

Standard: ● 7.NS.1: Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. ○ 7.NS.1.b: Understand $p + q$ as the number located a distance q from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. ○ 7.NS.1.c: Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. ○ 7.NS.1.d: Apply properties of operations as strategies to add and subtract rational numbers.	Big Idea: I can solve real world situations that require finding a distance with subtraction expressions.
Point: ● Solve word problems that involve finding a distance between 2 rational numbers. ● Identify expressions that can represent a distance word problem.	
Vocab: <i>*Indicates this is the first lesson this vocab is used</i> ● Sum: The answer to an addition problem. ● Difference: The answer to a subtraction problem. ● Equivalent expression: Expressions that have the same value (even if looking different). ● Integer: Whole numbers and their opposites. ● Rational number: A number that can be expressed as a fraction. ● Absolute value: A number's distance from zero. Absolute value is the same as magnitude. Absolute values, magnitude and distances are always positive. The absolute value of a number is represented with mathematical symbols: x. ● Positive number: A number greater than zero. ● Negative number: A number less than zero. ● Sign: The indication of a number being positive or negative. ● Neutral: Not positive nor negative. Zero is a neutral number. ● Magnitude: A number's distance from zero. Distance and magnitude are always positive. ● Opposite numbers: Numbers that are equally distant from 0. Opposites have different signs. The sum of opposite numbers is 0. ● Expression: A math phrase that contains numbers, variables and operation or grouping symbols. ● Evaluate: To find the numerical value or to solve. ● Simplify: To make a number or an expression simpler while keeping the value the same.	

- **Balance**: The money available in a bank account after all deposits and debts are put into the account.
- **Withdraw**: To take out an amount of money from a bank account.
- **Deposit**: To put an amount of money into a bank account.
- **Fee**: A payment or charge for a service.
- **Profit**: A gain of an amount of money.
- **Debt**: An amount, typically money, that is owed or due.
- **Breaking even**: Reaching a point when the money you've earned is equal to the money you've spent. Zero dollars represents breaking even.
- **Elevation/altitude**: A height compared to sea level.

Extra materials:

None

Misconceptions:

- Selecting the wrong operation to solve a word problem.
- Writing an incorrect expression to represent a word problem even if the operation is correct.
- Mixing up finding a distance with finding a change and vice versa.
- Absolute values are opposite numbers.
- Value and magnitude are the same thing.
- Errors evaluating integer addition and subtraction expressions.
 - Especially: forgetting to put a negative sign on a negative answer after operating.
- Errors with fraction and decimal addition.

Notes for teachers:

Today students will solve word problems that involve finding a distance.

Similar to the last lesson, when asked to find a distance, students can write and evaluate a subtraction expression with or without absolute value. They need to continue to remember that distances are always positive.

$$\begin{aligned} \text{Distance} &= |p - q| \\ \text{or} \\ \text{Distance} &= \text{bigger value} - \text{smaller value} \end{aligned}$$

Mixed in will be word problems that require finding a change which can sometimes be confused with distance. A change has a clear starting value, a direction and a final value. Unlike distance, a change can be negative (a decrease). A change can also be positive (an increase). Instead of using absolute value, students should write expressions like they did in 8.08:

$$\text{Change} = \text{Final value} - \text{initial value}$$

The PST includes a distance word problem, #1, and a change word problem, #2, with very similar contexts. Be ready to discuss the difference and why #1 **must** be a positive answer and why #2 is a negative answer.

Section A will be entirely on distance word problems to cap off what students have learned about distance from the past 2 lessons.

Section B will be a mix of distance and change word problems.

In Section C, both integer addition and subtraction problems will be mixed in. That will create the added challenge of selecting the appropriate operation.

Similar to past word problem lessons, whenever students are unsure or making errors, tell students to visualize what's happening by creating a sketch on a number line. The PST requires this. If students struggled on the PST, make sketches or number lines a requirement for the rest of the lesson.

If students create number lines, they do **not** need to create a scale and put tick marks for every integer but they should include brackets to represent a distance or arrows to represent increases and decreases (see the PST and Exit Ticket exemplars).

