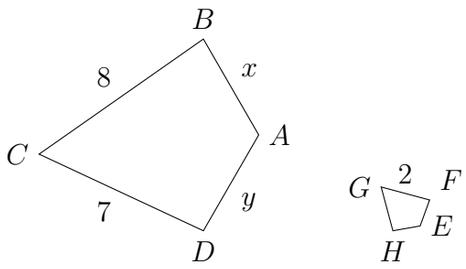


Score: /3

Problem 8: Take 4 ropes of equal length, each 12 units long: use the first to form an equilateral triangle; the second, a square; the third, a regular hexagon; the fourth, a circle. Note that each has the same perimeter of 12 units. Find the area of each shape **except the hexagon**. Conjecture which shape has the greatest area in this construction. Provide some rationale to your conjecture.

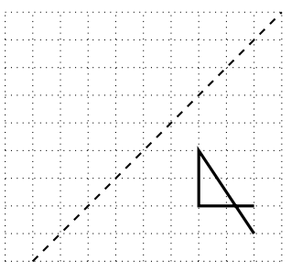
Score: /5

Problem 9: Given two similar quadrilaterals: quadrilateral $ABCD$ is similar to quadrilateral $EFGH$, find the values of x and y given that $\overline{FE} = 1/2$, and $\overline{HE} = 3/5$.



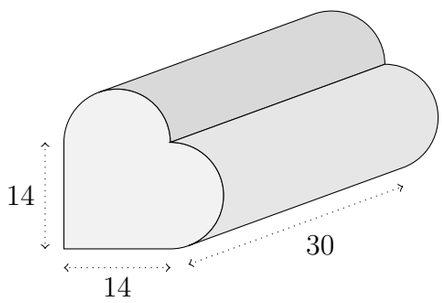
Score: /3

Problem 10: Reflect the given figure along the dashed line.



Score: /2

Problem 11: Find the volume and surface area of the heart shaped prism.



Score: /4