Imagine Schools
Summer Math Challenge

Grade 5

Dear Imagine Student,

We hope you will enjoy this Math Challenge Packet and work hard to complete all problems on your own or with help from a parent or guardian. All projects in the challenge packet are based on the Common Core Standards. Therefore, this should be a review for you in some ways, but should stretch you as you apply your understanding of concepts you learned throughout this past year. We suggest doing one project each day. Once you have finished with the project you select for the day, try to find a way to discuss it with a friend, parent, or relative. Think about how the skills and concepts in the problem you completed are connected to other things in your home, environment, or daily routine. Find ways to apply your new understanding to real world situations.

Math is all about problem solving. One of the best ways to learn math is to try out problems in which you have to devise your own strategy to find the solution. There is usually more than one way to solve math problems. While working on the problems in this packet, you may discover shortcuts and use your own process or set of rules to calculate or determine the appropriate solution. Make sure to keep notes, include your work so you can justify your solutions. In other words, be sure you can answer the question, "How do you know?" Explaining how you arrived at an answer immediately tells others what you're learning along the way.

Sincerely,
Imagine Schools National Academic & Character Team

Project #1

Domain: Operations and Algebraic Thinking

Standard:

5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

Directions:

1. Write out the order of operations in correct order.

Subtraction	Exponents	Division
Multiplication	Addition	Parenthesis

2. Write a common acronym used to help you remember the order of operations (that your teacher taught you or you came up with on your own).

3. Complete the following problem using the order of operations:

   1,006 – 4 (10 X 8) + 7 = _____

   Show your work.

4. Create five problems of your own with at least three operations in each.
5. Show your solutions for each problem.

Project # 2

Domain: Operations and Algebraic Thinking

Standard:

5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

Directions:

Part I:

Evaluate the following expressions.

1. (2 x 6) + (6 x 4)

2. 486 – (12 x 3)

3. 6 x (14 ÷ 7) – 3

4. 89 (16 ÷ 4) + 8^3

5. 328 ÷ (8 x 3) + 6 x 2

6. 4.8 x 36 ÷ 12

Part II:

Tell how the order of operations affects the outcomes of each of the above problems. Write out the answer you would get if you did not follow the order of operations and common mistakes that are made when the order of operations is not applied.

Part III:

Evaluate the expression: 2{ 5[12 + 5(500 - 100) + 399]}

Project # 3

Domain: Operations and Algebraic Thinking

Standard:

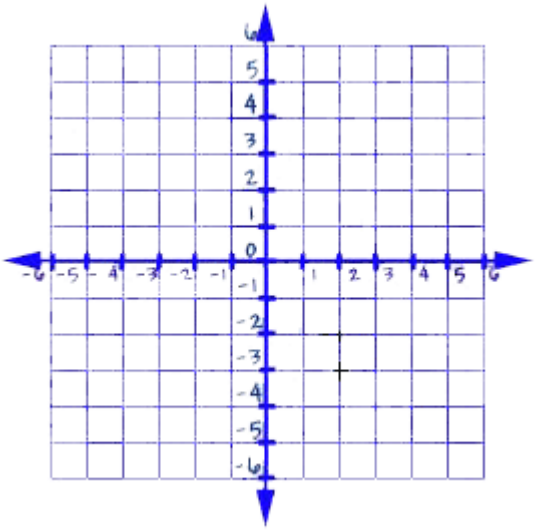
5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Directions:

1. Make a chart (table) to represent the number of fish that Sam and Terri catch.

   Sam: 0, 2, 4, 6, 8, 10
   Terri: 0, 4, 8, 12, 16, 20

2. Describe the pattern.
3. How many fish do they have after each of the five days?
4. Make a graph of the number of fish.
5. Plot the points on a coordinate plane and make a line graph, and then interpret the graph.



Project #4

Domain: Operations and Algebraic Thinking

Standard:

5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Directions:

1. Play "Guess My Rule."
2. Make up a rule that generates one number from another.
   Example: "Add 5" generates 8 from 3.
3. Make a table of both numbers from this rule in an input/output tale.
4. Plot the points on a graph and describe the graph.

Rule: _____

Table:

5. Try out this problem using the same methods as above.
   Choose one of three different situations by looking at the pattern in each option:

   Mr. Trumpet would like to offer you a job. He will hire you for ten days.
   He will pay you one of three ways:

   a) $2 the first day, $4 the second day, $6 the third day and so on.
   b) $0.50 the first day, $1.00 the second day, and each day after will be double the day before.
   c) $6 a day for each of the ten days.

