# TEKS Cluster: Whole Number Operations

**2.4** **Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy.

**2.5** **Number and operations.** The student applies mathematical process standards to determine the value of coins in order to solve monetary transactions.

**2.6** **Number and operations.** The student applies mathematical process standards to connect repeated addition and subtraction to multiplication and division situations that involve equal groupings and shares.

**2.7** **Algebraic reasoning.** The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships.

### Addition/Subtraction of Whole Numbers

***Readiness Standards***

2.4(C) solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms

2.4(D) generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000

***Supporting Standards***

2.4(A) recall basic facts to add and subtract within 20 with automaticity

2.4(B) add up to four two-digit numbers and subtract two-digit numbers using mental strategies and algorithms based on knowledge of place value and properties of operations

2.7(C) represent and solve addition and subtraction word problems where unknowns may be any one of the terms in the problem

### Money

***Readiness Standards***

2.5(A) determine the value of a collection of coins up to one dollar

***Supporting Standards***

2.5(B) use the cent symbol, dollar sign, and the decimal point to name the value of a collection of coins

### Contextual Multiplication/Division of Whole Numbers

***Supporting Standards***

2.6(A) model, create, and describe contextual multiplication situations in which equivalent sets of concrete objects are joined

2.6(B) model, create, and describe contextual division situations in which a set of concrete objects is separated into equivalent sets

2.7(A) determine whether a number up to 40 is even or odd using pairings of objects to represent the number

# 2.4(C) Readiness

Subcluster: Addition/Subtraction of Whole Numbers

## TEKS Scaffold

| TEKS | Student Expectation |
|---|---|
| 3.4(A) | solve with fluency one-step and two-step problems involving addition and subtraction within 1,000 using strategies based on place value, properties of operations, and the relationship between addition and subtraction (R) |
| 2.4(C) | **2.4 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy. The student is expected to:<br>**(C) solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms** |
| 1.3(F) | generate and solve problem situations when given a number sentence involving addition or subtraction of numbers within 20 (R) |

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

addition
difference
subtraction
sum

## Content Builder (see Appendix for Tree Diagram)

- Solve one-step word problems within 1,000:
  - addition using place value strategies
  - subtraction using place value strategies
- Solve multi-step word problems within 1,000:
  - addition using place value strategies
  - subtraction using place value strategies
  - addition and subtraction using place value strategies

## Instructional Implications

In conjunction with 2.4(B), students apply strategies for addition and subtraction to solve real-world problems. Instruction should include how the subtraction symbol represents distance (e.g., How far away is 3 from 11 on the number line in the following problem, 11 − 3 = ___?). This understanding of subtraction representing distance lays the foundation for future learning of subtraction of integers (e.g., In the problem 11 – (-3) = 14, -3 is 14 spaces away from 11). Students are required to solve multi-step word problems. Instruction should include samples of multiple step addition, subtraction, and a mixture of addition and subtraction problems. Students may need a visual to represent multiple-step understanding. Word problems should include a variety of contexts.

| | Result Unknown | Start Unknown | Change Unknown |
|---|---|---|---|
| Joining | Sarah had 43 pencils. Juan gave her 18 more pencils. How many pencils does Sarah have now? (43 + 18 = ?) | Sarah had some pencils. Juan gave her 18 pencils. Now Sarah has a total of 43 pencils. How many pencils did Sarah have to begin with? (? + 18 = 43) | Sarah had 25 pencils. Juan gave her some more pencils. Now Sarah has 43 pencils. How many pencils did Juan give her? (25 + ? = 43) |
| Separating | Sarah had 43 pencils. She gave 18 pencils to Juan. How many pencils does Sarah have now? (43 – 18 = ?) | Sarah had some pencils. She gave 18 to Juan. Now Sarah has 25 pencils left. How many pencils did Sarah have to begin with? (? – 18 = 25) | Sarah had 43 pencils. She gave some to Juan. Now she only has 25 pencils. How many pencils did she give to Juan? (43 – ? = 25) |
| | Difference Unknown | | Set Unknown |
| Comparing | Juan has 43 pencils and Sarah has 25 pencils. How many more pencils does Juan have than Sarah? Or, Juan has 43 pencils and Sarah has 25 pencils. How many more pencils does Sarah need to have the same amount as Juan? | Juan has 18 more pencils than Sarah. If Juan has 43 pencils, how many pencils does Sarah have? | Sarah has 18 fewer pencils than Juan. If Sarah has 25 pencils, how many pencils does Juan have? |

