

## First Grade Nemeth Braille Code Curriculum

### Module 2: Vertical Spatial Problems and Equations with Omissions

**Note:** *It is recommended that this module be completed with hard copy braille and a braillewriter instead of a refreshable braille display.*

It's time to board the airplane for another fun adventure! Before we begin our journey, find the first line of braille on the page. It is at the top of the page. Softly glide your fingers across the line. It says First Grade Nemeth. Now move your hands down to the second line of braille on the page. It says Curriculum Module 2. Now move your hands down to the third line of braille on the page.

There is just one symbol on the third line. It is on the left side of the page.

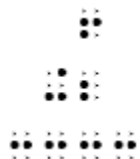


This is called an opening Nemeth Code indicator. It tells us that we are going to read math or science. Dots 4-5-6 are in the first cell, and dots 1-4-6 are in the second cell.

**Fun fact:** Pilots are in command of the aircraft and everyone on it. Before the flight, they check safety notices and plan alternative routes.

For the first part of our adventure, let's learn how to read addition problems that are vertically aligned. This is another way to write addition problems, and this format is very helpful when we calculate or compute the answer! Sometimes people call this format a spatial arrangement!

Directly below the opening Nemeth Code indicator, there is a problem for you to explore with your hands.



Six plus two is written going down the page instead of across a single line. It is vertically aligned. This means that the first addend is written directly above the second addend in the problem. Math problems are considered to be in spatial format when the numbers are vertically aligned.

Did you notice that the problem did not begin with a numeric indicator? When we read and write addition problems in vertical alignment, we do not use numeric indicators.

The problem begins with the dots 2-3-5 in the first line. What number is this? That's right. It's the number 6. Now move your hands down to the next line. You will find a plus sign. Which dots make the plus sign? You got it! Dots 3-4-6 make the plus sign. Notice that there is not a numeric indicator after the plus sign.

The plus sign is always spaced one cell to the left of the widest number in the spatially aligned addition problem. Since the addends contain only one digit in this problem, there is not a space between the plus sign and the second addend.

After the plus sign, there are the dots 2-3. What number is made with dots 2-3? Yes, the number 2 is made with dots 2-3.

So far our problem reads 6+2. On the third line, there is a line of dots 2-5. In Nemeth we call this a separation line. Sometimes it is called an equals line or a separation bar. It begins one cell to the left of the plus sign and continues to the right one cell beyond the numbers. So what does 6+2 equal? Yes, it equals 8.

Try reading the next problem. What does it begin with?

```

      ⠠⠠⠠
      ⠠⠠⠠
      ⠠⠠⠠⠠⠠
  
```

You got it, Nemeth superstar! The problem begins with the number 1. What follows the number 1 on the next line? Yes, there is a plus sign, followed by the number 5. Did you remember that there is not a space after the plus sign and that we will not use numeric indicators because the problem has been written in vertical alignment?

So what does one plus five equal? That's correct! One plus five equals 6!

**Fun fact:** Copilots are responsible for completing a visual inspection of the aircraft to ensure that the fuel lines, tires, and engine turbine blades are in good working order.

Read the last two vertically aligned addition problems on the braille page. Afterwards, tell me the answer to the problems.

```

      ⠠⠠
      ⠠⠠⠠
      ⠠⠠⠠⠠⠠
  
```

$$\begin{array}{r} 8 \\ + 0 \\ \hline 8 \end{array}$$

Yes, that's right. The first problem is  $8+0$ . What is the line under the second addend called? Outstanding work! It is called a separation line. What does  $8+0$  equal? Yes, eight plus zero equals eight!

Now it is time to read the second problem. Yes, the second problem is  $3+6$ . What does  $3+6$  equal? You got it! Three plus six equals nine.

**Activity time:** Let's use flash cards to practice reading problems in vertical alignment. Afterwards, tell me the answer before moving to the next flash card. Once you finish, go back and time how quickly you can read the problems! Do you think you can read the problems even quicker? If so, try one more time!

**Note:** *Flash cards are available in braille within the curriculum. It may be helpful to place the flash cards on a nonslip surface such as a rubber shelf liner for this activity.*

Way to go, math superstar! Let's begin the second part of the adventure by placing Wikki Stix<sup>®</sup> between three problems on page 2. I will help you place a Wikki Stix<sup>®</sup> between the first and second problem. Then it will be your turn to place a Wikki Stix<sup>®</sup> between the second and third problem by yourself.

**Note:** *Offer additional assistance as needed. If you would prefer, the student can place pipe cleaners or stickers between the problems.*

$$\begin{array}{r} 8 \\ + 0 \\ \hline 8 \end{array} \quad \begin{array}{r} 3 \\ + 6 \\ \hline 9 \end{array} \quad \begin{array}{r} 5 \\ + 4 \\ \hline 9 \end{array}$$

Excellent work, Nemeth superstar! Now find the addition problems in the middle of the page.

$$\begin{array}{r} 8 \\ + 0 \\ \hline 8 \end{array} \quad \begin{array}{r} 3 \\ + 6 \\ \hline 9 \end{array} \quad \begin{array}{r} 5 \\ + 4 \\ \hline 9 \end{array}$$

You found the addition problems! Before we read the problems together, let's check your understanding of the words: right, middle, and left. Listen carefully.

**Note:** Repeat saying each sentence as needed. Also assist the student in locating the targeted problem as needed.

1. Show me which problem is on the right.
2. Show me which problem is on the left.
3. Now show me which problem is in the middle?

Good work, as always, Nemeth superstar! Now that all of the passengers are on the plane, it is time for the airplane to leave the gate! While we push back from the gate and move toward the runway, read the addition problem on the left.

Yes, that's right. The first problem is  $3+1$ . What does  $3+1$  equal? You got it! Three plus one equals four. Now move to the problem in the middle and read it. Good job! The problem is  $9+0$ . What does  $9+0$  equal? Yes, it equals 9. Now find the problem on the right and read it. Yes, the problem is  $2+5$ . What does  $2+5$  equal? Perfect! Two plus five equals seven.

