

Meeting Mathematics Standards With a Deck of Playing Cards

CAMTA Session I

Saturday, March 1, 2008, 9:15 a.m. - 10:05 a.m.

Session Description

Engage in hands-on activities that utilize a deck of playing cards to meet mathematics content and process standards. Activities include variations of card games, but with a mathematical twist (e.g., Integer War, Attribute Eights), and other card-based tasks.

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Games/Activities (Grades 3 through 8)

Integer War, p. 2

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Fraction War, p. 4

24 with playing cards, p. 5

Set with playing cards, p. 6

Quiz Time, p. 7

Area, p. 8

Standards References

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author. (See <http://standards.nctm.org/>.)
(Goals and Expectations are listed with games/activities.)

Tennessee Department of Education. (n.d.). *K-8 mathematics* [Current standards]. Retrieved February 26, 2008, from <http://state.tn.us/education/ci/math/index.shtml>
(Learning Expectations and Accomplishments are listed with games/activities.)

Tennessee Department of Education. (2007). *Tennessee mathematics standards: Draft 12-12-07* [2009 standards, approved 01/25/08].
(State Performance Indicators are listed with games/activities.)

Integer War

Using a standard deck of cards, or the cards from 1 (ace) to 10, cards are dealt to each student. Each student turns over a card. The first student to correctly add the numbers on the cards wins the hand and receives the cards. For integers, the given color code will be black is positive and red is negative. After all cards are played, the student who has the most cards wins the game.

Variations

- ❖ Addition (positive only).
- ❖ Multiplication (positive only).
- ❖ Integers (black is positive, red is negative).
- ❖ The jack, queen, and king cards can be counted as 10, or as 11, 12, and 13, respectively, or removed from the deck.
- ❖ Exponent War could be played, with the assistance of a calculator. Use a base (first card) and an exponent (second card), or a base (my card) and exponent (your card).
- ❖

NCTM Standard 1, Number and Operations

Understand meanings of operations and how they relate to one another.

Grades 3-5

Understand various meanings of multiplication and division.

Understand the effects of multiplying and dividing whole numbers.

Compute fluently and make reasonable estimates.

Grades 3-5

Develop fluency in adding, subtracting, multiplying, and dividing whole numbers.

Tennessee Curriculum Standards, Number and Operations

1.3 Solve problems, compute fluently, and make reasonable estimates.

Grade 3 - Mentally calculate the sum or difference of any two numbers up to 100.

Grade 4 - Multiply and divide efficiently and accurately with single-digit whole numbers.

Grade 5 - Add, subtract, multiply, and divide whole numbers and decimals.

Grade 6 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, and percents in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 7 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 8 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

SPI 0306.2.9 Solve contextual problems involving one arithmetic operation.

Salute

One general and two privates are needed for this game. Each private has half of a deck of cards, using 1 (ace) through 10. When the general says, “salute,” each private deals one card away from the deck and holds it face-up on his or her forehead. The general computes and states the product of the two numbers (positive only). Each private must find the value of the card on his or her forehead. After all cards are played, the student who has the most cards wins the game.

Variations

- ❖ Use integers (black is positive, red is negative).
- ❖ The jack, queen, and king cards can be counted as 11, 12, and 13, respectively, or removed from the deck.
- ❖

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Understand meanings of operations and how they relate to one another.

Grades 3-5

Understand various meanings of multiplication and division.

Understand the effects of multiplying and dividing whole numbers.

Compute fluently and make reasonable estimates.

Grades 3-5

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Tennessee Curriculum Standards, Number and Operations

1.3 Solve problems, compute fluently, and make reasonable estimates.

Grade 3 - Mentally calculate the sum or difference of any two numbers up to 100.

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Grade 6 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, and percents in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 7 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 8 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

SPI 0306.2.5 Identify various representations of multiplication and division.

SPI 0306.2.6 Recall basic multiplication facts through 10 times 10 and the related division facts.

SPI 0306.2.8 Solve problems that involve the inverse relationship between multiplication and division.

Tennessee Mathematics Standards Draft, Standard 3, Algebra

SPI 0306.3.3 Find the missing values in simple multiplication and division equations.

Fraction War

Using a standard deck of cards, or the cards from 1 (ace) to 10, cards are dealt to each student. Each student turns over two cards: a numerator (first card) and a denominator (second card). The student who has the larger fraction receives the cards. After all cards are played, the student with the most cards wins the game.

Variations

- ❖ The jack, queen, and king cards can be counted as 10, or removed from the deck.
- ❖

NCTM Standard 1, Number and Operations

Understand numbers, ways of representing numbers, relationships among numbers, and number systems
Grades 6-8

Work flexibly with fractions, decimals, and percents to solve problems.

