Summit Public Schools

Summit, New Jersey

Grade Level 9-10/ Content Area: Mathematics

Length of Course: Semester Course over a Full Academic Year

Curriculum: Mathematical Strategies

Developed by:
Alicia Grysko
Anticipated Timetable for Mathematical Strategies

Quarter 1 Number Sense, Concepts, and Applications

<table>
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<tr>
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<th>Week</th>
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<td>Evaluating equations using substitution</td>
<td>1</td>
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<td>Using proportional techniques to solve problems</td>
<td>2</td>
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<td>Solving linear equations</td>
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<td>Solving linear inequalities</td>
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Quarter 2 Spatial Sense and Geometry

<table>
<thead>
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<td>9</td>
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</tbody>
</table>

Quarter 3 Patterns, Functions, and Algebra

<table>
<thead>
<tr>
<th>Topic</th>
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<td>Input output tables</td>
<td>11</td>
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</table>

Quarter 4 Data Analysis, Probability, Statistics, and Discrete Mathematics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Week</th>
</tr>
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<tr>
<td>Mean, median, mode and range</td>
<td>18</td>
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<td>21</td>
</tr>
</tbody>
</table>

Course Description: The Mathematics Section of the HSPA assessment is divided into four content clusters. Each of these clusters reflects knowledge and skills specified in New Jersey’s Core Curriculum Content Standards. Students in this course will improve content skills from eighth grade common core standards.
## Unit 1: Number Sense, Concepts, and Applications

**Standard NS**

Students will know that there are numbers that are not rational, and approximate them by rational numbers.

### Big Ideas: *Course Objectives / Content Statement(s)*

- Understand types of numbers, our numeration system, and the ways they are used and applied in real-world situations.
- Apply ratios, proportions, and percents in a variety of situations.

### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- What are our basic number types?
- What is order of operations and how can it be applied to solve complex problems?
- How can proportions be used?
- How are inverse operations used to solve linear equations and inequalities?

### Enduring Understandings

*What will students understand about the big ideas?*

- Students will…
  - Recognize the difference between rational and irrational numbers.
  - Be able to apply order of operations to solve algebraic expressions and word problems.
  - Recognize when to use proportions to solve word problems.
  - Understand how to use inverse operations.

### Areas of Focus: Proficiencies (Cumulative Progress Indicators)

**Students will:**

- **NS. 1** Know that numbers that are not rational are called irrational.
- **NS. 2** Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions.

### Examples, Outcomes, Assessments

**Instructional Focus (5 weeks):**

- Students will use techniques of substitution to apply their knowledge of signed numbers and order of operations to word problems.
- Students will use proportion techniques to calculate rate of change.
- Students will solve linear equations and inequalities. Solutions to inequalities will be sketched on a number line.

**Technology and Cross-Curricular Learning Integration**

- Students will create a budget project for a vacation for their family. The budget project is described in the attached [WEQUEST](http://www.glencoe.com/sites/common_assets/mathematics/mc2/webquest/MC2_Unit2.html).

**Student Centered Learning:**

- Student will practice techniques of precision teaching with signed numbers and operations of addition, subtraction, multiplication and division.

### Webquest:

http://www.glencoe.com/sites/common_assets/mathematics/mc2/webquest/MC2_Unit2.html
Examples of weekly themed problems:

**Theme week 1: Using equations to predict outcomes**

If \( y = 4(-3x + 5) - 9 \), find \( y \) if:  
- a. \( x = 10 \)  
- b. \( x = -10 \)  
- c. \( x = 0.5 \)  
- d. \( x = 0 \)  
- e. \( x = -1 \)  
- f. \( x = \frac{2}{3} \)

The number of visitors \( V \) to a swimming pool varies with the day’s high temperature in degrees Fahrenheit, \( T \), according to the following equation: \( V = 150 + 25(T - 80) \)

- a. Create a table that begins with a temperature of 80 degrees and increases by 1 degree until 90 degrees.
- b. What does the output value represent?
- c. Is there a temperature where the pool would decide not to open? Explain your reasoning.

**Theme week 2: Using proportions to calculate values**

Jamie works for the Summit YMCA. Before taxes, Jamie earned $127.50 for 15 hours of work. Lauren works at Flash and works 20 hours per week. If both Lauren and Jamie are paid the same hourly rate. How much should Lauren’s check be at the end of the week before taxes?

**Theme week 3: Solving involved equations using inverse operations**

Solve each linear equation.

