Problem-Based Learning Activities

Below are suggested summer tasks separated by course. Teachers will be reviewing the appropriate grade level problems when you return to school in September.

If you need assistance with the below problems, feel free to contact the district's math supervisor, Dr. Jeremy Cohen at jcohen@twpunionschools.org.

Have a wonderful summer!

All students entering Algebra I and Algebra I with Lab

Task

You are a representative for a cell phone company and it is your job to promote different cell phone plans.

1. Your boss asks you to visually display (graph) three plans and compare them so you can point out the advantages of each plan to your customers.
    - Plan A costs a basic fee of $29.95 per month and 10 cents per text message
    - Plan B costs a basic fee of $90.20 per month and has unlimited text messages
    - Plan C costs a basic fee of $49.95 per month and 5 cents per text message
    - All plans offer unlimited calling
    - Calling on nights and weekends are free
    - Long distance calls are included

2. A customer wants to know how to decide which plan will save her the most money. Determine which plan has the lowest cost given the number of text messages a customer is likely to send.

All students entering Geometry and Honors Geometry

Task 1

Alex and his friends are studying for a geometry test and one of the main topics covered is parallel lines in a plane. They each write down what they think it means for two distinct lines in a plane to be parallel:

1. Rachel writes, "two distinct lines are parallel when they are both perpendicular to a third line."
2. Alex writes, "two distinct lines are parallel when they do not meet."
3. Briana writes, "two distinct lines are parallel when they have the same slope."

Analyze each definition, indicating if it is mathematically correct and if it has any drawbacks

Task 2

Three students have proposed these ways to describe when two lines ℓ and m are perpendicular:

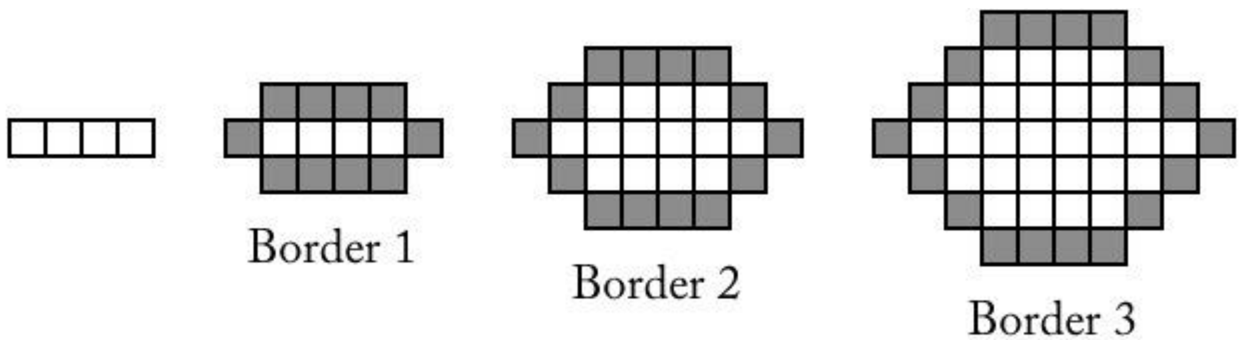
1. ℓ and m are perpendicular if they meet at one point and one of the angles at their point of intersection is a right angle.
2. ℓ and m are perpendicular if they meet at one point and all four of the angles at their point of intersection are right angles.
3. ℓ and m are perpendicular if they meet at one point and reflection about ℓ maps m to itself.

Explain why each of these definitions is correct. What are some of the advantages and disadvantages with each?

All students entering Algebra II or Honors Algebra II

Task

Fred has some colored kitchen floor tiles and wants to choose a pattern using them to make a border around white tiles. He generates patterns by starting with a row of four white tiles. He surrounds these four tiles with a border of colored tiles (Border 1). The design continues as shown below:



Fred writes the expression $4(b-1)+10$ for the number of tiles in each border, where b is the border number, $b \geq 1$.

1. Explain why Fred's expression is correct.
2. Emma wants to start with five tiles in a row. She reasons, "Fred started with four tiles and his expression was $4(b-1)+10$. So if I start with five tiles, the expression will be $5(b-1)+10$. Is Emma's statement correct? Explain your reasoning.
3. If Emma starts with a row of n tiles, what should the expression be?

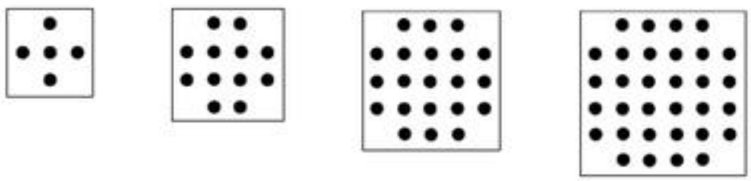
All students entering Algebra III/Trigonometry

Task

Consider the algebraic expressions below:

$$(n+2)^2 - 4 \quad \text{and} \quad n^2 + 4n.$$

1. Use the figures below to illustrate why the expressions are equivalent:



2. Find some ways to algebraically verify the same result.

All students entering General Math and Math Readiness

Task

A candy shop sells a box of chocolates for $30. It has $29 worth of chocolates plus $1 for the box. The box includes two kinds of candy: caramels and truffles. Lita knows how much the different types of candies cost per pound and how many pounds are in a box. She said,

If x is the number of pounds of caramels included in the box and y is the number of pounds of truffles in the box, then I can write the following equations based on what I know about one of these boxes:

- $x + y = 3$
- $8x + 12y + 1 = 30$

Assuming Lita used the information given and her other knowledge of the candies, use her equations to answer the following:

1. How many pounds of candy are in the box?
2. What is the price per pound of the caramels?
3. What does the term $12y$ in the second equation represent?
4. What does $8x+12y+1$ in the second equation represent?

