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Grade 7

Sample Tasks for PreK-8, developed by New York State teachers, are clarifications, further explaining the language and intent of the associated Performance Indicators. These tasks are not test items, nor are they meant for students' use.

Strands

Process	**Content**
Problem Solving	Number Sense and Operations
Reasoning and Proof	Algebra
Communication	Geometry
Connections	Measurement
Representation	Statistics and Probability

Problem Solving Strand

Students will build new mathematical knowledge through problem solving.

7.PS.1 Use a variety of strategies to understand new mathematical content and to develop more efficient methods

7.PS.1a
Divide the class into groups of four. Give each group a pile of manipulatives that are *not* a multiple of four. Have students record the *total number* of manipulatives in their group.

Round 1: Each person in the group gets one manipulative. On paper students show the original number of manipulatives less the number distributed.

Round 2: Students continue to distributive manipulatives and record each subtraction until there are not enough manipulatives for a complete round.

The students have done repeated subtraction. What is left is the *remainder*.
Have the students determine a more efficient way to accomplish this task.
Relate the results to division, remainders, decimal and fraction representations. From this activity the students should develop a more efficient method to do this task, using division. Have students use the calculator to obtain the number of items each person will eventually obtain.
Students should be able to mathematically obtain the remainder with the calculator.

7.PS.2 Construct appropriate extensions to problem situations

7.PS.2a
According to the Humane Society, a cat and her offspring produce an average of 420,000 kittens in 7 years. Write the number of kittens produced by a cat and her offspring in 7 years as a number in scientific notation. If this rate continues, write the number of kittens that would be produced after 14 years.

7.PS.3 Understand and demonstrate how written symbols represent mathematical ideas

7.PS.3a
Expand and rename the fractions below by factoring out factors common to the numerator and denominator.

$4^3/4^2$, $4^5/4^2$, $5^4/5^7$, $7^5/7^5$, $6^{10}/6^8$, n^5/n^2

Ask students to make a generalization about dividing exponents with a common base.

Students will solve problems that arise in mathematics and in other contexts

7.PS.4 Observe patterns and formulate generalizations

7.PS.4a
The information in the table below shows the cost to enter the Fun House at the carnival. Determine how much it will cost for a family of 8 to enter the fun house. How much will it cost for a family size of n?

Number in Family	Cost of Admission
1	3.50
2	4.00
3	4.50
4	5.00
5	5.50
6	6.00

7.PS.5 Make conjectures from generalizations

7.PS.5a
List the numbers 7, 9, 13, 16, and 20. Ask students to identify which numbers are perfect squares and which numbers are non-perfect squares. Find the value of the non-perfect squares to the nearest thousandths.

7.PS.6 Represent problem situations verbally, numerically, algebraically, and graphically

7.PS.6a
A cellular phone company is offering a new phone service exclusively for students. They offer a monthly plan for $9.99 per month, including unlimited local and long distance phone calls and $0.25 per text message.
When would a student's cellular phone bill be more than $20 per month under this new cellular phone service plan? Describe how you would solve this problem and then show the work.

Students will apply and adapt a variety of appropriate strategies to solve problems.

7.PS.7 Understand that there is no one right way to solve mathematical problems but that different methods have advantages and disadvantages

7.PS.8 Understand how to break a complex problem into simpler parts or use a similar problem type to solve a problem

7.PS.8a
Ask students to find the sum of the numbers 1 to 1,000. Have them create a simpler but related problem. Did they notice a pattern? Share solutions.

7.PS.9 Work backwards from a solution

7.PS.9a
The first class bell at Joleen's school rings at 8:05 am. It takes her 13 minutes to walk to school. Joleen wants to get to school early so that she can visit with her friends for 10 minutes before going to homeroom. It takes Joleen 65 minutes to get ready for school. When the alarm goes off in the morning, Joleen always presses the snooze bar on her alarm clock so that she can get an additional 15 minutes of sleep. What time should Joleen set her alarm so that she will be on time for her first class?

7.PS.10 Use proportionality to model problems

7.PS.10a
The students from Mountain View School are taking a 154-mile trip to the Catskill Mountain Region. After 45 minutes on the bus, the students asked the bus driver, "How many *more* minutes until we will arrive?" The bus driver said, "We have gone 33 miles so far. If we continue to travel at the same rate, how many more minutes until we arrive?"

7.PS.11 Work in collaboration with others to solve problems

7.PS.11a
Form groups of 4 and distribute one clue to each student in the group. The students may *read* their clues as many times as needed to the members of their group, but the students may not *show* their clue to anyone in their group. Have them determine the answer, based on the clues. Find the number.

CLUES:
Student 1: The number is a perfect square.
Student 2: The number is a multiple of 5.
Student 3: The number has exactly 9 factors.
Student 4: The number is an integer.

Students will monitor and reflect on the process of mathematical problem solving

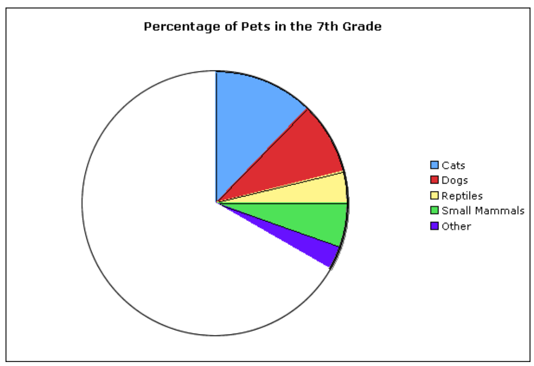
7.PS.12 Interpret solutions within the given constraints of a problem

7.PS.12a
Lakes Junior High School publishes an annual yearbook for the students in grades 7 and 8. Two costs associated with the yearbook are photography for $700 and printing for $2400. The yearbook committee sold advertisements to local businesses for $1600, and they sold 400 yearbooks for $10 each. Have students calculate the net profit for the yearbook committee.

7.PS.13 Set expectations and limits for possible solutions

7.PS.13a
Lee surveyed 120 students and compiled her information in the chart below. She then made a circle graph to represent the information. If she surveyed only students who have a pet, is this graph reasonable? Explain your answer.

Type of Pet	Number of Students Who Own This Type Of Pet
Cats	44
Dogs	32
Reptiles	14
Small Mammals	20
Other	10



7.PS.14 Determine information required to solve the problem

7.PS.14a
Jackie has volunteered to feed her neighbor's cats dinner. She was left with directions that said:

Feed the kittens, Stripes and Patches, the same amount of food.
Amber, the mother cat, gets twice as much food as the kittens.

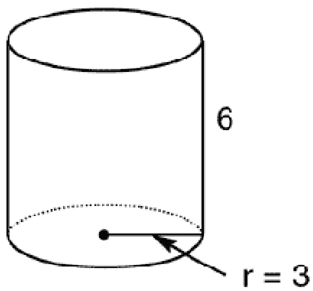
There is a container with 5 cups of food. Write an equation and determine to how much food each animal should receive.

7.PS.15 Choose methods for obtaining required information

7.PS.16 Justify solution methods through logical argument

7.PS.17 Evaluate the efficiency of different representations of a problem

7.PS.17a
Find the surface area of a cylinder. Have the students solve the problem using 2 methods. One method is to find the surface area for each face and then add totals together. Method 2 is to apply the formula.



Method 1

Area of circle

$A = \quad r^2$

$A = \quad (3)^2$

$A = 9$

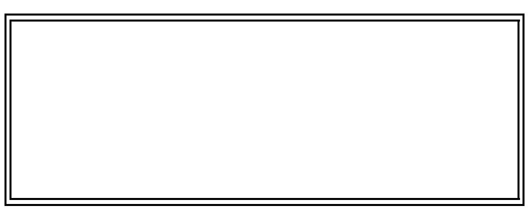
$a = 28.27433388$

$2circles = 56.54866776$

$C = \quad d$

$C = 6$

$C = 18.84955592$

6

18.84955592

$A = 113.097335$

$S = 113.097335 + 56.54866776$

$S = 169.6460033$

Method 2

$S = \quad rh + 2 \quad r^2$

$S = 2 \quad (3)(6) + 2 \quad (3)^2$

$S = 36 \quad + 18$

$S = 54$

$S = 169.6460033$

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Reasoning and Proof

Students will recognize reasoning and proof as fundamental aspects of mathematics.

7.RP.1 Recognize that mathematical ideas can be supported by a variety of strategies

7.RP.1a
According to the USDA, a 1600 calorie diet should include about 5 ounces of lean meat and beans, and a 2600 calorie diet should include about 7 ounces of lean meat and beans each day. Over a period of 30 days, how many more pounds of lean meat and beans are consumed under the 2600 calorie diet as compared to the 1600 calorie diet? Explain the method used to solve this problem and determine additional methods for solving the problem.

Students will make and investigate mathematical conjectures.

7.RP.2 Use mathematical strategies to reach a conclusion

7.RP.2a
Ask students to prove or disprove the statement below:

The product of two odd numbers is odd.

Then have the class determine what happens to the product of two odd numbers if each odd number is increased by 2.

7.RP.3 Evaluate conjectures by distinguishing relevant from irrelevant information to reach a conclusion or make appropriate estimates

7.RP.3a
Divide the students into pairs. Provide each pair of students with a bag containing an assortment of different colored objects that are the same size. Have students shake the bag and predict what is in the bag (object and color).

Have students remove an object from the bag, note its color, and replace it in the bag. After the students have sampled 10 objects, have them once again predict what is in their bag.

Ask the students to repeat the experiment. Once again have the students predict what is in the bag.

Next, ask the students to remove all the objects from the bag and record the number of objects and the colors of the objects. Have the students sample without replacement until all of the objects are removed from the bag.

