Fluency Through Problem Solving

Presented by

David Hedges

david@EDsentials.com

Developed with Dean Ballard
dballard@corelearn.com
www.corelearn.com

Addition Four-Packs with 1 to 9

An Addition Four-Pack is four addition problems that

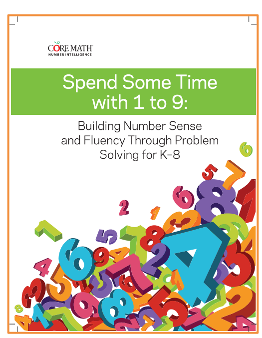
- Use the same six digits (not including zero)
- No digit is used more than once in each problem
- Each problem in the pack has different addends than the other problems

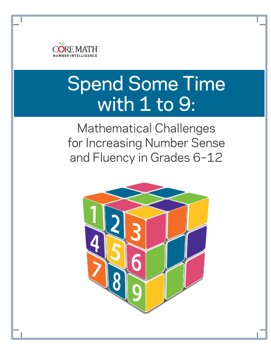
For example,

$$\begin{array}{r} \boxed{2}\ \boxed{1} \\ +\ \boxed{5}\ \boxed{3} \\ \hline \boxed{7}\ \boxed{4} \end{array} \qquad \begin{array}{r} \boxed{2}\ \boxed{3} \\ +\ \boxed{5}\ \boxed{1} \\ \hline \boxed{7}\ \boxed{4} \end{array} \qquad \begin{array}{r} \boxed{1}\ \boxed{5} \\ +\ \boxed{3}\ \boxed{2} \\ \hline \boxed{4}\ \boxed{7} \end{array} \qquad \begin{array}{r} \boxed{1}\ \boxed{2} \\ +\ \boxed{3}\ \boxed{5} \\ \hline \boxed{4}\ \boxed{7} \end{array}$$

Create more Addition Four-Packs

This and the next three problems come from the books ***Spend Some Time with 1 to 9*** by Dean Ballard (Corelearn.com)





Create Equations with the Digits 1–9

Create as many equations as you can with the following conditions:

- Use the digits 1–9 to create many different equations.
- Use some or all of the digits in each equation.
- Do not use any digit more than once within any single equation.
- Do not use the digit zero.
- You may use any math operation, including exponents.

For example,

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

$5 + 6 \times 4 = 29 \times 1$ → uses the digits 1, 2, 4, 5, 6, and 9

from ***Spend Some Time with 1 to 9***, CORE Math, 2014

Fill In the Fractions from Least to Greatest with 1 to 9

Fill in the remaining numbers from 1 to 9 in the boxes to create **proper** fractions that make the inequalities true.

- Create only fractions with single digit numerators and denominators.
- No digit may occur more than once within a set of inequalities.

For example, one possible solution to the inequality set shown to the left below, is shown to the right of the problem.

$$\frac{\square}{6} < \frac{\square}{8} < \frac{3}{\square} < \frac{\square}{5} \quad \rightarrow \quad \frac{\boxed{1}}{6} < \frac{\boxed{2}}{8} < \frac{3}{\boxed{7}} < \frac{\boxed{4}}{5}$$

Solve each inequality problem below. If it is not possible to solve explain why.

1) $\frac{\square}{9} < \frac{\square}{8} < \frac{\square}{7} < \frac{\square}{6}$

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2) $\frac{\square}{9} < \frac{\square}{8} < \frac{3}{\square} < \frac{\square}{6}$

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3) $\frac{\square}{9} < \frac{\square}{4} < \frac{5}{\square} < \frac{\square}{7}$

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4) $\frac{1}{\square} < \frac{2}{\square} < \frac{\square}{9} < \frac{\square}{4}$

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5) $\frac{\square}{\square} < \frac{\square}{\square} < \frac{\square}{\square} < \frac{1}{2}$

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6) $\frac{1}{2} < \frac{\square}{\square} < \frac{\square}{\square} < \frac{\square}{\square}$

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from ***Spend Some Time with 1 to 9***, CORE Math, 2014

Order of Operations with 1 to 9

1. Create an expression that includes parenthesis using any of the numbers 1 to 9.
   - The numbers cannot be used more than once in the expression.
   - May not include exponents.
   - The parentheses are necessary in each expression – the expression would equal a different value if the parenthesis were removed.
2. Create a second expression that includes the same numbers in the same order with the same operation symbols, but uses parenthesis differently than in the first expression such that the result is a different overall value for the expression.

