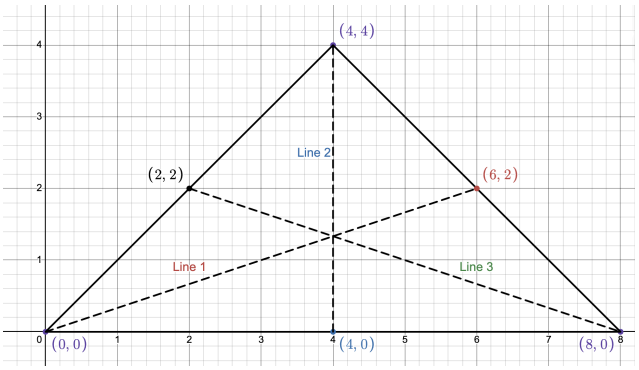
Here is a set of problems that we use to assess problem-solving on in-class assessments.

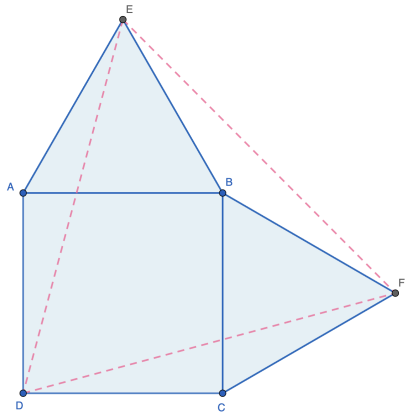
Geometry

1. In the diagram above, the vertices and midpoints on the sides of the triangle are labeled. Three dotted lines are created by joining the vertices to the opposite midpoint.
   Find the midpoints of these three dotted lines labeled Line 1, Line 2, Line 3.



   Prove that the area of the triangle formed by connecting these three midpoints is 1/16 the original area of the triangle.

2. In the diagram below, two equilateral triangles, $\triangle ABE$ and $\triangle BCF$, are created on adjacent sides of the square, $\square ABCD$. The outside vertices of the triangles and the square are connected by the dotted pink lines, forming a new triangle, $\triangle DEF$.



   Prove that this new triangle is an equilateral triangle.

3. Below are five linear sequences (patterns) that are all related to each other.

   a. Look at each pattern, and describe the relationship between the patterns mathematically or in words.

   b. **Prove** that only **one** of the sequences contains the number 1000. To fully justify, you must show that the other four do not include 1000.
   *Hint, use linear equation notation or sequence notation to help justify your answer.

$\{1, 3, 5, 7, 9, 11, 13, \ldots\}$
$\{2, 6, 10, 14, 18, 22, 26, \ldots\}$
$\{4, 12, 20, 28, 36, 44, 52, 60, \ldots\}$
$\{8, 24, 40, 56, 72, 88, 104, \ldots\}$
$\{16, 48, 80, 112, 144, \ldots\}$

Algebra II

1. Given the function $f(x) = 3x - 4$
   a. Graph f(x)
   b. On the same graph, graph $g(x) = |f(x)|$
   c. Write g(x) as a piecewise function

2. Given that $\log_7(4) = x$ and $\log_7(12) = y$, evaluate the following in terms of *x* and *y:*

   a. $\log_7(48)$

   b. $\log_7(16)$

   c. $\log_7(3)$

3. Given the quadratic: $y = x^2 + bx + 9$. For what values of *b* will the quadratic have ONE x-intercept?

Precalculus

1. We define $\cos^2\left(\frac{1}{2}\theta\right) = \frac{1}{2}(1 + \cos(\theta))$

   Graph the equation $y = 4\cos^2(\frac{\pi}{2}x)$. Determine the period, amplitude, and midline, and scale your axes appropriately.

2. Suppose that a_n is an arithmetic sequence with

   $$a_1 + a_2 + \ldots + a_{100} = 100 \text{ and } a_{101} + a_{102} + \ldots + a_{200} = 200$$

   What is the value of $a_2 - a_1$?

3. Using the function and the graph, find the coordinate for the hole in the following graph.

   $$f(x) = \frac{x^3 - 12x - 16}{x^3 + 4x^2 - 16x - 64}$$