Ask students to compare the experimental probability to the theoretical probability of selecting an object.

Students will develop and evaluate mathematical arguments and proofs.

7.RP.4 Provide supportive arguments for conjectures

7.RP.4a
Rosalina said the product of two factors is always larger than the two factors. She supported her conjecture with examples such as 50 x 2 = 100, 7 x 9 =63.

Sylvan said that multiplication always results in a product larger than or the same as one of the factors. He supported his conjecture with examples such as 3 x 4 = 12, -3 x -4 = 12, 0 x 6 = 0, 1 x 1 = 1. Conduct a discussion of the definition of *conjecture*. Have the students determine whether Rosalina's or Sylvan's conjecture is accurate.

7.RP.5 Develop, verify, and explain an argument, using appropriate mathematical ideas and language

7.RP.5a
Review the divisibility rules for 2 and 3. Then have students make a conjecture of the divisibility rule for 6. Ask each student to support their conjecture using mathematical ideas.

Students will select and use various types of reasoning and methods of proof.

7.RP.6 Support an argument by using a systematic approach to test more than one case

7.RP.6a
Using a protractor, have the students draw polygons with 3, 4, 5, 6 and 7 sides, and use a protractor to measure the angle of each polygon. Sum the angle measures for each polygon and record. Do this for 5 polygons and compile the information. From this trial of 5 polygons, have students develop a rule for determining the sum of the interior angles of polygons.

7.RP.7 Devise ways to verify results or use counterexamples to refute incorrect statements

7.RP.7a
Using two colored counters to subtract integers, have students explain why subtracting a number is the same as adding its opposite.
Then have students explain why subtracting is the same as adding the opposite when using a number line.

7.RP.8 Apply inductive reasoning in making and supporting mathematical conjectures

7.RP.8a
Ask the class the following question:
How many squares are there on a checkerboard?
Have students provide a systematic approach to solve this problem.

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Communication

Students will organize and consolidate their mathematical thinking through communication.

7.CM.1 Provide a correct, complete, coherent, and clear rationale for thought process used in problem solving

7.CM.1a
Divide students into pairs and have them take turns solving problems. Have one student solve one of the following problems and explain their results to their partner.

Problem 1: The corner newspaper box accepts any of the following: nickels, dimes, quarters or half dollars. It does not accept pennies. The weekday paper costs $.50. What are all of the possible coin combinations that can be used?

Problem 2: A snail is at the bottom of a 10-inch hole. The snail climbs up 2 inches each day but falls back one inch each night. How many days will it take the snail to crawl out of the hole?

Problem 3: Ellen has two copies of a photograph. One is 3 inches by 5 inches, and the other copy is 4 inches by 6 inches. Are these photographs similar rectangles?

7.CM.2 Provide an organized argument which explains rationale for strategy selection

7.CM.2a
Have students reach into a box and select a problem to solve. Have students choose the best strategy for solving their problem. The student will *not* solve the problem, but will explain to the class why they believe they selected the best strategy for solving the problem.

Sample problems:

1. Sam's dad gave him three wooden boards to make a bookcase. All the shelves need to be the same size. The boards are 108 inches, 60 inches and 24 inches. Sam's dad said that there can be no pieces left over. What is the largest sized shelf Sam can make?

2. At the end of the year party Lisa brought a big box of doughnuts. The boys ate half the donuts; the girls ate 6 of the donuts. The teachers ate as many as the girls ate and there were 3 left over. How many dozen donuts did Lisa bring?
3. The school photographer is taking pictures for the yearbook. There are 27 pictures on each roll of film. The photographer takes 4 pictures of each student. How many rolls of film are needed to take pictures of 185 students?
4. The math class is planning a party. There are 29 students in the class. 10 students want plain cheese pizza, 15 students want pepperoni pizza and 4 students do not care what kind of pizza they eat. The large pizzas are cut into 8 pieces. What is the fewest number of pizzas that can be ordered so that each student gets two pieces of pizza?

7.CM.3 Organize and accurately label work

7.CM.3a
A cell phone company is offering two special plans for students.
PLAN A: \$8.95 per month flat rate and \$.10 per local call
PLAN B: \$30.00 per month, including monthly fee and unlimited local calls.
Which plan is the better buy? Explain how you arrived at your answer.

Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

7.CM.4 Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models and symbols in written and verbal form

7.CM.4a
The Beverage Barn Cola is on sale for 6 cans for \$2.22. How much does one can cost? Create a drawing, a chart, and a paragraph that describe this problem and solution.

7.CM.5 Answer clarifying questions from others

7.CM.5a
Divide the class into small groups. Provide each group of students a picture of an item (e.g., elephant, truck, cat, mouse, large marble column, grain of sand, baby, planet). Have each group propose the best tool and technique to measure the mass of their item. Present the solution to the class and ask students to ask clarifying questions and state why they believe the tool and technique were appropriate.

Students will analyze and evaluate the mathematical thinking and strategies of others.

7.CM.6 Analyze mathematical solutions shared by others

7.CM.6a
Divide the class into small groups. Provide small groups of students with an empty sealed box in the shape of a rectangular prism, and a single square that has a 2 cm side. Have students determine the surface area of the box in square centimeters and explain their answer to the class.

7.CM.7 Compare strategies used and solutions found by others in relation to their own work

7.CM.7a
Anna says that the expression a^2 means the same as a x 2 because if a= 2 then 2^2= 4 and 2 x 2 =4. Is Anna correct? Explain your answer.

7.CM.8 **Formulate mathematical questions that elicit, extend, or challenge strategies, solutions, and/or conjectures of others**

7.CM.8a
Have students discuss how they would solve the problem below and create additional questions on related problems:

> Given the set of numbers 7, 14, 21, 28, 35, 42, find a subset of these numbers that sum to 100.

Students will use the language of mathematics to express mathematical ideas precisely.

7.CM.9 **Increase their use of mathematical vocabulary and language when communicating with others**

7.CM.9a
Ask two students to sit back to back. Have one student draw a three-dimensional figure and then direct the other student to draw the same figure using only mathematical terms. When finished, ask the students to compare the original drawing with its copy. Ask each pair of students what their drawing represents. Discuss how mathematical vocabulary was helpful in completing the drawing.

7.CM.10 **Use appropriate language, representations, and terminology when describing objects, relationships, mathematical solutions, and rationale**

7.CM.10a
Hon's family has a rectangular-shaped pool that is 14 feet by 20 feet. They need to put one-foot square tiles around the pool for a walkway. Determine the dimensions of the entire area that includes the pool and walkway if they only use one row of tiles all the way around the pool. How many square feet will the pool and walkway occupy in total? Draw a picture, labeling it with mathematical terms that show the problem. Explain your answer.

7.CM.11 **Draw conclusions about mathematical ideas through decoding, comprehension, and interpretation of mathematical visuals, symbols, and technical writing**

7.CM.11a
Given the information below, predict which color one would expect to select from a box containing the same items in white, green, red, and orange. Predict the minimum number of items in the box. Explain your predictions.

$p(white) = 2/7$
$p(green) = 0/7$
$p(red) = 3/14$
$p(orange) = 2/7$

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Connections

Students will recognize and use connections among mathematical ideas.

7.CN.1 **Understand and make connections among multiple representations of the same mathematical idea**

7.CN.2 **Recognize connections between subsets of mathematical ideas**

7.CN.2a
Jose received grades of 40, 70, 60, 70, and 90 on 5 math tests. Which is a best measure of his progress in class: mean, median or mode? Explain your answer.

7.CN.3 **Connect and apply a variety of strategies to solve problems**

7.CN.3a
Have students determine how many handshakes will take place in the room if everyone shakes everybody else's hand only once. Have students make a conjecture on the number of handshakes that will take place. Discuss strategies that can include solving a simpler problem (e.g., only 4 students, then 6 students, etc.), drawing a picture, or acting it out.

Students will understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

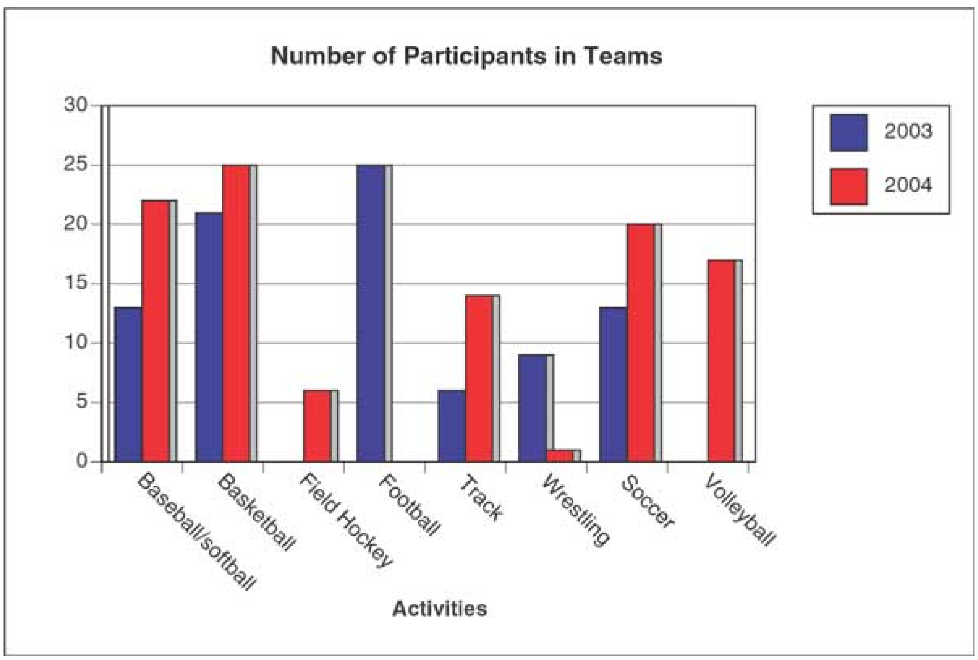
7.CN.4 **Model situations mathematically, using representations to draw conclusions and formulate new situations**

7.CN.5 **Understand how concepts, procedures, and mathematical results in one area of mathematics can be used to solve problems in other areas of mathematics**

Students will recognize and apply mathematics in contexts outside of mathematics.