Vertical number lines can be especially useful when thinking about elevation and temperature. Sketches of number lines can also provide insight into what answers would be reasonable or unreasonable for the given scenario.

As you circulate during the PST, look for a number line that resembles the absolute value number lines with brackets students used in 7.10 for #1. Look for number lines with a downwards arrow for #2.

Fact Power (3 min):

- Students should get 60 seconds to complete the Fact Power

Make sure students know which Level to work on before starting class.

- **Students who passed Level 1 (14 or 15 questions correct) move to Level 2**
- **Students who passed Level 2 (14 or 15 questions correct) move to Level 3**
- ***New today!* Students who passed Level 3 (14 or 15 questions correct) move to Level 4**

Let the whole class know that the next opportunity to level up will be in the next lesson. Keep framing student students that 90%+ is our goal to be “7th grade ready!”

- Review all answers and have students write their score AND correct any wrong answers.
- (Optional) Students rip off and turn in their Fact Power

Problem Solving Task (25 min):

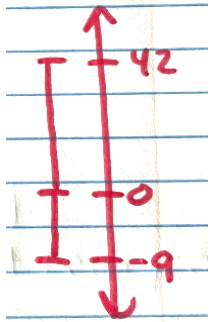
Create a sketch or number line to model the following scenarios. Then write and evaluate a **subtraction expression** to solve.

1. Carla is adventurous and jumped from a cliff 42 feet above sea level. She landed safely 9 feet below the surface of the water. What is the distance from the top of the cliff to where she landed in the water?

Discussion: Core questions that should be asked, and potential answer

- **Ask:** What is the scenario in #1 about without using the numbers from the prompt. What do you need to find?
 - *Carla is jumping from a cliff above sea level. She lands underwater. We need to find the distance from the top of the cliff to where she landed.*
 - *We need to find a distance*

Post a sketch of a number line that represents the scenario. If there was a common error in number lines, post that first. Have students name the error and fix their work.



$$42 - (-9) = 51$$

OR

$$|42 - (-9)| = |51| = 51$$

OR

$$|-9 - 42| = |-51| = 51$$

2. Malia is also adventurous and jumped from a cliff with an elevation of 60 feet. She landed safely 11 feet below the surface of the water. How did Malia's elevation change from the top of the cliff to where she landed underwater?



If there wasn't a common error, post an exemplar number line that shows brackets for the distance.

- **Say:** Evaluate this work.
 - *I agree because 42 should be above 0 to represent above sea level.*
 - *9 should be represented with -9 for below the surface of the water and be below 0 on the number line.*
 - *We're finding a distance so it's the same value in both directions. (Student name) is showing that with brackets.*
- **Ask:** Based on our number lines and the context of the problem, what answers are reasonable and what answers are not reasonable.
 - *-33 feet and -55 feet are not reasonable. We're finding a distance and distance is always positive.*
 - *33 feet is also not reasonable. We know the distance between 0 to 42 feet is more than 33 feet so the total distance between 42 and -9 will be more.*
 - *The only reasonable answer is D, 51 feet. It's positive and it's more than 42 feet.*
- **Ask:** What was the benefit of creating a number line?
 - *We can find the multiple choice answer just by reasoning.*
- **Ask:** For those of you that wrote an expression to represent and find this distance, what did you write? Justify your expression.
 - *$42 - (-9) \leftarrow \text{big \# - small \#}$*
 - *OR $|42 - (-9)| \leftarrow \text{the absolute value of their difference}$*
 - *OR $|-9 - 42| \leftarrow \text{the absolute value of their difference}$*

$$-11 - 60 = -71$$

- **Ask:** How is the scenario in #2 similar and different than the scenario in #1?
 - *Similar:*
 - *Cliff jumping above the surface of the water*
 - *Landing below water*
 - *Different:*
 - *Different #s*
 - *#1 asks "What is the distance" vs. #2 asks "How did Malia's elevation change"*

If you saw both types of number lines for #2, post a number line with brackets and a number line with a downwards arrow.

