# Unit 5 - Math Applications in Society

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **15 blocks**
Status: **Published**

## Course Description & Instructional Notes

**Course Description:** This course is designed to help students in grade 12 develop and strengthen basic mathematical skills, problem solving techniques and the application of such skills. The course is intended to further develop the mathematical skills necessary for the college entrance exam.

In this unit, students wll apply the skills acquired from the first three marking periods to real-life scenarios.

**Prior Knowledge:** Students will already have knowledge of the measures of center, and choosing the best measure of center to describe a distribution from the Algebra 1 standards.

**Instructional Notes**: Teacher should create a Performance Task for students to complete based on the ability to analyze and interpret data.

**Graphing Calculator Integration:** Teacher will model the usage of the graphing calculator throughout the unit. Students will become comfortable with navigating and using the graphing calculator to solve a variety of problems efficiently (i.e. Calculating Measure of Center Using STAT Function, computing interest formulas, etc.).

**Technology Integration:** Students will conduct research to support their projects.

## Enduring Understandings

Algebraic representation can be used to generalize patterns and relationships.

Understanding the differences in types of interest and investment is necessary to develop correct decision making.

It is necessary to understand how units of measurement or currencies relate to each other when traveling.

## Essential Questions

- How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations?
- What skills are essential for effectively managing your money?
- What are the mathematical characteristics of team performances related to baseball and other sports?

## Student Learning Objectives

- Calculate simple and compound interests.
- Assess and evaluate types of credit card fees.
- Use mathematical formulas to calculate budgets for travel and monthly expenses.
- Critique player performances using statistics (i.e. assess field averages, winning percentages, games ahead/behind, etc.)
- Apply the perimeter and area formulas for polygons to real life scenarios (fencing, flooring, etc.)

## Vocabulary & Learning Experiences

**Essential Academic Vocabulary**

amount, annually, appreciate, area, biannually, budget, compound interest, compound probability, depreciate, interest rate, perimeter, principal, probability, quarterly, simple probability, statistics, tax

**Planned Learning Experiences**

Scavenger Hunt

Projects

Experiments

## Resources

- Math IXL
- Delta Math

- Khan Academy

## Assessments

**Formative Assessments**

Quiz - Compound Interest

Quiz - Project Outlines

**Summative Assessments**

Project - Vacation Budget

Project - Flooring Budget

Project - Athlete Statistics

## NJSLS Standards - Mathematics

*NJSLS Standards in Mathematics Copied and Pasted as well as linked.*

**NJSLS Standards - Mathematics**

**Quantities★ N -Q**

**A. Reason quantitatively and use units to solve problems.**

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

2. Define appropriate quantities for the purpose of descriptive modeling.

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

**Interpreting Functions F-IF**

**C. Analyze functions using different representations**

8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$ , $y = (0.97)^t$ , $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.

**Linear and Exponential Models★ F-LE**

**A. Construct and compare linear and exponential models and solve problems**

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

**Mathematical Practices**

**1 Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**2 Reason abstractly and quantitatively.** Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**3 Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account New Jersey Student Learning Standards for Mathematics 4 the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**4 Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**5 Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation

and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**6 Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

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| MA.N-Q.A | Reason quantitatively and use units to solve problems. |
| MA.N-Q.A.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| MA.N-Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| MA.N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| MA.F-IF.C.8b | Use the properties of exponents to interpret expressions for exponential functions. |
| MA.F-LE.A.1 | Distinguish between situations that can be modeled with linear functions and with exponential functions. |
| MA.F-LE.A.1a | Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| MA.F-LE.A.1b | Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. |
| MA.F-LE.A.1c | Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. |
| MA.F-LE.A.3 | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. |

## Additional NJSLS Standards

*NJSLS Standards Copied and Pasted as well as linked.*

***Interdisciplinary Connections***

**NJSLS Companion Standards Grades 9-12 (Reading & Writing in Science & Technical Subjects)**

**RST.11-12.1**. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

**RST.11-12.3**. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**RST.11-12.8**. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**WHST.11-12.4**. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

## Techonolgy (8.1 & 8.2)

**8.1 Educational Technology**: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

**A. Technology Operations and Concepts**: Students demonstrate a sound understanding of technology concepts, systems and operations.

**8.1.12.A.CS1** Understand and use technology systems.

**8.1.12.A.CS2** Select and use applications effectively and productively.

**8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming**: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

**E. Computational Thinking: Programming**: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

**8.2.12.E.1** Demonstrate an understanding of the problem-solving capacity of computers in our world.

## 21st Century Life and Careers (9.1 & 9.2)

**CRP1.** Act as a responsible and contributing citizen and employee.

**CRP2.** Apply appropriate academic and technical skills.

**CRP4.** Communicate clearly and effectively and with reason.

**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.

**CRP11.** Use technology to enhance productivity.

**CRP12. Work productively in teams while using cultural global competence.**

**9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.**

**9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.**

**9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.**

## Modifications/Accommodations