7.CN.6 **Recognize and provide examples of the presence of mathematics in their daily lives**

7.CN.6a
The graph below shows the number of students who participated in sports at Milla Middle School. Have the students discuss enrollments in the different sports in 2003 and 2004 and draw conclusions based on the graph.



7.CN.7 **Apply mathematical ideas to problem situations that develop outside of mathematics**

7.CN.7a
The Green Valley Middle School is planning a trip to Toronto, Canada. How much United States money will Sally need to purchase a souvenir bear that costs $9.95 Canadian? Use the currency conversion $1.00 US: $1.23 Canadian.

7.CN.8 Investigate the presence of mathematics in careers and areas of interest

7.CN.8a
Have each student interview adults, asking how they use mathematics in their job. The students can either write their interview, or incorporate it into a career poster to share with the class.

7.CN.9 Recognize and apply mathematics to other disciplines, areas of interest, and societal issues

7.CN.9a
The chart below includes the population of New York State according to the U.S. Census Bureau for 1960, 1980, and 2000.

1960	1980	2000
16,782,304	17,558,072	18,876,457

Calculate the population increase from 1960 to 1980, and 1980 until 2000. In which 20 year period was the population increase greater? Discuss significant historical events that occurred in New York State in 1960, 1970, and 2000.

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Representation

Students will create and use representations to organize, record, and communicate mathematical ideas.

7.R.1 Use physical objects, drawings, charts, tables, graphs, symbols, equations, or objects created using technology as representations

7.R.2 Explain, describe, and defend mathematical ideas using representations

7.R.3 Recognize, compare, and use an array of representational forms

7.R.3a
Select a starting and ending point for a car trip of local interest. Provide each student a map and ask the students to calculate how many miles the trip will be, using the roads on the map. Ask students how they might calculate the distance a different way.

Approximately how long will it take to arrive at their destination in a car if their average speed is 45 miles per hour?

7.R.4 Explain how different representations express the same relationship

7.R.5 Use standard and non-standard representations with accuracy and detail

Students will select, apply, and translate among mathematical representations to solve problems.

7.R.6 Use representations to explore problem situations

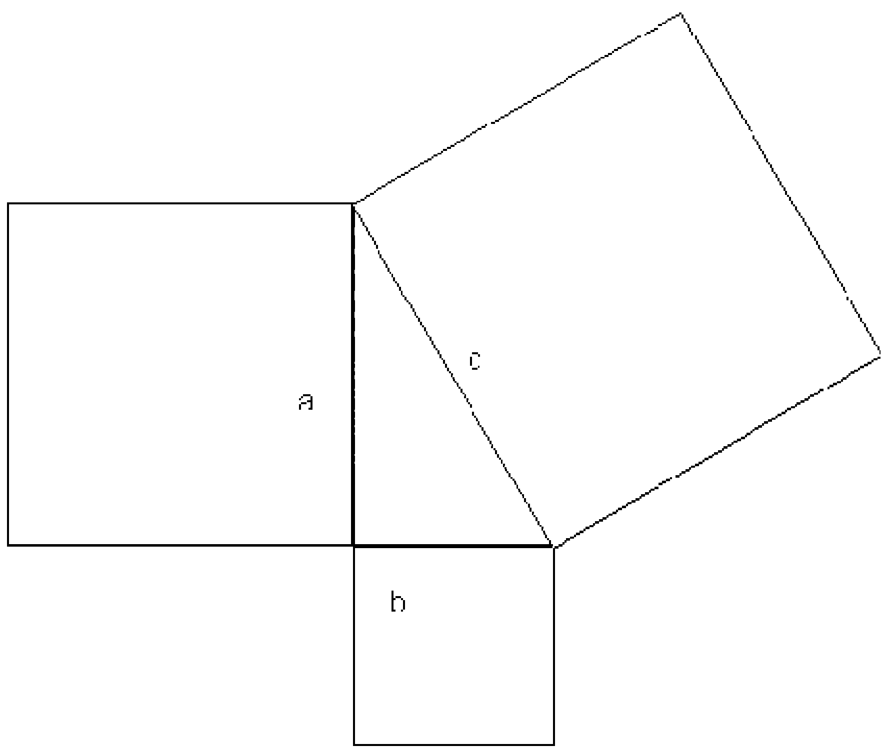
7.R.6a
Using cubes, have students show and sketch all of the different rectangular prisms that can be made using 24 cubes. Then use the volume formula to confirm the results. Ask the students if they can make a cube using the 24 cubes.

7.R.7a
Based on the information in the table below, which type of disk can store the most amount of information? Explain your answer. State the range of the data.

Disk Type	Data Capacity (bytes)
8 inch floppy disk	5×10^5
5.25 inch disk	1.2×10^6
3.5 inch disk	1.44×10^6
CD-Rom disk	6.5×10^8
DVD	8.5×10^9

7.R.8 Use representation as a tool for exploring and understanding mathematical ideas

7.R.8a
Have students draw a right triangle on grid paper with the legs of the triangle as an integral number. From another piece of grid paper, have students draw and cut out 3 squares, as follows: one square has sides that are the same length of one leg of the triangle, the second square has sides that are the same length of the second leg of the triangle, and the third square has sides that are the length of the hypotenuse of the triangle. Have students verify that the sides of the squares each match up one of the sides of the triangle. Have students cut up the two smaller squares and rearrange the pieces so that the larger, third square is completely covered. Have students state the relationship between the lengths of the three sides of the right triangle.



Students will use representations to model and interpret physical, social, and mathematical phenomena.

7.R.9 Use mathematics to show and understand physical phenomena (e.g., make and interpret scale drawings of figures or scale models of objects)

7.R.9a
In technology class, Garret is making a scale drawing of a CD case. In his drawing the CD case is 2 inches high. When he makes his CD holder it will be 2 feet 6 inches. What is the scale of his drawing?

7.R.10 Use mathematics to show and understand social phenomena (e.g., determine profit from sale of yearbooks)

7.R.10a
The seventh grade class is planning a dance. The disc jockey will cost $250 for 4 hours and it will cost $100 to decorate the gym. If there are 270 students in the school and two-thirds of the students have purchased tickets for $5, complete a table of values and construct a graph to show how much profit the seventh grade will make.

7.R.11 Use mathematics to show and understand mathematical phenomena (e.g., use tables, graphs, and equations to show a pattern underlying a function)

7.R.11a
Provide measuring tapes, calipers, rulers and a variety of cans, lids, and other cylinders or circular objects. Have students measure a variety of cylindrical objects and record the diameter and the circumference. Students may have to trace the circumference on paper to measure the diameter, or use calipers. Have students create a table and ask them to determine the relationship between the diameter and circumference.

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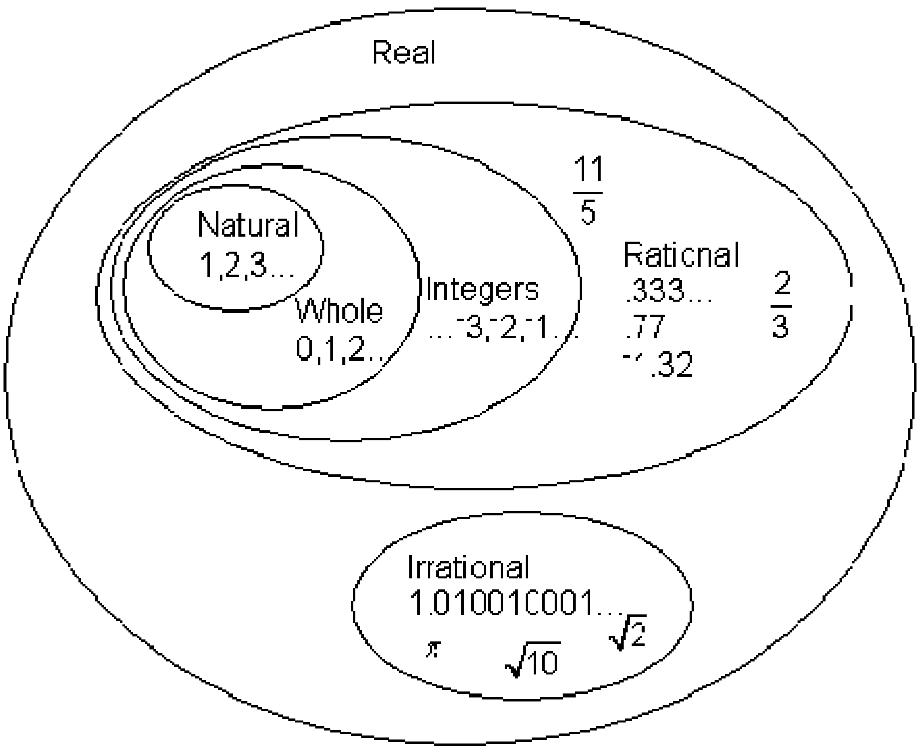
Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

7.N.1 **Distinguish between the various subsets of real numbers (counting/natural numbers, whole numbers, integers, rational numbers, and irrational numbers)**

7.N.1a
Draw a concept map to display the relationship among natural/counting numbers, whole numbers, integers, rational numbers, irrational numbers, and real numbers. Place numbers from each of the subsets on index cards. Using tape or string place a large concept map on the floor and give each student an index card. Have the students arrange themselves in the concept map according to the subset in which the number belongs. Below is an example of a concept map.