   For example the following two equations show expressions on the left side of each equation that have the same numbers and same operations. However, the operations are done in a different order because the parentheses have been changed. The result is a different overall value.

   (1 + 2) × (4 + 9) = 39.   (1 + 2) × 4 + 9 = 21

   Create at least five such pairs of equations.

Each challenge below requires the same rules from above.

3. **Challenge 1:** Create a pair of expressions that have the greatest difference in value that you can.
4. **Challenge 2:** Create three or more versions of an expression with different values.
5. **Challenge 3:** Create expression(s) that use all nine digits from 1 to 9.

from ***Spend Some Time with 1 to 9***, CORE Math, 2014

Mystery Math Grid Challenges

I. Directions:

Plan a grid by choosing an operation, and choosing numbers for the outside (that are different numbers from 1-9).

Fill in the grid based on the chosen operation and outside numbers.

Final form: Create a version without the outside numbers. Challenge someone to solve your grid – figure out the outside numbers.

X	3	5	8
4			
2			
6			

→

X	3	5	8
4	12	20	32
2	6	10	16
6	18	30	48

→

X	___	___	___
___	12	20	32
___	6	10	16
___	18	30	48

II. Solve the grid to the right:

X	___	___	___
___	6	21	24
___	10	35	40
___	12	42	48

III. Create a grid.

Create a grid and rewrite the final form of the grid (without the outside numbers) on a separate piece of paper or sticky note, and exchange and challenge a partner with each other's grids.

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→

X	___	___	___
___			
___			
___			

IV. Create other size grids

Golden Ratio Design Challenge

Background:
The "golden ratio" is an irrational number, **1.61803398874989484820...** (etc.), that represents a ratio between dimensions within an object that are considered by many as an ideal ratio between the dimensions visually. With students you can share much more, such as examples of this ratio occurring in nature, art, and architecture, as well has how the ratio is derived. For this activity an approximation can be used, such as 1.6, 1.62, 1.618, etc.
In this activity we will apply the golden ratio to the faces of rectangular buildings.

Directions:
Give students a set length for a city block (such as 200 feet or 300 feet). They are to design five buildings – by design we mean students are simply choosing the dimensions for the rectangular face of the building. Include the following:

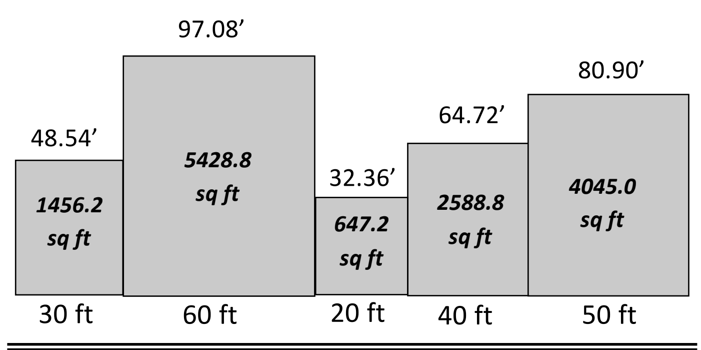
- Design five buildings using five different widths that sum to the block width.
- The heights of each building should be based on the Golden Ratio.
- Determine the
  - Area of the face of each building.
  - Total area of all building faces together.
  - Sum of the five building heights.
- Create 2-3 different designs (all buildings with different dimensions than before).
- What patterns do you notice?
- Write a conjecture about the total area of the faces for a five-building design.

Redo with other parameters, such as:

- "Widths must be multiples of 3, but not multiples of 10."
- "One building must have a height of 80 feet."

Example:

Width	Height	Area
20	1.618*20=32.36	647.2
30	1.618*30=48.54	1456.2
40	1.618*40=64.72	2588.8
50	1.618*50=80.90	4045
60	1.618*60=97.08	5824.8
Total = 200 ft	Total = 323.60 feet	14562