- **Ask:** Which number line do you agree with and why?
 - *The number line with the downwards arrow because we're looking for the change, or decrease from 60 to -11.*
- **Ask:** Based on this number line, what answers can you rule out? What is the answer?
 - *71 and 11 feet. They are positive numbers which are increases.*
 - *-11 feet because the arrow is much longer than -11 feet.*
 - *-71 is the answer because it's negative and Malia's elevation decreased. It also has a magnitude that is greater than 60 feet which would be the distance between the top of the cliff and the surface of the water.*
- **Ask:** The scenarios in these problems are so similar. Why is one answer positive and one answer negative?

	○ #1 is a positive answer because it asks for a distance and distance is always positive. ○ #2 is negative because it asks for a change and changes can be negative if it is a decrease. ● Ask: What are your takeaways from today's PST? ○ (There are no new notes in today's lesson but take the time to stamp any takeaways that came up in your discussion)
Section A (10 min): ● Solve word problems that require finding a distance	
Section B (10 min): ● Solve word problems that require finding a distance or a change	#7 is from the <u>7th Grade</u> 2013 MCAS Item 11 (Brooke 69%, State 78%)
Section C (remaining time): ● Solve mixed rational number addition and subtraction word problems	
Exit Ticket (5 min): 1. A whale is swimming at an elevation of -125 feet. A shark directly above the whale at an elevation of -92 feet. What is the distance between the whale and the shark? (A) 33 feet (B) 217 feet (C) -33 feet (D) -217 feet $ -125 - (-92) $ $ -125 + 92 $ $ -125 + 92 $ $ -33 $	

33 feet

Name: _____

FACT POWER!**LEVEL 1****Adding Integers:**

- 1 positive and 1 negative number

Time: 60 seconds

$9 + (-1) = \underline{\hspace{2cm}}$	$2 + (-3) = \underline{\hspace{2cm}}$	$0 + (-4) = \underline{\hspace{2cm}}$	$(-8) + 7 = \underline{\hspace{2cm}}$	$-10 + 10 = \underline{\hspace{2cm}}$
$-3 + 4 = \underline{\hspace{2cm}}$	$1 + -9 = \underline{\hspace{2cm}}$	$6 + (-2) = \underline{\hspace{2cm}}$	$0 + (-7) = \underline{\hspace{2cm}}$	$5 + (-9) = \underline{\hspace{2cm}}$
$0 + -6 = \underline{\hspace{2cm}}$	$7 + (-4) = \underline{\hspace{2cm}}$	$(-8) + 5 = \underline{\hspace{2cm}}$	$2 + (-9) = \underline{\hspace{2cm}}$	$3 + -3 = \underline{\hspace{2cm}}$

Score: _____ ← **GOAL:** 14 or 15 questions correct!

Name: _____

FACT POWER!**LEVEL 2****Adding Integers:**

- 1 positive and 1 negative number
- 2 negative numbers

Time: 60 seconds

$(-10) + 1 = \underline{\hspace{2cm}}$	$-4 + (-5) = \underline{\hspace{2cm}}$	$8 + (-2) = \underline{\hspace{2cm}}$	$0 + -7 = \underline{\hspace{2cm}}$	$-3 + 6 = \underline{\hspace{2cm}}$
$-9 + (-2) = \underline{\hspace{2cm}}$	$-4 + -5 = \underline{\hspace{2cm}}$	$9 + (-9) = \underline{\hspace{2cm}}$	$-1 + 7 = \underline{\hspace{2cm}}$	$-3 + (-6) = \underline{\hspace{2cm}}$
$-3 + 10 = \underline{\hspace{2cm}}$	$-9 + (-1) = \underline{\hspace{2cm}}$	$-4 + 6 = \underline{\hspace{2cm}}$	$2 + (-7) = \underline{\hspace{2cm}}$	$-8 + -8 = \underline{\hspace{2cm}}$

Score: _____ ← **GOAL:** 14 or 15 questions correct!

Name: _____

FACT POWER!