7.N.2 **Recognize the difference between rational and irrational numbers (i.e., explore different approximations of π)**

7.N.2a
Place various rational and irrational numbers on the board in two separate lists and have the students, using calculators, make observations and create additional examples. Have students explain why each number is placed in List A or List B.

List A	**List B**
$.\overline{36}$	$-\sqrt{3}$
-6	$\sqrt{2}$
1/2	$\sqrt{10}$
$\sqrt{9}$	□
5	3.1011011101111...
3.14	$\sqrt{50}$
□̃□	-.2020020002...
$\sqrt{64}$	$5\sqrt{6}$
16/3	5□

7.N.2b
Ask students to explain the difference between □ and its various approximations: 22/7, 3.14, 3.14159, etc. and have them place them on a number line.

7.N.3 **Place rational and irrational numbers (approximations) on a number line and justify the placement of the numbers.**

7.N.3a
Place a variety of rational and irrational numbers on index cards and distribute the cards to students. Have students fasten their cards to a clothesline stretched across the room. As numbers are added to the line, students may have to adjust the spacing of some of the cards already placed on the "number" line. Hang a final card that has a question mark on it. Have the class guess what number it represents.

7.N.4 **Develop the laws of exponents for multiplication and division.**

7.N.4a
Make up several examples, such as the following, and have the students write them in standard form using what they already know about exponents.

$5^2\ 5^3 = (5\cdot 5)\cdot(5\cdot 5\cdot 5)=5^5$

$2^3\ 2^3 = (2\cdot 2\cdot 2)\cdot(2\cdot 2\cdot 2)=2^6$

$3^1\ 3^4 = 3\cdot(3\cdot 3\cdot 3\cdot 3)=3^5$

$4^2\ 4^4 = (4\cdot 4)\cdot(4\cdot 4\cdot 4\cdot 4)=4^6$

Continue with more examples with larger exponents, such as: $2^{10} \cdot 2^9$.

Ask the students for their observations of the factors, products, bases, and exponents. Have them develop the law of exponents for multiplication. Do a similar process for division based on what students already know about exponents and factoring forms of one, and after several examples, have them make observations to guide them to the law of exponents for division.

Continue to have the students factor out forms of one to arrive at the answer in simplest form. Continue with several more examples such as the following:

$$\frac{5^4}{5^3} = \frac{5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5} = 5$$

$$\frac{3^7}{3^3} = \frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3} = 3 \cdot 3 \cdot 3 \cdot 3 = 3^4$$

$$\frac{2^5}{2^3} = \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2} = 2 \cdot 2 = 2^2$$

$$\frac{10^4}{10^5} = \frac{10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10} = \frac{1}{10} = 10^{-1}$$

7.N.5 Write numbers in scientific notation.

7.N.5a

Make up several decks of cards for each group of students to play *Challenge*, the card game that students may know as *War*. Each card, written in standard form, should represent one large number, billions or higher, or one small number, millionths or smaller. Some of the cards should have the same value. To play, deal all the cards to a small group of players. All players lay down the top card from their hand and highest card wins the pile. In case of a tie, challenge is declared and those players lay two cards face down and one face up to decide who wins the pile. Again, high card wins. Play this for a few minutes to give the students the idea of how difficult it is to read these numbers.

Then supply the students with blank cards and direct each group to convert their deck of standard notation numbers into scientific notation.

7.N.6 Translate numbers from scientific notation into standard form.

7.N.6a

Rewrite each of the following in standard form:

$2.83 \text{ X } 10^5$
$4.36 \text{ X } 10\text{-}^3$
$5.3452 \text{ X } 10^{12}$
$9.6643 \text{ X } 10^{-11}$

7.N.7 Compare numbers written in scientific notation.

7.N.7a

Play *Challenge* as described in 7.N.5a, but use the cards that the students converted into scientific notation.

7.N.8 Find the common factors and greatest common factor of two or more numbers

7.N.8a

Venn diagrams can be used in a variety of ways to show common factors and greatest common factors of two or more numbers. For example:

a) Using Venn diagrams, give students two or three numbers and have them place the factors of those numbers in the appropriate sections.
b) Place factors of numbers, one at a time, in the sections of a Venn diagram. As you are adding factors to the diagram, have students try to guess the rule. Then have them label the Venn diagram.
c) Have students make up partial Venn diagrams and give them to partners to complete.

7.N.9 Determine multiples and least common multiple of two or more numbers

7.N.9a
At a party, the prize box contained enough one-dollar bills so that one to six winners could share it equally. What is the least amount of money that could be in the prize box?

7.N.10 Determine the prime factorization of a given number and write in exponential form

7.N.10a
Tell whether each statement below is true or false and explain your answer.

a. $x3^2x5$ is the prime factorization of 90.
b. 3x4x7 is the prime factorization of 84.
c. 2^3x3x5 is the prime factorization of 90.

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

7.N.11 Simplify expressions using order of operations ***Note: Expressions may include absolute value and/or integral exponents greater than 0***

7.N.11a
Give the students both a calculator that has not been programmed to do order of operations (usually a 4-function calculator) and a scientific calculator that has been programmed to do order of operations. Have students do the operations for the problems below and compare their results.

Give them such problems as $5 + 3 \cdot 8$ to evaluate. They will get 64 and 29 on the two different calculators. You may want to give them a few more such as 3 + 12 ÷ 4; 17 - 2(2 + 3). Discuss why it is necessary to agree on the order of calculations.

7.N.11b
Evaluate the expressions below using order of operations and check using a scientific calculator.

a) $4 - \frac{2(3+6)}{9}$

b) 7 - 3(8 - 5)

c) $3 + |3 - 7| \div 2$

d) $2- 3^2 + 2^3$

e) $\sqrt{9 + 16} \div 5$

f) $6^1 + 3(-4 + 2)$

7.N.12 Add, subtract, multiply, and divide integers

7.N.12a
Provide numeric expressions and ask students to relate them to football, money, temperature, positive/negative chips, etc. Then ask them to solve the expression.

a) 6 x -5	d) -8 + -4
b) -42 ÷ -6	e) -9 - (-5)
c) -4 x -5	f) -48 ÷ -6.

7.N.12b
Develop a set of cards with word problems and another set of cards that contain the corresponding equations to be used as a matching game. This could be played by the entire class or by groups of student. Make sets of cards for each group. See examples below:

a) How much is Shantel's total worth if she borrowed three dollars each from eight people? 8 x -3 = -24
b) The Patriots lost eight yards on their first play and lost three more yards on the next play. What was their net result after these two plays? -8 + -3 = -11
c) The temperature was 8^{o} below zero in the morning, and then it rose 3^{o}. What is the temperature? -8 + 3 = -5
d) Jon's bank statement revealed that he has eight dollars. The bank charged three dollars for checks, but he has free checking so the bank made a mistake. Now they have to take away the three-dollar check charge. What is his balance now? 8 - (-3) = 11.

7.N.13 Add and subtract two integers (with and without the use of a number line)

7.N.13a
Using two-color counters where the yellow side represents positive charges and the red side represents negative, have students model and record their results. For example:

5+(-7)
-3 + (-4)
-8 + 3, 6 + (-3)
-7 + 15)

Assist the students in explaining each of these problems using such examples as football gain and loss, money, temperature, etc.

7.N.13b
Distribute number lines and have students solve a variety of addition problems using the number line, recording their results. Follow this with a variety of subtraction problems using the number line, recording results.

7.N.13c
Provide students a set of subtraction problems. For example:

-8 - (-5)
5 - (-3)
-8 -5
-3 - (-5)
0 - 5
0 - (-5)

Ask them to explain each as a word problem (e.g., eight points were deducted on a quiz, but the teacher made a mistake and had to take away five of the points that were already taken off on a problem. This results in a loss of only three points.) Then ask students to solve the related addition problems.

-8 + 5
5 + 3
-8 + (-5)
-3 + 5
0 + (-5)
0 + 5)

Ask students to compare the addition and subtraction problems and discuss how they are related.

7.N.13d
Ask students to write a note to a student who is absent explaining the difference between subtracting a negative amount versus subtracting a positive amount and how subtraction and addition are related.

7.N.14 **Develop a conceptual understanding of negative and zero exponents with a base of ten and relate to fractions and decimals (i.e., 10^{-2} = .01 = 1/100)**

7.N.14a

List various powers of tens on the board and have students write them out expressed both as factors and their products in standard form.

10^6 = 10.10.10.10.10.10 =1,000,000
10^5 =
10^4 =
10^3 =
10^2 =
10^1 =

Have the students describe their observations about the pattern of the exponents, the factors, and the products.

Discuss the pattern of dividing by the base, 10, for the next power of ten. For example: to go from 1,000,000 to the next product of 100,000, you divide by 10. To go from 100,000 to 10,000, you also divide by 10. Have the students discuss this pattern for the remainder of the products.

Following the pattern of subtracting 1 to get the next exponent, it would follow that 10^o would be the next. Using this pattern of dividing by the base, since 10^1=10, the pattern would indicate that 10^o would have to be 10 ÷ 10 = 1. From the pattern of dividing by 10, the understanding of negative exponents can then be developed. Have the students express them both as fractions and as decimals.

10^{-1} = 1 ÷ 10 = .1 = 1/10 . Continue this for 10^{-2}, 10^{-3}, etc.