   Which way would you choose? Explain why. Show the work you completed to reach your decision.

Project #5

Domain: Number and Operations in Base Ten

Standard:

5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

Directions:

1. Explain the difference in the value of the number 5 in the following numbers:

   1,005 543 5,099,433 1.05 51

   *Hint: Tell what the five represents in each of the numbers above and how it's position within the number is related to its value.

2. Write out each of the above numbers in expanded form to prove the value of each.
3. Look for numbers in your home, around your neighborhood, on the internet, or in the newspaper. Write down these numbers when you find them and keep a log of them throughout the summer. Choose one of your numbers to tell what would happen if you multiplied the number by 10. Choose one of your numbers to tell what would happen to it if you divided by ten.

Project #6

Domain: Number and Operations in Base Ten

Standard:

5.NBT.3 Read, write, and compare decimals to thousandths.
a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).
b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Directions:

1. Complete the following problems below.

    1. Write eighteen hundredths written in standard form?

    2. Write the following in standard form:
        a. 234,000,000
        b. 76,000
        c. 0.000543

    3. Now write 12,345,678.

        Short word form

        Expanded form

        Standard form

    4. Write each of the following in short word form.

        3,560,099

        950,382

        39,678,381

    5. Write the following in standard form.

        600,000+50,000+2,000+300+7

        32 million, 379 thousand, 408

398 thousand, 6

200,000+500+20+8

6. Choose a correct number for each of the following.

   Write any number with an 8 in the hundred thousands place.

   Write any number that has a 2 in the hundredths place.

   Write any number that has 20 thousands + 3 thousands.

   Write the number that is 10 thousand less than 845,340.

2. Create ten original problems comparing decimals with numbers in the thousandths place to challenge a friend or family member.

Project #7

Domain: Number and Operations in Base Ten

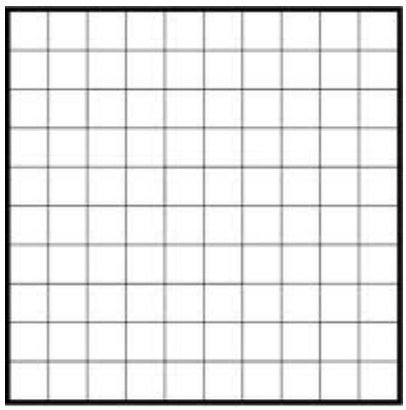
Standard:

5.NBT.4 Use place value understanding to round decimals to any place.

Directions:

1. Round 14.235 to the nearest tenth.
2. Explain your thinking.

3. Using a hundreds chart, create a model by shading to show the number 72.



Project #8

Domain: Number and Operations in Base Ten

Standard:

5.NBT.4 Use place value understanding to round decimals to any place.

Directions:

1. Round each of the following to the tens place.

884	973	8,222	10.02	8,003

2. Round each of the following to the hundreds place.

884	973	8,222	10.02	8,003

3. Round each of the following to the tenths place.

0.667	30.09	432.002	78.8	3.4007

4. Round each of the following to the hundredths place.

0.667	30.09	432.002	78.8	3.4007

5. Round each of the following to the thousandths place.

0.667	30.09	432.002	78.8	3.4007

6. Create twenty rounding problems with decimals and whole numbers for a friend to solve. Include an answer key.

Project #9

Domain: Number and Operations in Base Ten

Standard:

5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.

Directions:

1. Solve the following. Explain your thinking and how you solved the problem.

   There are 225 dozen cookies in the bakery. How many cookies are there?

2. Draw an array model for 225 x 12…. 200 x 10, 200 x 2, 20 x 10, 20 x 2, 5 x 10, 5 x 2

Project #10

Domain: Number and Operations—Fractions

Standard:

5.NF.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Directions:

1. Read the following scenario and make a plan for how to solve.
   Considering that one box of cake mix usually makes 24 cupcakes, how many boxes of cake mix would you need to purchase to feed your entire math class if each student and teacher were going to have 2 ½ cupcakes?

2. Create 10 addition problems with fractions with unlike denominators (including mixed numbers).
   Example: 8 ½ + 2 ¼
   *Make sure to create an answer key with answers and explanations.