Let's try a few more. Move down to the bottom of the page and read the problems, beginning with the one on the left. Then tell me the answer before moving to the next problem.



Answer:

$$\begin{array}{r} 1 \\ +8 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 6 \\ +2 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 10 \\ +0 \\ \hline 10 \end{array}$$

The last problem began with an addend of 10. Use your hands and carefully review how the problem is set up. First, how is the last problem similar to the other problems in this row? Second, how is the problem different than the other problems in this row?

**Note:** Explain the terms similar and different if needed. There are several possible correct responses to the questions. The last problem is similar to

the other problems in several ways. For example, the problem is vertically aligned like the other problems. It also includes a separation line. In addition, numeric indicators are not used in the problem similar to the other problems.

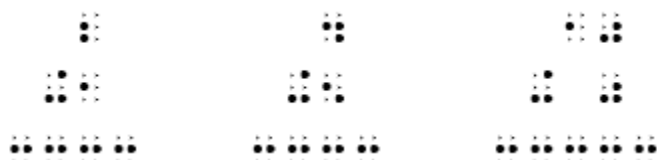
The last problem is also different than the other problems in several ways. The separation line in the last problem is 5 cells long, and it is only 4 cells long in the other problems. The first addend is two cells long in the last problem, and all of the other addends are only one cell long. There is also a space between the plus sign and the zero.

Since there was an addend of 10 in the last problem, we needed a space between the plus sign and zero. We needed this space because the plus sign is spaced one cell to the left of the widest number above the separation line in the arrangement.

Since digits in numbers are aligned by place value in vertically aligned problems, the zero is in the ones column and the one is in the tens column. The second addend was zero. Notice how it was also placed in the ones column. As we discussed previously, there is a space between the plus sign and the zero since we place the plus sign one cell to the left of the widest number above the separation line in the problem. The separation line is also one cell longer.

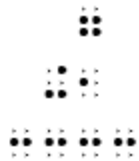
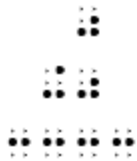
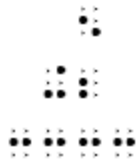
**Fun fact:** The average Boeing 747 airplane has around 150-175 miles of wiring inside it.

**Activity time:** Read each addition problem on page 3, and then tell me the answer before moving to the next problem.



Answer:

2	4	10
+1	+5	+0
3	9	10

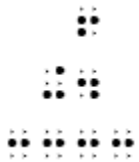
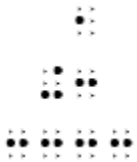
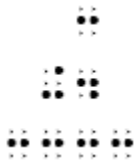


Answer:

$$\begin{array}{r} 5 \\ +2 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 0 \\ +0 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 7 \\ +1 \\ \hline 8 \end{array}$$



Answer:

$$\begin{array}{r} 3 \\ +4 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 1 \\ +3 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 6 \\ +4 \\ \hline 10 \end{array}$$

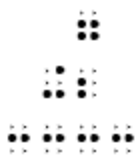
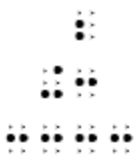
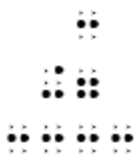


Answer:

$$\begin{array}{r} 2 \\ +2 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 4 \\ +1 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 9 \\ +0 \\ \hline 9 \end{array}$$



Answer:

$$\begin{array}{r} 3 \\ +7 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 2 \\ +3 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 7 \\ +2 \\ \hline 9 \end{array}$$

**Fun fact:** The newest Boeing 787 airplane can fly 10,000 miles on a single tank of gas!

For the third part of the adventure, let's use our last set of addition problems on page 3 and learn how to write answers for addition problems that are vertically aligned. Begin by placing page 3 in the braillewriter, and then roll the paper into the braillewriter by using the knobs on either side of the braillewriter. The paper should stop automatically. Then push the line spacing key.

We will write the answer to each addition problem on the line that is below the separation line. So, let's work together to find the first problem and press the line spacing key until the embossing head is on the line below the separation line. Then we will use the space bar to line up the embossing head so that we can write the sum directly under the addends. You can see now how vertical aligned problems make it easier to calculate or compute the answer!

**Note:** *Provide assistance as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on pages 1-2 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".*

Read the first problem again. Yes, it is two plus one. What does two plus one equal? You got it! The sum is three. We will braille the answer below the separation line so that it is vertically in line with the two and one. Since the problem is vertically aligned, we will not use a numeric indicator.

Press your line spacing key so that you are below the separation line. Also make sure that your embossing head is vertically in line with the addends, the two and the one. You got it!

**Note:** *Provide assistance in lining up the embossing head with the addends as needed.*

What keys on the braillewriter should we press for 3? Yes, we would press dots 2-5. Confirm that your fingers are on the correct keys, and then you will be ready to braille the number 3!

Good job, Nemeth superstar! Let's try two more together. Use your hands and find the next problem. You found it! Now read the problem. Yes, it is four plus five. Show me where we will write the answer. Perfect! We will write the answer below the separation line and the embossing head will be vertically in line with the addends.

What does four plus five equal? Yes, four plus five equals nine.

What keys on the braillewriter should we press for 9? Excellent! We would press dots 3-5. Once you finish writing the number, check your work.

We are ready to read the last problem on this row. Once you find the problem, read the problem. You got it! It is ten plus zero. What does that equal? Yes, ten plus zero equals ten.

Where will we braille answer? Yes, we will write the answer below the separation line. The digits in ten will be aligned by place value. The one will be in the tens column and the zero will be in the ones column. Let's line up our embossing head together. You are ready to write your answer! You got it! Congratulations!

Co-pilot, you are ready to write the answers for the rest of the problems. Afterwards, we will check your work together. Let me know if you need any help.

**Fun fact:** The world's largest passenger plane is the Airbus A380. It is a double-decker four-engine jetliner.

**Note:** *The activity page "Find the Path" is available within the curriculum. It may help to place the activity page on a nonslip surface such as a rubber shelf liner. If preferred, the student may use the braillewriter to create the picture of the plane. An answer key in print and braille is provided in separate documents.*

**Activity time:** Complete a set of new math problems to find the path! Help the pilot find her airplane by solving addition problems! You will need the activity page, your braillewriter, large stickers, and tactile graphic supplies such as Wikki Stix®, buttons, cork board, cardboard, felt or textured paper.

