1-2-3 Go!

This module is designed to help you explore how math affects your life each day.

1. Choose A *or* B *or* C and complete ALL the requirements.
   A. Watch an episode or episodes (about one hour total) of a show that involves math or physics. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. Then do the following:
      (1) Make a list of at least two questions or ideas from what you watched.
      (2) Discuss two of the questions or ideas with your counselor.
   B. Read (about one hour total) about anything that involves math or physics. Then do the following:
      (1) Make a list of at least two questions or ideas from what you read.
      (2) Discuss two of the questions or ideas with your counselor.
   C. Do a combination of reading and watching (about one hour total) about anything that involves math or physics. Then do the following:
      (1) Make a list of at least two questions or ideas from what you read and watched.
      (2) Discuss two of the questions or ideas with your counselor.

2. Complete ONE adventure from the following list for your current rank or complete option A or B. (If you choose an Adventure, choose one you have not already earned.) Discuss with your counselor what kind of science, technology, engineering, and math was used in the adventure or option.

Wolf Cub Scouts	**Bear Cub Scouts**	**Webelos Scouts**	**AOL Scouts**
Code of the Wolf	Race Time Bear	Game Design	Game Design
Air of the Wolf	Balancing Bears	Math on the Trail	Race Time AOL
Race Time Wolf		Modular Design	Estimations

Option A: Complete both of the following: (a) Conduct an opinion survey through which you collect data to answer a question and then show your results with a chart or graph. For example, what is the favorite food of the scouts in your den (chart how many like pizza, how many like cookies, etc.). (b). Conduct and keep a record of a coin toss probability experiment. Keep track of at least 25 tosses.

Option B: Complete both of the following: (a) Interview four adults in different occupations and see how they use measurement in their job. (b) Measure how tall someone is. Have them measure you. Complete in both inches and centimeters.

3. Explore TWO options from A *or* B *or* C and complete ALL the requirements for those options. Keep your work to share with your counselor. The necessary information to make your calculations can be found in a book or on the Internet. (See the Helpful Links box for ideas.) You may work with your counselor on these calculations.
   A. Choose TWO of the following places and calculate how much you would weigh there.
      (1) On the sun or the moon
      (2) On Jupiter or Pluto
      (3) On a planet that you choose
   B. Choose ONE of the following and calculate its height:
      (1) A tree
      (2) Your house
      (3) A building of your choice
   C. Calculate the volume of air in your bedroom. Make sure your measurements have the same units—all feet or all inches—and show your work.

4. Secret Codes
   A. Look up, then discuss each of the following with your counselor:
      (1) Cryptography
      (2) At least three ways secret codes or ciphers are made
      (3) How secret codes and ciphers relate to mathematics
   B. Design a secret code or cipher. Then do the following:
      (1) Write a message in your code or cipher.
      (2) Share your code or cipher with your counselor.

5. Discuss with your counselor how math affects your everyday life.

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1-2-3 Go!
Counselor edition

Math and physics are used in almost every kind of invention, including cars, airplanes, and telescopes. Math also includes cryptography, the use of secret codes.

This module is designed to help you explore how math affects your life each day.

1. Choose A *or* B *or* C and complete ALL the requirements.
   A. Watch an episode or episodes (about one hour total) of a show that involves math or physics. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. Then do the following:
      (1) Make a list of at least two questions or ideas from what you watched.
      (2) Discuss two of the questions or ideas with your counselor.

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision.

   B. Read (about one hour total) about anything that involves math or physics. Then do the following:
      (1) Make a list of at least two questions or ideas from what you read.
      (2) Discuss two of the questions or ideas with your counselor.

Books on many topics may be found at your local library. Examples of magazines include but are not limited to Odyssey, KIDS DISCOVER, National Geographic Kids, Highlights, and OWL or owlkids.com.

   C. Do a combination of reading and watching (about one hour total) about anything that involves math or physics. Then do the following:
      (1) Make a list of at least two questions or ideas from what you read and watched.
      (2) Discuss two of the questions or ideas with your counselor.

2. Complete ONE adventure from the following list for your current rank or complete option A or B. (If you choose an Adventure, choose one you have not already earned.) Discuss with your counselor what kind of science, technology, engineering, and math was used in the adventure or option.

Wolf Cub Scouts	**Bear Cub Scouts**	**Webelos Scouts**	**AOL Scouts**
Code of the Wolf	Race Time Bear	Game Design	Game Design
Air of the Wolf	Balancing Bears	Math on the Trail	Race Time AOL
Race Time Wolf		Modular Design	Estimations

Option A: Complete both of the following: (a) Conduct an opinion survey through which you collect data to answer a question and then show your results with a chart or graph. For example, what is the favorite food of the scouts in your den (chart how many like pizza, how many like cookies, etc.). (b). Conduct and keep a record of a coin toss probability experiment. Keep track of at least 25 tosses.

Option B: Complete both of the following: (a) Interview four adults in different occupations and see how they use measurement in their job. (b) Measure how tall someone is. Have them measure you. Complete in both inches and centimeters.