7.N.15 **Recognize and state the value of the square root of a perfect square (up to 225)**

7.N.15a

Tell the students to sketch a square and label its area as 25 square units. Have them find and label the dimensions and give justification for the answer. Continue this exercise with squares of 36, 49, 81, and any other perfect squares up to 225. Then review how addition and subtraction are inverse operations, as well as multiplication and division.

Relate these inverse operations to 5^2 = $5 \cdot 5$ = 25 and discuss $\sqrt{25}$ =5. Explain the relationship between finding the dimensions of the sides of a square once the area is known, and the finding of the square root. Have the students write a reflection on squaring a number and taking the square root and how they are related.

7.N.15b

Evaluate the expression below.

1) $\sqrt{169}$

2) $\sqrt{144}$

3) $\sqrt{81} + \sqrt{225}$

4) $\sqrt{196} - \sqrt{121}$

7.N.15c

Find the length of the side of a square whose area is 64 square inches.

7.N.16 **Determine the square root of non-perfect squares using a calculator**

7.N.16a

Find the value of $\sqrt{568}$ to the nearest hundredth.

7.N.16b

Find the value of $\sqrt{1355}$ to the nearest thousandth.

7.N.16c
Find the length of the side of a square (to the nearest tenth of a square foot) whose area is 500 square feet.

7.N.17 Classify irrational numbers as non-repeating/non-terminating decimals

7.N.17a
After completing the activities in 7.N.2, have the students explain how a number can be recognized as an irrational number. With the use of a calculator show how irrational numbers can be represented as non-repeating/non-terminating decimals. Have them justify why the following are irrational numbers:

π

$\sqrt{3}$

$\sqrt{5}$

$\sqrt{20}$

$-\sqrt{24}$

3.8080080008...

Students will compute accurately and make reasonable estimates.

Estimation

7.N.18 Identify the two consecutive whole numbers between which the square root of a non-perfect square whole number less than 225 lies (with and without the use of a number line)

7.N.18a
Have the students sketch a square and label the area as 30 square units. Ask them to find the approximate whole number, length of the sides. Have them justify their choice and discuss between what two whole numbers the dimension would be located. Continue this activity with other size squares whose areas are non-perfect square whole numbers less than 225. Have them check their answers by using the calculator.

7.N.18b
Stretch a clothesline across the front of the classroom and attach 16 colored index cards, labeled 0 to 15, equally spaced. Make another set of cards using a different color and label each with a square root of a non-perfect square, whole number less than 225. Pass out one card to each group of students. Ask each group to place their number between the two whole numbers in which the square root lies. Ask the groups to verify each others work, justify why it was placed in that particular place, verify placements by using a calculator.

7.N.19 Justify the reasonableness of answers using estimation

7.N.19a
Estimate the product of 395 and 4.9, and then perform the actual computation. Is the answer reasonable? Explain your answer.

7.N.19b
Using your estimation skills, choose the correct answer from the two choices provided below. Explain why you made your choice, and then justify your choice by doing the actual computation.

Problem	Answer Choices
5 x 2/5 ;	10/25 or 2
51 ÷ 5	1.2 or 10.2
1.2 + 5 + .45 + 6	6.8 or 12.65
1/5 + 1/4	2/9 or 9/20
6 ÷ 2/3	1/9 or 9

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Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

7.A.1 Translate two-step verbal expressions into algebraic expressions

7.A.1a
Create two sets of cards, one with verbal expressions and the other with the equivalent algebraic expressions. Ask small groups to find the matched pairs, record their results, and explain why they believe that they are correct.
Examples of verbal expressions:

a) the difference of twice a number and nine
b) twice the difference of a number and nine
c) three times the sum of a number and four
d) the sum of three times a number and four
e) nine less than three times a number
f) nine decreased by three times a number

Matching algebraic expressions.

a) 2x-9
b) 2(x-9)
c) 3(x+4)
d) 3x+4
e) 3x-9
f) 9-3x

7.A.1b
Write an algebraic expression depicting the cost of renting a car for *n* days if the daily charge is $24.98 plus 12 cents a mile.

7.A.1c
Write an algebraic expression representing the perimeter of a rectangle with a height that is twice its base, using one variable.

Students will perform algebraic procedures accurately.

Variables and Expressions

7.A.2 Add and subtract monomials with exponents of one

7.A.2a
Using algebra tiles, ask students to model each of the addition problems below:

a) Find the sum of 3x, 4x, and 4.
b) Find the sum of -3x, 8, 2x, and -9.
c) Find the sum of -2x, 4y, -3x, and 5.
d) Find the sum of -3x, 3, 3y, 5x, and -y.

7.A.2b
Using algebra tiles ask students to model each of the subtraction problems below:

e) 5x - 3x
f) 3x - 5x
g) -4x - 7x
h) 3x - -2x

Simplify the expressions below:

a) 5x + 3 + (-4x) -12
b) -8x - 5 - 5x + 6

7.A.3 Identify a polynomial as an algebraic expression containing one or more terms

7.A.3a
Provide the students with two lists. Have the students explain the differences and similarities between the lists. Then have them add algebraic expressions to each list and justify their placement. When finished, have them place the appropriate title at the top of each list, labeling them *monomial* and *polynomial*.

List A	List B
5x	4x2 + 2x - 6
$2x^2$	4x + 3y +8
3xy	-8y + 3x
2/3 m	3m - 2

2) 3x - 1 -2x = 4
3) -x +2 +3x -1 = 3

7.A.4 Solve multi-step equations by combining like terms, using the distributive property, or moving variables to one side of the equation.

7.A.4a
Using algebra tiles have students model and solve equations (e.g., 2x + 3 + 5x = 10). Have them record each step as they model with the tiles. Provide each student with a sketch of a balance beam. Ask students to model one side of the equation with the corresponding algebra tiles on one side of the balance beam, and model the other side of the equation on the other side of the balance beam with tiles.

7.A.4b
Ask students to model the distributive property with the algebra tiles (e.g., $2(x + 3)$ can be shown by making two groups of $x + 3$ and combining like terms.) Ask them to record as they model and continue with examples to help them gain an understanding of its meaning.
Examples below.

A. combine like terms
1) $2x + 3 + 5x = 10$
2) $3x - 1 -2x = 4$
3) $-x +2 +3x -1 = 3$

B. variables on both sides
1) $3x -4 = 5x + 6$
2) $2x +3 = 4x + 1$
3) $3x - 2 = 6 + x$
4) $3x = x - 8$

C. distributive property
1) $2(x + 4) = 2$
2) $2(x + 3) = 10$
3) $3(x - 2) = 3$

D. combination problems
1) $4x - 3 + x + 2 = 3x + 5$
2) $3x - 2(4x + 3) = -7x -12$
3) $2 + 3(x - 2) = 2 - x$
4) $3x - 2(4x + 3) = -7x -12$

7.A.5 Solve one-step inequalities (positive coefficients only)

7.A.5a
Have students solve one-step inequalities and graph the solution set on a number line.
Examples:

a) $9 + x \leq 3$	$9 + x \geq 3$
b) $x - 4 < 8$	$x - 4 < 8$
c) $3x \geq 9$	$3x \leq 9$
d) $x/4 \leq -4$	$x/4 \geq -4$
e) $2/3x > 4$	$2/3x < 4$

7.A.6 Evaluate formulas for given input values (surface area, rate, and density problems).

7.A.6a
Using the formula to calculate density, (D= *m/v*), find the density (D) if the mass (m) is 12 grams and the volume (v) is 5 cm^3.

7.A.6b
Using the formula to calculate rate, (r = *d/t*), find the rate (r), if the distance (d) is 660 miles and time (t) equals 11 hours.

7.A.6c
Explain the formula to calculate the surface of a cylinder area:

$(SA = 2\pi r^2 + 2\pi rh)$

Find the surface area, SA, if r the radius is 12 inches and h the height is 18 inches.

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, Functions

7.A.7 Draw the graphic representation of a pattern from an equation or from a table of data.

7.A.7a
The Zoom factory builds motorcycles. The table below shows how many motorcycles the factory produced during the first four days of production. If the factory can continue at this rate, complete the table and then construct a line graph representing the data. Let the x-axis represent the days (D) and the y-axis represent the total number of motorcycles built (B).

Day (D)	1	2	3	4	5	6	7
Total Built (B)	2	5	8	11			

7.A.7b
Using the information in 7.A.7a, describe a pattern for determining the total number of motorcycles built based on the number of days.

7.A.7c
From the pattern predict the number of motorcycles built in 10 days, and check your answer by extending the graph.

7.A.8 Create algebraic patterns using charts/tables, graphs, equations, and expressions

7.A.8a
A few years ago a woman named Dot Com was given an incentive to stay in her house for a year. She was only allowed to contact the outside world using her computer to connect to the Internet. People could come to visit, but she could not leave. Her first monthly paycheck would be only $24, but her paycheck would double each month that she remained in the house. Complete the chart below to determine the total amount of money she would receive after twelve months.

Month	Pay	Pattern	Rewrite with powers of 2
January	$24	1 x 24 = 24	2^0 x 24= 24
February	$48	__ x 24 =	__ x 24 =
March		__ x 24 =	__ x 24 =
April		__ x 24 =	__ x 24 =
May		__ x 24 =	__ x 24 =
June		__ x 24 =	__ x 24 =
July		__ x 24 =	__ x 24 =
August		__ x 24 =	__ x 24 =

September		__ x 24 =	__ x 24 =
October		__ x 24 =	__ x 24 =
November		__ x 24 =	__ x 24 =
December		__ x 24 =	__ x 24 =
Total:			

Discuss the pattern. Calculate Dot Com's average monthly salary. Explain why she was offered this pay schedule rather than equal monthly payments. As an extension, use the information from the last column, determine a formula using *N* for the month number, which would give her the paycheck amount for any given month.