## Learning from Mistakes

Students may make the following mistakes:

- Trying to apply “key words” to select the appropriate operation instead of understanding the context of the problem
- Not recognizing a number sentence and its inverse as being equivalent (e.g., multiple choice answer of 18 + ___ = 42 not being selected as student’s representation of 42 − 18 = ___ )

# 2.4(D) Readiness

Subcluster: Addition/Subtraction of Whole Numbers

## TEKS Scaffold

| TEKS | Student Expectation |
|---|---|
| 3.5(A) | represent one- and two-step problems involving addition and subtraction of whole numbers to 1,000 using pictorial models, number lines, and equations (R) |
| 2.4(D) | **2.4 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy. The student is expected to:<br>**(D) generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000** |
| 1.3(F) | generate and solve problem situations when given a number sentence involving addition or subtraction of numbers within 20 (R) |

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Content Builder (see Appendix for Tree Diagram)

- Generate problem situations for given mathematics number sentences within 1,000 using:
  - addition
  - subtraction
  - addition and subtraction
- Solve problem situations for given mathematics number sentences within 1,000 using:
  - addition
  - subtraction
  - addition and subtraction

## Instructional Implications

Students must connect word problems to given number sentences and create their own story problems to given number sentences. This standard assesses whether students understand the conceptual difference between addition and subtraction. Instruction should provide students opportunities to write story problems with multiple representations of various number sentences, for example:

- 42 − 18 = ____
- ____ = 42 − 18
- 18 + ____ = 42
- 18 + ____ + 6 = 42
- ____ = 42 − 6 − 18
- ____ = 42 − 18 + 4

## Learning from Mistakes

Students may make the following mistakes:

- Trying to apply "key words" to select the appropriate operation instead of understanding the context of the problem
- Not recognizing a number sentence and its inverse as being equivalent (e.g., multiple choice answer of 18 + ____ = 42 not being selected as student's representation of 42 − 18 = ____ )

## Academic Vocabulary

addition
comparing
difference
distance
joining
number sentence/equation
separating
subtraction
sum

2.4(A) **2.4 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy. The student is expected to:

**(A) recall basic facts to add and subtract within 20 with automaticity**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

addition
difference
fact family
subtraction
sum

## Role in Concept Development

**Supports**

- 3.4(A) solve with fluency one-step and two-step problems involving addition and subtraction within 1,000 using strategies based on place value, properties of operations, and the relationship between addition and subtraction
- 2.4(C) solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms
- 2.4(D) generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000

**Connection/ Relevance**

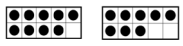
Efficiency and accuracy with basic addition and subtraction facts is a critical foundation for students to solve multi-step addition and subtraction problems using place value strategies.

**When to Teach**

Before/Prerequisite to 3.4(A), 2.4(C), 2.4(D)

**Instructional Implications**

In conjunction with 1.3(D), students continue to apply the following strategies to recall basic facts:

| | Make Ten with Two Ten Frames | Make Ten with Open Number Lines | Doubles | Count On |
|---|---|---|---|---|
| Addition |  <br>9 + 8 = ___<br>9 + 1 + 7 = ___<br>  <br>10 + 7 = ___<br>10 + 7 = 17 |  <br><br>9 + 8 = ___<br>9 + 1 + 7 = ___<br>10 + 7 = ___ | 6 + 8 = ___<br>6 + 6 + 2 = ___<br>12 + 2 = ___ | 3 + 8 = ___<br>8, 9, 10, 11 |

| | Make Ten with Two Ten Frames | Make Ten with Open Number Lines | Count Back | Think Addition/ Count On |
|---|---|---|---|---|
| Subtraction | 12 – 9 = ___<br>12 – 10 = 2<br>2 + 1 = 3 | 12 – 9 = ___<br>12 – 10 = 2<br>2 + 1 = 3 | 12 – 3 = ___<br>12, 11, 10, 9 | 12 – 9 = ___<br>9 + ___ = 12<br>9 + 3 = 12 |

Students continue to practice using these strategies in order to recall their basic facts with automaticity.