The directions are in braille on the activity page, but here is a quick overview. Begin by writing the answer to each of the vertically aligned addition problems. Then, use tactile graphic supplies to make a picture of the airplane. Afterwards, place stickers on each problem where the number 8 or 9 is the answer to reveal a path from the pilot to the airplane.

**Fun fact:** One of the longest military aircrafts, called the C-5, is longer than the height of a six story building. The C-5 aircraft is 143 feet longer than the Wright Brother's first flight of 120 feet!

It is time for the airplane to take-off again! Make sure that your seat belt is fastened securely! For the fourth part of the adventure, let's work together and learn how to write spatially aligned one-digit addition problems.



We will begin by building an addition problem using a cookie sheet and magnets with Nemeth numbers and symbols.

**Note:** *If preferred, you can also use a ½ sheet of 1-inch graph paper from American Printing House for the Blind to create a board for the activity. Attach a Velcro dot in each square. Afterwards, braille the numbers 0-9 without the numeric indicator as well as the plus sign and separation line. Then cut the numbers apart, cut out the right top corner, and place a Velcro dot on the back of each card.*

*It may help to place the numbers and symbols on a nonslip surface such as a rubber shelf liner or a work tray so they will not move as much. There are additional instructions about how to build problems using graph paper and Velcro dots in the Teacher Reference Materials.*

*This activity may also be completed with the Math Window Braille Basic Math Kit in Nemeth.*

Begin by helping me build

$$\begin{array}{r} 1 \\ +4 \\ \hline \end{array}$$

The first step is to locate the numbers and symbols needed to build the problem. Help me find the numbers 1 and 4 as well as the plus sign and the separation line. Remember that the numbers will not begin with a numeric indicator since they will be used in a spatially aligned addition problem.

You are welcome to place your hands on top of my hands so that you can see how I am building the problem. We are ready to place the first addend on the cookie sheet. I am placing the number 1 in the middle of the cookie sheet. Let's move our hands directly below the number 1 and place the number 4. Where will we place the plus sign? Yes, we will place the plus sign one cell to the left of the number.

Now we are ready to build the separation line below the plus sign and number 4. We will place it slightly below and one cell to the left of the plus sign because the separation should extend one cell to the left of the plus sign and one cell to the right of the numbers. You got it!

Help me remove the numbers and symbols from the cookie tray so that you can build a problem! The plane is leaving the gate, so let's build another problem while we taxi to the runway.

$$\begin{array}{r} 3 \\ +5 \\ \hline \end{array}$$

Begin by locating the numbers and symbols needed to build the problem. What numbers and symbols will we need? Yes, we will need a 3, a 5, the plus sign and the separation line.

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed.

We are ready to place the first addend on the cookie sheet. Place the number 3 in the middle of the cookie sheet. Where should we place the number 5 on the cookie sheet? That's right! The number 5 should be placed directly below the number 3. Where will we place the plus sign? Yes, we will place the plus sign one cell to the left of the number 5.

Now you are ready to build the separation line below the plus sign and the number 5. You got it! The separation line extends one cell to the left of the plus sign and one cell to the right of the numbers.

Help me remove the numbers and symbols from the cookie tray so that you can build three more problems!

$$\begin{array}{r} 9 \\ +0 \\ \hline \end{array} \qquad \begin{array}{r} 6 \\ +2 \\ \hline \end{array} \qquad \begin{array}{r} 4 \\ +5 \\ \hline \end{array}$$

Good job, Nemeth superstar! Now we are ready to write addition problems that are vertically aligned on the braillewriter. We will begin by writing

$$\begin{array}{r} 1 \\ +2 \\ \hline \end{array}$$

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on page 3 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

In this problem, the addend in the first line will begin in cell 3 because the plus sign on the second line will begin in cell 2 and the separation line will begin in cell 1 on the third line. Place your fingers on the correct keys on your braillewriter, and let's get started. In order to braille the number 1 in cell 3, press the space bar twice.

How should we braille the number 1 in a vertically aligned problem? Yes, you should press dot 2. We will not need a numeric indicator since the problem is vertically aligned.

Press the line spacing key only once and move to the next line. The number 2 will be brailled directly below the number 1. Since this is a vertically aligned problem, how do we write the number 2? Yes, you should press dots 2-3. We will not need a numeric indicator again since the problem is vertically aligned.

Where will we braille the plus sign? Yes, we will place the plus sign one cell to the left of the number 2. Use the backspace key to line up the embossing head so that we can write the plus sign one cell to the left of the number 2. Then press the line spacing key only once and move to the next line.

Now you are ready to braille the separation line below the plus sign and number 2. How do you braille a separation line? Yes, we press the dots 2-5 four times to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers.

Way to go, co-pilot! Let's write another problem.

$$\begin{array}{r} 3 \\ +4 \\ \hline \end{array}$$

What should we braille first? Yes, begin by brailing the number 3 on the first line. What cell will it begin? You got it! The number 3 will be in the third cell in this problem since the addends are one digit numbers again. Place your fingers on the correct keys on your braillewriter and press the space bar twice so that we can write the number 3 in the third cell.

How should we braille the number 3 in a vertically aligned problem? Yes, you should press dot 2-5. We will not need a numeric indicator again since the problem is vertically aligned.

What should we do next? That's correct. We need to press the line spacing key only once to go the next line and braille the plus sign and number 4. The number 4 will be brailled directly below the number 3. Use the backspace key to line up the embossing head and braille the plus sign and number 4. Remember that the plus sign should be one cell to the left of the numbers.

Once you are finished, press the line spacing key only once and move to the next line. Now you are ready to braille the separation line below the plus sign and numbers. How do you braille a separation line? Yes, press the dots

2-5 four times to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers.

**Fun fact:** A commercial jet has an average cruising speed of 550-580 mph.

Now it is time for us to write three more vertically aligned spatial problems together!