7.A.9 Build a pattern to develop a rule for determining the sum of the interior angles of polygons

7.A.9a
Have students draw six polygons (three regular polygons and three irregular polygons) drawing in all of the diagonals from **only one** vertex. Since the students already know that the sum of the interior angles of a triangle is 180°, have them determine how many triangles comprise the polygon and determine the total number of degrees for that particular polygon. Have them study the relationship between number of sides and number of triangles and the resulting sum of angles. The students should write down their discoveries and any patterns they notice. Discuss a rule for finding the sum when the number of sides are known, without drawing in the triangles. Below is an example of a recording sheet that can be used for this activity.

Polygon	**# of Sides**	**Sketch**	**# of Triangles**	**Sum of the Triangles ^{0}**
Triangle	3		1	180^0
Quadrilateral	4			

7.A.10 Write an equation to represent a function from a table of values

7.A.10a
The table below shows the height in inches of a plant during a period of 3 weeks. The plant was originally three inches tall. The table indicates the growth rate of the plant for week one through week three.

1) Complete the table below if the plant continues to grow at the same rate.
2) Explain a pattern for generating the height. How can the height (H) be determined if you only know the week (W)?
3) Write an equation that expresses the height (H) in inches of the plant in terms of the number of weeks (W). H= ______________________________________ . Using a graphing calculator, plot the eight points and then graph the equation you wrote on the same page, to check your equation.
4) Use the table or your equation to predict the height of the plant in inches after 12 weeks.

Weeks (W)	0	1	2	3	4	5	6	7
Height (H) in inches	3	7	11	15				

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Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

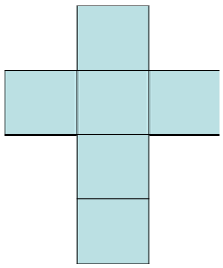
7.G.1 Calculate the radius or diameter, given the circumference or area of a circle

7.G.1a
Which shape of a garden (square, rectangle, or circle) will enclose the largest area if you are given a fence to enclose the garden that is 80 feet long? Justify your answer. Find the dimensions of this shape to the nearest hundredth of a foot and calculate the area.

7.G.1b
If a circle has an area of 400 square cm, determine its radius to the nearest tenth of a centimeter.

7.G.2 Calculate the volume of prisms and cylinders, using a given formula and a calculator

7.G.2a
Provide the students with cardstock and have them cut and tape to form a rectangular prism with an open lid (see drawing below). Then ask the students how many cubes would be needed to fill the bottom of the box. Have them fill the bottom of the box to check their answers. Ask them how many cubes they think they would need to fill the entire box. Discuss the relationship between the area of the base and the number of cubes needed to fill the base. Then have them figure out how many cubes are needed to fill the box. Have them fill their boxes to check their answers. Then discuss the formula and relate it to other prisms and the cylinder. Using models of other prisms and cylinders, demonstrate that knowing the area of the base, they can find the volume of a shape.



7.G.3 **Identify the two-dimensional shapes that make up the faces and bases of three-dimensional shapes (prisms, cylinders, cones, and pyramids)**

7.G.3a
Provide the students with actual models and nets of prisms, cylinders, cones, and pyramids. Using the actual shapes as references, on the nets of each of the shapes have them identify and label the shape that make up each face and base. Next give them a worksheet with the drawings of each of these three-dimensional shapes and have them identify the two-dimensional shapes that make up the faces and bases.

7.G.4 **Determine the surface area of prisms and cylinders, using a calculator and a variety of methods**

7.G.4a
Pass out the rectangular prisms that the students made in 7.G.2 and also provide students a rectangular prism net made from graph paper. Use both of these models to help them to identify all of the faces of the prism. Ask students to find the area of each surface and calculate the total surface area of the prism. Ask students to compare the total surface area to the volume of the rectangular prism. Have students compare the rectangular prism model to the net, to facilitate computing surface area from a diagram.

7.G.4b
Ask students to roll a piece of paper into the shape of a cylinder and make a sketch of it in their notebooks. By unrolling the cylinder, have them sketch the 2-dimensional surfaces, one rectangle and two circles. Guide them to see that the length of the rectangle is really the circumference of the cylinder and its height is the width of the cylinder. They may have to roll the cylinder up again to grasp this concept. Guide them to see that the bases are circles. Then develop the formula to calculate the surface area of a cylinder. Have them write a letter to a classmate explaining how to calculate the surface area of a cylinder. The letters should contain details and diagrams. Have students record their letters with another student to see if their directions are understandable and accurate.

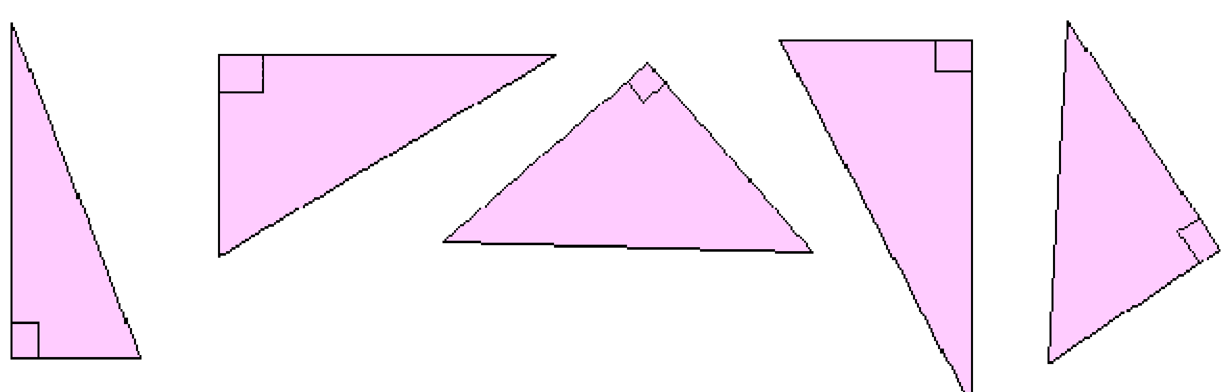
Students will identify and justify geometric relationships, formally and informally.

Geometric Relationship

7.G.5 **Identify the right angle, hypotenuse, and legs of a right triangle**

7.G.5a
Ask students to draw a right triangle and label it ABC with the right angle at C. Label the hypotenuse and legs.

7.G.5b
Ask students to draw five right triangles with different letters for each of the angles and arrange the triangles in different orientations. For example:



7.G.6 Explore the relationship between the lengths of the three sides of a right triangle to develop the Pythagorean Theorem

7.G.6a
Prepare a worksheet containing 10 triangles, six of which are right triangles and the remaining are obtuse or acute triangles. Label each triangle with a different capital letter, and also label each side with letters a, b, and c. Use c for the longest side of each triangle. Have students measure all of the sides of the triangles to the nearest tenth of a centimeter, record the measurements on the chart below, and highlight each row that represents a right triangle.

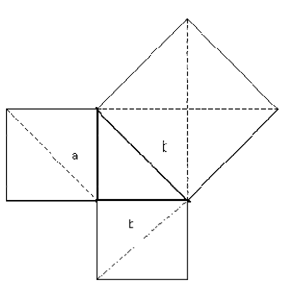
Triangle	a	b	c	a^2	b^2	c^2
A						
B						
C						
D						
E						
F						
G						
H						
I						

Have students record their observations. Follow up with class discussion and guide the discovery by comparing the a^2 and b^2 columns with the c^2 column of the highlighted rows. Once the relationship, $a^2 + b^2 = c^2$ is established, compare to the rows that are not highlighted and discuss that this relationship seems to work for just right triangles.

7.G.6b
Provide each student with a tangram. Select the smallest triangle and trace it on the center of the paper. Discuss the parts of a right triangle and ask students to label the hypotenuse, *c*, and the two legs, *a* and *b*.

> Find the tangram piece that would form a square with one side along side *a*. Trace around the square and do the same along side *b*. Discuss the concept of area and how many small triangles it takes to cover each square (two triangles for each).

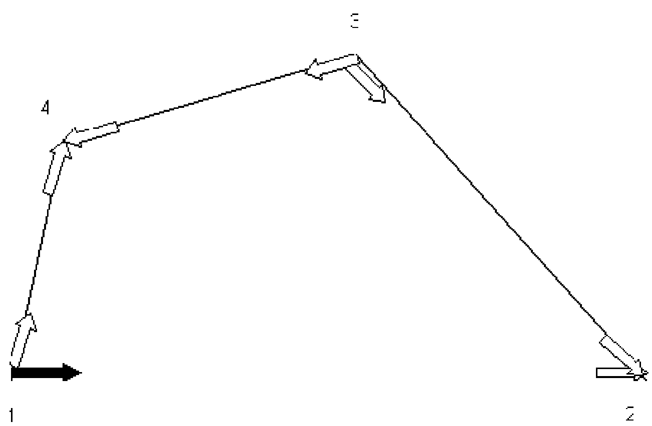
Find two pieces (of a tangram) that would form a square with one side along side c, and trace around the square. Discuss the pieces used and how many small triangles cover this square. Compare this with the number of small triangles needed to cover the squares along sides *a* and *b*. (See example below).
You can repeat this process with the medium triangle, and then with the large triangle. Then discuss finding the area of each of the squares using the area formula (A= lw). The area of the square on side *a* is a^2, side *b* is b^2, and side *c* is c^2. Discuss the equation $a^2 + b^2 = c^2$.



