

Date: 13.11.2013

Teacher: Ezgi Çallı

Number of Students: 16

Grade Level: 10

Time Frame: 40 minutes

## Mathematics Learning Plan

### 1. Goal(s)

- To develop an understanding of linear equations and their graphics in the coordinate plane.

### 2A. Specific Objectives (measurable)

- The students should be able to formulate the equation of a line, given the slope and a point on the line.
- The students should be able to find the intersection points of two lines.

### 2B. Ministry of National Education (MoNE) Objectives

- *10.4.1.3. Analitik düzlemde doğru denklemini oluşturur ve denklemleri verilen iki doğrunun birbirine göre durumlarını inceler.*
  - İki noktası ile ya da eğimi ve bir noktası ile verilen doğrunun denklemleri oluşturulur.
  - İki doğrunun birbirine göre durumları (çakışık, paralel, tek noktada kesişme ve dik kesişme) incelenir ve kesişen iki doğrunun kesişme noktası bulunur.

### 2C. NCTM-CCSS-IB or IGCSE Standards:

- All students should use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations. (NCTM, Geometry Standards for Grades 9–12, 2000-2004)
- All students should understand the meaning of equivalent forms of expressions, equations, inequalities, and relations. (NCTM, Algebra Standards for Grades 9–12, 2000-2004)

### 3. Rationale

- Students will be informed about how analytical geometry will help them in mathematical communication and in solving algebraic problems.
- Students will be informed about the real life applications of coordinate geometry, in particular line equations, such as computer graphics, architecture and construction industry, cartography, or feasibility problems in business.

#### 4. Materials

- Video about the game Asteroids (video game): <http://www.youtube.com/watch?v=WYSupJ5r2zo>
- Worksheets: Grid papers with x and y axis drawn.
- 4 Rulers, one for each group.

#### 5. Resources

- [http://en.wikipedia.org/wiki/Asteroids\\_\(video\\_game\)](http://en.wikipedia.org/wiki/Asteroids_(video_game))
- <http://www.thirteen.org/get-the-math/teachers/overview-of-the-lessons/uncategorized/teachers-math-in-videogames-overview/75/>
- Textbook for assigning homework problem

#### 6. Getting Ready for the Lesson (Preparation Information)

- Make sure the computer and the projector works
- Make sure there exists internet connection.
- Groups will be formed according to the seating clusters.
- Each group will be given one single worksheet.
- Write the keywords as the agenda of the day on the board.

#### 7. Prior Background Knowledge (Prerequisite Skills)

- Students should have learned the terminology: coordinate plane, origin, x axis, y axis, quadrants and linear relationship.
- Students should have learned how to calculate the distance between two points on the coordinate plane.
- Students should have learned the meaning and interpretation of the slope.

### **Lesson Procedures**

*Transition: Greeting and motivation.*

#### 8A. Engage (5 minutes)

- Ask the students if they have ever heard about Atari. Tell them it was a game console which was popular mainly in eighties.
- Give information about one of the most famous video arcade games of Atari: Asteroids.
- Show one minute video.
- Give information about the objective of Asteroids referring to the video: to score as many points as possible by destroying asteroids and flying saucers.

The player controls a triangular-shaped ship that can rotate, fire shots straight forward, and travels at a uniform rate.

- Ask them what shape does the route of the objects in the game have? How can we determine the place of the fire in a given period of time? (**knowledge and analysis**)
- Ask them how we can express the location of the correct shooting point? (**analysis**) (Intersection of the routes)

*Transition: Now, you are going to work on your worksheets in groups of four.*

B. Explore (7 minutes)

- Give each group one worksheet.
- Give instructions to represent the initial points of the two asteroids, their rates and directions of the asteroids.  
1<sup>st</sup> asteroid is at the point A1 (-1,-1) at time t=0 and it is at (-1, 0) at time t=1sec.  
2<sup>nd</sup> asteroid is at the point A2 (-15,-20) at time t=0 and is at (-14,-18) at time t=1sec.
- Give instructions to represent the initial place of the ship and about the rate and direction of the fire.  
The ship is at point S (4, 9) at time t=0 and the fire of the ship is at (3, 8) at time t=1 sec.
- Draw the routes of the asteroids and the fire on the plane. Does the fire hit both of the asteroids? Find their intersection points. How much time do you think will it take the fire to meet the two asteroids without changing its direction? (**knowledge and application**)
- Ask them to think about how they could compute those points for a very large scale plane that does not fit into a grid paper? (**synthesis**)

*Transition: Keep your worksheets aside and open your notebooks.*

C. Explain (20 minutes)

- Ask the students how they can express the location of the points that are on the same line, when they know the direction, so the slope of the line and a single point on the line. Give the definition of the slope as a hint. (**application & analysis**)
- Give the formulation of the line equation, given the slope and a single point on the line.

$$y - y_1 = m(x - x_1)$$

$$y = m x + n$$

Examples:

Ask the students to write the equations of the lines given the slope and the point below: (**application**)

m = -1 and point (2, 2)

m = 1/3 and point (1,-1)

- Ask the students how they can find the intersection point of two lines? What does that algebraically mean? (**comprehension and application**)

- Give algebraic examples to find the intersection of two line equations. Use substitution and elimination.

Examples:

$$y = 2x + 1 \text{ and } y = x + 3$$

$$y = x \text{ and } y = 5x$$

$$y = -x + 5 \text{ and } y = x + 6$$

- Give an example of pair of parallel lines. Ask the students to interpret the algebraic solution. (**analysis**)

$$y = \frac{1}{2}x + 1 \text{ and } y = \frac{1}{2}x + 9$$

*Transition: Now, go back to your worksheets.*

D. Extend (5 minutes)

- Ask the students to write the equation of the two lines that you have constructed on your worksheets. (**application**)
- Ask the students to find the intersection of two line equations and compare the algebraic solution with the graphical solution they found at the exploration part. (**application**)
- Ask the students whether the system of linear equations are best solved by graphing on the coordinate plane or algebraically by substitution or elimination. Why? (**evaluation**)

*Transition: Take a piece of paper*

E. Evaluate (2 minutes)

- Ask the students to write two mathematical concepts that you have learned today and what attracted your attention the most in this lesson? (**comprehension and analysis**)  
(No more than 3 sentences)
- Check regularly, ask why questions. Take notes of your observations about the group study.

9. Closure & Relevance for Future Learning

- Wrap the lesson up by referring to the agenda on board.
- Ask the students to think about where else the topic can be used in real life. (**synthesis**)
- Give homework assignment from the book.
- Tell them you are going to provide a link on Moodle, where they can play an updated version of Asteroids free.  
<http://www.atari.com/arcade#!/arcade/asteroids/play>

- Tell what topic you will continue with next time. (how to find the distance of a point to a line)

#### 10. Specific Key Questions:

- The questions and the related taxonomy levels are provided throughout the plan.

#### 11. Modifications

- Remember to note the names of the students who are falling behind the class and cannot keep up with the topic. Call them for a compensation period.

### **Reflective Evaluation of the Lesson**

- Lesson planning is a necessarily important task for effective teaching. It is useful for thinking about our teaching process in a more structured and a systematic way, it makes the realization of our curricular aims more meaningful. It is also a very helpful for classroom management. It reminds us that we should also be careful about time management when making teaching plans.