INITIATE Lesson Plan: *Avoiding a Crash*

Lesson plan at a glance...

Name: Avoiding a Crash

Course: Functions and Trig

Grade Level: 11

Prerequisites:
*Solving for y to graph a line using slope and y-intercept.
*Find x and y intercepts to plot the points and graph the line.
*Basics in Bloxter

Time: 2 class periods

In this lesson plan…

Lesson Overview

In this lesson, students will solve systems of linear equations graphically and prove the answer works in both equations. They will use smart car technology to show their solution.

Driving Questions

Overarching Driving Questions for Bowsher Wide Project:

- How can we make smart cars safer and more convenient?
- How can we protect them from cyberattacks?

Lesson Specific Question:

How can two smart cars with pre-determined paths avoid crashing?

Materials and Equipment

Smart cars, tablets, worksheet: Avoiding a Crash (attached)*, pencil, large graph paper for smart cars*

Preparation Tasks

	Prepare materials and assign partners	*5 minutes*

The Lesson

Warm-up Activity: Review Methods of Graphing Lines	*10 minutes*
Activity 1: Find Where Two Lines Cross	20 minutes
Activity 2: Program car to pause and repeat	20 minutes
Activity 3: Program car to stop if another car is in path	20 minutes
Wrap-up Activity: Compare programs	10 minutes

Warm-up Activity: Review Methods of Graphing Lines (10 minutes)

Activity Overview: In this activity, students will recall and demonstrate different methods for graphing lines.

Activity: Ask students to look at two example equations. Work with a partner to graph each line on the same coordinate plane. Explain why they chose each method.

Eq. 1: $y = (1/3)x + 4$ (Students should choose to use slope and y-intercept to graph.)

Eq. 2: $2x – y = 1$ (Students can either solve for y to use slope and y-intercept, or use x- and y-intercepts to graph.)

Activity 1: Find Where Two Cars Cross Paths (on paper) (20 minutes)

Activity Overview: In this activity, students will graph several pairs of lines on graph paper. Determine where they cross or that they will not cross.

Activity: Students will work in pairs to graph two lines on graph paper to determine where they will cross or if the lines are parallel.

Teaching Tips:

- *Ask students to share solutions on the board as they go to make sure they are graphing properly.*

Activity 2: Program Car to Pause and Repeat (20 minutes)

Activity Overview: In this activity, students will use two cars. They will need to decide how to travel slowly, OR drive and pause, and manually stop the vehicles from colliding.

Activity: Remind students how to use Bloxter. Task: Move each car along the path of the given line in a very safe way so that the cars can be manually stopped by programmer to prevent colliding.

Teaching Tips:

- *Ask students to think about how to be absolutely sure to never crash their car. Would they rather have the control themselves, or leave it up to other drivers or a computer program?*

Activity 3: Program Car to Stop Using Sensors (20 minutes)

Activity Overview: In this activity, students will use the sensors on smart cars to avoid a crash.

Activity: Program cars to move each car along the path of the given line in a very safe way so that the cars can be stopped by sensors to prevent colliding.

Teaching Tips:
Ask students to think about how many inches they would want to allow between themselves and another car. Be sure they are finding the correct commands to prevent frustration with the Bloxter program.

Wrap-up Activity: Analysis and reflection (20 minutes)

Activity Overview: In this activity, students will discuss their level of comfort with smart cars, first with a partner, and then as a class.

Activity: Discuss with partner:
Were you able to manually stop your car from crashing into the other car?
Did the sensor work to prevent a crash?
Do you prefer to have control to stop the smart car yourself, or trust the sensor or other driver to stop? Be ready to explain to the class which method you prefer and why.

Class discussion with the same questions.

