1. **(5)** Divide the nine containers into 3 equal groups. Pick any two groups and ***place*** one group on each side of the balance scale. There are two possibilities: the pans balance or the pans do not balance.

If the pans balance the light one is In the third group.

If the pans do not balance the light one is in the group on the light side of the balance.

Take the group of three with the light container. Choose any two and place them on the balance.
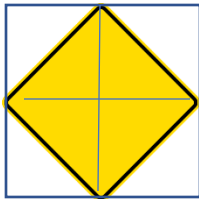
If the scale is balanced the light one if the third one.

If the scale is not balanced the light one is on the high side of the balance.

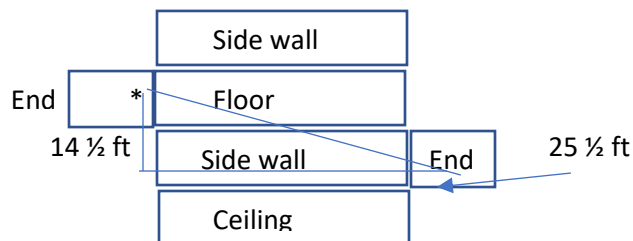2. (5) The old window is a diamond. The two windows look like this:
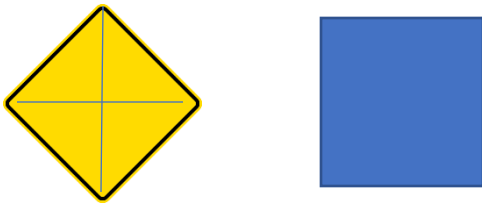
If we superimpose the two we can see that the first is exactly half of the second)

3. (8 – 5 for the path and 3 for the length)

 If you visualize the room as a net you see the spider utilizes three of the four walls plus both the floor and the ceiling. The path is app. 29 feet.)

Using the Pythagorean theorem we get $(14.5)^2 + (25.5)^2 = c^2$

(for partial credit – 4 pts) The spider could move straight down to the floor (1/2 ft), straight across the floor to a point directly beneath the fly (20 ft), and then up the wall to the fly (9 ½ ft) traveling a total of 30 ft.   or other scenarios also equaling 30 ft.

4. (6 pts – 2 answer; 4 explanation)

    82 toothpicks

    It takes 4 + (6 x 3) = 22 toothpicks to build a 1 x 7 grid. Each new row requires 3 + (6 x 2) = 15 new toothpicks. Since we need four more rows, we need 4 x 15 = 60 more for a total of 82.
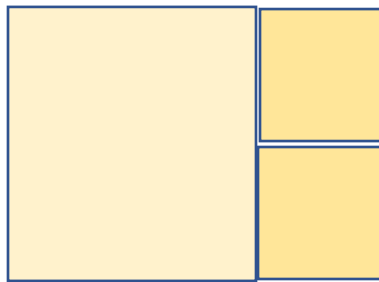
    Or, another pattern description.

5. (6 – 2 answer; 4 process)
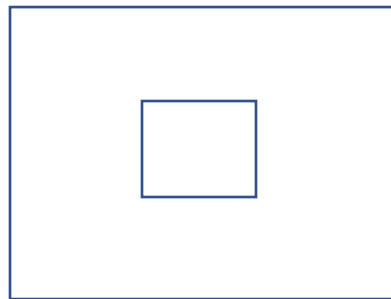
There are 85 squares.

There are 5 x 7 = 35 unit squares; 4 x 6 = 24 squares of size 2 x 2; 3 x 5 = 15 squares 3 x 3; 2 x 4 = 8 squares of size 4 x 4, and finally 1 x 3 = 3 squares of size 5 x 5 for a total of 85.
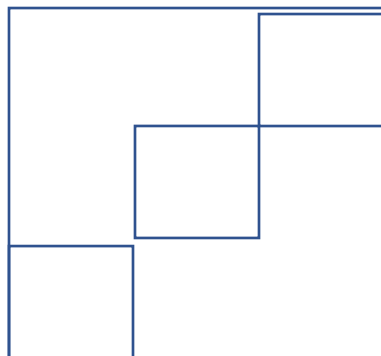
6. (5 pts) There are several possible solutions. Here is an example (not in proportion they should be squares)

7. (5 pts)

8. (5)

9.

   a)   (6 – 2 answer; 4 explanation) Is Gilbert right? How do you know?

   No Gilbert is not correct

   Layers Calculation Result Percent

   1 1*(0.80) 0.80*100 80%

   2 1*(0.80) *(0.80) 0.64*100 64%

   3 1*(0.80) *(0.80) *(0.80) 0.512*100 51%

   4 1*(0.80) *(0.80) *(0.80)*(0.80) 0.4096*100 41%

   Gilbert is not correct that four layers of film will absorb 80% of the incoming light. Since 41% of
   the light passes through, only 100 - 41 or 59% of the light has been absorbed by four layers of
   film.

   b)   (2 pts) Write a formula that will calculate the percentage of light that will pass through n
        layers of filter film.

   $$L = (0.80)^n \cdot 100$$

Where n is the layers of film and L is the percentage of light that will pass through.

(Looking at the results of question 1, I can see that I need to multiply as many 80%'s, or 0.80's, as
there are layers of film. That suggests that for n layers of film I would need to multiply by 0.80 n
times, which I can write using an exponent. Then I need to multiply that decimal result by 100 to
turn it into a percent)

10. (24 – 1 pt. per correct match)

Situation	Graph (G cards)	Formula (A cards)
A. Plumber	G2	A3
B. Cycling	G10	A4
C. Movie subscription	None or G3 or G4	A1
D. Internet café	G7	A2
E. Cooling kettle	G9	A11
F. Ferris wheel	G11	A10
G. Folding paper	None or G3 or G4	A12
H. Speed of golf shot	G8	A7
I. Test drive	G1	A5
J. Balloon	G6	A6
K. Height of golf shot	G5	A9
L. Film projector	G12	A8

11. (6 – 2 pts, answer; 4 for explanation)

Let's use A, B, C and D to represent Ailee, Bailey, Camie and Demi, respectively. Starting with the fact that Bailey is older than Demi and younger than Camie, the possible arrangements of the girls from youngest to oldest are DBCA, DBAC, DABC and ADBC. Since Ailee is a year older than Demi, the correct arrangement must be DABC, which means that Ailee is 15 years old.

(6 – 2 answer; 4 explanation)

Since Ailee participates in an activity that does not utilize a ball, she must be a cheerleader. We also are told that neither Bailey nor Demi plays softball. Therefore, Camie must be the one who plays softball. That leaves field hockey and basketball as the possible activities for Bailey. But since Bailey participates in activity that typically takes place indoors and field hockey is an outdoor activity, Bailey must play basketball.

(6 – 2 answer; 4 explanation)

Since Demi's room number is prime, she must be assigned to room 101 or 103. We also see that Demi must be assigned to an adjoining room with either Bailey or Camie. If Demi is in an adjoining room with Camie, that leaves Ailee and Bailey in adjoining rooms. But we are told that there is one room between Ailee and Bailey, so Demi must be in an adjoining room with Bailey. That means the room assignments could be 101-Demi, 102-Bailey, 103-Camie, 104-Ailee; or 101-Camie, 102-Ailee, 103-Demi, 104-Bailey. In either case, the sum of Camie's and Demi's assigned room numbers is $101 + 103 = 204$.