
If there is a problem you can't solve, then there is an easier problem you can solve: find it.

– George Polya

NYU Middle School C

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The NYMC Middle School C class covers challenging topics at the 8th grade level. Topics include geometry, number theory, combinatorics, and probability. The problems can be difficult, but hopefully they're also interesting and fun. Here are some sample problems.

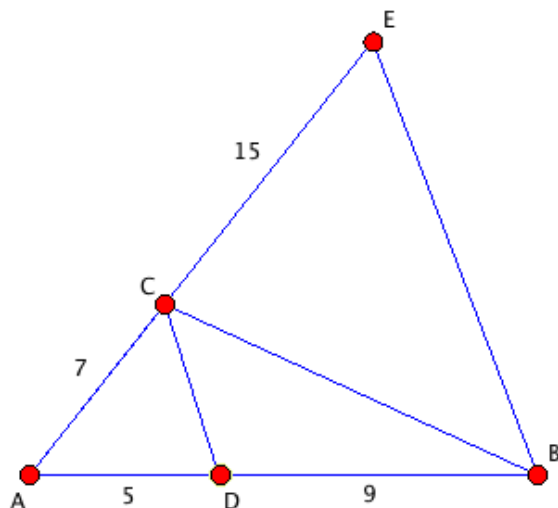
1. Problems that you ought to be able to solve before taking this class

- (a) Daisy has 5 pairs of shoes, 7 pairs of pants, and 10 shirts. How many days can she go before she has to wear the same outfit twice?
- (b) How many factors does 60 have?
- (c) An isosceles triangle has a base of length 6 inches. If the area of the triangle is 12 square inches, what is its perimeter?

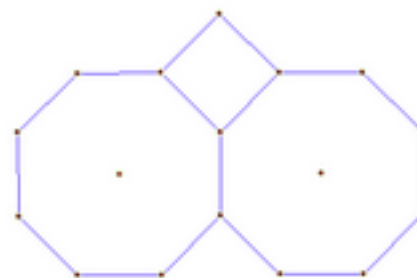
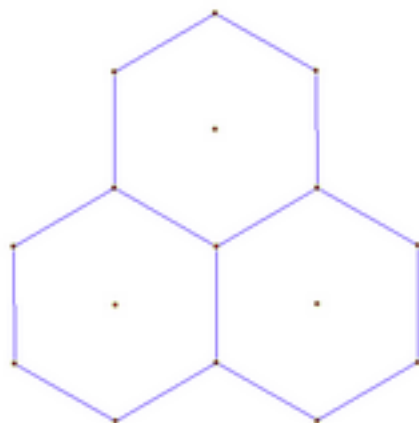
2. Examples of interesting problems that we'll consider in this class

- (a) A giant segmented tootsie roll is so enormous that you can only eat one or two segments at a time. How many ways are there to eat the tootsie roll if the tootsie roll is 12 segments long?
- (b) 10,000 people are lined up in a large room with 10,000 closed doors. The first person opens every door, and the second person then closes every second door. The third person changes every third door, opening it if it is closed and closing it if it is open. The fourth person changes every fourth door, and so on until the 10,000th person changes only the last door. After every person has opened or closed doors, how many doors are open?
- (c) Andy Ant is meant to meet his friend Adam Ant at 3:00 PM on the North East corner of the top of a block of cheese. However, it's already 3:10, and Andy has only now arrived at the South West corner of the bottom of the block of cheese. Fortunately, Andy is adept at crawling on vertical walls of cheese. If the cheese is 5 cm by 7 cm by 9 cm, and if Andy crawls at 2 centimeters per second, how quickly can Andy get to Adam?
- (d) How many factors of 1,000,000,000 are not multiples of 1,000?
- (e) What is the sum of all of the six digit numbers which can be made using the digit 1 once, the digit 2 twice, and the digit 3 three times?

- (f) In the following problem, the notation $[ABC]$ means the area of $\triangle ABC$.



- (g) What is the value of $\frac{[EBC]}{[ADC]}$?
- (h) It's possible to completely surround a point by fitting together three regular polygons. (All of the polygons have the same length sides.) Below are pictured two ways this can be done; three hexagons can be fit together and also two octagons and a square can be fit together. I refer to these configurations as 6,6,6, and 4,8,8, respectively.



- (i) Find all possible configurations of three regular polygons which can be fit together with no overlap and no empty space.