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on page 3 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

$$\begin{array}{r} 6 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ +5 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ +1 \\ \hline \end{array}$$

**Activity time:** You will need your braillewriter and braille paper for the next activity. Listen as I read the vertically aligned addition problems and then braille what you hear. After you write each problem, write the answer below the separation line and then press your line spacing key twice. You can do it!

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed.

Encourage the student to verbalize the process they use to determine the missing number. Provide assistance as needed. An answer key in braille is provided on pages 4-5 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

$$\begin{array}{r} 9 \\ +0 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ +4 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ +2 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ +5 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ +6 \\ \hline \end{array}$$

$$\begin{array}{r} 0 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ +2 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ +4 \\ \hline \end{array}$$

**Fun fact:** Flight attendants assist passengers in boarding the plane, help stow luggage and prepare the plane cabin for departure. Once the plane is in the air, they serve food and beverages.

The plane has climbed to its cruising altitude. For the fifth part of the adventure, let's work together and learn how to write spatially aligned addition problems with one or more two-digit numbers.

Once again we will begin by using a cookie sheet and magnets with Nemeth numbers and symbols to build the addition problems.

**Note:** *If preferred, this activity may also be completed with the graph paper board that you created in the previous activity. You will need to create two number 10 cards and a separation line that is 5 cells long.*

*In addition, this activity may be completed with the Math Window Braille Basic Math Kit in Nemeth.*

Begin by helping me build

$$\begin{array}{r} 10 \\ +0 \\ \hline \end{array}$$

The first step is to locate the numbers and symbols needed to build the problem. Help me find the numbers 10 and 0 as well as the plus sign and the separation line. Remember that the numbers will not begin with a numeric indicator since they will be used in a spatially aligned addition problem.

You are welcome to place your hands on top of my hands so that you can see how I am building the problem. We are ready to place the first addend

on the cookie sheet. I am placing the number 10 in the middle of the cookie sheet. The one is in the tens column and the zero is in the ones column.

Let's move our hands directly below the number 10 and place the second addend 0 in the ones column. We will place the plus sign one cell to the left of the widest number above the separation line in the problem. That means that there will be a space between the plus sign and the zero in this problem.

Now we are ready to build the separation line below the plus sign and number 0. We will place it slightly below and one cell to the left of the plus sign because the separation line should extend one cell to the left of the plus sign and one cell to the right of the numbers. You got it! Notice this time that the separation line is five cells long.

Good job, Nemeth superstar! Co-pilot, let's move to the braillewriter! Begin by inserting a piece of your paper in your braillewriter and then we will be ready to write the same addition problem.

$$\begin{array}{r} 10 \\ +0 \\ \hline \end{array}$$

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on page 6 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

In this problem, the addend of 10 in the first line will begin in cell 3 because the plus sign on the second line will begin in cell 2 and the separation line will begin in cell 1 on the third line. Place your fingers on the correct keys on your braillewriter, and let's get started. In order to begin the number 10 in cell 3, press the space bar twice.

How should we braille the number 10 in a vertically aligned problem? Yes, you should press dot 2, followed by dots 3-5-6. We will not need a numeric indicator since the problem is vertically aligned. The one is in the tens column and the zero is in the ones column.

Press the line spacing key only once and move to the next line. The number zero will be brailled directly below the number 10. The number 0 in the second line will be in the ones column. This means that the number 0 will be placed directly below the zero in ten.

Where will we braille the plus sign? Yes, we will place the plus sign one cell to the left of the number 0. There will be a blank space between the plus sign and the number 0. Use the backspace key to line up the embossing head so that the plus sign will be one cell to the left of the widest number in the problem. Then press the line spacing key only once and move to the next line.

Now you are ready to braille the separation line below the plus sign and number 0. How do you braille a separation line? Yes, we press the dots 2-5 to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers. Way to go, co-pilot!

**Fun fact:** Flight attendants also explain safety procedures and make sure passengers follow regulations.

**Activity time:** You will need your braillewriter and braille paper for the next activity. Listen as I read the vertically aligned addition problems and then braille what you hear. Some of the problems will have a two-digit number and some will not have any two-digit numbers. After you write each problem, write the sum below the separation line and then press your line spacing key twice.

**Note:** *Encourage the student to verbalize the process they use to determine the missing number. Provide assistance as needed. An answer key in braille is provided on pages 6-7 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".*

$$\begin{array}{r} 3 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ +0 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ +2 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 0 \\ +5 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ +8 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ +0 \\ \hline \end{array}$$

**Fun fact:** Flight engineers inspect the aircraft and oversee fueling operations before the flight. During the flight, they monitor engine performance, cabin pressurization, air conditioning and other systems.

For the sixth part of our adventure, let's learn how to read subtraction problems that are vertically aligned. Let's begin by exploring two examples on page 4.

$$\begin{array}{r} \cdot\cdot \\ \cdot\cdot\cdot \\ \cdot\cdot\cdot\cdot \\ \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot \end{array} \quad \begin{array}{r} \cdot\cdot\cdot\cdot \\ \cdot\cdot\cdot\cdot\cdot\cdot \\ \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot \end{array}$$

What did you notice about the examples?

**Note:** *There are several possible correct responses to the question. For example, the problems are similar to the addition problems in the previous sections. They are vertically aligned and include a separation line. Additionally, numeric indicators are not used and the minus sign is placed one cell to the left of the widest number in the arrangement.*

The first problem begins with the dots 2-5-6 in the first line. What number is this? That's right. It's the number 4. Now move your hands down to the next line. You will find a minus sign. Which dots make the minus sign? You got it! Dots 3-6 make the minus sign. Notice that there is not a numeric indicator after the minus sign.

Similar to the plus sign, the minus sign is always spaced one cell to the left of the widest number in the spatially aligned subtraction problem. Since both the minuend and subtrahend contain only one digit in this problem, there is not a space between the minus sign and the subtrahend.

After the minus sign, there are the dots 2-3. What number is made with dots 2-3? Yes, the number 2 is made with dots 2-3.