Assessment:*Exit slip:*

1. *Did you and your partner both stop the car manually to prevent a crash? YES or NO*
2. *Did the sensors work on both cars to prevent a collision? YES or NO*
3. *What is your current level of comfort with trusting the sensors on a smart car to keep you safe?*

0 1 2 3 4 5 6 7 8 9 10
Don't trust at all *Neutral* *Completely comfortable*

4. *Write at least one sentence to explain your answer to question 3:*

Learning Objectives and Standards

Learning Objectives	Standards
Graph functions expressed symbolically and identify key features of the graph, by hand and using technology.	F.IF.7
Solve systems of linear equations exactly and approximately (e.g. with graphs), focusing on pairs of linear equations in two variables.	A.REI.6
Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of	A.REI.7 (extension for more advanced

intersection between the line y = -3x and the circle x2 + y2 = 3	students)

Additional Information and Resources

Project-based Learning Features

Feature	Where does this occur in the lesson?
Driving Question	*At start of lesson, students are asked, "*Can two smart cars with pre-determined paths avoid crashing?" *Students explore with manual stopping as well as sensors.*
Making Sense of Data	*Throughout the lesson, students need to decide the best way to graph each line, and experiment with the best method of preventing a crash.*
Collaboration	*Throughout the lesson, students work together.*
Technology	*In Activities 2 and 3, students create programs using Bloxter and run smart cars.*

Computational Thinking Concepts

Concept	Where does this occur in the lesson?
Decomposition	*Activities 2 and 3 help students explore the difference between being in control of stopping the cars VS. allowing sensors to prevent a crash.*
Pattern Recognition	*Students who have time to program more than system of linear equations will use the same program*.
Algorithmic Thinking	*Students compare their program with their partner and later with other pairs of students to determine the best way to program the smart cars to use with similar problems in the future.*

Administrative Details

Contact info: Sandi Christoff Email: sandichristoff@gmail.com

Sources: Bloxter.com Kuta Worksheet

Possible videos:
https://www.youtube.com/watch?v=iHzzSao6ypE The Solution to Traffic Jams
https://www.youtube.com/watch?v=fzkv5beS4uk Non-Collision at Intersection

Date Written: June 2018

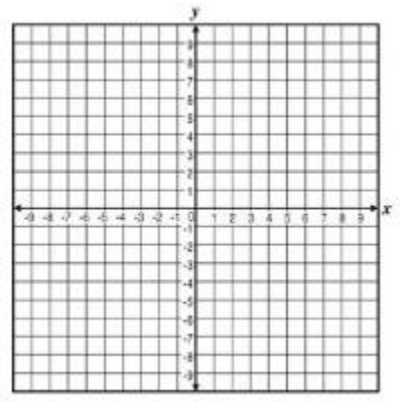
Template adapted from: https://edu.google.com/resources/programs/exploring-computational-thinking/

Avoiding a Crash ☺ Name _____ Date _____ Hour ___

Warm Up: Graph both lines on the same coordinate plane. SHOW WORK! Label the point of intersection.

1) y = 1/3 x + 4

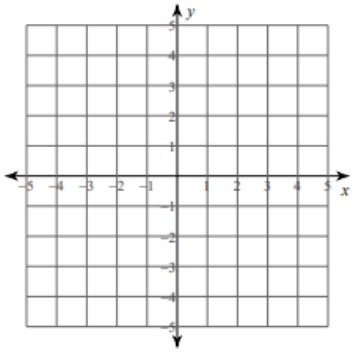
2) 2x – y = 1



Activity One: With a partner, graph both lines on the same coordinate plane. Label the point of intersection.