**Learning from Mistakes**

Students may make the following mistakes:

- Relying primarily on memorization of facts rather than investigating numerical strategies for fluency

2.4(B) **2.4 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy. The student is expected to:

**(B) add up to four two-digit numbers and subtract two-digit numbers using mental strategies and algorithms based on knowledge of place value and properties of operations**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

addition
difference
subtraction
sum

## Role in Concept Development

**Supports**

- 3.4(A) solve with fluency one-step and two-step problems involving addition and subtraction within 1,000 using strategies based on place value, properties of operations, and the relationship between addition and subtraction
- 2.4(C) solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms
- 2.4(D) generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000

**Connection/ Relevance**

Adding multi-digit numbers based on place value and properties of operations is a fundamental skill in order to solve multi-step addition problems.

**When to Teach**

Before/Prerequisite to 3.4(A), 2.4(C), 2.4(D)

**Instructional Implications**

Students employ their understanding of place value and expanded notation to develop mental strategies to add multiple two-digit numbers. Properties of operations include the commutative, associative, and inverse properties. Although the teacher may model the names of the properties (e.g., commutative, associative, inverse, etc.), students will only be asked to employ the underlying concepts in order to solve addition and subtraction problems.

- Commutative & Associative Property (e.g., 34 + 16 + 23 + 12= ____; (30 + 4) + (10 + 6) + (20 + 3) + (10 + 2) = _____; (30 + 10 + 20 + 10) + (4 + 6 + 3 + 2) = _____; 70 + 15 = 85).
- Compatible Numbers (e.g., 34 + 23 + 16 = ___; 34 + 16 + 23 = ____; 50 + 23 = ___; 50 + 23 = 73 )
- Inverse Property (e.g., 62 – 58 = ___; 58 + ____ = 62; applying add-on, 59, 60, 61, 62; 62 – 58 = 4).

Once students become fluent using the mental strategies, the traditional algorithm can be introduced relating the steps in the algorithm to the steps in the strategies described above.

**Learning from Mistakes**

Students may make the following mistakes:

- Relying primarily on algorithms rather than investigating mental strategies
- Overgeneralizing the commutative property to include subtraction
- Not recognizing a number sentence and its inverse as being equivalent (e.g., multiple choice answer of 18 + ____ = 42 not being selected as student's representation of 42 − 18 = ____ )

**2.7 Algebraic reasoning.** The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:

2.7(C) **(C) represent and solve addition and subtraction word problems where unknowns may be any one of the terms in the problem**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

addition
difference
number sentence/equation
subtraction
sum
unknown value

## Role in Concept Development

**Supports**

- 3.5(A) represent and solve one- and two-step problems involving addition and subtraction of whole numbers to 1,000 using pictorial models, number lines, and equations
- 2.4(D) generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000

**Connection/ Relevance**

Representing and solving addition and subtraction word problems where the unknown may be any one of the missing terms builds student contextual understanding of real-world problems as they relate to the abstract representation of the number sentence.

**When to Teach**

Before/Prerequisite to 3.5(A), 2.4(D)

**Instructional Implications**

In conjunction with 2.4, students continue to demonstrate their understanding of addition and subtraction with the appropriate number sentence. Instruction should vary the context of addition and subtraction problems provided to students [see 2.4(C) for examples]. Students should represent the same word problem with a variety of number sentences, for example:

- 17 + 18 = _____; 18 + 17 = _____; _____ = 18 + 17; ____= 17 + 18
- 42 – 16 = _____; ____ = 42 – 16; 16 + ____ = 42; 42 = ____ + 16

Instruction should include the use of objects, strip diagrams, and verbal descriptions to represent problem-solving situations.