3. Create 10 subtraction problems with fractions with unlike denominators.
   Example: 4 (2/3) – 1 (2/5)
   *Make sure to create an answer key with answers and explanations.

4. Finally, create your own story problem using one of your problems from #2 or #3 above. Use #1 to help you if needed. *Be sure to work out the problem and explain your thinking.

Project #11

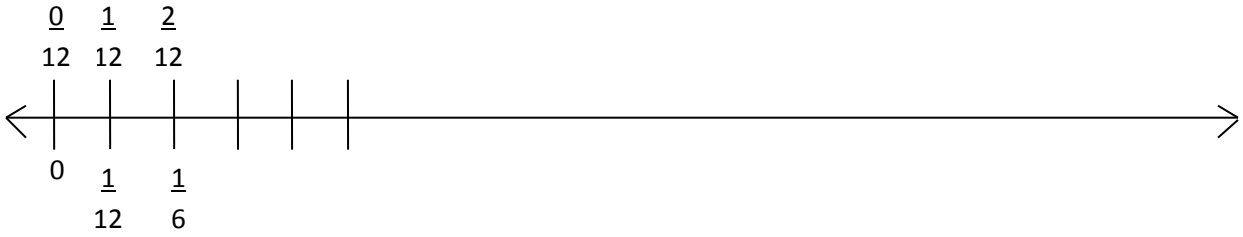
Domain: Number and Operations—Fractions

Standard:

5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Directions:

1. Finish drawing a number line divided into twelfths. Show that the twelve equal parts add up to one whole.
2. Label your twelve parts on the number line.
3. Below the line, write each fraction in lowest terms.



4. Draw your own number line below (or on a separate sheet of paper) to show fifteenths.
5. Label your fifteen parts on the number line.
6. Below the line, write each fraction in lowest terms.
7. Finally, shade your number line to show how it might be divided into thirds and halves.

8. Solve the following:

   Your teacher gave you 1/7 of the bag of candy. She also gave your friend 1/3 of the bag of candy. If you and your friend combined your candy, what fraction of the bag would you have? Estimate your answer and then calculate. How reasonable was your estimate?

Project # 12

Domain: Number and Operations—Fractions
Standard:
5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. a. Interpret division of a unit fraction by a non-zero whole number and compute such quotients.

Directions:
Part I:

1. Create a story context for (1/2) ÷ 6.

2. Use a visual fraction model to show the quotient.

3. Finally, use the relationship between multiplication and division to explain that (1/2) ÷ 6 = n because n x 6 = 1/2.

Part II:

1. Create a story context for 5 (1/4) ÷ 8.
2. Use a visual fraction model to show the quotient.

3. Finally, use the relationship between multiplication and division to explain that 5 (1/4) ÷ 8 = n because n x 8 = 5 (1/4).

Project #13

Domain: Measurement and Data

Directions:
Read the following problems and solve using the information provided and by creating graphs or charts to help.

1. Sara has saved $20. She earns $8 for each hour she works.

   A. If Sara saves all of her money, how much will she have after working 3 hours? 5 hours? 10 hours?
   B. Create a graph that shows the relationship between the hours Sara worked and the amount of money she has saved.
   C. What other information do you know from analyzing the graph?

2. Use the graph below to determine how much money Jack makes after working exactly 9 hours.

   Explain your answer.

Project #14

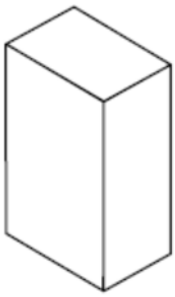
Domain: Measurement and Data

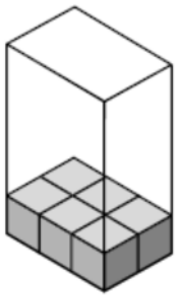
Standard:

5.MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.
5MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

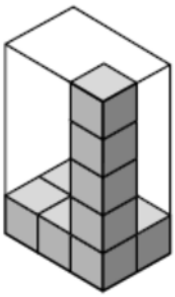
Directions:

1. Estimate how many cubic yards would be needed to fill your classroom with cubic centimeters.
2. Estimate how many cubic centimeters would be needed to fill a pencil box.
   *Use the model below to help you.





one layer



five layers
fill the box

(3 x 2) represented by first layer
(3 x 2) x 5 represented by number of 3 x 2 layers
(3 x 2) + (3 x 2) + (3 x 2) + (3 x 2)+ (3 x 2) = 6 + 6 + 6 + 6 + 6 + 6 = 30
6 representing the size/area of one layer

3. Choose one additional space to estimate and find the true measure of how many cubic centimeters are needed to fill it. *Example: Your kitchen, bedroom, backpack or little brother's toy chest.

