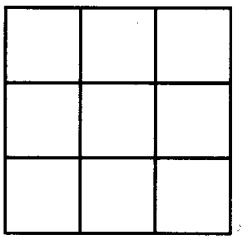
This exam has 5 questions, for a total of 100 points.

Write your answers in the Blue Book. Print your names & write the number of students taking this test in the upper right corner of the Blue Book. Put the test and the Blue Book in the provided envelope.

1. (20 points) Place the numbers $1, 2, 3, 4, 5, 6, 7, 8, 9$ in the grid like the one below, such that the number in the middle is the average of the 2 outside numbers. Do this for each row, column and diagonal.



2. In the year 2104, humans live on the planet Mars, where it gets very cold. In fact, UC has a branch campus there, UC on Mars or U$\mathfrak{C}$M. Of course, the UC on Earth or U$\mathfrak{C}$E is still in Cincinnati, OH. Emily goes to U$\mathfrak{C}$E and her friend Maria goes to U$\mathfrak{C}$M . They like to talk about the temperature outside, but in Cincinnati the Fahrenheit system is still used; however, on Mars the Celsius system is used. Recall that water boils at 100 degrees and freezes at 0 degrees in the Celsius system. In the Fahrenheit system, water boils at 212 degrees and freezes at 32 degrees.

   (a) (5 points) Find a formula that converts Fahrenheit to Celsius.

   The scientific system is the kelvin scale, the formula for converting Celsius to kelvins is

$$K =^{\circ} C + 273.16$$

   The kelvin system is an absolute scale and 0 kelvins is the hypothetical temperature where there is a complete absence of heat energy.

   (b) (5 points) Find a formula that converts degrees Fahrenheit to kelvins.

   (c) (10 points) Last winter there were times it was 0°F at U$\mathfrak{C}$E and Emily thought that was very cold, but her friend Maria who lives on Mars said that it was three as cold at U$\mathfrak{C}$M. Ed said it must be the same temperature since $-3 \times 0 = 0$. Emily, who is a math major, did some computing with kelvins and she told Maria that she was wrong. How does Emily know Maria is wrong?

3. A certain magic plant called the $2X$-plant doubles in height each day. On day one, it is 2 inch tall, on day 2, it is 4 inches tall, on day 3, it is 8 inches tall and so on. It is called the $2X$-plant because every day it doubles in height.

(a) (10 points) How many days will it take for it to reach the moon? The distance of the moon from the earth is 238,857 miles and there are 5280 feet in a mile and 12 inches in a foot.

(b) (10 points) A light year is how far light travels in one year (365.25 days), light travels at 1.86×10^5 miles-per-second. The $2X$ plant is a native of planet Ööç which is 5.6 light years from earth. How long will it take the for plant $2X$ to get to planet Ööç?

4. (20 points) A man has 9 children and they are all born g years apart and today is the birthday of each of them. The product of the ages of the youngest child and the oldest child is the man's age plus 4 and the sum of the squares of the children's ages is the man's age squared. How old are the children and how old is the man?

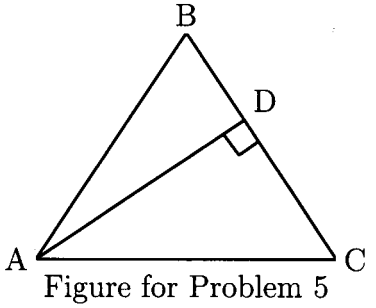


Figure for Problem 5

5. (20 points) Triangle ABC has the property that the length of side AB is the length of side BC. Assume $\angle ADC$ is a right angle. Prove $2 \times \angle CAD = \angle ABC$.