LEVEL 3

Subtracting Integers:

- 1 positive number - 1 negative number
- 1 negative number - positive number
- 1 positive number - 1 negative number
- 1 negative number - 1 negative number

Time: 60 seconds

$-6 - 5 = \underline{\hspace{2cm}}$	$3 - 10 = \underline{\hspace{2cm}}$	$1 - (-4) = \underline{\hspace{2cm}}$	$(-8) - 2 = \underline{\hspace{2cm}}$	$7 - 9 = \underline{\hspace{2cm}}$
$-1 - (-1) = \underline{\hspace{2cm}}$	$0 - 9 = \underline{\hspace{2cm}}$	$(-3) - 4 = \underline{\hspace{2cm}}$	$2 - (-7) = \underline{\hspace{2cm}}$	$5 - 8 = \underline{\hspace{2cm}}$
$10 - (-9) = \underline{\hspace{2cm}}$	$5 - 8 = \underline{\hspace{2cm}}$	$-1 - 6 = \underline{\hspace{2cm}}$	$-(-7) - 4 = \underline{\hspace{2cm}}$	$-3 - 3 = \underline{\hspace{2cm}}$

Score: _____ ← **GOAL:** 14 or 15 questions correct!

Name: _____

FACT POWER!

LEVEL 4

😊 This is what fluency looks like in 7th grade! 😊

Adding and subtracting Integers:

Mixed practice!

Time: 60 seconds

$-9 + -2 = \underline{\hspace{2cm}}$	$3 - (-1) = \underline{\hspace{2cm}}$	$0 - 10 = \underline{\hspace{2cm}}$	$(-2) + 8 = \underline{\hspace{2cm}}$	$4 - 6 = \underline{\hspace{2cm}}$
$-5 + 8 = \underline{\hspace{2cm}}$	$1 - 2 = \underline{\hspace{2cm}}$	$(-7) + 0 = \underline{\hspace{2cm}}$	$-4 - 9 = \underline{\hspace{2cm}}$	$-3 - (-8) = \underline{\hspace{2cm}}$
$-6 + -2 = \underline{\hspace{2cm}}$	$-10 + 8 = \underline{\hspace{2cm}}$	$0 - (-4) = \underline{\hspace{2cm}}$	$3 - 5 = \underline{\hspace{2cm}}$	$7 + (-9) = \underline{\hspace{2cm}}$

Score: _____ ← **GOAL:** 14 or 15 questions correct!

Name: _____

Classwork**Problem Solving Task:**

Create a sketch or number line to model the following scenario.

Then write and evaluate a **subtraction expression** to solve the problem.

1.	Carla is adventurous and jumped from a cliff 42 feet above sea level. She landed safely 9 feet below the surface of the water. What is the distance from the top of the cliff to where she landed in the water?
2.	Malia is also adventurous and jumped from a cliff with an elevation of 60 feet. She landed safely 11 feet below the surface of the water. How did Malia's elevation change from the top of the cliff to where she landed underwater?

Section A:

1.	James and Talia decide to have a race. They go to a track with a starting line. Talia is confident she will win so she tells James to start three meters ahead of the starting line on the track. Talia starts nine meters behind the starting line. How far apart were James and Talia at the start of the race?
2.	The elevation of Death Valley is -282 feet. The elevation of the Dead Sea is -485 feet. What is the difference between the elevation between Death Valley and the Dead Sea?
3.	Matthew is fishing from a pier. The tip of his fishing rod is 4 feet above the surface of the water. The hook at the end of the fishing line is directly below the tip of his fishing rod, 6 feet below the surface of the water. What is the distance between the tip of Matthew's fishing rod and the hook?

Section B:

4.	A deep-sea exploring ship is pulling up a diver. The diver was at an elevation of -94 feet. The ship just pulled him up to the boat 4 feet above the surface of the water. What distance did the diver travel from his original elevation to where he is on the boat?
5.	Jayna has credit card debt. Her balance was $-\$560$. She spent money on a new coat and now her credit card balance is $-\$750$. How did Jayna's credit card balance change?
6.	The temperature in Chicago today is 76°F . In Juneau it is -12°F . How much warmer is it in Chicago than in Juneau today?

