

## What's Open Middle?

The name “Open Middle” might sound like a strange name for a website about math problems. However, it references a very specific type of problem we try to encourage here. Most of the problems on this site have:

- A “closed beginning” meaning that they all start with the same initial problem.
- A “closed end” meaning that they all end with the same answer.
- An “open middle” meaning that there are multiple ways to approach and ultimately solve the problem.

Open middle problems generally require a higher Depth of Knowledge than most problems that assess procedural and conceptual understanding. They support the Common Core State Standards and provide students with opportunities for discussing their thinking.

Some additional characteristics of open middle problems include:

- They generally have multiple ways of solving them as opposed to a problem where you are told to solve it using a specific method.
- They may involve optimization such that it is easy to get an answer but more challenging to get the best or optimal answer.
- They may appear to be simple and procedural in nature but turn out to be more challenging and complex when you start to solve it.
- They are generally not as complex as a performance task, which may require significant background context to complete.

We hope you enjoy these problems. Please be sure to send us any ideas for problems we can add.

Thanks!

Co-founders *Nanette Johnson* and *Robert Kaplinsky*

Name \_\_\_\_\_

Date \_\_\_\_\_

Activity # \_\_\_\_\_

Using digits from 1-9 at most one time each, create a true equation.

$$\square + \square = \square$$

Name \_\_\_\_\_

Date \_\_\_\_\_

Activity # \_\_\_\_\_

Using digits from 1-9 at most one time each, create a true equation.

$$\begin{array}{|c|} \hline \square \\ \hline \end{array} \begin{array}{|c|} \hline \square \\ \hline \end{array} + \begin{array}{|c|} \hline \square \\ \hline \end{array} \begin{array}{|c|} \hline \square \\ \hline \end{array} = \begin{array}{|c|} \hline \square \\ \hline \end{array} \begin{array}{|c|} \hline \square \\ \hline \end{array}$$

Name \_\_\_\_\_

Date \_\_\_\_\_

Activity # \_\_\_\_\_

Using digits from 1 to 9 at most one time each, create as many true equations as possible.

$$\square + \square = \square$$

Explain your reasoning:

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Name \_\_\_\_\_

Date \_\_\_\_\_

Activity # \_\_\_\_\_

Using the digits from 1 to 9 at most one time each, create as many true equations as possible.

$$\square\square + \square\square = \square\square$$

Explain your reasoning:

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Name \_\_\_\_\_

Date \_\_\_\_\_

Activity # \_\_\_\_\_

Using digits from 1-9 at most one time each, create as many true equations as possible.

$$\square\square\square + \square\square\square = \square\square\square$$

Explain your reasoning:

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## Cards to Support, Structure, Guide, and Extend Student Reasoning

<p>Change the operation in the equation from addition to <b>subtraction</b>. Does that have any impact on the total number of possible solutions? How many solutions are there now?</p>	<p>Change the operation in the equation from addition to <b>multiplication</b>. Does that have any impact on the total number of possible solutions? How many solutions are there now?</p>	<p>Change the operation in the equation from addition to <b>division</b>. Does that have any impact on the total number of possible solutions? How many solutions are there now?</p>
<p>Instead of using the digits from <b>1 to 9</b>, use the digits from <b>0 to 8</b>. Does that have any impact on the total number of possible solutions? How many solutions are there now?</p>	$\square\square + \square\square = \square\square$ <p>For an equation with <b>six</b> blank squares, only use the digits <b>1, 2, 3, 4, 5, and 6</b> to make a true equation. How many solutions exist?</p>	
$\square + \square = \square$ <p>For an equation with <b>three</b> blank squares, only use the digits <b>1, 2, and 3</b> to make a true equation. How many solutions exist?</p>	$\square\square\square + \square\square\square = \square\square\square$ <p>For an equation with <b>nine</b> blank squares, only use the digits <b>1, 2, 3, 4, 5, 6, 7, 8, and 9</b> to make a true equation. How many solutions exist?</p>	