Project # 15

Domain: Measurement and Data

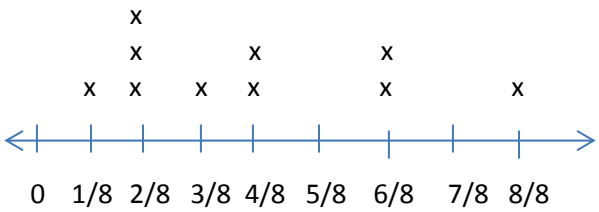
Standard:

5.MD.2 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.

Directions:

1. Solve the following:

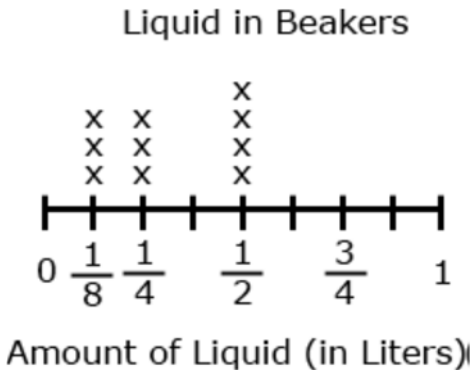
   Students measured objects in their desk to the nearest 1/8 of an inch then displayed data collected on a line plot. How many objects measured?



   If you put all the objects together end to end what would be the total length of **all** the objects?

2. Solve the following using the information on the line plot.

   Ten beakers, measured in liters, are filled with a liquid.



   The line plot above shows the amount of liquid in liters in 10 beakers. If the liquid is redistributed equally, how much liquid would each beaker have? (This amount is the mean.)

Project # 16

Domain: Geometry

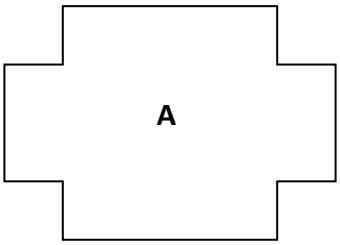
Standard:

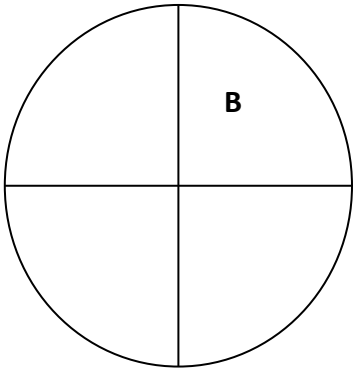
5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*

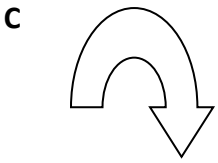
5G.4 Classify two-dimensional figures in a hierarchy based on properties.

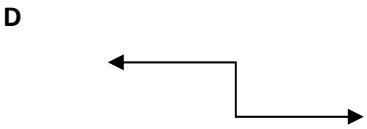
Directions:

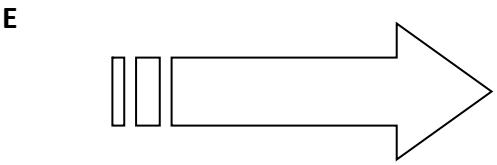
1. Look at figure A below. Label it using your knowledge of the lengths of sides of polygons.
2. Use your ruler to measure the lengths of all of the sides. Determine the perimeter and area of the figure.
3. Now look at the circle (figure B). Find the area of one of the four sections of the circle.
4. Complete a reflection of figure C.
5. Complete a 90 degree clockwise rotation of figure D.
6. Create a tessellation on graph paper with figure E.





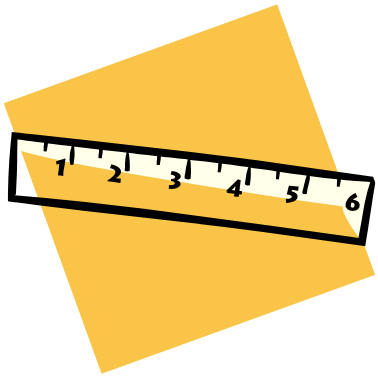






Extensions

The following projects are based on standards you will learn in sixth grade. They should be challenging for you at this point. Try them out and save your work along the way.