All students entering Statistics, AP Statistics, or Sports Statistics

Task

A statistically-minded state trooper wondered if the speed distributions are similar for cars traveling northbound and for cars traveling southbound on an isolated stretch of the Garden State Parkway. He uses a radar gun to measure the speed of all northbound cars and all southbound cars passing a particular location during a fifteen minute period. Here are his results:

Northbound Cars				
60	62	62	63	63
63	64	64	64	65
65	65	65	66	66
67	68	70	83	

Southbound Cars				
55	56	57	57	58
60	61	61	62	63
64	65	65	67	67
68	68	68	68	71

Draw box plots of these two data sets, and then use the plots and appropriate numerical summaries of the data to write a few sentences comparing the speeds of northbound cars and southbound cars at this location during the fifteen minute time period.

All students entering Pre-Calculus or Honors Pre-Calculus

Task

Given below is a table that gives the populations of foxes and rabbits in a national park over a 12 month period. Note that each value of t corresponds to the beginning of the month and t=0 corresponds to the beginning of January.

***t*, month**	0	1	2	3	4	5	6	7	8	9	10	11
***r*, number of rabbits**	1000	750	567	500	567	750	1000	1250	1433	1500	1433	1250
***f*, number of foxes**	150	143	125	100	75	57	50	57	75	100	125	143

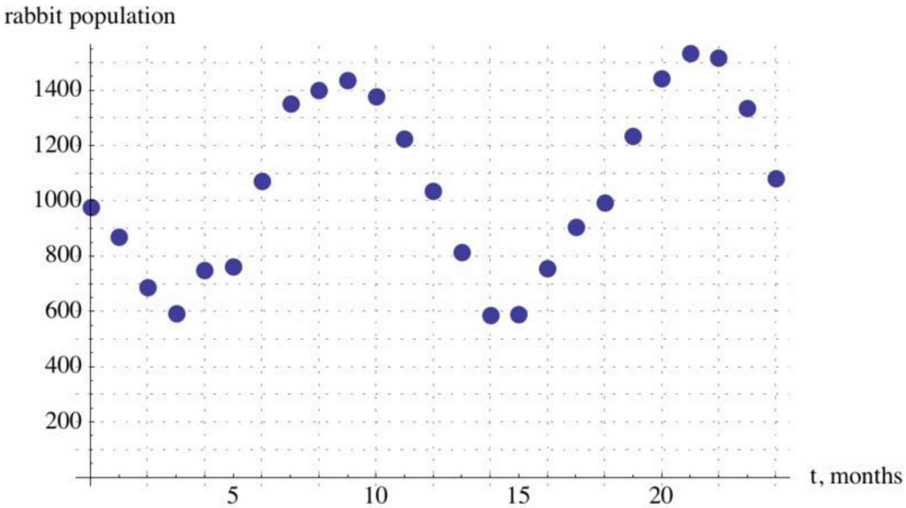
Note that the number of rabbits and the number of foxes are both functions of time.

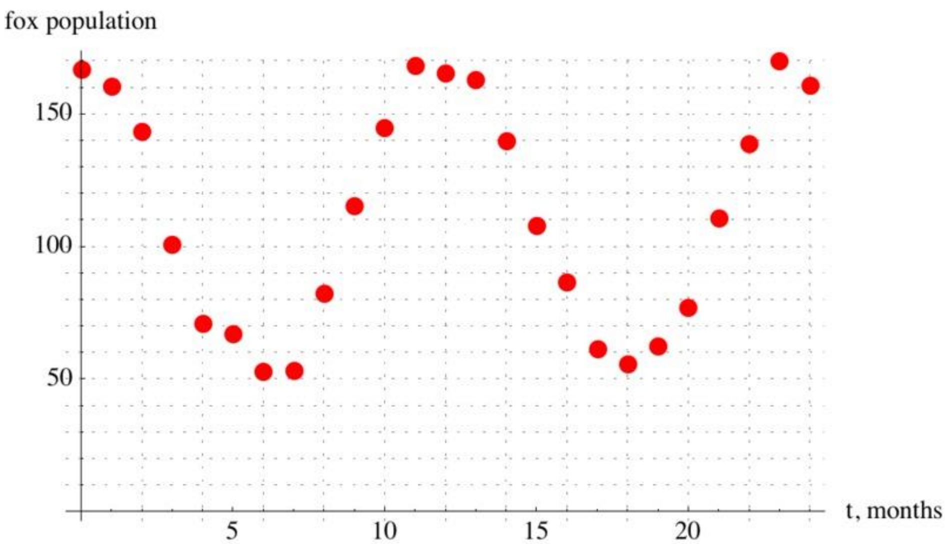
1. Explain why it is appropriate to model the number of rabbits and foxes as trigonometric functions of time.
2. Find an appropriate trigonometric function that models the number of rabbits, $r(t)$, as a function of time, t, in months.
3. Find an appropriate trigonometric function that models the number of foxes, $f(t)$, as a function of time, t, in months.
4. Graph both functions and give one possible explanation why one function seems to “chase” the other function.

All students entering Calculus or AP Calculus

Task

Given below are two graphs that show the populations of foxes and rabbits in a national park over a 24 month period.





1. Explain why it is appropriate to model the number of rabbits and foxes as trigonometric functions of time.
2. Find an appropriate trigonometric function that models the number of rabbits, $r(t)$, as a function of time, with t in months.
3. Find an appropriate trigonometric function that models the number of foxes, $f(t)$, as a function of time, with t in months.