- a. \( 3x - 12 = 24 \)
- b. \( 6x - 17 = 20 - 9x \)
- c. \( 10 - (5 - 2x) = 7 \)
- d. \( -4(2x + 8) = 3(4 - x) \)
- e. \( x = 2x - 9 \)
- f. \( \frac{1}{2}x + 2 = \frac{5}{2}x - 10 \)

**Theme week 4: Finding ranges of solutions**

Solve each inequality.

- a. \( 3x + 14 = 2 - n \)
- b. \( 2(5n - 1) = 7(n + 1) \)
- c. \( 3n + 4 < 1 \)
- d. \( \frac{(4 - n)}{2 + 5} \geq 9 \)
## Unit 2: Spatial Sense and Geometry

### Standard G

Students will understand and apply the Pythagorean Theorem. Students will understand congruence and similarity using physical models, transparencies, or geometry software.

### Big Ideas: Course Objectives / Content Statement(s)

- Recognize, visualize, analyze, and apply geometric properties, relationships, and patterns in real-world and/or problem-solving contexts using models, manipulatives, or technology.
- Use coordinate geometry in problem-solving situations and apply the principles of congruence, similarity, and transformations.
- Apply the principles of measurement and geometry to solve problems involving direct and indirect measurement.

### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- What is the meaning of congruency?
- What is the meaning of similarity? How can similarity techniques be used to solve triangles?
- What is the Pythagorean Theorem and what is it used for?

### Enduring Understandings

*What will students understand about the big ideas?*

- Students will…
  - Recognize congruent triangles and pick out corresponding congruent parts
  - Apply proportions to find lengths of similar triangles.
  - The theorem states that the sum of squares of the sides of a right triangle is equal to the square of the hypotenuse. This theorem can be used to find side lengths of right triangles.

### Areas of Focus: Proficiencies

*(Cumulative Progress Indicators)*

Students will:

- G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

### Examples, Outcomes, Assessments

#### Instructional Focus (5 weeks):

- Students will analyze the Pythagorean theorem using algebraic techniques. Worksheets and manipulative will be used.
- Students will compare similar triangles and discover that sides are proportional and angles are congruent.
- Students will cut out a shape that is non-circular and will use this shape to construct 4 shapes that display 90 degree rotations.

#### Cross-Curricular Learning Integration

- Students will use their knowledge of the Pythagorean theorem to create a spiral. The shape will be further applied to other locations where the right triangles are found. See project below.

#### Technology:

- Use of Sketch pad to show and calculate proportions
Televisions are advertised by the length of the diagonal of the screen. Find the missing dimensions of the television screens pictured below.

a. 

b. 

On his way to school each day, Mike can walk around the park or on a diagonal from one corner to the other, as shown on this sketch. How much distance will Mike save by walking through the park?

Describe all line symmetries found in the figure below. Then create a chart of a 90°, 180°, 270°, 360° rotation of the figure about its center.

What is the relationship between the two triangles shown below? Explain how you know.

Find length A and length B.
Pythagorean Theorem Spiral

You will use compass constructions to create a poster of the Pythagorean spiral. The result needs to be colored and may be creatively decorated. You will need to turn in your poster and a separate piece of paper with all calculations.

**Materials: + poster board + ruler + pencil, colored pencils or markers**

**Step 1:** Place the poster board in landscape orientation. Measure from the top left hand corner 27.5 cm right and 20.5 cm down. This will be the starting point for your diagram. It will assure that your diagram stays on the page.

**Step 2:** Using your ruler create a segment that is 10 cm across starting from the starting point and heading towards the center of the poster. Make this segment perpendicular to the side of the poster. Use your ruler (without measuring) to construct a congruent segment that is perpendicular to the original. Connect the endpoints of the two segments to create a right isosceles triangle.

![Diagram of Pythagorean Spiral]

**Step 3:** On a separate piece of paper, use the Pythagorean Theorem to calculate the length of the hypotenuse. Show all work and write your answer in decimal form.

**Step 4:** Using the hypotenuse of the first triangle, create another right triangle on top of the previous hypotenuse. The old hypotenuse will be the new base and construct a perpendicular segment to this, with a length of 10. Then connect the two segments to form a new hypotenuse.

**Step 5:** On your separate piece of paper, show the calculations to find the length of the new hypotenuse.

**Step 6:** Continue to repeat this process of connecting and constructing new triangles with a side length of 10, using the previous hypotenuse as the other side. Continue to show your calculations on your separate piece of paper. Construct triangles until you have formed a full spiral.

