



San Diego Unified School District

Instructional Module to Enhance the Teaching of

HARCOURT

Math

California Edition

Grade 4

Module 9 – Revised

Unit 9: Probability

— WORK IN PROGRESS —

MODULE 9 – PROBABILITY

Modules represent individual units of study that lead to the essential learnings

THREADS THROUGHOUT THE YEAR

The threads represent ongoing learning opportunities in which students should be actively engaged throughout all units of inquiry during the entire school year. These items should not be isolated to any one particular unit of inquiry.

Students will:

- Develop understanding of numbers and the number system and use their understanding to solve problems and recognize reasonable results.
- Develop understanding of and fluency in basic computation and procedural skills.
- Use mathematical reasoning to solve problems.
- Communicate their mathematical thinking by using words, numbers, symbols, graphs and charts and translate between different representations.
- Use equations and variables to express generalizations of patterns and relationships.
- Develop logical thinking to analyze evidence and build arguments to support or refute a hypothesis.
- Make connections among mathematical ideas and between other disciplines.
- Develop and use strategies, skills, and concepts to solve problems.
- Use appropriate tools, including technology, as vehicles to learn mathematical concepts.

These are essential learnings that represent bigger ideas/concepts:

- Students conduct simple probability experiments and verbally and numerically represent predictions regarding likelihood of events occurring.
- Students discover how an increase in the amount of data gathered results in experimental results that more closely approximate the theoretical results.

These are essential questions that learners ask themselves in order to achieve the essential learnings:

- How do I organize, represent, interpret and communicate clearly the actual results of simple probability situations using: diagrams, tables, tree diagrams, an organized list and fractions*?
- How do I determine all the possible outcomes for simple probability situations?
- **How do I express outcomes of probability situations verbally and numerically?*
- How do I predict the likelihood for simple probability situations?
- How do I use probability to design a fair game and to test a game for fairness?
- How do I show and explain that probability experiments illustrate that the results of an experiment may not be exactly the same as the mathematical probability?
- **How do I show and explain what happens to the relationship between experimental and theoretical probability as I increase the amount of data?*

*** Presented in previous grades**

Resources: Van de Walle: Chapter 21 (pp. 386 & 405-411)

UNIT 9: Probability
MODULE 9 – 2 Weeks of Instruction

Key Mathematical Concepts:

- Understand that probability refers to the likelihood that an event will occur-
- Recognize that probability is expressed as a fraction from 0 to 1, inclusive-
- Understand that probability is defined as the number of favorable outcomes compared to the total number of possible outcomes-
- Understand how to organize, represent, interpret and communicate clearly the results of simple probability situations-
- Understand how to make predictions for likely and unlikely events for simple probability situations-
- Know how to organize and represent all possible outcomes for simple probability situations-
- Know how to express the outcomes of probability situations (numerically and verbally)-
- Understand that the mathematical probability is the chance of an event occurring and that the results of an experiment may not be exactly the same as the mathematical probability-
- Understand the experimental results and mathematical results become closer with an increase number of results from the experiment-

Chapter 29: <u>Outcomes</u>	Chapter 30: <u>Probability</u>
Lesson 29.1: Hands On: Record Outcomes	Lesson 30.1: Probability as a Fraction
Lesson 29.2: Tree Diagrams	Lesson 30.2: Hands On: More About Probability
Lesson 29.3: Problem Solving Strategy: Make an Organized List	Lesson 30.3: Test for Fairness
Lesson 29.4: Predict Outcomes of Experiments	Lesson 30.4: Problem Solving Skill: Drawing Conclusions

Unit 9: Probability
Chapters 29-30

MODULE 9 NOTES

The following lessons are optional if additional instructional time is needed for other concepts:

- Lesson 29.4: Predict Outcomes of Experiments
Predicting is not addressed in the California Standards. However, the lesson can be incorporated with the others – it provides good practice in finding and expressing outcomes.
- Lesson 30.4: Problem Solving Skill: Draw Conclusions
- Spinner Blackline Masters: Teacher’s Resource Book: Pages 63 – 67

Unit 9: 2 Weeks of Instruction

<p><u>Day 1</u> CHAPTER 29 Outcomes Lesson 29.1: Hands On: Record Outcomes</p>	<p><u>Day 2</u> Lesson 29.2: Tree Diagrams</p>	<p><u>Day 3</u> Lesson 29.3: Problem Solving Strategy: Make an Organized List</p>	<p><u>Day 4</u> Lesson 29.4: Predict Outcomes of Experiments</p>	<p><u>Day 5</u> CHAPTER 30 Probability Lesson 30.1: Probability as a Fraction</p>
<p><u>Day 6</u> Lesson 30.2: Hands On: More About Probability</p>	<p><u>Day 7</u> Lesson 30.3: Test for Fairness</p>	<p><u>Day 8</u> Lesson 30.4: Problem Solving Skill: Draw Conclusions</p>	<p><u>Day 9</u> California Connection Unit Assessment</p>	