So far our problem reads four minus two. On the third line, there is a separation line made of dots 2-5. It begins one cell to the left of the minus sign and extends one cell to the right beyond the minuend and subtrahend. So what does four minus two equal? Yes, four minus two equals 2.

Read the second problem. You got it! The problem begins with the number 10 on the first line. It is followed by a minus sign and the number 3 on the second line. Did you notice that there was a space between the minus sign



and the minuend? Why did we need the space? Yes, we needed the space because the minus sign needed to be one cell to the left of the two-digit minuend.

There is a separation line on the third line. So what does ten minus three equal? That's correct! The difference is seven. Good job, Nemeth superstar!

**Fun fact:** The world's smallest jet is the BD-5 Micro. The span of its wings is 14-21 feet, and the jet only weighs 358 pounds.

Read the second row of subtraction problems on the braille page. These problems will be numbered. Afterwards, tell me the answer to the problems.

Yes, that's right. The first problem would be read

$$\begin{array}{r} 1. \quad 8 \\ - 5 \\ \hline \end{array}$$

What does 8-5 equal? Yes, eight minus five equals three! What is the line under the subtrahend called? Outstanding! It is called a separation line. Now read the next problem. Good job, pilot! The second problem would be read

$$\begin{array}{r} 2. \quad 7 \\ - 6 \\ \hline \end{array}$$

What is the answer? You got it! Seven minus six equals one. Now read the third problem.

$$\begin{array}{r} 3. \quad 10 \\ - 0 \\ \hline \end{array}$$

Way to go, pilot! What does 10-0 equal? You got it! The difference is 10.

**Activity time:** Let's use flash cards to practice reading subtraction problems in vertical alignment. Afterwards, tell me the answer before moving to the next flash card. Once you finish, go back and time how quickly you can read the problems! Do you think you can read the problems even quicker? If so, try one more time!

**Note:** Flash cards are available in braille within the curriculum. It may be helpful to place the flash cards on a nonslip surface such as a rubber shelf liner for this activity.

**Fun fact:** The world's largest passenger plane has about 4 million parts.

**Activity time:** Read each of the numbered subtraction problems on page 5 and tell me the answer before moving to the next problem.

$$\begin{array}{r} 10 \\ -2 \\ \hline \end{array}$$

Answer:

$$\begin{array}{r} 8 \\ -2 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 4 \\ -1 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 10 \\ -9 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 10 \\ -2 \\ \hline \end{array}$$

Answer:

$$\begin{array}{r} 10 \\ -10 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 7 \\ -3 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 5 \\ -4 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 10 \\ -2 \\ \hline \end{array}$$

Answer:

$$\begin{array}{r} 9 \\ -5 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 3 \\ -1 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 8 \\ -7 \\ \hline 1 \end{array}$$

$$\begin{array}{r}
 10. \quad 2 \\
 -0 \\
 \hline
 2
 \end{array}
 \qquad
 \begin{array}{r}
 11. \quad 6 \\
 -4 \\
 \hline
 2
 \end{array}
 \qquad
 \begin{array}{r}
 12. \quad 1 \\
 -1 \\
 \hline
 0
 \end{array}$$

Answer:

$$\begin{array}{r}
 13. \quad 7 \\
 -6 \\
 \hline
 1
 \end{array}
 \qquad
 \begin{array}{r}
 14. \quad 3 \\
 -2 \\
 \hline
 1
 \end{array}
 \qquad
 \begin{array}{r}
 15. \quad 9 \\
 -6 \\
 \hline
 3
 \end{array}$$

Answer:

**Fun fact:** Most airplanes have a flight data recorder that keeps track of everything the plane does. These, along with the cockpit voice recorder, are often called “black boxes” even though they are orange.

Before we begin our initial descent, let’s use our last set of subtraction problems to review how to write answers for problems that are vertically aligned. Begin by placing your paper in the braillewriter. Roll the paper into the braillewriter until you are at the top of the braille page.

We will write the answer to each subtraction problem on the line below the separation line. So, let’s work together to find the first problem and press the line spacing key until the embossing head is on the line below the separation line. Then we will use the space bar to line up the embossing head so that we can write the answer directly under the minuend and subtrahend.

**Note:** *Provide assistance as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on pages 8-9 of the document entitled “B3 Module 2\_Answer Key for Writing Activities\_1”.*

Read the first problem again. Yes, it is eight minus two. What is the difference? You got it! Eight minus two equals six. We will braille the answer below the separation line so that it is vertically in line with the eight and two. Since the problem is vertically aligned, we will not use a numeric indicator.

Press your line spacing key so that you are below the separation line. Also make sure that your embossing head is vertically in line with the eight and two. Excellent work, co-pilot!

**Note:** *Provide assistance as needed.*

What keys on the braillewriter should we press for 6? Yes, we would press dots 2-3-5. Confirm that your fingers on the correct keys, and then you will be ready to braille the number 6!

Use your hands and find the next problem. You found it! Now read the problem. Yes, it is four minus one. Show me where you will write the answer. You got it! Once you finish writing the answer, check your work and then move to the next problem.

We will check your work together once you are finished. Let me know if you need any help.

**Fun fact:** A windshield of a jet costs as much as a new car.

For the seventh part of the adventure, let's learn how to write subtraction problems that are vertically aligned on the braillewriter. We will begin by writing

$$\begin{array}{r} 5 \\ - 3 \\ \hline \end{array}$$

**Note:** *Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided in the middle of page 9 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".*

In this problem, the minuend in the first line will begin in cell 3 because the minus sign on the second line will begin in cell 2 and the separation line will begin in cell 1 on the third line. Place your fingers on the correct keys on your braillewriter, and let's get started. In order to braille the number 5 in cell 3, press the space bar twice.

How should we braille the number 5 in a vertically aligned problem? Yes, you should press dot 2-6. We will not need a numeric indicator since the problem is vertically aligned.

Press the line spacing key only once and move to the next line. The number 3 will be written directly below the number 5. Since this is a vertically aligned problem, how do we write the number 3? Yes, you should press dots 2-5. We will not need a numeric indicator.