**Step 7:** Detail your Pythagorean Spiral with a design. Use color and a pattern to make a creative picture.

**Step 8:** What does the spiral look like to you? Research another historical or scientific place that right triangles are formed/used. Attach a one paragraph statement of your findings.
### Unit 3: Patterns, Functions, and Algebra

<table>
<thead>
<tr>
<th>Side a</th>
<th>Side b</th>
<th>Side c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle 5</td>
<td></td>
<td></td>
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<tr>
<td>Triangle 6</td>
<td></td>
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<td>Triangle 7</td>
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<td>Triangle 8</td>
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<td>Triangle 9</td>
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<td>Triangle 10</td>
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<td>Triangle 11</td>
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<td>Triangle 12</td>
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<td>Triangle 13</td>
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<td>Triangle 14</td>
<td></td>
<td></td>
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<td>Triangle 15</td>
<td></td>
<td></td>
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<tr>
<td>Triangle 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle 17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Standard F**

Students will define, evaluate, and compare functions. They will use functions to model relationships between quantities.

**Big Ideas:** *Course Objectives / Content Statement(s)*
- Recognize, create, and extend a variety of patterns and use inductive reasoning to understand and represent mathematical and other real-world phenomena.
- Use various types of functions to represent mathematical or real-world situations.
- Use algebraic concepts and processes to concisely express, analyze, and model real-world situations.

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What provocative questions will foster inquiry, understanding, and transfer of learning?</strong></td>
<td><strong>What will students understand about the big ideas?</strong></td>
</tr>
</tbody>
</table>
| - What is an input output table?  
- How can tables be used to predict values?  
- What are some patterns associated with linear relationships? | Students will…  
- Be able to identify the input and output values for a function and model the information in a table.  
- See the correlation between values and interpret the direction a function is moving in to predict and outcome.  
- Be able to find the initial value of a simulation and identify the increasing factor. |

**Areas of Focus: Proficiencies** *(Cumulative Progress Indicators)*

Students will:

F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.  
F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.  
F.3. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two \((x, y)\) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

**Examples, Outcomes, Assessments**

Instructional Focus (6 weeks):
- Introduce students to the idea of input and output values. Use scrap paper and calculators where necessary.  
- Have student make conclusions about tables.  
- Use techniques of think, pair, share to develop conclusions about problems.

Cross Curricular Activities/Technology:
- Health and Wellness Project: Students will use computers or iPads to look at a table to interpret calories burned completing a certain activity. See project below weekly themes.
Theme week 11: Using input output tables to predict values

In planning a post-prom party, the senior class officers at Kennedy High School get a price quotation from a local athletic club. There would be a basic charge of $450 for the facility plus $10 per student for food and drinks.

a. Display the (number of students, cost) data in the following table.

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. The class officers decide to charge each student $15 to attend the party. Display (number of tickets sold, income) data in a table and in a graph.

<table>
<thead>
<tr>
<th>Number of Tickets</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c. When does the classes profits exceed their cost?

Theme week 12-13: Writing and using equations to predict data

- The school Booster Club is planning to sell state championship T-shirts. They expect the following expenses and income.

Expenses: $50 art-screen fee, $5.75 per shirt
Income: $10 per shirt

a. Write an expression for the cost of n shirts.

b. Write an expression for the income earned from the sale of n shirts.

c. Write two equivalent expressions for the profit earned from the sale of n shirts.

d. What is the minimum number of shirts that must be sold in order not to lose money?

-Suppose a provider of local telephone service offers to charge only $15 per month plus $0.15 per call.

a. What will the monthly bill be if 45 calls are made?

b. What equation shows how to calculate the monthly bill.

c. How many calls must have been made if one monthly bill was $30
Theme week 14: Examining non-linear functions
Imagine folding a square piece of paper in half, then in half again, and then in half again, and so on. The fold marks at each stage divide the original square into a number of smaller regions.

a. Complete the table showing the number of regions for n folds.

<table>
<thead>
<tr>
<th>n folds</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>R regions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Make a graph showing the relationship between the number of folds and the number of regions. Describe the pattern in the data.

c. Predict the number of regions for 8 folds.

Theme week 15: Examine percent increase
The vendors at a baseball stadium are paid $20 per game and 10% of the value of the food and drinks they sell.

a. Write an equation to model this situation.

b. Determine the game pay for a vendor who sells $350 worth of food and drinks.

c. How much food and drink must a vendor sell to earn a game pay of $75?

Theme week 16: Comparing and contrasting percent increase and constant increase
Neil has accepted a new job that will pay an annual salary of $28,000 for the first year. He has the option of a 5% annual raise or a fixed annual raise of $1,500.

a. Create a table to model each situation over the next 10 years.

b. Which is the better option for a long-term stay in the company? Explain your reasoning.
Burning Calories

Name_____________________
Partner____________________

To begin, Follow the link in the webpage marked Burning Calories or go directly to the webpage
http://www.nutristrategy.com/activitylist.htm. Each person in your group needs to choose one activity
to use to burn calories from the calorie chart on the internet. You and your partner must select
different activities. Each person needs to complete items 1 to 6 individually. However, work together to
get with answers to questions 7 to 10.

