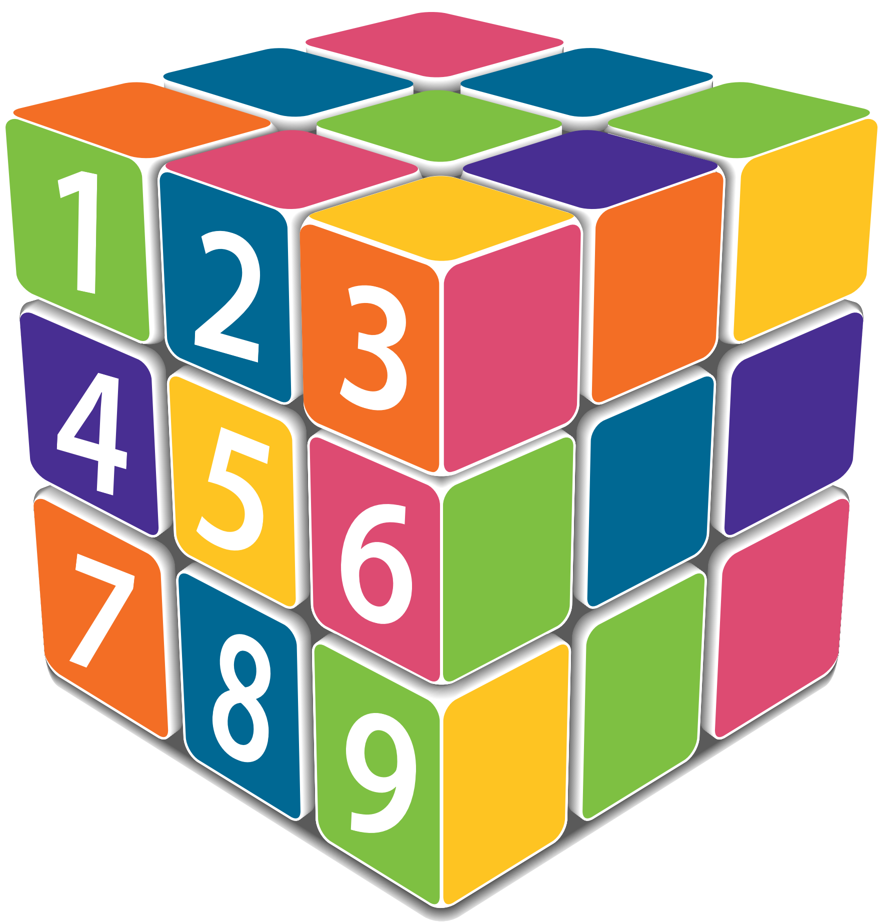
CORE MATH®
NUMBER INTELLIGENCE

Spend Some Time with 1 to 9:

Mathematical Challenges for Increasing Number Sense and Fluency in Grades 6–12



ISBN: 978-0-9915355-1-4

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CORE Mission
CORE serves as a trusted advisor at all levels of preK–12 education, working collaboratively with educators to support literacy and math achievement growth for all students.

Our implementation support services and products help our customers build their own capacity for effective instruction by laying a foundation of research-based knowledge, supporting the use of proven tools, and developing leadership.

As an organization committed to integrity, excellence, and service, we believe that with informed school and district administrators, expert teaching, and well-implemented programs, all students can become proficient academically.

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What Can You Do with 5, 6, 8, and 2?

Use the four digits 5, 6, 8, and 2 to make many other numbers. For example, the digits can be used to create 56 + 82, or 26 + 58, or 5 – 6 + 82, or 56 × 8 + 2. The rules are as follows:

- Use all four digits exactly once each time.
- Use any operation(s) and use at least one operation in each expression.
- Create only positive values as the overall value of the expression (values greater than zero).

1. What is the greatest positive integer value you can create?

2. What is the least positive integer value you can create?

3. What is the greatest possible positive rational number value you can create?

4. What is the least possible positive rational number value you can create?

5. For any of your answers for 1–4, explain or show how you know you have the greatest or least possible value that can be created.

What Can You Do with 5, 6, 8, and 2?

CCSSM: 1NBT.4, 2.OA.2, 2.NBT.5, 2.NBT.6, 5.NBT.5-7, 7.NS.1

Prompts/Questions/Extensions

- What strategies or reasoning did you use to get the greatest possible value or the least possible value?
- Limit the possible operations to addition, subtraction, multiplication, and division.
- Use a specific operation, such as exponents and/or radicals.
- Repeat questions 1–5 using a different set of numbers, such as 3, 4, 7, and 9. This is especially useful after students share and discuss strategies and the mathematical connections are made explicit. Then students can try out newly learned strategies on a new set of numbers.

Create Variable Equations with Coefficients 1 to 9

Create at least five variable equations with the following conditions:

- Use the digits 1–9 for coefficients.
- Use some or all of the digits in each equation.
- Do not use any digit more than once for the coefficients within any equation.