Where will we braille the minus sign? Yes, we will place the minus sign one cell to the left of the number 3. Use the backspace key to line up the embossing head so that we can write the minus sign one cell to the left of the number 3. Then press the line spacing key only once and move to the next line.

Now you are ready to braille the separation line below the minus sign and number 3. How do you braille a separation line? Yes, we press the dots 2-5 four times to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers.

Way to go, co-pilot! Let's write two additional problems. This time the problems will be numbered.

1.    8  
    - 1

2.    10  
    - 5

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on page 9 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

What should we braille first? Yes, begin by braille the number 1 followed by a punctuation indicator and period on the first line. What cell will it begin? You got it! The numeric indicator will begin in cell 1.

Now that you are finished numbering the problem, let's talk through how many times we will need to press the space bar. First, we will need to press it once so that we will have a blank cell between the period and the beginning of the problem. Second, we will need to press it two more times. This will leave room for the beginning of the separation line and the minus sign.

How should we braille the number 8 in a vertically aligned problem? Yes, you should press dot 2-3-6. We will not need a numeric indicator again since the problem is vertically aligned.

What should we do next? That's correct. We need to press the line spacing key only once to go the next line and braille the minus sign and number 1. The number 1 will be brailled directly below the number 8. Use the backspace key to line up the embossing head and braille the minus sign and number 1. Remember that the minus sign should be on the left side of the numbers.

Once you are finished, press the line spacing key only once and move to the next line. Now you are ready to braille the separation line. It will begin one cell before minus sign and continue one cell beyond the numbers. How do you braille a separation line? Yes, press the dots 2-5 to make the separation line.

**Fun fact:** In the 1920s a plane ticket cost just \$5.00. Today, most tickets cost several hundred dollars.

It is time to braille the second problem that is numbered. Begin by pressing your line spacing key twice. What should we braille first? Yes, begin by brailing the number 2 followed by a punctuation indicator and period on the first line. What cell will it begin? You got it! The numeric indicator will begin in cell 1.

Now that you are finished numbering the problem, let's talk through how many times we will need to press the space bar. First, we will need to press it once so that we will have a blank cell between the period and the beginning of the problem. Second, we will need to press it two more times. This will leave enough room for the beginning of the separation line and the minus sign.

How should we braille the number 10 in a vertically aligned problem? Yes, you should press dot 2, followed by dots 3-5-6. We will not need a numeric indicator again since the problem is vertically aligned.

What should we do next? That's correct. We need to press the line spacing key only once to go the next line and braille the minus sign and number 5. The number 5 will be brailled directly below the zero in 10. Use the backspace key to line up the embossing head and braille the number 5.

Now it is time to braille the minus sign. Use the backspace key again to line up the embossing head so that the minus sign will be one cell to the left of the widest number in the problem.

Once you are finished, press the line spacing key only once and move to the next line. Now you are ready to braille the separation line. It will begin one cell before minus sign and continue one cell beyond the numbers. How do you braille a separation line? Yes, press the dots 2-5 to make the separation line.

**Fun fact:** In 1947, Chuck Yeager became the first person to fly faster than the speed of sound.

**Activity time:** You will need your braillewriter and braille paper for the next activity. Listen as I read the numbered subtraction problems and then braille what you hear. After you finish writing each problem, press your line spacing key twice and listen for the next problem.

**Note:** Repeat saying each problem as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on pages 10-11 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

1. 
$$\begin{array}{r} 3 \\ - 0 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 4 \\ - 2 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 7 \\ - 1 \\ \hline \end{array}$$

4. 
$$\begin{array}{r} 10 \\ - 4 \\ \hline \end{array}$$

5. 
$$\begin{array}{r} 6 \\ - 2 \\ \hline \end{array}$$

6. 
$$\begin{array}{r} 9 \\ - 5 \\ \hline \end{array}$$

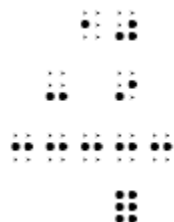
7. 
$$\begin{array}{r} 8 \\ - 1 \\ \hline \end{array}$$

8. 
$$\begin{array}{r} 10 \\ - 5 \\ \hline \end{array}$$

We are beginning our descent to our final destination! During the last part of our journey, let's learn more about vertically aligned equations. Sometimes the general omission symbol is used in vertically aligned equations. It stands for a missing number and can be used anywhere in an equation.

What dots make a general omission symbol? That's right! Dots 1-2-3-4-5-6 are used to write the general omission symbol.

Explore the example at the top of page 6, and find the general omission symbol.



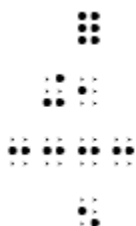
Way to go, pilot! The general omission symbol is directly below the separation line. When you read an equation with a general omission symbol, you may use the words "what number" or simply call it by its name, general omission symbol.

Let's read the equation together. The equation begins with the dot 2, followed by the dots 3-5-6. What number is this? That's right. It's the number 10. What is on the next two lines? Yes, there is a minus sign followed by a space and the number 9. They are followed by a separation line on the next line.

What symbol is on the last line of the equation? You got it! It is the general omission symbol. Good job, Nemeth superstar!

We would read this equation as ten minus nine equals what number. So what does ten minus nine equal? That's correct! Ten minus nine equals one.

Read along with me as I read another equation. Then it will be your turn.



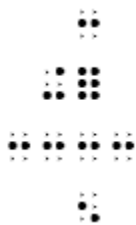


What number plus one equals 5. How can we figure out the missing addend? That's right. We can ask ourselves some number plus 1 equals 5. So what is the missing addend?

**Note:** *Encourage the student to verbalize the process they use to determine the missing number. If needed, a Five/Ten Frame and pennies may be used.*

Yes, the missing addend is 4 because 4 plus 1 equals 5. Way to go, math superstar!

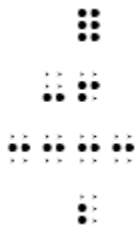
Now it is your turn. Read the next two equations and tell me what the general omission stands for.