1) What activity did you choose? Your partner? (1pt)

2) How many calories would a 140 pound person burn per hour when engaged in this activity? (1pt)

3) Would a person burn the same amount of calories every hour they worked out?

   In terms of a linear equation what type of change does burning calories per hour represent? (2 pts)

4) When you begin to exercise and burn calories, how many calories have you burned to begin
with? In other words what is the starting point (or y-intercept) for the relationship between
hours and calories burned? (2pts)

   Explain in a complete sentence why this is your starting point. (2pts)

5) Write an equation of the form $y = mx$ to represent the amount of calories burned per $x$ hours in
this activity. (4pts)

6) Use your equation to complete this chart: (4pts)

<table>
<thead>
<tr>
<th>$x$ (time in hours)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$ (calories burned)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Work with your partner on 7, 8, 9, and 10. Note you will both have different graphs for question 7.

7) Graph the ordered pairs you created in Question 6.

8) State 2 ways you could use this chart in daily life. Use at least two complete sentences to explain your answer. (4pts)

9) If you want to lose weight, how would you use your equation to set up an exercise routine for yourself? Use at least two complete sentences to explain your routine. (3pts)

10) What additional information would you need to know to set up the exercise routine? Use at least two complete sentences in your response. (2pts)
### Standard S
Students will investigate patterns of association in bivariate data.

#### Big Ideas: Course Objectives / Content Statement(s)
- Determine, interpret, and use probabilities of simple and compound events.
- Understand and interpret statistical distributions and apply to real-world situations.
- Collect, organize, represent, analyze, and interpret data.
- Apply the concepts and methods of discrete mathematics to model and explore a variety of practical situations.
- Use iterative and recursive patterns and processes to model a variety of practical situations and solve problems.

#### Essential Questions
*What provocative questions will foster inquiry, understanding, and transfer of learning?*
- What are mean, median, mode, and range and how are they used to analyze data?
- What is a scatter plot?
- What is a line of best fit?

#### Enduring Understandings
*What will students understand about the big ideas?*
- Students will…
  - Mean is the average of a set of data, median is the middle, mode is the most often and range is the difference between the lowest and highest value of the set.
  - A scatter plot is a real life scenario of data plotted on a graph.
  - A line of best fit is an equation for a line that best fits the data presented.

### Areas of Focus: Proficiencies (Cumulative Progress Indicators)

#### Examples, Outcomes, Assessments

**Instructional Focus (3 weeks):**
- Introduce students mean, median, mode and range. Use data such as temperatures and test scores to give meaning to the data.
- Show how central tendencies can be adjusted by simply adding one more score.

**Technology Integration**
- This is a great place to introduce linear regression and line of best fit using a graphing calculator. Use the glencoe common core supplement for additional problems.

**Problem based leaning activity**
- “What grade would you need on your final to be able to get the next higher grade?”
  Student should use their powerschool grades for Q1-Q4 and X1 to determine what their final average would be if they got a 0 or a 100 for each of their courses. Then investigate what score they would need to get the next higher grade.

**Scatter Plot Resource:** [http://glencoe.mcgraw-hill.com/sites/dl/free/0078884802/633197/CCS_Algebra1_se.pdf](http://glencoe.mcgraw-hill.com/sites/dl/free/0078884802/633197/CCS_Algebra1_se.pdf)
Week 18

- Find the range, mean, and median of the following set of numbers:
6.72, 5.803, 3.5, 7, 8.07

- International Falls, Minnesota is often the coldest spot in the lower 48 states during the winter season. During one week in January, the low temperatures in Fahrenheit were: -5°, -15°, -20°, -35°, -4°, 6° and 10°.

  a. What was the mean and median low temperature for that week?
  b. What was the range of low temperatures for that week?

Week 19

On the first three tests in a marking period Paula has scores of 85, 90, and 75.

  a. What is the lowest possible score Paula can get on the fourth and final unit test in order to have a mean of at least 85 for the marking period?
  b. What will her median score be for the marking period if she gets the lowest possible score in Part a?
  c. What will her range of scores be for the marking period if she gets the lowest possible score in Part a?

Week 20

On the first five quizzes of a marking period, a student has a mean of 6 on a scale of 0 to 10. Find the student’s new mean quiz score if, on the next 10-point quiz, the student earned…

  a. A score of 10   b. A score of 6   c. A score of 4