It's a Numbers Game
Systems of Equations

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Grade Level	8th – 9th Grade	**Time Frame**	120 minutes
Subject	Mathematics	**Duration**	2-3 periods
Course	Algebra 1		

Essential Question
How can systems of equations be used in real-world situations?

Summary
This lesson asks students to apply their previous knowledge of solving systems of equations to real-life contexts, including basketball games.

Snapshot

Engage
Students watch a highlight video from a professional basketball game and discuss key components of the game, focusing on the score.

Explore
Students create and solve systems of equations to determine each team's point total and the total number of 2- and 3-point shots made in the game.

Explain
As a class, students discuss and justify the steps they took to create and solve their systems of equations.

Extend
Students Create the Problem to write a system of equations for a new scenario.

Evaluate
Students engage in a Gallery Walk to solve other students' equations.

Standards

Oklahoma Academic Standards for Mathematics (Grades 9, 10, 11, 12)

A1.A.1.3: Analyze and solve real-world and mathematical problems involving systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination. Interpret the solutions in the original context.

Attachments

- Lesson Slides—It's a Numbers Game.pptx

Materials

- Lesson Slides (attached)
- Poster paper or other large paper
- Markers
- Notebook paper
- Pens or pencils

Engage

> **Teacher's Note: Prerequisites**
>
> This lesson assumes that students have already begun learning about systems of equations. It builds on their existing knowledge of this topic by having them apply systems of equations to basketball and basketball statistics.

Introduce the lesson using the attached **Lesson Slides.** Go to **slide 3** to display the lesson's essential question: How can systems of equations be used in real-world situations? Then, share the lesson objectives on **slide 4**.

Go to **slide 5** and play the Oklahoma City Thunder highlight video. Ask students to take note of things they notice as they're watching and be prepared to discuss them afterwards.

> **Embedded video**
>
> https://youtube.com/watch?v=oM_Exn8UET8

> **Teacher's Note: Make it Relevant**
>
> To help ensure that students don't become disengaged, consider watching only the first five minutes of the video.
>
> You could also change the highlight video to another team or another game to make it more meaningful for your students. If you chose to change the highlight video, be aware that the equations throughout this lesson will need to be modified. However, the general activities can remain the same.

Go to **slide 6.** After watching the highlight video, ask students to share what they noticed as they watched. Use this as an opportunity to engage students' prior knowledge about what is represented in a basketball game. As they share, write students' observations on the board.

> **Possible Student Responses**
>
> - The Oklahoma City Thunder are playing the Minnesota Timberwolves.
> - The teams scored a lot of points in this game.
> - The teams each made two-pointers, three-pointers, and free throws.

Ask students what types of statistics are measured in a basketball game. Write students' responses on the board.

Possible Student Responses

- The final score
- Who won
- Total points per team
- How many shots were made
- How many rebounds for each team
- Total assists
- Blocked shots
- Individual player statistics

If they didn't know the final score of the game, ask students what statistics they might use to figure it out. Write students' responses on the board.

Possible Student Responses

- We could figure out the score based on how many types of shots (2's, 3's, free throws) each team made.
- If we knew the total number of points scored in the game and how many more points one team scored than the other, we could figure out the final score.
- We could determine the score if we knew how many points each player had.

After completing your discussion, tell students that they will continue learning about systems of equations by using what they know about basketball to explore the options for solving system of equations problems.

Teacher's Note: Lesson Format

The rest of this lesson is set up for students to work through three different systems of equations, with an Explore and Explain section for each. The systems build upon one another to have students determine components of the game score and types of baskets made. If you choose to not complete all three systems, you might need to provide students with additional information in order for them to set up and solve the systems that you choose.

Team Total Points System

Explore

Go to **slide 7** to provide students with additional information about the game to use when setting up their first system of equations. Share the total score as well as the fact that the Thunder scored two more points than the Timberwolves.

Ask students to consider what this information means and what the total score includes. Then, ask them to consider how, mathematically, they would express the difference in points.

Possible Student Responses

The total score is both team scores added together.

The Thunder scored two more points than the Timberwolves.

There's a difference of two points between the two scores, so either adding or subtracting two from one team's score will give you the other team's score.

Working in groups of two or three, have students create a system of equations and solve it to determine each team's score. To create the equations, students will need to break down the parts of the word problem and apply their knowledge of systems of equations. Provide a large sheet of paper or poster board to each group to write the equations on, but instruct them to use only 1/4 of the paper to leave room for the remaining equations.

