Field Goal for the Win

Pre-Assignment Activity

This page is to be done by each student the day before starting the STEM Behind Football activity.

Part Two – A Different Way to Graph Points on a Grid

We are going to create ordered pairs to graph on a grid in a different way than you have done before.
We are going to use one equation, called $x(t)$ (read "x of t"), to calculate the x-coordinate and another equation, called $y(t)$ (read "y of t"), to calculate the y-coordinate. The independent variable is t, which can represent time. These are called parametric equations (not because there are two (a pair) of them).

Let's look at an example of parametric equations.

$x(t) = t + 2$
$y(t) = 2t - 1$

To plot the points described by these parametric equations, you can make a table supplying values for t, and then calculate values for x and y based upon the given equations.
For example, when $t = 4$, substitute 4 in place of t in each equation and simplify:

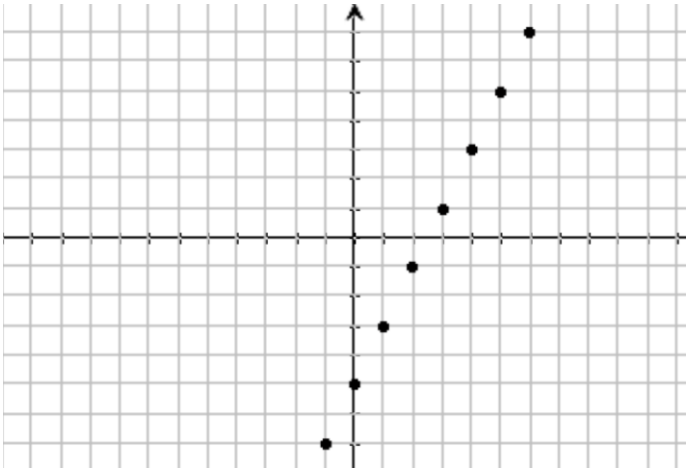
$x(t) = t + 2$ $y(t) = 2t - 1$ So $x(4) = 4 + 2 = 6$ $y(4) = 2(4) - 1 = 7$

Therefore, the ordered pair (6, 7) is on the graph of these parametric equations.

Let's generate several ordered pairs on the graph and organize them in the table below.
We will use $t = -3, -2, -1, 0, 1, 2, 3, 4$.

t	$x(t) = t + 2$	$y(t) = 2t - 1$	(x, y)
– 3	– 3 + 2 = – 1	2(– 3) – 1 = – 7	(– 1, – 7)
– 2	– 2 + 2 = 0	2(– 2) – 1 = – 5	(0, – 5)
– 1	– 1 + 2 = 1	2(– 1) – 1 = – 3	(1, – 3)
0	0 + 2 = 2	2(0) – 1 = – 1	(2, – 1)
1	1 + 2 = 3	2(1) – 1 = 1	(3, 1)
2	2 + 2 = 4	2(2) – 1 = 3	(4, 3)
3	3 + 2 = 5	2(3) – 1 = 5	(5, 5)
4	$x(4) = 4 + 2 = 6$	$y(4) = 2(4) - 1 = 7$	(6, 7)

Plot these ordered pairs (x, y) below:



This is the graph of $x(t) = t + 2$, $y(t) = 2t - 1$

What pattern do you notice about these points?
The points are collinear.
A good idea is to have the students write the Cartesian equation that models these points: $y = 2x - 5$

Then verify this, use the parametric equations as below:
$x = t + 2 \rightarrow t = x - 2$
Since $y = 2t - 1$, substitute $(x - 2)$ for t.

$y = 2(x - 2) - 1$
$y = 2x - 4 - 1$
$y = 2x - 5$

Compare this to the equation we obtained by looking at the graph. They are the same. There is a connection between parametric and Cartesian coordinates.

We will use other parametric equations to do the activity Field Goal for the Win.