That's right! Three plus what number equals five. Now tell me what number the general omission symbol stands for.

**Note:** *If needed, remind the student that they can ask themselves "three plus what number equals five" to determine the missing number.*

You got it! The missing number is two because three plus two equals five. Just one more equation to read before the activity!



Yes, the equation is what number minus six equals two. What is the missing number? You are correct! The missing number is eight.

**Fun fact:** There are four forces of flight that push the plane up, down, forward, or slow it down. These four forces are lift, thrust, drag and weight.

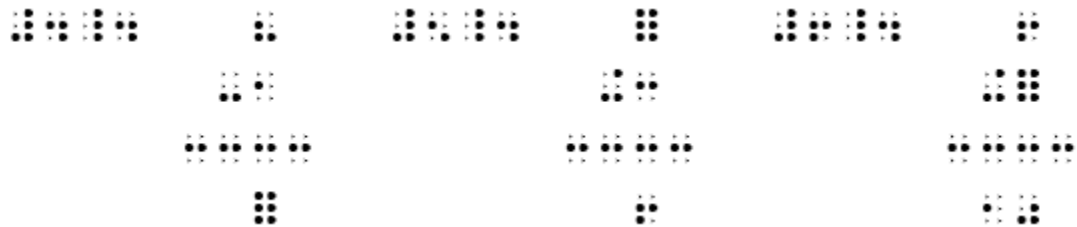
**Activity time:** Read the equations on page 7, and find the general omission symbol. Tell me the missing number before moving on to the next problem. You can do it, Nemeth superstar!

$$\begin{array}{r} 1. \quad 2 \\ -? \\ \hline 0 \end{array}$$
$$? = 2$$

$$\begin{array}{r} 2. \quad 6 \\ +3 \\ \hline ? \end{array}$$

$? = 9$

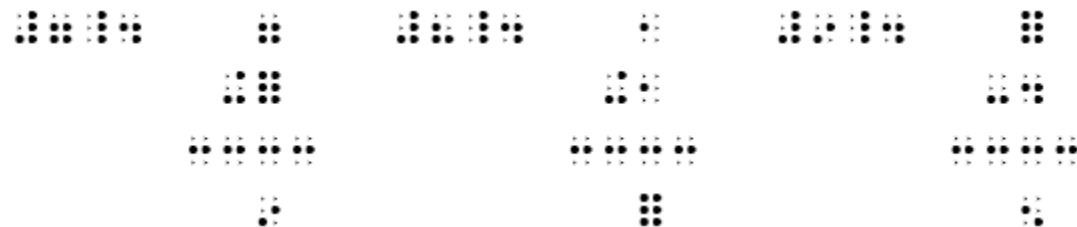
3.  $\frac{10}{5} = ?$   
 $? = 5$


$$\begin{array}{r} 4. \quad 8 \\ -1 \\ \hline ? \end{array}$$

$? = 7$

5. 
$$\begin{array}{r} ? \\ +3 \\ \hline 6 \end{array}$$
  
 $?\ =\ 3$

6. 
$$\begin{array}{r} 6 \\ +? \\ \hline 10 \end{array}$$
  
 $? = 4$

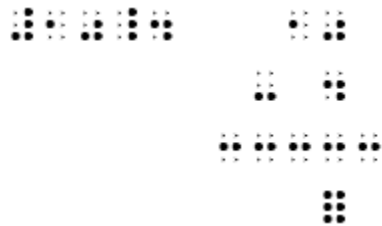


Answer:

$$\begin{array}{r} 7. \quad 7 \\ +? \\ \hline 9 \\ ? = 2 \end{array}$$

$$\begin{array}{r} 8. \quad 1 \\ +1 \\ \hline ? \\ ? = 2 \end{array}$$

$$\begin{array}{r} 9. \quad ? \\ -4 \\ \hline 5 \\ ? = 9 \end{array}$$



Answer:

$$\begin{array}{r} 10. \quad 10 \\ -4 \\ \hline ? \\ ? = 6 \end{array}$$

Below the last problem, there is a Nemeth Code terminator.



This symbol tells us that we are almost finished with our math adventure. Sometimes this symbol comes at the end of a braille document, just like it is this time. This symbol can also be used in other places within a document to tell us that we are finishing a math section and are moving to literary material.

Now that we are almost finished, the passengers have moved their seat backs and tray tables to an upright position. Make sure your seat belt is fastened and your carry-on luggage is stowed underneath the seat in front of you or in the overhead bins. Before the plane lands, let's learn how to write vertical equations with a general omission symbol. Place your fingers on the correct keys on your braillewriter

Begin by writing

$$\begin{array}{r} ? \\ -2 \\ \hline 3 \end{array}$$

**Note:** When voicing the equation, say "general omission symbol (or what number) minus 2 equals 3." An answer key in braille is provided on page 12 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

What should we braille first? Yes, we will begin by brailleing general omission symbol. How do we write a general omission symbol in braille? That's right. Dots 1-2-3-4-5-6 are used to write the general omission symbol. In order to begin the general omission symbol in cell 3, how many times should you press the space bar? You got it! You will press the space bar twice.

Press the line spacing key only once and move to the next line. The number two will be brailled directly below the general omission symbol. Where will we braille the minus sign? Yes, we will place the minus sign one cell to the left of the number 2. Use the backspace key to line up the embossing head so that the minus sign will be one cell to the left of the widest number in the problem. Then press the line spacing key only once and move to the next line.

Now you are ready to braille the separation line below the minus sign and number 2. How do you braille a separation line? Yes, we press the dots 2-5 to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers. Way to go, co-pilot!

Move to the next line by pressing the line spacing key twice. Practice writing the same problem several times.

$$\begin{array}{r} ? \\ -2 \\ \hline 3 \end{array}$$

You will need to press your line spacing key twice to move to the next line before brailleing the equation each time.

**Note:** Repeat saying the vertically aligned equation as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed.

Let's practice brailleing another equation.

$$\begin{array}{r} 5 \\ +5 \\ \hline ? \end{array}$$

**Note:** When voicing the equation, say "5 plus 5 equals what number (or general omission symbol)." An answer key in braille is provided on page 12 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".