Equations

Student groups should come up with equations that are equivalent to the following, where X=Thunder point total and Y=Timberwolves point total:

- X + Y = 238
- Y + 2 = X

Explain

Ask groups to share their equations with the class, justifying how they set them up and solved them to determine the individual team scores. Before wrapping up the conversation, make sure that groups each have the correct team scores. They will use these scores to help set up the third set of equations.

Total Scores

By solving their system of equations, students should have determined the following team scores:

- Thunder: 120
- Timberwolves: 118

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https://learn.k20center.ou.edu/lesson/1425?rev=30123

Go to **slide 8.** Ask students what else they might consider related to the scores. For example, now that they know how many points each team scored, how might they break down the scores even further?

Possible Student Responses

- How many of each type of basket a team made
- Which team made more 3-pointers
- How many points each team member scored

Total 2-Point and 3-Point Baskets System

Explore

Go to **slide 9** to provide students with additional information about the second system of equations scenario. Ask them to take a few minutes to consider what new information they have been given and and what they have been asked to find.

Groups will use the new information to determine how many 2-pointers and how many 3-pointers the teams scored in total. Groups should create their new systems of equations on the same large paper/poster board.

> **Equations**
>
> Groups should come up with equations that are equivalent to the following, where X= number of 2-pointers and Y=number of 3-pointers:
>
> - $2X + 3Y = 210$
>
> - $X + Y = 93$
>
> Note that students need to subtract the total points the two teams scored from free throws (28) from the total score (238) to come up with the simplified version of the first equation shown above that includes only points scored from 2- and 3-point shots.

Explain

Have groups share their equations with the class, justifying how they set up their equations and solved them to determine the number of 2-point shots and the number of 3-point shots scored. Make sure groups each have the correct totals to use in determining the next system of equations.

> **2-Point and 3-Point Basket Totals**
>
> Combined, the two teams scored 69 2-point shots and 24 3-point shots.

Display **slide 10**. As a class, discuss all the information that students have been given have solved for so-far. Ask students to consider what else they might be able to find using this information.

Individual Team 2-Point and 3-Point Baskets Systems

Explore

Go to **slide 11** to provide students with the additional information they need for the third system of equations scenario. This time, groups will set up a system of equations to determine how many 2-point shots each team made, and then they will use their solutions to determine how many 3-point shots each team made.

Two-Point Baskets Equations

Groups should come up with equations that are equivalent to the following for the number of two-point baskets (where K=Thunder 2-point baskets and M=Timberwolves 2-point baskets):

- $K + 1 = M$
- $K + M = 69$

Number of Two-Point Baskets

The Thunder scored 34 2-point baskets and the Timberwolves scored 35.

Three-Point Baskets Equations

To find the number of three-point baskets for each team, groups can plug the number of two-point baskets each team scored into the equations below and solve each equation for the three-point variable (X or Y).

Thunder three-point baskets: $2K + 3X + 16 = 120$

Timberwolves three-point baskets: $2M + 3Y + 12 = 118$

Number of Three-Point Baskets

The Thunder and Timberwolves each scored 12 3-point baskets.

Explain

Have groups share their equations with the class, justifying how they set them up and solved them to determine the total number of 2-point and 3-point baskets scored by each team.

Extend

Display **slide 12**. Working individually, students will use the [Create the Problem](#) strategy to identify their own real-life scenario that can be represented by a system of equations. Pass out large sheets of paper or poster boards for students to use to write out the problem scenario (story problem). Students should write their systems of equations and the problem solution on a separate sheet of notebook paper to turn in to you.

Evaluate

Go to **slide 13**. Students will be completing a [Gallery Walk](https://learn.k20center.ou.edu/lesson/1425?rev=30123) to view their classmates' problems. Have students take a notebook and pencil with them to write down and solve the system of equations for each problem they visit as they travel around the room.

Resources

- CCBN. (2021, February 6). Timberwolves vs OKC Thunder full game highlights | 2021 NBA season [Video]. YouTube. https://youtu.be/oM_Exn8UET8
- K20 Center. (n.d.). Create the problem. Strategies. https://learn.k20center.ou.edu/strategy/149
- K20 Center. (n.d.). Gallery walk/carousel. Strategies. https://learn.k20center.ou.edu/strategy/118