Lesson Title: *Understand and Use the Inverse Relationship between Addition and Subtraction to Solve Problems and Check Solutions*

Objectives:

Students will be able to commit to memory their addition facts (sums to twenty) and the corresponding subtraction facts. Students will be able to use the concept that addition and subtraction are inverse operations to each other to help them solve problems.

Language to Learn:

Sum, total, difference, inverse operation.

The students have already learned how to add and subtract one and two digit numbers without borrowing. In first grade, the students learned their number facts, with sums up to 20, and then used the concept that addition and subtraction are inverse operations to confirm their answers.

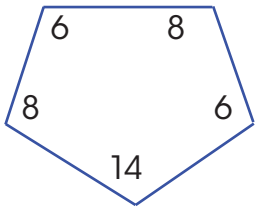
We will begin this lesson with the assumption that the students are familiar with their addition facts whose sums are up to twenty.

- Ask the students: What is 6 + 8?
- Ask the students: What is 8 + 6?
- Ask the students: If 6 + 8 =14, what conclusion can you make about 14 - 8?
- Ask the students: what other subtraction fact do you know using the numbers 6, 8, and 14? 14 – 6 = 8
- Have the students represent the addition and subtraction sentences vertically.

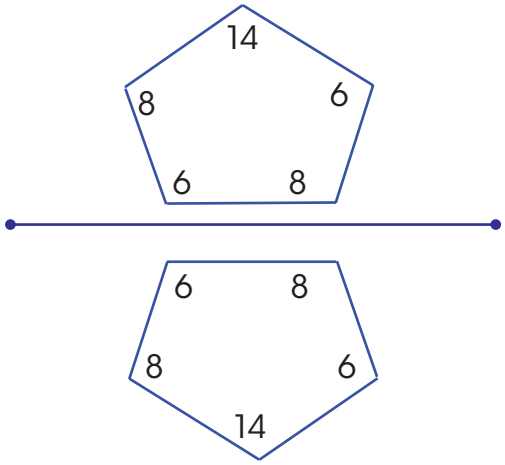
$$\begin{array}{r} 6 \\ +\,8 \\ \hline 14 \end{array} \qquad \begin{array}{r} 14 \\ -\,8 \\ \hline 6 \end{array} \qquad \begin{array}{r} 8 \\ +\,6 \\ \hline 14 \end{array} \qquad \begin{array}{r} 14 \\ -\,6 \\ \hline 8 \end{array}$$

- Ask the students: How can the addition facts help with the subtraction facts?
- Ask the students: What is the relationship between addition and subtraction?

To help the students learn the addition and subtraction facts, have the students create pentagon cards. The students can fill in the numbers and use the cards as flash cards. Below is an example of a pentagon card.



- If the students add the numbers in the corners on the left side, they see that:
  6 + 8 = 14
- If the students add the numbers in the corners on the right side, they see that:
  8 + 6 = 14
- Have the students reflect (flip) the card as shown below. The back of the card will be face up, with a vertex of the pentagon facing up.



- Have the students create a subtraction card. If the students subtract using the number at the top vertex on the left-hand side of the card, they will see:
  14 – 8 = 6
- If the students subtract using the number at the top vertex on the righthand side of the card, they will see:
  14 – 6 = 8

The pentagon card will assist the students to remember their addition and subtraction facts. The card visually demonstrates the addition and subtraction.
The students can use the pentagon cards as study cards. Have the students create pentagon cards for the other sets of numbers.

Although students should now recognize that addition and subtraction are inverse operations of each other, we should note that when students solve problems using addition and subtraction, we only use addition to check our subtraction. You will never check an addition problem by using subtraction.

Keeping that in mind, the exercises within each level group are only to set up and learn how to use the relationship that addition and subtraction are inverse operations.

English Language Learner (ELL): & Intensive Level Student:

The ELL and Intensive Level students should create the pentagon cards and use them on a daily basis to help them remember their addition and subtraction facts. In order to be successful in mathematics, it is important for the students to know these facts by heart. The pentagon cards are a tool to help the students visualize and see the addition on paper. It is not sufficient for the students to create the cards and refer to them, or to use counters to arrive at an addition or subtraction answer. The students must eventually have these facts memorized. If need be, the students should have additional drill at home in the form of worksheets, with assessment tests to check their skills. When the worksheets are created, make sure that the students see the addition and subtraction problems written vertically as well as horizontally. They need to be exposed to the two visual forms.