DAY 1

Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING

Chapter 29 Outcomes

LESSON 29.1, Pp. 556-557

<p>MATERIALS:</p>	<p>For each student: 1 penny and 2 colored counters. TR 52. Spinners for Explore, Try It & Connect</p>								
<p>LESSON FOCUS:</p>	<p>Recording Outcomes</p>								
<p>CALIFORNIA STANDARDS:</p>	<p>Statistics, Data Analysis, and Probability 2.1 2.1: Represent all possible outcomes for a simple probability situation in an organized way. Mathematical Reasoning 1.0</p>								
<p>PURPOSE OF LESSON:</p>	<ul style="list-style-type: none"> • Understand how to use a table to record the outcomes of experiments. • Recognize that each outcome of an experiment is unique, but different events might have common outcomes. • Understand that a <i>sample space</i> lists all the possible outcomes of an experiment. 								
<p>LAUNCH: Introduce students to concepts. <i>Grid paper-TR 52</i></p>	<p>What's an Outcome? P. 554</p> <ul style="list-style-type: none"> • Discuss gum machine questions with student. Emphasize vocabulary: likely; unlikely; least likely; certain. • Further discussion: <i>Have you noticed that some things or events are more likely to happen than others?</i> <i>For example: Is it more likely to rain in the winter or in the summer in San Diego? What other kinds of events can you think of that are more likely or less likely to happen.</i> • Students share and discuss ideas about why. 								
<p>EXPLORE: Work with the concept. Focus on students "doing mathematics." <i>Penny and 2 color counters.</i></p>	<p>Check What You Know, P. 555 # 1-10.</p> <ul style="list-style-type: none"> • Discuss why results are certain or impossible. • Penny Toss: <i>1 penny per student.</i> <i>If you toss your penny what are the possible outcomes?</i> • Discuss. Ask students to estimate: <i>If you toss your coin 10 times, how many times do you think you will get heads? Tails?</i> <table border="1" data-bbox="987 1507 1474 1686"> <tr> <th colspan="2">Coin Toss Possible Outcomes:</th> </tr> <tr> <th>Heads</th> <th>Tails</th> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </table> <ul style="list-style-type: none"> • Discuss possible outcomes: 10 heads, 10 tails, and other combinations. Record table on board/overhead • Toss a penny 10 times and tally each toss with class. • Ask students: <i>If you toss the coin 10 more times, do you think you will get the same results? Discuss.</i> • Students toss coin 10 times and record results. Review tallying as 	Coin Toss Possible Outcomes:		Heads	Tails				
Coin Toss Possible Outcomes:									
Heads	Tails								

	<ul style="list-style-type: none"> • Learn, P. 558: Decisions, Decisions. Write problem on board/overhead. <p>Students predict numbers of combinations: Work with partners to solve. Discuss solution and strategies for solving.</p> <ul style="list-style-type: none"> • Teach, P. 558; Guided Instruction questions to guide discussion. • Check, P. 558 #1 & 2. Do with students.
PRACTICE: Focus on Communication and Representation.	Practice & Problem Solving, P. 559: #s 3-4. <ul style="list-style-type: none"> • Students solve with partners. Discuss solutions /strategies and patterns students notice. Practice & Problem Solving, P. 559: #s 5-9: <ul style="list-style-type: none"> • Students predict/estimate number of outcomes. • Discuss/explain strategies/reasoning. Solve with partners. • Discuss solutions and methods for recording/finding all combinations. <u>Connect</u> approaches/tree diagram to multiplication.
SUMMARIZE: Connect purpose to activities.	ASSESS, P. 559: DISCUSS. <ul style="list-style-type: none"> • Students discuss Sam's Shoe Store problem. • Students solve and explain solutions/strategies. ASSESS, P. 559: WRITE. <ul style="list-style-type: none"> • Students draw a tree diagram showing the number of different sandwiches they could make. • Share and discuss.
HOMEWORK:	Practice & Problem Solving, P. 559: # 10: <ul style="list-style-type: none"> • Read with students. Mixed Review and Test Prep, P. 559 #s 11-15

ROUTINES:
Compare and Simplify Fractions and Mixed Numbers

Write 2 fractions or mixed numbers.

Students identify which is greater.

For example, say and write $\frac{2}{3}$ and $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{3}{8}$, etc.

Vary by having them identify the lesser of the 2.