7.G.7 Find a missing angle when given angles of a quadrilateral

7.G.7a

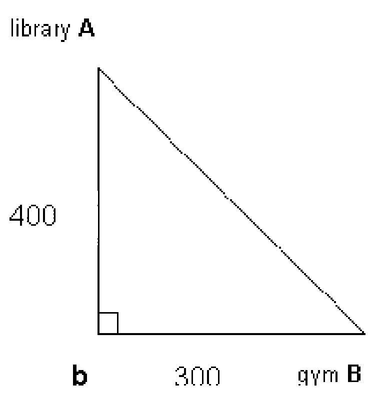
Tape a variety of quadrilaterals on the floor and ask a volunteer to "walk the quadrilateral." In the diagram below, the point of the arrow represents the toe and the end of the arrow represents the heel. (The arrow does not always represent the direction the student walks as sometimes the student will walk backwards, but it represents the placement of the toe and heel.) A student starts out with one heel placed on the vertex of $\angle 1$ and walks along the side of the quadrilateral until the toe touches the vertex of $\angle 2$. The weight of the body should be put on the toe, keeping it on the vertex and rotate the body on the inside of the shape until the heel touches the other side of the angle. The student's body has just rotated the number of degrees as that angle. Now walk backwards until the heel touches the vertex of $\angle 3$ and rotate the toe to the other side of the angle with the heel on the vertex and rotate on the inside of the shape. Walk until the toe touches $\angle 4$, and rotate the heel until it touches the other side of this angle. Continue to walk backwards until the heel touches $\angle 1$, and rotate the toe until it touches the other side of the angle. Compare the body position at the start with the ending position and the number of degrees the body turned, 360°. Have students demonstrate this with the other quadrilaterals.



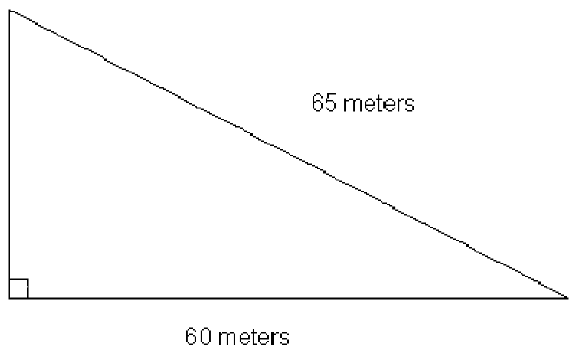
7.G.8 Use the Pythagorean Theorem to determine the unknown length of a side of a right triangle

7.G.8a

To walk from the library, A, to the gym, B, students have to take two sidewalks, $\overline{AC}$ and $\overline{CB}$, that are perpendicular to each other. Some students decided to walk across the lawn to cut down on the distance walked. How many feet would they save by taking the shortcut?



7.G.8b
Find the length of the missing side in the right triangle below.



7.G.9 Determine whether a given triangle is a right triangle by applying the Pythagorean Theorem and using a calculator

7.G.9a
A football coach was discussing a football play with Jason, a player on his team. He asked Jason why he ran in the direction that he did. The coach had told him to run straight out 10 yards and then run 10 yards to the right. He insisted that Jason did not run this pattern. Jason's reply was that he went $10\sqrt{2}$ yards at a 45^{o} angle, which would have the same result. Make a sketch of the situation described above. What kind of triangle would this make? Is what Jason said true? Explain your answer.

7.G.9b
Determine if a triangle with sides of 9", 12", and 18" is a right triangle. Explain your answer.

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

7.G.10 Graph the solution set of an inequality (positive coefficients only) on a number line.

7.G.10a
Solve and graph the solution set for each of the inequalities below and compare the solution sets. Discuss finite and infinite sets.

$9 + x \leq 3$
$9 + x \geq 3$
$9 \leq x + 3$
$9 \geq x + 3$

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Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

7.M.1 Calculate distance using a map scale

7.M.1a
Provide students with a map and a ruler and ask them to calculate the distance between two cities.

7.M.2 Convert capacities and volumes within a given system

7.M.2a
To make one batch of tropical punch, the recipe calls for 3 cups of orange juice. How many gallons of orange juice are needed to make 32 batches?

7.M.2b
Provide students a net to make a cubic centimeter to show the relationship between the metric units. Explain that the cubic centimeter would hold a milliliter of water that would weigh a gram. Provide a cubic decimeter model and centimeter cubes. Ask students to explain how many cubic centimeters are contained in a cubic decimeter. Explain that the cubic decimeter has the capacity of one liter. Have them weigh a milliliter of water, which would have the mass of a kilogram.

Have the students construct a model of a cubic meter with meter sticks. Compare the number of cubic centimeters that will fit along one side of the cubic meter and then have them figure out how many would be needed to fill the entire cubic meter.

7.M.2c
Show the relationship between a cubic foot and a cubic yard by using foot-long rulers. Have the students place the rulers to form a cubic foot. Then around the cubic foot, using yardsticks, have them construct a cubic yard. Have the students determine the number of cubic feet in a cubic yard and explain.

7.M.3 Identify customary and metric units of mass

7.M.3a
Place the following words on index cards: pound, ounce, ton, milligram, kilogram, and gram. Distribute the cards so that each small group of students gets one card. Have the groups identify whether the term on their card is customary or metric. Find one thing that would have the mass of that unit. Have them state how it relates to the other units in that system. Have them name a few items that could be measured using that unit. Provide for the students a model or physical example of each unit to be used as a reference or comparison.

7.M.4 Convert mass within a given system

7.M.4a
Gabriel loads 325 cases of bananas, each weighing 75 pounds, on his truck. He is allowed to carry only 12 tons. Is he under or over the limit? Justify your answer.

7.M.4b
Marcel weighed his daily newspaper and its mass was 268 grams. If he collects 45 newspapers similar to the one he weighed, determine the mass in kilograms.

7.M.5 Calculate unit price using proportions

7.M.5a
Calculate the unit price of a 5.5 ounce jar of sauce if the item costs $1.29, using proportions. Find the unit price, using proportions, if 5.5 ounces of sauce costs $1.29.

7.M.5b
At a local pizza parlor you can purchase a 12-inch diameter pizza for \$7.49 or a 14-inch diameter pizza for \$9.49. How much pizza are you getting for the price in each case? Using proportions find the cost per square inch in each case. Which is the better buy?

For example, one way of setting up a proportion for the 12-inch pizza is as follows:

$$\frac{\text{cost}}{\text{sq. in.}} \quad \frac{7.49}{113.09} = \frac{n}{1}$$

7.M.6 Compare unit prices

7.M.6a
Michael wants to determine which cake in the bakery is a better buy. One is a 9-inch square cake with a side of 9 inches. The square cake is \$8.95. The other cake is a circular cake with a 10" diameter for \$7.50. Both cakes have the same thickness. Michael calculates the number of square inches in each cake and performs the following calculations: 81 ÷ \$8.95 ≈ \$9.05 and 78.5398 ÷ \$7.50 ≈ \$10.47. He then states that the square cake is the better deal as it costs less per square inch than the circular cake. Justify your answer.

Donna disagrees with Michael and says that it should be done as follows: \$8.95 ÷ 81 ≈ .110 and \$7.50 ÷ 78.54 ≈ .095. She then states that the round cake is the better deal as it costs less per square inch. Who is correct, Michael or Donna? Explain your answer.

7.M.7 Convert money between different currencies with the use of an exchange rate table and a calculator

7.M.7a
Below is an exchange rate table. How many Australian dollars would you be able to get for \$100 U.S.? How many European Euros would you be able to purchase for \$250 U.S.? Which currency, the Euro, Pound, Canadian dollar or Australia dollar, is worth the most when purchasing American dollars? Justify your answer by finding out the amount of U.S. dollars you would be able to purchase for 100 Euros, 100 Pounds, 100 Canadian dollars and 100 Australian dollars.

United States Dollar	European Euro	British Pound	Canadian Dollar	Australian Dollar
1.00	0.749513	0.51835	1.2163	1.225408

7.M.8 Draw central angles in a given circle using a protractor (circle graphs)

7.M.8a
Divide the class into pairs. Give each pair of students a small package of colored candies. Have them record the number of each color found in their bag and find the percentage of each color. Have them use this information to create a circle graph and to determine how many degrees would be represented by each of the sectors. Have them use a protractor to draw the central angles to make a circle graph of the percentages of each color found in the package of candy. Have them title and label the graph.

7.M.9 Determine the tool and technique to measure with an appropriate level of precision: mass

7.M.9a
Provide students with various tools to measure mass: triple beam balance, bathroom scale, baby scale, postage stamp scale, kitchen scale, and other scales that the science, technology, or home and careers teachers may have. Provide students with items of varying masses, such as: textbook, letter, can of soup, person, suitcase, one piece of candy, box of cereal, eraser and a ruler. Have them choose the correct tools to measure the mass of the items and explain their choices.

Students will develop strategies for estimating measurements.

Estimation

7.M.10 Identify the relationships between relative error and magnitude when dealing with large numbers (i.e., money, population)

7.M.10a
Aubrey and Javaid were estimating the value of two different houses. Aubrey estimated a $ 415,000 house to be $400,000. Javaid estimated a $90,000 house to be $100,000. To get an idea as to who gave the better estimate, complete the chart below:

a	b	c	d	e
Estimate	Actual Amount	Actual error, difference between a & b	Relative error, fraction ***c/b***	Relative Error as % : ***c/b*** to %
400,000	415,000			
100,000	90,000			

Compare the actual error to the relative error. Who made the largest error? Who has the largest relative error? What conclusions can you make about relative and actual error? What conclusions can you draw about Aubrey and Javaid's estimates?