Wolf Cub Scouts

Code of the Wolf*: Working with numbers, logic, and math*
Air of the Wolf: *Have fun making different types of airplanes and other flying objects*
Race Time Wolf: *Design and build your own Pinewood Derby® car or Raingutter Regatta™ boat*

Bear Cub Scouts

Race Time Bear: *Learn different ways to make and propel vehicles*
Balancing Bears: *Mathematics of symmetry and patterns*

Webelos Scouts

Game Design: *Working with logic*
Math on the Trail: *Learn how to estimate the time it takes to take a walk*
Modular Design: *Gain an understanding of modular design*

AOL Scouts

Game Design: *Working with logic*
Race Time AOL: *Design and build your own Pinewood Derby® car or Raingutter Regatta™ boat*
Estimations: *Simple ways to estimate things*

3. Explore TWO options from A *or* B *or* C and complete ALL the requirements for those options. Keep your work to share with your counselor. The necessary information to make your calculations can be found in a book or on the Internet. (See the Helpful Links box for ideas.) You may work with your counselor on these calculations.
   A. Choose TWO of the following places and calculate how much you would weigh there.
      (1) On the sun or the moon

Earth weight (in pounds) × 28 (27.97) = Sun weight Earth
weight (in pounds) × 0.166 = Moon weight

      (2) On Jupiter or Pluto

Earth weight (in pounds) × 2.36 = Jupiter weight

Pluto is no longer considered a planet because it is so small. Pluto is now considered a planetoid. A human would weigh less on Pluto than on Earth's moon.

Earth weight (in pounds) × 0.059 = Pluto weight

      (3) On a planet that you choose

Earth weight (in pounds) × 0.378 = Mercury weight
Earth weight (in pounds) × 0.907 = Venus weight
Earth weight (in pounds) × 1.000 = Earth weight
Earth weight (in pounds) × 0.377 = Mars weight
Earth weight (in pounds) × 2.36 = Jupiter weight
Earth weight (in pounds) × 0.916 = Saturn weight
Earth weight (in pounds) × 0.889 = Uranus weight
Earth weight (in pounds) × 1.12 = Neptune weight

Very young Cub Scouts may not be familiar with decimal numbers yet or may be familiar with decimal numbers only up to one or two places after the decimal point. Feel free to round a given gravity multiplier to the tenths or hundredths place if this will help a Cub Scout complete the activity on his own. Alternatively, one can avoid decimals entirely by thinking in terms of ratios; for example, every 10 pounds on Earth equals about 9 pounds on Venus, so a child who weighs 60 pounds on Earth will weigh about 54 pounds on Venus.

B. Choose ONE of the following and calculate its height:
   (1) A tree
   (2) Your house
   (3) A building of your choice

Step 1—On a sunny day, choose a tree that casts a clear shadow. Trees and other tall objects that stand by themselves are easiest to work with.

Step 2—Hold a 12-inch ruler perpendicular to the ground, right next to the tree.

Step 3—Measure the shadow of the ruler in inches, and record the measurement. Call this measurement A.

Step 4—Measure the shadow of the tree in feet, and record the measurement. Call the tree shadow measurement B.

Step 5—Multiply measurement B by 12, then divide that answer by measurement A. The result is the height of the tree in inches.

C. Calculate the volume of air in your bedroom. Make sure your measurements have the same units—all feet or all inches—and show your work.

Volume = Length × Width × Height
The answer will be in cubic feet or cubic inches (ft3 or in3).

4. Secret Codes

A. Look up, then discuss each of the following with your counselor:
   (1) Cryptography

One of the earliest recorded uses of cryptography, the practice of hiding information, was when Roman leader Julius Caesar (100 b.c. to 44 b.c.) used a substituted letter code to hide information. Cryptography has been very useful during wars for transmitting information without revealing it to the enemy (unless the code is broken). The major use of cryptography today is with computers, especially in finance and electronic data transmissions. ATM cards, computer passwords, and personal identification numbers depend on cryptography.

(2) At least three ways secret codes or ciphers are made

A code is a symbol or signal used to represent or communicate something else. A cipher is a way to make a secret message by changing or rearranging the letters in the message. Codes replace words, phrases, or sentences with groups of letters or numbers; ciphers rearrange or substitute letters. Examples of codes and ciphers include but are not limited to:

- *Transposition ciphers: Rearrange the letters in a word.*
- *Book code/dictionary code: Use two copies of the same book (dictionaries work best). For each word in the code, give the page number, (and column number for a dictionary), row number, and word number. Usually, it is best to use two or three digits for each coded word, using zeros as placeholders.*
- *Letter shifts: Shift every letter in the alphabet a set number of places.*
- *Number substitutions: Assign every letter a number. This can be combined with letter shifts.*
- *Keyboard ciphers: Using a keyboard, shift a set number of places.*
- *Date shift ciphers: Use a date to create a letter shift.*
- *Stacked ciphers: Combine two or more codes and/or ciphers*

(3) How secret codes and ciphers relate to mathematics

Many ciphers can be broken by using what is called frequency analysis. For example, the letter "e" is the most frequently used letter in the English language. Ciphers are pairs of algorithms, rules or a set of rules to solve a problem, used to encrypt and decrypt information (make information unreadable or readable). Since the early 20th century, cryptography has made a much more extensive use of mathematics, including information theory, computational complexity, statistics, number theory, and abstract algebra.

B. Design a secret code or cipher. Then do the following:
   (1) Write a message in your code or cipher.
   (2) Share your code or cipher with your counselor.

5. Discuss with your counselor how math affects your everyday life.