What should we braille first? Yes, we should braille the number 5 first. How many times should you press the space bar? You got it! You will press the space bar twice and then press dots 2-6 for the number 5.

Press the line spacing key only once and move to the next line. Where will you braille the number 5? Yes, it will be brailled directly below the number 5 on the previous line. Where will we braille the plus sign? Yes, we will place the plus sign one cell to the left of the number 5. Use the backspace key to line up the embossing head so that the plus sign will be one cell to the left of the widest number in the problem. Then press the line spacing key only once and move to the next line.

Now you are ready to braille the separation line below the minus sign and number 5. How do you braille a separation line? Yes, we press the dots 2-5 to make the separation line. It will begin in cell 1 and continue one cell to the right of the numbers.

Move to the next line by pressing the line spacing key. What will you braille next? That is correct. We will braille the general omission symbol. How do we write a general omission symbol in braille? That's right. Dots 1-2-3-4-5-6 are used to write the general omission symbol.

**Fun fact:** KLM (Koninklijke Luchtvaart Maatschappij, meaning Royal Dutch Airlines) is the oldest airline in the world. It was established in 1919, and its first flight between Amsterdam and London took place on May 17, 1920.

**Activity time:** You will need your braillewriter and braille paper for this activity. Listen and then braille what you hear. You will need to press your line spacing key twice to move to the next line before brailing an equation each time.

**Note:** *Repeat saying each equation as many times as needed. Also remind the student to move his/her fingers across the braille and check his/her work if needed. An answer key in braille is provided on pages 13-14 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".*

$$\begin{array}{r} ? \\ +1 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 5 \\ +? \\ \hline 8 \end{array}$$

$$\begin{array}{r} 7 \\ - 4 \\ \hline ? \end{array}$$

$$\begin{array}{r} ? \\ + 2 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 10 \\ - 3 \\ \hline ? \end{array}$$

$$\begin{array}{r} 8 \\ - ? \\ \hline 4 \end{array}$$

Now go back and tell me the missing number in each equation.

Answer:

$$\begin{array}{r} ? \\ + 1 \\ \hline 9 \end{array}$$

$$? = 8$$

$$\begin{array}{r} 5 \\ + ? \\ \hline 8 \end{array}$$

$$? = 3$$

$$\begin{array}{r} 7 \\ - 4 \\ \hline ? \end{array}$$

$$? = 3$$

$$\begin{array}{r} ? \\ + 2 \\ \hline 3 \end{array}$$

$$? = 1$$

$$\begin{array}{r} 10 \\ - 3 \\ \hline ? \end{array}$$

$$? = 7$$

$$\begin{array}{r} 8 \\ - ? \\ \hline 4 \end{array}$$

$$? = 4$$

Excellent work, Nemeth superstar! Let's try a few more. This time number the equations.

**Note:** *If needed, remind the student how to number the equations, including the dot configuration for the punctuation indicator. Continue to repeat saying each equation as many times as needed. An answer key in braille is provided on pages 15-16 of the document entitled "B3 Module 2\_Answer Key for Writing Activities\_1".*

$$1. \quad \begin{array}{r} ? \\ + 3 \\ \hline 6 \end{array}$$

$$2. \quad \begin{array}{r} 4 \\ + 0 \\ \hline ? \end{array}$$

$$3. \quad \begin{array}{r} 5 \\ - ? \\ \hline 4 \end{array}$$

$$4. \quad \begin{array}{r} ? \\ - 2 \\ \hline 8 \end{array}$$

$$5. \quad \begin{array}{r} 7 \\ - 0 \\ \hline ? \end{array}$$

Now go back and tell me the missing number in each equation.

Answer:

$$\begin{array}{r} 1. \quad ? \\ +3 \\ \hline 6 \end{array}$$

$$? = 3$$

$$\begin{array}{r} 2. \quad 4 \\ +0 \\ \hline ? \end{array}$$

$$? = 4$$

$$\begin{array}{r} 3. \quad 5 \\ - ? \\ \hline 4 \end{array}$$

$$? = 1$$

$$\begin{array}{r} 4. \quad ? \\ - 2 \\ \hline 8 \end{array}$$

$$? = 10$$

$$\begin{array}{r} 5. \quad 7 \\ - 0 \\ \hline ? \end{array}$$

$$? = 7$$

**Fun fact:** The jet engine operates on Issac Newton's third law of motion which states that for every action, there is an equal and opposite reaction.

Since we have completed our final descent and arrived at the airport, let's taxi to the gate with a follow-up activity.

**Follow-up activity:** We are going to play a new game called Roll and Race! You will need a homemade cube with Nemeth numerals, Roll and Race game cards, and markers. Small stickers or pieces of Wikki Stix® can be used for markers.



**Note:** *The game cards (in both print and braille) are included in separate documents. You will need at least 2 players for this game. It can easily be played with several students who read print or braille. If some of the players read print, add print to the homemade cube.*

*There are additional instructions about how to create the homemade cube with Nemeth numerals in the Teacher Reference Materials. If preferred, you may use tactile dice or flash cards with the numbers 1-6. If you use Wikki Stix® pieces, roll them into a ball with your hand so that they will stick to the paper more easily. Other options include using pushpins on a cork board or magnets on a cookie sheet. An answer key in print and braille is provided in separate documents.*

The first player to get 3 markers in a row wins the game! Each time you find a missing number in an equation with the same value as you rolled on the cube, you will earn the right to place a marker on the problem. Once you have 3 markers horizontally in a row, call out "Roll and Race".

Let's get started by using your hands to explore the Roll and Race game card. You will find the title centered on the first line. Afterwards there will be three rows of problems with four addition and/or subtraction problems on each row. We will play until a winner calls out "Roll and Race".

Next take turns rolling the homemade cube and finding an equation on your game board that has a missing number with the same value as you rolled on the cube. Then place a marker on top of the equation. There may be more than one equation with a missing number of the same value, so you get to decide where to place your sticker or Wikki Stix® each time. Think about which one will help you get 3 markers in a row horizontally.