More control with equations

1. Open Investigation 3 Activity 3.3.
   Edit the Graph so that Blue Waters and Green Grass race for 500 miles (use the zoom if necessary).
   Create a race using the graph so that:
   - Blue Waters is travelling at 50 miles per hour.
   - Blue Waters starts at a position 150 miles ahead of the start line.
   - Green Grass starts at the start line and travels at 100 miles per hour.

   A. Who wins the race? (Check your prediction by playing the simulation) Is it possible to find the speed of each car from the Table of Values? Explain your answer.

   B. How can you tell who wins from the graph?

   C. How can you tell who wins from the table?

   Now click on the drop down menu beside Equation.

   D. Write down the equations for both cars.

   E. The equations show the speed of each car. Underline the speed of each car in your equations.

   F. The equations show start positions. Circle the start positions of each car in your equations.

   G. Have you noticed how all the equations for the journeys look in general? Write a memo to the senior programmer to say how she/he can use the equation to create the journey for any character's motion in the game.

2. Hide the Equation window. Edit the graph in 3.3 so that:
   Blue Waters starts 200m ahead, has a speed of 25 miles per hour while Green Grass starts at start position 0 and has a speed of 100 miles per hour.

   A. Predict the equations for each cars' journeys.

   Now create the journeys using the graph. Reveal the equation menu to check.

   B. Was your prediction correct? If not, can you tell/explain what you did wrong?

3. Hide the Graph window and the Equation window.
   Green Grass starts the race at the start position while Blue Waters starts a race 20 miles ahead of the start position. Both cars travel at 80 mph.

   A. Predict the equations for each of Green Grass and Blue Waters journeys.

   Check: Create the graph for the journeys by editing the equations. Check they are correct using the table of values and then reveal the graph.

   B. Was your prediction correct? If not, can you tell/explain what you did wrong?

   C. Use the equation to work out the distance Blue Waters will have travelled after
      i) 2 hours    ii) 4.5 hours.

   D
   E
   F
   G

   E. The equations show the speed of each car. Underline the speed of each car in your equations.

   F. The equations show start positions. Circle the start positions of each car in your equations.

   G. Have you noticed how all the equations for the journeys look in general? Write a memo to the senior programmer to say how she/he can use the equation to create the journey for any character's motion in the game.
Here you will create races by editing the equation. All straight lines graphs have a general equation that can be written as $y = mx + c$, where $m$ and $c$ are numbers.

4 **Refresh Activity 3.3.**

Edit the equations of each car to create a journey where:

A Blue Waters travels at 30 mph and starts 150 miles ahead of the start of the race. Write your equation.

B Green Grass travels at 60 mph and starts at the beginning of the race. Write your equation.

Using either the graph, table of values or equation to answer the following questions.

C At what time does the Green Grass overtake the Blue Waters?

D Which representation (graph, table or equation) did you use to work this out and how?

E How far has the car travelled after 7 hours?

F Which representation did you use to work this out and how?

G How far will each car have travelled after 30 hours?

5 **Refresh Activity 3.3.**

As before, the cars race for 300 miles and you create the race so that:

- Blue Waters is travelling at 50 miles per hour and has a 100 mile head start.
- Green Grass wins the race, finishing an hour before the blue car.

Using the graph,

A How can you calculate the speed of the Green Grass?

B For what length of time did each car travel?

C At what time in the race did Green Grass overtake the Blue Waters? How do you know?

Using the table,

D Show how you can calculate the speed of Green Grass.

Using the equations,

E How can you check that you created the graphs correctly?