

# Trigonometry and Statistics

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Chris Foley [cfoley@lrhsd.org](mailto:cfoley@lrhsd.org) ext. 8465

Chris Callinan [ccallinan@lrhsd.org](mailto:ccallinan@lrhsd.org) ext. 8364

Robert Kibler [rkibler@lrhsd.org](mailto:rkibler@lrhsd.org) ext. 8583

Mike Spera [mspera@lrhsd.org](mailto:mspera@lrhsd.org) ext. 8340

## Unit #5, Probability

### Stage 1 – Desired Results

#### Established Goals

**2009 NJCCC Standard(s), Strand(s)/CPI #**  
(<http://www.nj.gov/education/cccs/2009/final.htm>)

**Common Core Curriculum Standards for Math and English**  
(<http://www.corestandards.org/>)

#### **Conditional Probability and the Rules of Probability S-CP #1-9**

- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model

#### **Using Probability to Make Decisions S-MD #1-7**

- Calculate expected values and use them to solve problems.
- Use probability to evaluate outcomes of decisions.

#### **Making Inferences and Justifying Conclusions S-IC #2,6**

- Understand and evaluate random processes underlying statistical experiments.
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

#### **21<sup>st</sup> Century Themes** ( [www.21stcenturyskills.org](http://www.21stcenturyskills.org) )

- \_\_\_ Global Awareness
- Financial, Economic, Business and Entrepreneurial Literacy
- \_\_\_ Civic Literacy
- \_\_\_ Health Literacy
- \_\_\_ Environmental Literacy

#### **21<sup>st</sup> Century Skills**

##### *Learning and Innovation Skills:*

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

##### *Information, Media and Technology Skills:*

- \_\_\_ Information Literacy
- \_\_\_ Media Literacy
- ICT (Information, Communications and Technology) Literacy

	<p><i>Life and Career Skills:</i></p> <p><input type="checkbox"/> Flexibility and Adaptability</p> <p><input checked="" type="checkbox"/> Initiative and Self-Direction</p> <p><input type="checkbox"/> Social and Cross-Cultural Skills</p> <p><input checked="" type="checkbox"/> Productivity and Accountability</p> <p><input checked="" type="checkbox"/> Leadership and Responsibility</p>
<p><b>Enduring Understandings:</b>  <i>Students will understand that . . .</i></p> <p><i>EU 1</i>  the probability of an event's occurrence can be predicted with varying degrees of confidence.</p> <p><i>EU 2</i>  experimental results tend to approach theoretical probabilities after a large number of trials.</p>	<p><b>Essential Questions:</b></p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> <li>• What is probability?</li> <li>• How do you determine if an event is independent or dependent?</li> <li>• How do you determine if an event is mutually exclusive or not?</li> </ul> <p><i>EU 2</i></p> <ul style="list-style-type: none"> <li>• How can experimental and theoretical probabilities be used to make predictions or draw conclusions?</li> <li>• Why might you get different results when repeating an experiment multiple times?</li> <li>• What are the drawbacks of using probability in regards to what will occur in the short term?</li> </ul>

**Knowledge:**

Students will know . . .

## EU 1

- probability is used in decision making
- the risk and reward of various situations
- compound events are either independent or dependent as well as mutually exclusive or not .

## EU 2

- probability does not aid in the prediction of an occurrence in the short term.
- that the probability of an event can be useful in decision making .
- the probability of an event can be used to support or dispute a claim .
- theoretical probability is what happens over the long run, whereas experimental probability is what is obtained from a given experiment .

**Skills:**

Students will be able to . . .

## EU 1

- compute probability for simple and compound events.
- use expectation and probability to evaluate the risk/reward of the situation.
- determine whether events are independent or dependent.
- determine whether events are mutually exclusive or not.

## EU 2

- compute probability for simple and compound events .
- use the probability obtained to make predictions about an event.
- compare and contrast experimental and theoretical probabilities.

**Stage 2 – Assessment Evidence****Recommended Performance Tasks:**

GROUP:

*EU 1* - the probability of an event's occurrence can be predicted with varying degrees of confidence. *EU 2* - experimental results tend to approach theoretical probabilities after a large number of trials.