Have the students practice subtraction, and check with addition. Start with numbers whose sum is up to 20. Have manipulatives or the number line available for the students.

Remember, these are the number facts that the students should have committed to memory.

Have the students fill in the addition sentence that can be used to check the given subtraction sentence. The first examples can be uses as a model.

Subtraction Fact	Addition Fact
13 - 6 7	6 + 7 13
18 - 9	
15 - 8	
17 - 6	

Once the students have reviewed the addition facts up to 20, introduce subtraction of two, two-digit numbers. Again, provide the students with the resources they need to help them in their subtraction and addition. More examples could be given if necessary.

Prior to giving the students practice with addition and subtraction of two, twodigit numbers, without carrying and borrowing, demonstrate the addition and subtraction process. Stress the importance of:

- Lining the numbers up directly under each other.
- First, add or subtract the numbers in the ones place.
- Place the answer in ones place.
- Second, add or subtract the numbers in the tens place.
- Place the answer in the tens place.

If the students are having difficulty in lining up the numbers, provide graph paper scaled at 4 boxes per inch. That will assist them in their writing.

Have the students fill in the addition sentence that can be used to check the given subtraction sentence. The first examples can be uses as a model.

Subtraction Fact	Addition Fact
28 -16 12	16 +12 28
59 - 23	
87 - 31	

These are just a few examples. Continue with more examples if needed.

Have the students fill in the chart to add and subtract two-two digit numbers.
Have the students verbalize the process of addition and subtraction.

- Ask the students to describe to the class the process for addition and subtraction of three, two-digit numbers. Tell them to use the process above for addition and subtraction of two, two-digit numbers as a model.

Have the students fill in the addition sentence that can be used to check the given subtraction sentence. The first examples can be uses as a model.

Subtraction Fact	Addition Fact
489 -132 357	357 + 132 489
517 - 416	
958 - 137	
245 - 115	

Strategic Level Student:

The Strategic Level Student should go through the same process as the ELL and Intensive Level Student. They too should create pentagon cards to help them learn their addition and subtraction facts. They also must have the facts memorized. Additional work at home will help reinforce these facts.

The Strategic Level student can use these facts to solve verbal problems. For example.

- I had 15 balloons and 3 popped.
- How many balloons did I have left?
- Write a mathematical sentence that can be used to check you answer.
- My mother baked 36 cookies and my friends ate 12.
- How many cookies were left for my family?
- Write a mathematical sentence that can be used to check you answer.
- I had 22 toy cars and received 4 more toy cars for my birthday. How many toy cars do I have now? (Notice that a subtraction problem would not help the student check his answer).
- I had 81 cents in my pocket and found 18 cents in my desk. How much money do I have now?
- I had 17 cents and bought a lollypop for 6 cents.
- How much money do I have left?
- Write a mathematical sentence that can be used to check you answer.

With these questions, not only are the students practicing their basic facts, but they are also practicing their reading and problem solving techniques that they learned earlier on.

At-Grade Level and Advanced Level Student:

The At-Grade Level and Advanced Level Students should also have their addition and subtraction facts memorized. They also have the option of creating the pentagon cards to help them memorize their facts.

As an interesting activity, the students could work in pairs and pick 2 cards from the number index cards they created. Have them create a math sentence using the index cards as shown below. Have their partner find the solution.

An additional activity may include 1 index card. Have one student pick a card. Both students must write down two addition and subtraction problems to yield that number. They should check each others work.

The At-Grade and Advanced Level students should have more challenging verbal problems. For instance:

- I had 15 balloons and 3 popped. My mother bought me 5 more.
- How many balloons do I have now?
- How can you check your answer?
- I had 86 cents in my pocket and found 6 cents in my desk.
- How much money do I have now?
- What are the possibilities of the different types of coins I could have? Explain your answer.
- How many more pennies do I need to make 1 dollar?

The last question is very sophisticated. Although the total amount of money is 92 cents, we would like the student to realize that he could only possibly have.

- 8 dimes and 12 pennies or
- 92 pennies or
- 18 nickel and 2 pennies
- and other possibilities

The students might be very excited to say 9 dimes and two pennies. Ask them: Why is that not possible?

As long as the students know their basic facts up to 20, they will be able to see the relationship between addition and subtraction. They will see that they are opposite or inverse operations. Use these facts to help challenge the students with verbal problems. Remember that in the end, the students must know these facts by heart.