Examples:

$8x^2 \div 4x = 5x - 3x$ → uses the digits 3, 5, 4, and 8

$5x^2 - 4y + 6y + 3x^2 = 8x^2 + 2y$ → uses the digits 2, 3, 4, 5, 6, and 8

$(6x)(3x) = 18x^2$ → uses the digits 1, 3, 6, and 8

$\frac{9y^5}{6y} = \frac{3}{2} y^4$ → uses the digits 2, 3, 6, and 9

Nonexamples:

$(9x^2 \div 3x) + 6x = 9x$ → uses the digit 9 more than once

$10x = 6x + 4x$ → uses a digit that is not from 1 to 9, the digit 0

$8x^2 + 4x + 5 = 29 \times 1$ → is not a true equation

Create Variable Equations with Coefficients 1 to 9

CCSSM: 6.EE.2-4, 7EE.1, A-APR.1, 7

Prompts/Questions/Extensions

- Create an equation that uses all nine digits as coefficients.
- Create at least one of each of the following types of equations: linear, quadratic, cubic, and exponential.
- Create a linear or quadratic equation such that the coefficients and the intercepts of the graph of the equation all use different digits from 1 to 9.
- What is the greatest number of terms you can have in one expression (on one side of the equal sign)?
- What is the greatest number of unlike variables you can have in one expression?
- Create an equation that uses as many different math operations as you can.
- Explain any strategies you used to create equations.

All Around and Solid with 1 to 9
(Width, Height, Depth, and Surface Area)

Create rectangular solids by assigning the width, height, and depth of the solid using only the numbers 1 to 9, such that each dimension has a different length. Compute the surface area. Find all rectangular solids that have different digits in the width, height, depth, and surface area, and that only include the digits 1 to 9 (not zero).

You may choose to draw some or all of the rectangular solids.

For example:

The rectangular solid below is correct because the width, height, and depth, and surface area all have different digits.

The rectangular solid below is not correct because the surface area uses the digit 2 twice.

All Around and Solid with 1 to 9

CCSSM: 6.G.4, 7.G.6
Prompts/Questions/Extensions Comparing volumes and surface areas of rectangular solids: • Consider the rectangular solid with dimensions $1 \times 6 \times 8$ units that has a volume of 48 cubic units and a surface area of 124 sq. units. Compare this to the rectangular solid with dimensions $2 \times 4 \times 7$ units that has a volume of 56 cubic units and a surface area of 100 sq. units. The second solid has greater volume than the first but less surface area. Which box is smaller? Explain your answer. • Identify at least three other pairs of rectangular solids such that as the volume increases, the surface area decreases. Explain why you think this occurs.

Spend Some Radical Time with 1 to 9
Make the Inequality Statements True

$\boxed{1}\ \boxed{3}\ \boxed{5}\ \boxed{7}\ \boxed{9}$

1. Place **any** of the digits from the set above into the blank spaces in each inequality shown to the right to make the statement true.

   For example, below we have used 3, 5, and 7 to make a true statement:

   $$\boxed{3}\sqrt{2} < \sqrt{4\boxed{5}} < \sqrt{\boxed{7}8}$$

   - Do not use a digit more than once in the same statement.
   - Do not use a calculator.

2. Show at least two possible solutions for any problem that can have more than one solution.

3. If you were required to place the same number in each blank, is there any statement that is impossible to solve with this condition? If so, explain or prove why there is no possible solution in these cases.

4. What ideas or strategies did you use to help you solve some or all of these problems? Why do your ideas or strategies work?

a. $\boxed{}\sqrt{2} < \sqrt{4\boxed{}} < \sqrt{\boxed{}8}$

b. $\sqrt{4\boxed{}} < \boxed{}\sqrt{2} < \sqrt{\boxed{}8}$

c. $\sqrt{\boxed{}8} < \sqrt{4\boxed{}} < \boxed{}\sqrt{2}$

d. $\sqrt{\boxed{}8} < \boxed{}\sqrt{2} < \sqrt{4\boxed{}}$

e. $\sqrt{4\boxed{}} < \sqrt{\boxed{}8} < \boxed{}\sqrt{2}$

f. $\boxed{}\sqrt{2} < \sqrt{\boxed{}8} < \sqrt{4\boxed{}}$

Spend Some Radical Time with 1 to 9

CCSSM: 8.NS.1, 8.NS.2
Prompts/Questions/Extensions
• What if the number set you had to work with was {1, 3, 5} for filling in the boxes? Show how you could complete some or all the inequalities with just the numbers in this set. Discuss which ones can and cannot be completed and why.
• Change the given numbers in the inequalities from 2, 4, and 8 to 3, 6, and 9, respectively, and complete the inequalities choosing from the set {2, 4, 6, 8}. This activity is especially beneficial after students share and discuss strategies with the original problem set and the mathematical connections are made explicit. Then students can try out newly learned strategies on a new set of numbers.