Compare and order fractions, decimals, and percents efficiently and find their approximate locations on a number line.

Tennessee Curriculum Standards, Number and Operations

1.2 Understand operations and how they relate to one another.

Grade 6 - Understand the meaning and effects of arithmetic operations on fractions and decimals.

Grade 7 - Understand the meaning and effects of arithmetic operations with fractions and decimals.

Grade 8 - Understand the meaning and effects of arithmetic operations with fractions, decimals, and integers.

1.3 Solve problems, compute fluently, and make reasonable estimates.

Grade 6 - Analyze procedures for computing with fractions, decimals, and integers.

Grade 7 - Analyze procedures for computing with fractions, decimals, and integers.

Grade 8 - Develop and analyze procedures for computing with fractions, decimals, and integers.

Tennessee Mathematics Standards Draft, Standard 1, Mathematical Processes

SPI 0306.1.4 Match the spoken, written, concrete, and pictorial representations of fractions with denominators up to ten.

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

SPI 0306.2.13 Recognize, compare, and order fractions (benchmark fractions, common numerators, or common denominators).

SPI 0406.2.7 Convert improper fractions into mixed numbers and/or decimals.

24 with playing cards

Using a standard deck of cards, or cards from 1 (ace) to 10, place four cards face-up on the table. Each student, in turn, will use the cards to find a value of 24 using the correct order of operations for addition, subtraction, multiplication, and division. The student takes the cards used. Empty slots are filled with new cards. Play continues until the deck is used. If a value of 24 cannot be reached, add another card to the table. After all cards have been played, the winner is the student with the most cards.

Variations

- ❖ The jack, queen, and king cards can be counted as 10 and/or as 11, 12, and 13, respectively, or removed from the deck.
- ❖ Use a fifth card for the target number, rather than 24. Place four cards in a row, with the target card beneath the row.
- ❖ Exponents can be used.
- ❖ Buy the game! See <http://www.math24.com/>
- ❖

NCTM Standard 1, Number and Operations

Understand meanings of operations and how they relate to one another.

Grades 3-5

Understand various meanings of multiplication and division.

Understand the effects of multiplying and dividing whole numbers.

Compute fluently and make reasonable estimates.

Grades 3-5

Develop fluency in adding, subtracting, multiplying, and dividing whole numbers.

NCTM Standard 6, Problem Solving

Grades P-12

Apply and adapt a variety of appropriate strategies to solve problems.

Monitor and reflect on the process of mathematical problem solving.

NCTM Standard 7, Reasoning and Proof, Grades P-12

Select and use various types of reasoning and methods of proof.

NCTM Standard 8, Communication, Grades P-12

Use the language of mathematics to express mathematical ideas precisely.

Tennessee Curriculum Standards, Number and Operations

1.3 Solve problems, compute fluently, and make reasonable estimates.

Grade 3 - Mentally calculate the sum or difference of any two numbers up to 100.

Grade 4 - Multiply and divide efficiently and accurately with single-digit whole numbers.

Grade 5 - Add, subtract, multiply, and divide whole numbers and decimals.

Grade 6 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, and percents in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 7 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Grade 8 - Select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil).

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

SPI 0306.2.6 Recall basic multiplication facts through 10 times 10 and the related division facts.

SPI 0406.2.12 Solve problems using whole number division with one- or two-digit divisors.

Set with playing cards

Place 12 cards, face up, on the table as a 3 by 4 array. When a set can be seen, the student says, “set,” and removes the cards. Empty slots are filled with new cards. Play continues until the deck is used. If a set cannot be found, add three cards to the table. After all cards have been played, the winner is the student with the most cards.

Sets include the following:

Three of a kind, e.g., 7 of hearts, 7 of diamonds, 7 of clubs.

Three in a row, all of the same suit, e.g., 3 of hearts, 4 of hearts, 5 of hearts.

Three in a row, all different suits, e.g., 8 of clubs, 9 of hearts, 10 of diamonds.

Ace can precede 2 or follow king.

Variations

- ❖ Buy a deck of Set cards!
- ❖ Solve the daily puzzle, online, with six solutions. See <http://www.setgame.com/>
- ❖

NCTM Standard 2, Algebra

Understand patterns, relations, and functions

Grades 3-5

Describe, extend, and make generalizations about geometric and numeric patterns.

Represent and analyze patterns and functions, using words, tables, and graphs.

Grades 6-8

Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.

NCTM Standard 7, Reasoning and Proof, Grades P-12

Select and use various types of reasoning and methods of proof.

NCTM Standard 10, Representation, Grades P-12

Use representations to model and interpret physical, social, and mathematical phenomena.