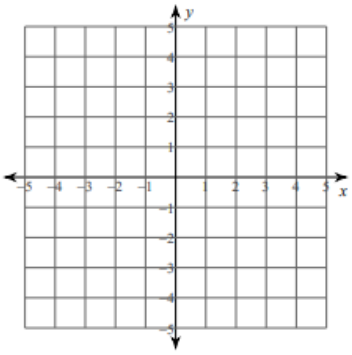
1) $y = -\frac{5}{3}x + 3$

$y = \frac{1}{3}x - 3$



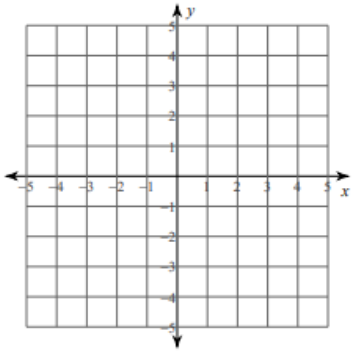
2) $y = 4x + 3$

$y = -x - 2$



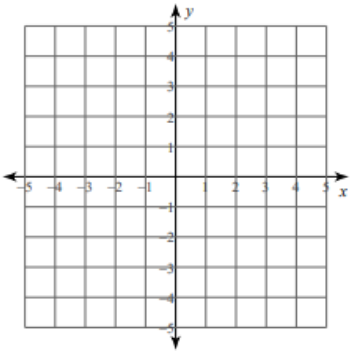
3) $y = -\frac{1}{2}x - 1$

$y = \frac{1}{4}x - 4$



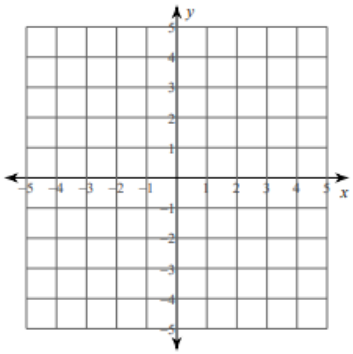
4) $y = -1$

$y = -\frac{5}{2}x + 4$



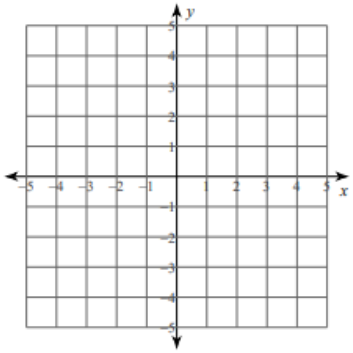
5) $y = 3x - 4$

$y = -\frac{1}{2}x + 3$



6) $y = -2x + 2$

$y = -2x - 2$



Activity Two: Program car and join with another group to avoid crashing.

1. In Bloxter, program car to drive forward, pausing often to avoid a collision.
2. Find another group that is ready. Start cars on the y-intercepts, one car on each line.
3. Avoid a collision by pressing STOP before the point of intersect.
4. How else could you avoid a crash? Write answers below.

Activity Three: Program car using sensors to avoid a crash.

1. In Bloxter, program car to drive forward and use sensors to avoid an obstacle.
2. With another group, start cars on the y-intercepts, one car on each line.
3. Run program to see if one car stops, both cars stop, or ….. hopefully they won't crash!
4. When finished, begin Wrap-Up below.

Wrap-Up: Analysis and Reflection

Discuss the follow questions with your partner. You do NOT have to write your answers unless it will help when we discuss as a class.

1. Were you able to manually stop your car from crashing into the other car?
2. Did the sensor work to prevent a crash?
3. Do you prefer to have control to stop the smart car yourself, or trust the sensor or other driver to stop? Be ready to explain to the class which method you prefer and why.

Exit Slip ☺ Names: _____ Date: _____

1. *Did you and your partner both stop the car manually to prevent a crash? YES or NO*
2. *Did the sensors work on both cars to prevent a collision? YES or NO*
3. *What is your current level of comfort with trusting the sensors on a smart car to keep you safe?*

0 1 2 3 4 5 6 7 8 9 10

Don't trust at all *Neutral* *Completely comfortable*

4. *<u>Write at least one sentence</u> to explain your answer to question 3:*

5. *What else would you like me to know about this activity?*

Exit Slip ☺ Names: _____ Date: _____

1. *Did you and your partner both stop the car manually to prevent a crash? YES or NO*
2. *Did the sensors work on both cars to prevent a collision? YES or NO*
3. *What is your current level of comfort with trusting the sensors on a smart car to keep you safe?*

0 1 2 3 4 5 6 7 8 9 10

Don't trust at all *Neutral* *Completely comfortable*

4. *<u>Write at least one sentence</u> to explain your answer to question 3:*

5. *What else would you like me to know about this activity?*