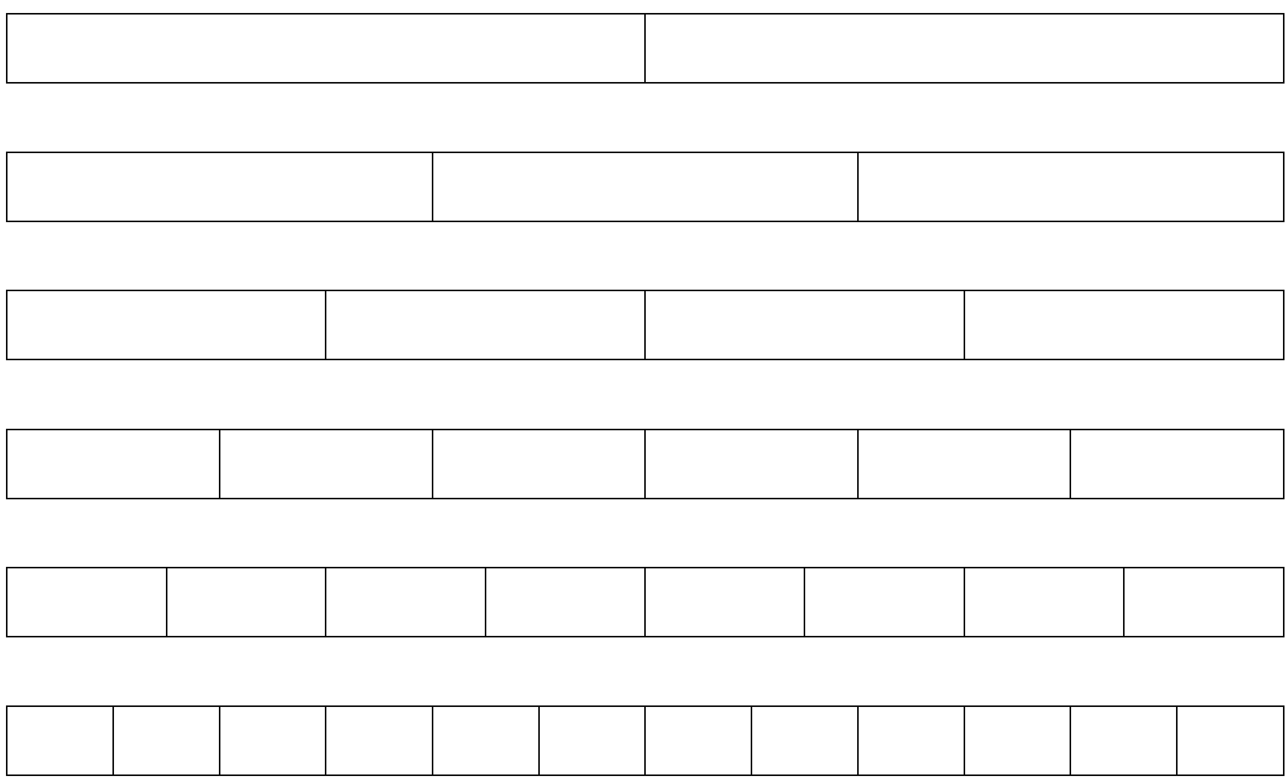
Sums of Fraction Strips Less One Unit

Directions for You vs. Partner:

1. Randomly pick three strips to put together.
2. Fold one unit on each strip underneath (back).
3. Calculate the sum of the fractions now showing on your three strips.
4. Who has the greater sum of the fractions showing of their three strips? Show visually and numerically.

Scaffold Idea: Do sums of the unit fractions first (the folded under part), then work with sums of remaining parts of each fraction strip.

Extension: Use addition and/or subtraction with your three fractions to get a total that is as close to ½ or as close to 1 as possible.



Consecutive Sums

Find all possible consecutive addition expressions for each sum using only positive integers. Three are done for you as examples.

Find and describe patterns in the consecutive sums. For example, which sums are impossible to create? Which sums can be created with three consecutive numbers? Etc.

1 =	
2 =	
3 =	1 + 2
4 =	
5 =	
6 =	
7 =	
8 =	
9 =	4 + 5; 2 + 3 + 4
10 =	
11 =	
12 =	
13 =	
14 =	
15 =	
16 =	
17 =	
18 =	
19 =	
20 =	2 + 3 + 4 + 5 + 6
21 =	
22 =	
23 =	
24 =	
25 =	

MapQuest Quest

Provide a map with one or two routes marked on it from one destination to another, or let students choose between two destinations.

Students measure and decide on driving distance between the two locations and the challenge is to get as close as possible to the MapQuest distance that you will reveal at the end.

Students can be given several distance problems on the same map and see who can get the least total differences between all their measurements and MapQuest measurements.

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