Tennessee Curriculum Standards, Algebra

2.1 Sort and classify objects by size, number, and other properties.

Grade 3 - Sort objects by two or more attributes; Devise, carry out, and explain a sorting scheme for a group of objects; Identify the rules by which objects or numbers have been sorted.

See <http://www.setgame.com/>

Quiz Time

For a 10-item, true-false quiz, a student decides to use a deck of playing cards to select answers. Red will represent “true” and black will represent “false.” After randomly drawing a card and recording the answer, replace the card within the deck so that each card will be as likely to be drawn for each of the quiz items. What the student doesn’t know is that the teacher made up the answer key in the same manner. Using two decks of cards, simulate the teacher’s answer key and the student’s answers. Approximately what percent of quiz items will be correct? Write this value as a fraction, a decimal, and a percent.

Variations

- ❖ Use the four card suits, clubs, diamonds, hearts, and spades, to represent multiple-choice answers, “a,” “b,” “c,” and “d.” Approximately what percent of quiz items will be correct? Write this value as a fraction, a decimal, and a percent.
- ❖ Conduct 10 trials. Report the mean, median, and mode.
- ❖ Conduct 10 trials. Display the results in a graph.
- ❖

NCTM Standard 5, Data Analysis and Probability **Understand and apply basic concepts of probability**

Grades 3-5

Predict the probability of outcomes of simple experiments and test the predictions.

Understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.

NCTM Standard 9, Connections, Grades P-12

Recognize and apply mathematics in contexts outside of mathematics.

NCTM Standard 10, Representation, Grades P-12

Create and use representations to organize, record, and communicate mathematical ideas.

Use representations to model and interpret physical, social, and mathematical phenomena.

Tennessee Curriculum Standards, Data Analysis

5.4 Understand and apply basic concepts of probability.

Grade 4 - Predict the probability of outcomes of simple experiments.

Grade 5 - Use a sample space to predict the probability of an event; Understand that the measure of the likelihood of an event can be represented as a number from 0-1.

Grade 6 - Model situations by devising and carrying out experiments and simulations.

Grade 7 - Connect the symbolic representation of a probability to an experiment.

Grade 8 - Connect the symbolic representation of a probability to an experiment.

Tennessee Mathematics Standards Draft, Standard 1, Mathematical Processes

SPI 0606.1.1 Make conjectures and predictions based on data.

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

- SPI 0606.2.5 Transform numbers from one form to another (fractions, decimals, percents, and mixed numbers).
- SPI 0706.2.6 Express the ratio between two quantities as a percent, and a percent as a ratio or fraction.

Tennessee Mathematics Standards Draft, Standard 5, Data Analysis, Statistics, and Probability

- SPI 0306.5.3 Make predictions based on various representations of data.
- SPI 0406.5.4 List all possible outcomes of a given situation or event.
- SPI 0506.5.1 Depict data using various representations, including decimal and/or fractional data.
- SPI 0506.5.3 Calculate measures of central tendency to analyze data.
- SPI 0606.5.1 Determine the theoretical probability of simple and compound events in familiar contexts.
- SPI 0606.5.3 Determine whether or not a sample is biased.
- SPI 0706.5.4 Use theoretical probability to make predictions.
- SPI 0806.5.1 Calculate probabilities of events for simple experiments with equally probable outcomes.

Area

1. Find the length, width, perimeter, and area of the playing card using U.S. customary units.
2. Find the length, width, perimeter, and area of the playing card using metric units.
3. If the playing card is an irregular shape, trace it on a piece of graph paper (square-inch, square-half-inch, or square-centimeter) to estimate the area.
4. Place one vertex of the playing card at the origin on a coordinate plane of square-inch paper (or square-half-inch paper, or square-centimeter paper). To the nearest inch (or unit used), label all vertices. Use both portrait and landscape orientations in each of the four quadrants.

Variations

- ❖ Adjust the unit size of the paper, and number of sheets of paper needed, based on the size of the card.
- ❖ In “portrait” orientation, draw one diagonal of the card, from the origin to the upper-right corner. Determine the slope of the line. Repeat with the other diagonal.
- ❖ Repeat the previous variation when the card is drawn in “landscape” orientation.
- ❖ Use the Pythagorean theorem to find the length of the diagonal.
- ❖ Use the distance formula to find the length of the diagonal.
- ❖ Find the point of intersection of the two diagonals using a system of two linear equations in two variables.
- ❖

NCTM Standard 3, Geometry

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Grades 3-5

Make and use coordinate systems to specify locations and to describe paths.

Apply transformations and use symmetry to analyze mathematical situations.

Grades 3-5

Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.

Identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.

Grades 6-8

Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling.

Examine the congruence, similarity, and line or rotational symmetry of objects using transformations.

