It's a Numbers Game

Systems of Equations

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Grade Level	8th – 9th Grade	**Time Frame**	135 minutes
Subject	Mathematics	**Duration**	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 existing knowledge of this topic by having them apply systems of equations to basketball and basketball statistics. Students also create their own problems. Emphasis is placed on clearly defining variables.

Snapshot

Engage

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

Explore 1

Students create and solve systems of equations to determine the final score of each team.

Explain 1

Students share how they created and solved their systems of equations and how they used them to determine the final scores.

Explore 2

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

Explain 2

Students share how they created and solved their systems of equations and how they used them to determine the total number of baskets of each type.

Explore 3

Students create and solve systems of equations to determine the number of 2- and 3-point shots made by each team.

Explain 3

Students share how they created and solved their systems of equations and how they used them to determine the number of shots made by each team.

Extend

Students create their own scenario that can be represented by a system of equations.

Evaluate

Students participate in a Gallery Walk to solve other students' story problems.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

A604: Solve systems of two linear equations

Oklahoma Academic Standards Mathematics (Algebra 1)

A1.A.1.3: Analyze, use and apply mathematical models to solve problems involving systems of linear equations with a maximum of two variables by graphing, substitution, and elimination. Graphing calculators or other appropriate technology may be utilized. Interpret the solutions in the original context.

Attachments

- Create Your Own Scenario—It's a Numbers Game.docx
- Create Your Own Scenario—It's a Numbers Game.pdf
- Lesson Slides—It's a Numbers Game.pptx
- Nothing But Net—It's a Numbers Game.docx
- Nothing But Net—It's a Numbers Game.pdf

Materials

- Lesson Slides (attached)
- Nothing But Net handout (attached; one per group)
- Create Your Own Scenario handout (attached; one per group)
- Poster paper or other large paper
- Markers
- Notebook paper
- Pens or pencils

20 minutes

Engage

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 objective on **slide 4**.

Go to **slide 5** and play the "Timberwolves vs OKC Thunder Full Game Highlights | 2021 NBA Season" video on the slide. Ask students to take note of things they notice as they are 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 2–3 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 choose 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.

After watching the highlight video, display **slide 6**. 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 did not 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 systems 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 not to 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.

10 minutes

Explore 1

Teacher's Note: Setting Expectations

During this lesson, students are solving systems of equations from real-world scenarios. Determine how you would like students to write their results, algebraically (a letter equals a number, maybe with units) or verbally (as a full sentence). Regardless of your choice, clearly communicate your expectations to students before distributing the attached **Nothing But Net** handout.

Have students get into small groups of 2–3 or assign groups. Show **slide 7** and give each group a copy of the attached **Nothing But Net** handout. Use the slide to provide students with additional information about the game, so they can determine each team's score:

- Together, the Thunder and Timberwolves scored 238 points.
- The Thunder scored 2 more points than the Timberwolves did.

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.

Direct students to use this information to set up their first system of equations on their handout. Have students use the "Variables" section to define their variables. Students can use notebook paper or the back of their handout for space to solve the system of equations, then record their results (each team's score) in the "Results" section of their handout.

To create the equations, students will need to break down the parts of the word problem and apply their knowledge of systems of equations. Groups should come up with equations that are equivalent to what is shown on the hidden **slide 8**.

10 minutes

Explain 1

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 have the correct team scores. They will use these scores to help set up the third set of equations.

Display **slide 9.** 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

15 minutes

Explore 2

Transition through slides **10–11** 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 what they have been asked to find.

- The teams scored a total of 28 points from free throws.
- The teams made 93 total 2-point and 3-point baskets.
- How many 2-point baskets and how many 3-point baskets did the teams make?

Groups will use the new information, in addition to the information given earlier, to determine how many 2-pointers and how many 3-pointers the teams scored in total. Groups should create their new systems of equations, label their variables, solve, and record their results on their handout as before. Groups should come up with equations that are equivalent to what is shown on the hidden **slide 12**.

10 minutes

Explain 2

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.

Display **slide 13**. As a class, discuss all the information that students have been given and have solved so far. Ask students to consider what else they might be able to find using this information.

15 minutes

Explore 3

Show **slide 14** to provide students with the additional information they need for the third system of equations scenario.

- The Thunder scored 16 points from free throws.
- The Timberwolves scored 12 points from free throws and made one more 2-pointer than the Thunder.

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.

Groups should come up with equations that are equivalent to what is shown on the hidden **slide 15**.

10 minutes

Explain 3

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.

25 minutes

Extend

Display **slide 16** and give each group a copy of the attached **Create Your Own Scenario** handout. Here, groups use the Create the Problem strategy to create their own real-life scenario that can be represented by a system of equations. Give each group poster paper or large sheets of paper for them to use to write out the scenario (story problem).

Groups should write their systems of equations, labeling their variables, and recording the solution to the system on their handout to turn in to you.

20 minutes

Evaluate

Teacher's Note: Setting Expectations

During this phase of the lesson, students are going to solve the system of equations created by their peers from the previous activity. Depending on your students' needs, determine how many practice problems and how much time your students need to spend on this task. Consider having students record and solve 2–3 systems of equations for practice.

Show **slide 17**. Have students complete a Gallery Walk to view their classmates' problems. Have students take a notebook and a 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://www.youtube.com/watch?v=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