Continue going around class by saying and writing numbers that need to be simplified, e.g., $\frac{7}{4}$, $\frac{3}{2}$, $\frac{9}{8}$, etc. Encourage students to compare the fractions to one another.

Students can also work with a partner and ask each other similar fractions.

DAY 3
Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
Chapter 29 Outcomes
LESSON 29.3, Pp. 560-561

MATERIALS:	
LESSON FOCUS:	Problem Solving Strategy: Make an Organized List
CALIFORNIA STANDARDS:	Statistics, Data Analysis, and Probability 1.1: Formulate survey questions; systematically collect and represent data on a number line; coordinate graphs, tables, and charts. 2.1: Make precise calculations and check the validity of results from the context of the problem. Measurement and Geometry 1.4, 2.0 Mathematical Reasoning 2.6
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Understand how to make an organized list as a strategy to solve problems. • Connect the strategy of making a list to tree diagrams.
LAUNCH: Introduce students to concepts.	HW: Discuss solutions to problem #10. (optional)
EXPLORE: Work with the concept. Focus on students “doing mathematics.”	Alternative Teaching Strategy, P. 560B. <ul style="list-style-type: none"> • Use to solve Problem on P. 560. It is not necessary to require students to use a tree diagram. • Use questions from teach section as appropriate. Review Problem Solving Process: Understand, Plan, Solve, and Check. <ul style="list-style-type: none"> • Discuss students’ solutions and strategies. • Students explain/justify solutions.
PRACTICE: Focus on Communication and Representation.	Problem Solving Practice, P. 561: #s 1-2: Do with students. Problem Solving Practice, P. 561: #s 3-4 Mixed Strategy Practice, P. 561 #5 - 8
SUMMARIZE: Connect purpose to activities.	Assess, P. 561: DISCUSS. <ul style="list-style-type: none"> • Chart students’ explanations of how making an organized list helps solve these problems.
HOMEWORK:	Mixed Strategy Practice, P. 561 # 9-10. Cumulative Review P. 567: #s 2-5.

ROUTINES:**Compare and Order Decimals**

Say and write 2 decimals. Students identify which decimal is greater or explain that they are equal.

Vary by having students identify the decimal that is smaller or equal pair. Students explain and “justify” solution.

Use decimals such as:

0.45 and 0.49

0.020 and 0.02

0.5 and 5.0

0.9 and 0.91

1.0 and 1.02

0.70 and 0.70.

08 and 0.80

2.19 and 2.2

If time permits, write 3 similar decimals and have students order them.

DAY 4
 Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
 Chapter 29 Outcomes
 LESSON 29.4, Pp. 562-565

MATERIALS:	<ul style="list-style-type: none"> • Number cube for each small group; • one bag or box, different colored counters or marbles
LESSON FOCUS:	Predict Outcomes of Experiments
CALIFORNIA STANDARDS:	Statistics, Data Analysis, and Probability 1.3 2.0: Make predictions for simple probability situations. Mathematical Reasoning 1.0, 1.1, 1.2, 2.2 Number Sense 2.0, 4.2
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Predict outcomes of experiments and recognize that events can be classified as: certain, likely, equally likely, unlikely, or impossible. • Understand that predictions are statements of what might happen but not a guarantee of outcomes.
LAUNCH: Introduce students to concepts.	HW: Partner check Cumulative Review P. 567: #s 2-5. (optional) What’s Certain? Likely? Unlikely? Impossible? <ul style="list-style-type: none"> • Generate “statements” for the meaning of each term. <i>What’s a prediction?</i> <i>Have you ever predicted anything?</i> Students give examples of predictions. • Record predictions on board/overhead.
EXPLORE: Work with the concept. Focus on students “doing mathematics.” <i>Bag or box with 2 red counters/marbles and 2 blue counters/marbles.</i> <i>Number cube – 1 per small group.</i>	HW: Partner check Cumulative Review P. 567: #s 2-5. (optional) What’s Certain? Likely? Unlikely? Impossible? <ul style="list-style-type: none"> • Generate “statements” for the meaning of each term. <i>What’s a prediction?</i> <i>Have you ever predicted anything?</i> Students give examples of predictions. • Record predictions on board/overhead. Alternative Teaching Strategy, P. 564. Discussion Questions: <i>Were the events <u>equally likely</u>?</i> <i>Do the results show equally likely events?</i> Discuss. <i>If you repeated this experiment many times, what do you think would happen to the results?</i> Learn, P. 562: What’s Possible. Read together. Teach, P. 562; Guided Instruction questions to discuss. Examples: A, B, C and D with students. <ul style="list-style-type: none"> • Students explain/justify responses. Omit P. 563: Predicted vs. Actual Outcomes
PRACTICE: Focus on Communication and Representation.	Practice & Problem Solving, P. 564: #s 6-12: <ul style="list-style-type: none"> • Do and discuss with students. Practice & Problem Solving, P. 564: #13-17, 19: <ul style="list-style-type: none"> • Students do with partners. Solutions include justifications for response: likely, equally likely, unlikely. Discuss.