7. David is climbing a tall tree. The base of the tree is at ground level. he climbs to a point 17.6 feet above the ground. He is trying to reach a rope that is hanging on the tree 39.2 feet above the ground. How far apart are David and the top of the rope?

Section C:

8. The temperature at 6pm was 16°F , which was 9°F lower than the temperature at noon. What was the temperature at noon?
- (A) 25°F
(B) 7°F
(C) -7°F
(D) -25°F
9. Sarah is managing her bank account. Her account balance was $-\$275.50$. She received her paycheck, and her new balance is $\$150.25$. How did Sarah's bank account balance change?
- (A) Increased $\$475.75$
(B) Increased $\$125.25$
(C) Decreased $\$475.75$
(D) Decreased $\$125.25$

10.	It is -6°F when you wake up on one winter morning. By 2pm, the temperature had risen 20°F . What was the temperature at 2pm?
11.	A submarine was initially at an elevation of -150 meters. It rose to an elevation of -91 meters. What was the change in the submarine's elevation? Was the submarine moving towards the surface or deeper underwater?

Name: _____

Exit Ticket

Write and evaluate an expression to show your work for the following problem.

- | | |
|-----------|--|
| 1. | <p>A whale is swimming at an elevation of -125 feet. A shark directly above the whale at an elevation of -92 feet. What is the distance between the whale and the shark?</p> <p>(A) 33 feet</p> <p>(B) 217 feet</p> <p>(C) -33 feet</p> <p>(D) -217 feet</p> |
|-----------|--|

Name: _____

Homework**Math Class:**

Write and evaluate an expression to show your work for the following problems.

- | | |
|-----------|--|
| 1. | Angelo lives in a high rise apartment in the city. He lives on the 45th floor and his car is parked in the parking garage five floors below ground level. What is the distance, in floors, between Angelo's apartment and his car in the parking garage? |
| 2. | A sea bass is swimming 25 feet below the surface of the water. A shark is swimming 102 feet below the surface of the water. What is the distance, in feet, between the shark and the sea bass? |
| 3. | Emily and Kyla are participating in a marathon. Emily has already started running and is 5.6 kilometers into the race. Kyla is still waiting for her turn to begin the race and is 0.2 kilometers behind the starting line. What is the distance between Emily and Kyla? |

Mixed Bag!

4.

THIS IS LEVEL 4 OF FACT POWER!

Find the sum or difference. **Take your time!**

$0 - 10 = \underline{\hspace{2cm}}$	$2 - (-9) = \underline{\hspace{2cm}}$	$-1 + 1 = \underline{\hspace{2cm}}$	$-3 + (-6) = \underline{\hspace{2cm}}$	$8 + (-7) = \underline{\hspace{2cm}}$
$-7 - 9 = \underline{\hspace{2cm}}$	$-5 + (-2) = \underline{\hspace{2cm}}$	$(-8) + 0 = \underline{\hspace{2cm}}$	$1 - 5 = \underline{\hspace{2cm}}$	$6 - (-4) = \underline{\hspace{2cm}}$
$3 - 5 = \underline{\hspace{2cm}}$	$-9 - 9 = \underline{\hspace{2cm}}$	$1 + (-10) = \underline{\hspace{2cm}}$	$(-6) + 1 = \underline{\hspace{2cm}}$	$-2 - (-5) = \underline{\hspace{2cm}}$
$(-9) + (-5) = \underline{\hspace{2cm}}$	$-4 - 1 = \underline{\hspace{2cm}}$	$-6 + 10 = \underline{\hspace{2cm}}$	$2 + (-7) = \underline{\hspace{2cm}}$	$3 - (-8) = \underline{\hspace{2cm}}$
$-4 + (-2) = \underline{\hspace{2cm}}$	$-10 + 5 = \underline{\hspace{2cm}}$	$0 - 9 = \underline{\hspace{2cm}}$	$3 - (-1) = \underline{\hspace{2cm}}$	$6 - 8 = \underline{\hspace{2cm}}$