NCTM Standard 4, Measurement

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Grades 3-5

Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute.

Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.

Grades 6-8

Understand both metric and customary systems of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

Grades 3-5

Develop strategies for estimating the perimeters, areas, and volumes of irregular shapes.

Tennessee Curriculum Standards, Geometry

3.3 Recognize and apply flips, slides, and turns.

Grade 3 - Predict and describe the results of sliding, flipping, and turning in two-dimensional shapes.

3.2 Specify locations and describe spatial relationships using coordinate geometry.

Grade 4 - Use appropriate mathematical language to find and specify points on a grid using whole number coordinates.

Grade 5 - Find and specify points in Quadrant I of a coordinate system.

3.3 Apply transformations and use symmetry to analyze mathematical situations.

Grade 4 - Investigate, predict, and describe the results of transformations of two-dimensional geometric figures (i.e., slides, flips, turns); Describe a motion that will show that two shapes are congruent.

Grade 5 - Investigate, predict, and describe the results of transformations of two-dimensional figures (i.e., slides, flips, turns); Describe line and rotational symmetry in two-dimensional figures; Describe a motion or a series of motions that will show that two shapes are congruent.

Grade 6 - Investigate, predict, and describe the results of transformations of two-dimensional figures (e.g., slides, flips, turns); Describe line and rotational symmetry in two-dimensional figures; Describe a motion or a series of motions that will show that two shapes are congruent.

Grade 7 - Relate symmetry and congruence to reflections about a line.

Grade 8 - Relate symmetry and congruence to reflections about a line.

Tennessee Curriculum Standards, Measurement

4.1 Demonstrate understanding of units of measure and measurable attributes of objects.

Grade 3 - Demonstrate understanding of the concepts of perimeter, area, and capacity.

4.1 Understand measurable attributes of objects and the units, systems, and processes of measurement.

Grade 4 - Demonstrate understanding of the concepts of length, perimeter, area, weight, capacity, volume, time, and angle measure; Apply appropriate estimation strategies using standard units of measure.

Grade 5 - Demonstrate understanding of the concepts of length, perimeter, circumference, area, weight, capacity, volume, elapsed time, and angle measure; Demonstrate understanding that measurements are approximations.

Grade 6 - Understand both metric and customary systems of measurement.

Grade 7 - Understand both metric and customary systems of measurement.

Grade 8 - Understand both metric and customary systems of measurement.

Tennessee Mathematics Standards Draft, Standard 1, Mathematical Processes

SPI 0306.1.5 Represent problems mathematically using diagrams, numbers, and symbolic expressions.

SPI 0306.1.6 Identify and use vocabulary to describe attributes of two- and three-dimensional shapes.

SPI 0306.1.7 Select appropriate units and tools to solve problems involving measures.

Tennessee Mathematics Standards Draft, Standard 2, Number and Operations

SPI 0606.2.7 Locate positive rational numbers on the number line.

SPI 0606.2.8 Locate integers on the number line.

SPI 0706.2.5 Solve contextual problems that involve operations with integers.

Tennessee Mathematics Standards Draft, Standard 3, Algebra

SPI 0606.3.9 Graph ordered pairs of integers in all four quadrants of the Cartesian coordinate system.

SPI 0706.3.4 Interpret the slope of a line as a unit rate given the graph of a proportional relationship.

SPI 0806.3.1 Find solutions to systems of two linear equations in two variables.

SPI 0806.3.5 Determine the slope of a line from an equation, two given points, a table or a graph.

Tennessee Mathematics Standards Draft, Standard 4, Geometry and Measurement

SPI 0306.4.4 Calculate the perimeter of shapes made from polygons.

SPI 0306.4.5 Choose reasonable units of measure, estimate common measurements using benchmarks, and use appropriate tools to make measurements.

SPI 0306.4.6 Measure length to the nearest centimeter or half inch.

SPI 0306.4.7 Solve problems requiring the addition and subtraction of lengths.

SPI 0406.4.3 Construct geometric figures with vertices at points on a coordinate grid.

SPI 0406.4.7 Determine appropriate size of unit of measurement in problem situations involving length, capacity or weight.

SPI 0406.4.9 Solve problems involving area and/or perimeter of rectangular figures.

SPI 0406.4.10 Identify images resulting from reflections, translations, or rotations.

SPI 0506.4.5 Find the length of vertical or horizontal line segments in the first quadrant of the coordinate system, including problems that require the use of fractions and decimals.

SPI 0806.4.1 Use the Pythagorean theorem to solve contextual problems.

SPI 0806.4.2 Apply the Pythagorean theorem to find distances between points in the coordinate plane to measure lengths and analyze polygons and polyhedra.