A group of students has been assigned a booth at the local carnival to raise money for a charity of your choice (the group will decide on a charity to research and write a 1-2 paragraph narrative describe the mission of the charity and your reasoning for selecting it). Using the rules of probability and mathematical expectation, develop a game of chance that the group will host. The game must be profitable, but at the same time fun and worthwhile for the customer. To decide on and develop your game, the group must take into account the probability of the customer winning a prize, the cost that

will be charged for the game and the appeal of the game to the customer. The group must determine the theoretical and experimental probabilities of the customer willing as well as the amount of money that will be raised for the charity per game.

**INDIVIDUAL:**

An outside evaluator has been assigned a game that was developed by another group. The task is to determine the theoretical probability of the customer winning and the amount of money that the game will raise for the specified charity. All of the calculations should take into account the rules and cost of the game. Along with this he has been tasked to critic the game, both positively and negatively, and offer suggestions that would make the game more of a “money maker”

Test and quizzes to include: Calculating the theoretical probability of simple and compound events, determine if events are independent or dependent, determine if events are mutually exclusive or not, obtain the experimental probability of events, supporting or disputing claims using probability, determining mathematical expectation, interpret the results from a simulation.

**Other Recommended Evidence:** *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

## Stage 3 – Learning Plan

**Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:** *Consider the WHERETO elements. Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

Ti-Nspire Activity #1: Statistics: Probability Distributions (M,T)

- Students will compare the distribution of a discrete sample space to distributions of randomly selected outcomes from that sample space
  - Students will identify the structure that emerges as more and more data are added to the distribution (that is, the features of the distribution of random processes stabilize as the sample gets larger)
  - Students will recognize that relative frequencies of particular outcomes after few observations are more likely to deviate substantially from expected values than are relative frequencies based on more observations
  - Students will use appropriate tools strategically
  - Students will look for and make use of structure
- <http://education.ti.com/calculators/timathnspired/US/Activities/Detail?sa=5026&t=5078&id=13335>

Ti-Nspire Activity #2: Statistics: Tossing Dice (M,T)

- Students will estimate the probability of outcomes from a dot plot.
  - Students will compare a simulated sampling distribution to the theoretical distribution for the underlying relationship and note that the simulated distribution will more closely approximate the theoretical after a large number of samples.
  - Students will model with mathematics
- <http://education.ti.com/calculators/timathnspired/US/Activities/Detail?sa=5026&t=5078&id=17177>

TI-Nspire Activity #3: Statistics: Conditional Probability (M,T)

- Students will identify the difference between the probability of an outcome and the conditional probability of an outcome.
  - Students will answer probability questions using information presented in a table and in a graph.
  - Students will reason abstractly and quantitatively
- <http://education.ti.com/calculators/timathnspired/US/Activities/Detail?sa=5026&t=5078&id=17175>

**Consider this problem:** (A,M,T)

- A con man has 3 coins. One coin has been specially made and has a head on each side. A second coin has been specially made and has a tail on each side. Finally, the third coin has a head and a tail on it. All coins are the same denomination. The con man places the 3 coins in his pocket, selects one, and shows you one side. It is heads. He is willing to bet you even money that it is the two-headed coin. His reasoning is that it can't be the two-tailed coin since a head is showing; therefore there is a 50-50 chance of it being the two-headed coin. Would you take the bet? Explain your reason using probability and expectation.

**Key Vocabulary Includes:** experimental probability, theoretical probability, sample space, independent events, mutually exclusive events, complementary events, compound events

The following is the suggested sequence of learning activities and number of days for the Trigonometry and Statistics class. Adjustments should be made accordingly to other levels.

Approximate time of completion of unit: 25 days

Student will

- find the probability of the occurrence of events, using the rules for classical probability and complementary events (A,M)
- use empirical probability to find the percentage of data that falls within particular interval (A,M)
- compare theoretical and experimental probability using the law of large numbers
- Ti-Nspire Activity #2 (M,T)
- utilize the rules of probability to evaluate risk taking (A,M,T)
- apply the addition rules of probability (mutually exclusive) (A,M)
- apply the multiplication rules for probability (independence) (A,M)
- apply the conditional rules for probability
- Ti-Nspire Activity #3 (M,T)
- find the number of combinations available in a specific situation using the Fundamental counting principle (M,T)
- develop a probability distributions and use it to determine mathematic expectation
- Ti-Nspire Activity #1 (M,T)
- develop and interpret simulations to represent real-life scenarios (M,T)