**Learning from Mistakes**

Students may make the following mistakes:

- Trying to apply "key words" to select the appropriate operation instead of understanding the context of the problem
- Not recognizing a number sentence and its inverse as being equivalent (e.g., multiple choice answer of 18 + ___ = 42 not being selected as student's representation of 42 − 18 = ___ )

# 2.5(A) Readiness

Subcluster: Money

## TEKS Scaffold

| TEKS | Student Expectation |
|---|---|
| 3.4(C) | determine the value of a collection of coins and bills (S) |
| 2.5(A) | **2.5 Number and operations.** The student applies mathematical process standards to determine the value of coins in order to solve monetary transactions. The student is expected to:<br>**(A) determine the value of a collection of coins up to one dollar** |
| 1.4(C) | use relationships to count by twos, fives, and tens to determine the value of a collection of pennies, nickels, and/or dimes (R) |
| K.4(A) | identify U.S. coins by name, including pennies, nickels, dimes, and quarters (S) |

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Content Builder (see Appendix for Tree Diagram)

- Determine the value of a collection of coins up to one dollar

## Instructional Implications

Students are to apply their knowledge of skip counting [see 1.5(B)] to determine the value of a collection up to one dollar (e.g., skip count by twos to count a collection of pennies, skip count by fives to count a collection of nickels, or skip count by tens to count a collection of dimes). As students become comfortable with determining the value of a collection of like coins, instruction should then address a mixture of unlike coins. Again, associating a student's understanding of skip counting allows them to add the value with ease (e.g., given 3 dimes, 4 nickels, and 6 pennies, students skip count by tens to add the value of the dimes 10, 20, 30; skip count by fives to add the value of the nickels 35, 40, 45, 50; and then skip count by twos to add the value of the pennies 52, 54, 56). Students should solve problems involving monetary transactions.

## Learning from Mistakes

Students may make the following mistakes:

- Not being able to recognize a coin (e.g., the student can only identify the head or tail side of a coin)
- Not recognizing nontraditional coins
- Confusing the size of the coin with its value (e.g., a nickel is worth more than a dime because it is larger in size)

## Academic Vocabulary

dime
dollar
nickel
penny
quarter

# 2.5(B) Supporting



2.5(B) **2.5 Number and operations.** The student applies mathematical process standards to determine the value of coins in order to solve monetary transactions. The student is expected to:

**(B) use the cent symbol, dollar sign, and the decimal point to name the value of a collection of coins**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

cent symbol
dollar sign
decimal point

## Role in Concept Development

**Supports**
2.5(A) determine the value of a collection of coins up to one dollar

**Connection/ Relevance**
Students must be able to symbolically represent the value of a collection of coins in order to solve monetary transactions.

**When to Teach**
With 2.5(A)

**Instructional Implications**
In conjunction with 2.5(A), students begin using the cent symbol or the dollar sign and decimal point to represent the value of a collection of coins. Instruction should address that money can be represented two ways (e.g., 42¢ or $0.42) but cannot be represented using both symbols (e.g., $0.42¢). Instruction should address how the decimal point is used to separate the dollars (whole) from the cents (part).

**Learning from Mistakes**
Students may make the following mistakes:
- Using both symbols simultaneously (e.g., $0.42¢)
- Misunderstanding when to use the appropriate symbol (e.g., 0.42¢ or $42 for 42¢)
- Not placing the decimal point correctly

2.6(A) **2.6 Number and operations.** The student applies mathematical process standards to connect repeated addition and subtraction to multiplication and division situations that involve equal groupings and shares. The student is expected to:

**(A) model, create, and describe contextual multiplication situations in which equivalent sets of concrete objects are joined**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

equal groups/sets
repeated addition

## Role in Concept Development

**Supports**

3.4(K) solve one-step and two-step problems involving multiplication and division within 100 using strategies based on objects; pictorial models, including arrays, area models, and equal groups; properties of operations; or recall of facts

**Connection/ Relevance**

This supporting standard develops the conceptual understanding of multiplication. The manipulation of objects into equal groups, the creation of multiplicative scenarios, and the verbal description of multiplicative situations provides the foundation for future problem solving.

