Overtime
Investigate the Math:

1. Explore the x and y-intercepts of exponential equations.
Create two tables of values, one for each equation below:

\[ y = 2^x - 1 \quad \text{and} \quad y = 2^{x+3} \]

- Find the y-intercepts and the x-intercepts of each equation, if they exist.
- How do these differ from the intercepts of the basic model, \[ y = 2^x \]?
- Does a multiplicative pattern exist in each table of values?
- If so, how does it compare to the basic model?
- Make up two more equations, by changing the numbers and using addition instead of subtraction. Create tables for these.
- Try to find a rule that explains what happens to the x-intercepts, y-intercept, and multiplicative pattern in these situations.
- Write up a report for your fellow students, explaining what you have discovered.

2. Explore the y-intercepts of quadratic equations.
When you have a quadratic equation in the form \[ y = ax^2 + c \], you can see the y-intercept – it is \( c \). But when you have the vertex model, \((y - k) = a(x - h)^2\), the y-intercept does not appear in the equation. For example, the y-intercept of the equation you found with your worksheet is -18.8, but that number does not appear.

- Find a formula for the y-intercept of the vertex model, using the letters h, k, and a. (Hint: Solve the formula for \( y \), and then find the y-intercept of the equation by using what you know about the x-value of the y intercept).
- Explore \((y - 1) = 3(x - 2)^2\) on the graphing calculator to test your formula.
- Create two additional equations and test those.
- Write up your results for the class.

3. Investigate statistics.
The branch of math that includes data analysis problems is usually called statistics.
- Investigate some of the basic work that statisticians perform.
- Research how statistics is related to algebra, geometry, and/or calculus.
- Explore the statistics programmed into the TI® 83 graphing calculator, and how you might use it in your high school or college math classes.
- Create a presentation of your findings.
Investigate the World:

4. Dig deeper into the sleep connection.
   • Look in the library and on the Internet to see if anyone has researched the connection between sleep and school success.
   • If so, read several studies and report the findings to the class.
   • If not, find a related topic that has been investigated, and report on it instead.

In either case, be thorough and look for more than one viewpoint.

5. Dig deeper into the basketball connection.
   • Watch a basketball game and make sketches of three different parabolas that have been traced by players’ shots.
   • Draw each of these on graph paper, placing the shot’s starting point at the origin.
   • Label the shots by player, and mark the vertex as accurately as possible.
   • Find the equation of each shot.
   • Create a poster with your graphs.

6. Parabolas in the world.
   • Investigate additional places in the world in which one might find parabolas. Look specifically at sports, science, art, and architecture.
   • Find photographs, paintings or other visuals of at least six parabolas.
   • Create a class presentation with a poster of your parabolas. Include an explanation of what each one is and where it can be found.