SUMMARIZE: Connect purpose to activities.	Practice & Problem Solving, P. 564: #18: <ul style="list-style-type: none">Students write an example of a likely event, an unlikely event, and an impossible event.
HOMEWORK:	Practice & Problem Solving, P. 565: # 20 Mixed Review and Test Prep #s 21-27.

ROUTINES:**Solve for “n”**

Say and write an equation with a variable (n). Students solve for “n”.

Examples:

$$6 \times n = 42$$

$$n - 30 = 40$$

$$25 - n = 12$$

$$n \div 2 = 4$$

$$9 \times n = 0$$

$$60 \div n = 10$$

$$n \div 5 = 5$$

Vary by having students say equations as you record them. Vary by having students find the value of an expression, e.g., “What is 3 times y if y is 7?”

Students explain/justify strategies for solving.

DAY 5
 Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
 Chapter 29 Outcomes
 LESSON 30.1, Pp. 570-571

MATERIALS:	
LESSON FOCUS:	Probability as a Fraction
CALIFORNIA STANDARDS:	Statistics, Data Analysis, and Probability 1.3 2.0: Make predictions for simple probability situations. 2.2: Express outcomes of experimental probability situations verbally and numerically. Measurement and Geometry 3.0 Mathematical Reasoning 2.4
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Use fractions to write the probability of simple events. • Understand that probability is expressed as a fraction from 0 to 1, inclusive. • Understand the meaning of probability: the number of favorable outcomes compared to the total number of possible outcomes.
LAUNCH: Introduce students to concepts.	<p>What’s the chances (likelihood or probability)?</p> <ul style="list-style-type: none"> • Present this context: <i>Suppose there are 4 boxes. In 3 of them are homework assignments. In the fourth box is a homework pass. You pick one box and get whatever is in it. What are your chances (what is the <u>probability</u>) of picking the box with the homework pass? (one out of four →written <u> </u>)</i> • Discuss. Students explain conjectures/reasons for answers. • Possible Discussion Questions: <ul style="list-style-type: none"> • <i>How many boxes are there in all? (four possible outcomes)</i> • <i>How many boxes have the homework pass in them?</i> • <i>What are different ways to describe this relationship?</i>
EXPLORE: Work with the concept. Focus on students “doing mathematics.”	<p>Learn, P. 570: Color Wheel Problem.</p> <ul style="list-style-type: none"> • Sketch spinner on P. 570 on board/overhead. Discuss the probability of Spinning 1, 2, 3 or 4. <p>Teach, P. 570; Guided Instruction questions to guide discussion of Explore, P. 570, including Examples.</p> <ul style="list-style-type: none"> • Students discuss meaning of “1 out of 4 or $1/4$ = less likely,” etc. <p>Practice & Problem Solving, P. 571 #6 – 12.</p> <ul style="list-style-type: none"> • Discuss with students.
PRACTICE: Focus on Communication and Representation.	<p>Practice 30.1:</p> <ul style="list-style-type: none"> • Sketch spinner with 5 parts on board/overhead. • Students determine probabilities for spinning each letter. • Discuss questions 1-7 and use terms: likely, equally likely, etc and refer to line representation. <p>Practice, P. 571: #s 13-15:</p> <ul style="list-style-type: none"> • Discuss solutions. Students create models, spinners, cubes in a bag, etc. to representation/model the correct solutions for the problems.

SUMMARIZE: Connect purpose to activities.	ASSESS, P. 571: DISCUSS. <ul style="list-style-type: none"> • Students choose a number from 1-50 and find the probability that is a multiple of 5. Discuss. • Students draw a spinner that shows a probability of $1/4 = \text{red}$.
HOMEWORK:	Mixed Review & Test Prep, P. 571 #s 16-20 <ul style="list-style-type: none"> • Draw a spinner that shows the probability of 1 out of 4 spins red and 1 out of 2 chances to spin blue.

ROUTINES:**How Far Around?**

What is the mathematical term for the distance around a rectangle?

Divide the class into 4-6 groups. Explain that you will be listing dimensions for some rectangles. Each group is to find the perimeter. Emphasize using correct unit to label perimeter.

Continue as needed. Use dimensions such as the following:

3 in. by 12 in.

6 ft. by 9 ft.

100 yd. By 24 yd. 1.5 ft by 2 ft

15 cm. by 15 cm.

30 mi. by 30 mi.

25 in. by 30 in.