**When to Teach**

Before/Prerequisite to 3.4(K)

**Instructional Implications**

Students should be provided a variety of opportunities to model the joining of equal groups with objects (e.g., using manipulatives, a student can model how many wheels are on six tricycles). Instruction should not represent the multiplication situations with a multiplicative number sentence (e.g., 3 x 6 = 18), but should be described as 3 groups of 6.

As outlined in 2.6, students should connect multiplicative situations to repeated addition as so many groups of the objects. Therefore, the recording of an addition number sentence would be appropriate (e.g., 3 + 3 + 3 + 3 + 3 + 3 = 18). Students should also create situations where repeated addition can be modeled.

**Learning from Mistakes**

Students may make the following mistakes:

- Misrepresenting and incorrectly describing an equivalent set of objects joined (e.g., three groups of five vs. five groups of three communicate two different multiplicative situations)

**2.6 Number and operations.** The student applies mathematical process standards to connect repeated addition and subtraction to multiplication and division situations that involve equal groupings and shares. The student is expected to:

2.6(B) **(B) model, create, and describe contextual division situations in which a set of concrete objects is separated into equivalent sets**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

equal groups/sets
repeated subtraction

## Role in Concept Development

**Supports**
3.5(B) represent and solve one- and two-step multiplication and division problems within 100 using arrays, strip diagrams, and equations

**Connection/ Relevance**
This supporting standard develops students' conceptual understanding of division so they can understand and appropriately represent, create, and solve division problems.

**When to Teach**
Before/Prerequisite to 3.5(B)

**Instructional Implications**
Students should be provided a variety of opportunities to model the separating of a set of objects into equivalent groups (e.g., using manipulatives, students model how many tricycles are needed using 18 wheels). Instruction should not represent the division situations with a division number sentence (e.g., 18 ÷ 3 = 6). As outlined in 2.6, students should connect divisional situations to repeated subtraction. Therefore, the recording of a subtraction number sentence would be appropriate (e.g., 18 − 3 − 3 − 3 − 3 − 3 − 3 = 0). Divisional situations should be limited to those that yield equal groupings/shares (no remainders). Students should also create situations where repeated subtraction are modeled.

**Learning from Mistakes**
Students may make the following mistakes:
- Misrepresenting and incorrectly describing a set of objects distributed equally (e.g., three groups of five vs. five groups of three communicate two different divisional situations)

2.7(A) **2.7 Algebraic reasoning.** The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:

**(A) determine whether a number up to 40 is even or odd using pairing of objects to represent the number**

## Stimulus

| | | | |
|---|---|---|---|
| Word Problem | Verbal Description | Chart/Table | Graph |
| Equation/ Expression | Manipulatives | Diagram/Image | Number Line |
| Base Ten Blocks | Measurement Tool | Formula | Geometric Figures |

## Academic Vocabulary

even
odd

## Role in Concept Development

**Supports**

- 3.4(A) solve with fluency one-step and two-step problems involving addition and subtraction within 1,000 using strategies based on place value, properties of operations, and the relationship between addition and subtraction
- 3.4(K) solve one-step and two-step problems involving multiplication and division within 100 using strategies based on objects; pictorial models, including arrays, area models, and equal groups; properties of operations; or recall of facts

**Connection/ Relevance**

As students solve problems using all operations, developing patterns with even and odd solutions can support students with their computational efficiency and accuracy (e.g., odd + odd = even; even + odd = odd; odd − odd = even; odd − even = odd).

**When to Teach**

Before/Prerequisite to 3.4(A), 3.4(K)

**Instructional Implications**

Students should pair objects to determine if a number is even or odd. As students begin pairing objects, instruction should relate this concept to the double facts (e.g., 18 is even as there are 9 groups of pairs (2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 18); 15 is odd as there are 7 groups of pairs with one left over (2 + 2 + 2 + 2 + 2 + 2 + 2 + 1 = 15).

**Learning from Mistakes**

Students may make the following mistakes:

- Not skip counting by 2 correctly
- Misunderstanding the meaning of “pairs” as 2 in each group