Project #17

Domain: Measurement and Data

Directions:

1. Every year you grow and change in many different ways. Get someone to help you measure and ask for help when needed.

   Measure your height to find out how tall you are:
   In feet & inches_____ In inches_____
   In meters _____ In meters & cm_____
   In millimeters _____
   Using non-standard measurement – you choose the tool to use to measure yourself (i.e., an eraser, paper clip, quarter, etc.) Make sure to include the unit along with your measurement.
   _____

2. Now complete the same measurements for 3 to 5 family members or friends.
3. Create a chart to record their information.
4. When you're finished, graph-to show all of your subjects' measurements (including your own).

5. Next, complete measurements for each of your subjects for the following:
   How much do you weigh? _____
   What is the circumference of your head? _____

6. Add this information to your chart as well.
7. Compare the information on your chart and make predictions about changes you might expect in the next few years based on the information you have recorded.

Project #18

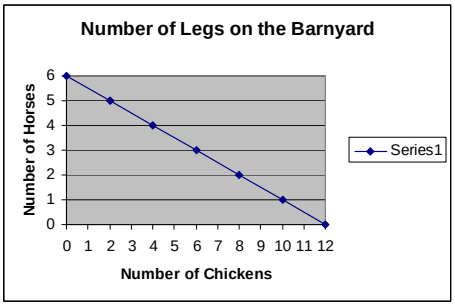
Domain: Operations and Algebraic Thinking

Directions:
1. Read the example below.
2. Create your own problem.
3. Include a graph and chart to explain the possible solutions to your problem.

Example:
Show the different combinations of chickens and horses in a barnyard where the total number of legs is 24.

Words	Expression or Equation
Multiply 2 legs by the number of chickens.	2c
Multiply 4 legs by the number of horses.	4h
The sum of the chicken legs and horse legs is 24.	2c + 4h = 24

A graph of this would show 6 combinations of chickens and horses. When there are 6 horses (6x 4 = 24) , there would be 0 chickens, When there are 12 chickens (12x 2= 24), there would be 0 horses.



Project #19

Domain: Number and Operations in Base Ten

Roller Coaster Challenge!

Directions:

1. Choose a picture of a roller coaster from the web site www.joyrides.com, that you think is fast, high, or cool.
2. Estimating the speed, height, length and duration of the ride.
3. Create a "Roller Coaster Data Sheet" to record your estimates on the next page.
4. Then work to find and record the actual data from the Roller Coaster Database (http://www.rcdb.com) and record this information on your "Roller Coaster Data Sheet."
5. Compare the actual data for your coasters, noting which coaster is faster, higher, etc. by circling the greater measurement in each category.

***Challenge a parent or friend to compete with you to select the highest, fastest, etc. roller coasters. When you find the actual data, you receive a point for each coaster that you estimated correctly.

Project #20

Domain: Geometry

Directions:

1. Read the introduction and complete the problem below.
2. Draw a picture to show how you arrived at your solution.

Someone said, "A picture is worth a thousand words." Turning the words of a problem into a picture or a diagram can help you "see" the problem. By using the part of your brain that visualizes a situation or object, you may see relationships or information that helps you solve the problem. When someone tells you a story, try turning the words into a motion picture or a cartoon. When reading a description, try "seeing it in your mind's eye." If you can do these things, this strategy may be for you! Try using a picture or make a diagram to solve this problem:

In a cozy family restaurant in Diller, Indiana there are 12 square tables. Only one person can sit on each side of each table. What is the greatest number of people that can be seated if the tables are pushed end to end into one large rectangle?

Project #21

Domain: Measurement and Data

Directions:

1. Read the following, then complete the steps below.

A baseball player's batting average compares a player's times at bat with the number of hits. To computer a batting average, divide the number of hits by the at bats. The result will be a decimal. The higher the decimal, the better the average.

Here are some sample batting averages from the 1996 baseball season.

Batting Averages			
Player	**At Bats**	**Hits**	**Average**
Ken Griffey, Jr.	545	165	.303
Cal Ripken	640	178	.278
Juan Gonzalez	541	170	.314

Based on this information, who do you think has the highest average?

Now look in the sports section of your newspaper to find the batting averages of 5 players on your favorite team. Keep track of the players' at bats and hits for a week or a month. Compute the batting average using the formula above. Create a chart similar to the one above to record your answers.

Compute the range, median, and mode of the statistics from your chart.