7.M.11 Estimate surface area

7.M.11a
You plan on putting a birthday gift in a shoebox. You need to purchase wrapping paper for the present. You would most likely need how many square feet of paper?

a) 1 sq. ft.
b) 2.5 sq. ft.
c) 10 sq. ft.
d) 25 sq. ft.

Explain why you made your choice. Be sure to mention how many surfaces you need to consider and the approximate size of each surface. Use a shoebox and calculate the surface area to check your answer.

7.M.12 Determine personal references for customary /metric units of mass.

7.M.12a
Provide students samples of a popular chocolate candy that is color-coated. Have them feel the weight of one piece of candy in their hands and have them associate this with 1 gram. Have them realize that if they cut this candy into 1,000 equal size pieces, (size of one grain of sand) its mass would be 1 milligram. Using various scales, ask the students to find something that weighs 1 kilogram, 1 pound, 1 gram, and 1 ounce. Ask students to suggest some things that have a mass of one ton.

7.M.13 Justify the reasonableness of the mass of an object.

7.M.13a
Display several packages of food items that have varying masses. (Cover up the information about the weights written on the package.) Have students handle them and compare their weights to 1-gram, 50-gram, 100-gram, and 500-gram weights. Have them estimate the weight of the food items in grams. After they make their estimates, have them explain their choices. Then have them check their estimates with the weights listed on the bottom of each package.

7.M.13b
Which is the best estimate of the weight of your mathematics textbook?

a) 10 oz. b) 3 lbs. c) 1/2 ton d) 25 grams

Justify your choice and explain why you eliminated the other choices.

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Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

7.S.1 Identify and collect data using a variety of methods

7.S.1a
Discuss with the students the various ways of collecting data. Include the use of such things as the Internet, magazines, newspapers, polls, surveys, books (e.g., *World Almanac*, the *Top 10 of Everything* by Russell Ash). Have them look at newspapers and magazines and identify stories that are based on the collection of data.

7.S.1b
One fun and meaningful way of collecting data is to have an origami frog-jumping contest. It incorporates measuring, reviewing geometry terms, and statistics. As the students are making the origami frogs from a 3" by 5" index card, review the following geometry terms: rectangle, square, rhombus, isosceles triangle, right triangle, hypotenuse, leg, similar triangles, congruent, trapezoid, pentagon, and quadrilateral.

Mark off a large (at least 10 meters long and wide enough for 5 to 8 contestants to race side by side) area on the floor in meter increments. Have the students race their frogs in races that are one minute long. The only correct moves they can make are by lightly tapping the back of their frogs or turning over a frog that flips on its back. Ask a partner to help each contestant measure the distance jumped to the nearest centimeter. Record the data in a chart that the class has already generated. This information then can be used to find measures of central tendency and to make graphs.

7.S.2 Display data in a circle graph.

7.S.2a
Sports, music, movies, television, and teams are quite popular items to survey. Have students select a topic of interest with the intention of creating a survey for the entire school. Discuss such things as how they would do the survey, what kind of questions they would ask, who they would ask, and how they would make sure the survey represents the views of the school. Show that a question that can be answered with a "yes" or "no" or with just one answer will be easier to tabulate than one with an open-ended question. For example:

From the following list of terms, which is your favorite team?
Do you like pepperoni on a pizza?
If you could pick one topping for pizza, what would it be?
If you could listen to only one type of music for 4 hours, what would it be?

Have the students create a survey and collect data. Remind students that the survey questions should be fair and unbiased. Have them convert the data to percentages and display it as a circle graph with their results. Help them find the measure of each central angle and use a protractor to complete their graphs. When completed, it is interesting for the students to compare their graphs with the other students.

7.S.3 Convert raw data into double bar graphs and double line graphs

7.S.3a
Give each student a 1/2 ounce box of raisins, but do not let them open the boxes. Ask them how many raisins they think would be in one of these boxes. Record the student responses on a chart containing the names of the students along with two columns, one labeled *prediction* and one labeled *actual count*. Next have them actually count the number of raisins in each box and record these results. Have the students create a double bar graph

comparing the predicted results to the actual results. Discuss the scale used and how to make a key to differentiate between the two bars used for each person, one for estimate and one for actual count. Once the graphs are completed, follow up with questions from 7.S.6a. The students can also create a double line graph, or half of the students could construct a double line graph and the other half a double bar graph. Have the class compare their graphs and discuss the advantages and disadvantages of each method.

7.S.4 Calculate the range for a given set of data

7.S.4a
Using the results from 7.S.3a, find the range for the predicted number of raisins in the box and the range of the actual number of raisins. Are these numbers the same? Explain your answer.

7.S.4b
Calculate the range of actual counts and estimates from the double bar graphs of each of the other classes in the above activity and compare the results.

7.S.5 Select the appropriate measure of central tendency

7.S.5a
A real estate agent sold homes at the following prices: $75,000; $250,000; $75,000; $75,000; $55,000; and $80,000. Find the mean, mode, median, and range. Which measure of central tendency is the most representative of the data? What effect, if any, does one high number have on the mean for a small set of data? the median? the mode? the range?

7.S.6 Read and interpret data represented graphically (i.e., pictograph, bar graph, histogram, line graph, double line/bar graphs or circle graph)

7.S.6a
Take the double bar graphs or line graphs made for each of the classes in performance indicator 7.S.3a and have the classes examine their graphs as well as the graphs from the other classes. Have the students first record all the information they can obtain from the graphs. Follow up with class discussion, with such questions as:

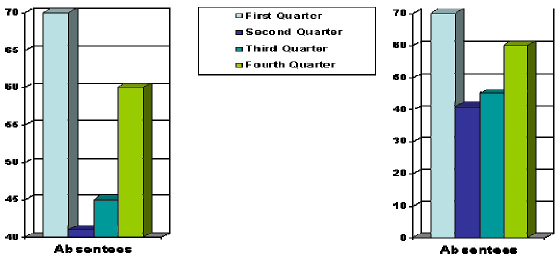
What is being compared in these graphs?
What is the highest prediction? The lowest? Which student(s) had them?
What is the highest actual count? The lowest? Which student(s) had them?
What is the range of the prediction? The actual counts?
What is the mode of the predictions? The actual counts?
Who made the best predictions? How can you tell?
How can the median of the actual number of raisins in a box be found from the graph?
Median of predictions?
How can the mean of the actual number of raisins in a box be found from the graph?
Mean of predictions?
What conclusions can one make from these graphs?

The cumulative data can be tallied and summarized into circle graphs and histograms.

Predictions from Data

7.S.7 Identify and explain misleading statistics and graphs

7.S.7a
Show the following graphs and discuss how one of them is misleading. Discuss how distorted statistics and graphs can be used to mislead.



7.S.7b
Evaluate the following advertisement run by the owner of a company and determine if the owner is telling the truth.

> Come and work for this new progressive company. Entry-level positions are available. The average salary is over $20,000.

Jonathon was hired and was surprised to find out that his salary was only $11,000. He then polled his fellow workers and found out that Ian's salary is $11,000, Natasha's salary is $11,000, Tuyen's salary is $10,000, and Tyberius's salary is $11,000. Then he found out that Karissa, the manager, earns $75,000. Calculate the mean, mode, median and range of *all* of the salaries. Then find the average salary of those surveyed, without including the manager's salary. Was the owner telling the truth?

Students will understand and apply concepts of probability.

Probability

7.S.8 Interpret data to provide the basis for predictions and to establish experimental probabilities

7.S.8a
Use the following problem to generate class discussion and ask the students to perform an experiment to establish experimental probability.

- The Best Taste Bubble Gum Company puts one of six different magic cards in each of the packs of gum. They printed a total of 600,000 cards (an equal amount for each type of card). About how many packs of gum would you expect to buy if you wanted to obtain all six of the magic cards? Poll the students and record the results. Find the mean, median, and mode.
- If you are very unlucky, what is the greatest number of packs of gum you would have to buy? If you are very lucky, what is the least number of packs of gum you would have to buy? Discuss the possibilities of each of these occurring.
- Have the students work in pairs and perform an experiment. They could use a six-sided number cube, spinner divided into 6 equal sections, drawing 6 different colored cubes out of a bag, drawing 6 slips of paper out of a bag, drawing 6 different cards out of a bag, or use random numbers from a table of random numbers. Before they start their experiment make sure they record their data and stop as soon as they have at least one of each of the numbers drawn, spun or rolled. The easiest way is to list numbers 1 to 6 on a paper and put a tally mark after each number when it is drawn. As soon as there is at least one tally mark beside each number, they should stop and total all of the tally marks.
- Write the totals of each group on the board and make a frequency distribution and ask the class to find the mode, range, and median. Then find the mean and compare to the median and mode.
- Compare the results to the original guesses. Based on the results, decide as a class how many packs of gum would probably need to be purchased in order to collect a set of six magic cards. Ask the students: Would you be willing to take the chance of buying 15 packs to try to obtain a complete set of cards?

7.S.9 Determine the validity of sampling methods to predict outcomes

7.S.10 Predict the outcome of an experiment

7.S.10a
A popular candy comes in packages containing brown, orange, blue, green, yellow, and red candies. If you selected 2 pieces of candy without looking, predict the probability of getting two of the same color.

7.S.11 Design and conduct an experiment to test predictions

7.S.11a
Ask the students how they could design and conduct an experiment to test the predictions made in performance indicator 7.S.10. Run the experiment 20 times. (Be prepared to supply each student pair with a small package of candy).

7.S.12 Compare actual results to predicted results

7.S.12a
Referring back to performance indicator 7.S.11, have the students compare their results to their predictions. Then have them empty their bags of candy and find the actual probability of randomly choosing two candies with the same color.

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