$\qquad$
$\qquad$

## In-Class UOnRbook

## The Number System:

## Unit 1-Part 2: Adding \& Subtracting Rational Numbers

## How can we classify different numbers, describe what they represent and their relationship with each other?

| Standard | Description |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7.NS. 1 | Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers. <br> $\rightarrow \quad$ 1a: Describe situations in which opposite quantities combine to make 0 . <br> $\rightarrow \quad$ 1b: Show that a number and its opposite have a sum of o (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. <br> $\rightarrow \quad 1 c$ : Understand subtraction of rational numbers as adding the additive inverse <br> $\rightarrow \quad$ 1d: Apply properties of operations as strategies to add and subtract rational numbers. |  |  |  |  |
| 7.NS. 3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |  |  |  |  |
| Workbook Completion Rubric |  |  |  |  |  |
| 4 |  | 3 | 2 | 1 | o |
| Workbook demonstrates significant effort. Student utilizes notes to help extend their thinking, writing questions, comments or reactions to the content. |  | Workbook demonstrates some effort. Student takes notes but could further understanding by questioning and interacting with the material. | Workbook shows little effort. Student takes notes sporadically, and could benefit from greater consistency with the material. | Workbook shows little to no effort. Student does not take notes and must demonstrate future interaction with the material to aid understanding. | Workbook is entirely incomplete or not turned in. |
| Grading Breakdown |  | n: $3.5-4=A$ | 3-3.4 $=$ B $2.5-2.9=$ C | 2-2.4 $=$ D $\quad 0-1.9=\mathrm{F}$ |  |

I am a person who believes in asking questions, in not conforming for the sake of conforming. I am deeply dissatisfied - about so many things, about injustice, about the way the world works - and in some ways, my dissatisfaction drives my storytelling.

Chimamanda Ngozi Adichie

## Unit 1 Part 2 Guiding Question:



## Lesson Objectives

| Lesson <br> After completing a <br> lesson, check the box | I can... $\quad$ After completing each lesson, you are on the right track if you can confidently state "I can..." |
| :--- | :--- |
| $\square$ | 1.6 | compare and problem solve using rational numbers and integers.


| DO-NOW | Directions: Circle the improper fractions and put a BOX around the mixed numbers. |
| :---: | :---: |
|  | $\frac{16}{4}$ $2 \frac{23}{26}$ $\frac{1001}{1000}$ |
|  | $5 \frac{3}{4}$ $\frac{6}{10}$ $\frac{62}{35}$ |
|  | $\begin{array}{l\|l\|l} \hline \frac{8}{1} & \frac{1000}{1001} & 100 \frac{25}{100} \end{array}$ |
| Homework Reminder | Shade in this box if you turned in your homework. <br> "For the things we have to learn before we can do them, we learn by doing them." <br> - Aristotle |
| Check-In | How are you feeling today? <br> What concepts do you feel you have mastered? What concepts do you want to practice more? |


| What is a rational number? |  |
| :---: | :---: |
|  | A $\qquad$ is a number that can be represented as the ratio of two whole numbers. <br> Examples: <br> Reminder: An integer is just a positive or negative whole number. |

## Do you remember this?!

Change the following mixed numbers into improper fractions.

$$
15 / 6 \quad 3^{3 / 4}
$$

Change the following improper fractions into mixed numbers.
$\frac{16}{3}$
$\frac{9}{2}$

## FOLDABLE ACTIVITY

## Notes

## Steps for Adding and Subtracting Fractions

1. Change mixed numbers into $\qquad$ .
2. Find the least common denominator (LCD) and create equivalent fractions.
3. Add or subtract the numerators (Leave the denominator the same!).
4. If necessary, change back into a mixed number and $\qquad$ _.

## Try it out!

$$
1^{2 / 3-5 / 6} \quad 3^{1 / 4}+3 / 8 \quad 3 / 4-2^{1 / 2}
$$

Steps for Adding and Subtracting Decimals

$$
0.301-0.2
$$

1. Line up the $\qquad$ and place value.
2. Fill in the blanks (on the right) with a zero if there is a place value you did not fill.
3. Add or subtract the numbers by place value starting on the right.
4. Bring down the decimal.

Try it out!
1.5-0.23
$8.5+3.26$
0.45-0.02

## When adding and subtracting decimals, ALWAYS line up the !

Let's Practice!




# Math in Real Life <br> Programming a basketball team's defense against the pick and roll 



By Los Angeles Times, adapted by Newsela staff
11/06/2013
The Golden State Warriors' Harrison Barnes dunks as the Los Angeles Clippers can only watch during the second quarter on Jan. 2, 2013, at Oracle Arena in Oakland, Calif.

LOS ANGELES - From their office window, Rajiv Maheswaran and Yu-Han Chang can catch a glimpse of Staples Center, home arena to both the Los Angeles Lakers and Clippers basketball teams.

To see the future of the NBA, they only have to swivel their heads. Whiteboards inside their office are filled with algorithms in shades of red, blue and green, describing the steps of complicated calculations. Programmers in their office sit around computers inputting lines of complex code.

What resembles gibberish to anyone without a degree in computer science could help NBA teams find the best ways to grab rebounds and defend pick and rolls through a software system developed by Maheswaran and Chang. Both work at the University of Southern California's Viterbi School of Engineering and are the NBA's newest go-to guys. For the first time this season, motion-tracking cameras will be placed in every arena. Their software can make sense of the oceans of analytic data that will be available. "It's 1,000 times more information than anyone had before," said Maheswaran, who has degrees in math, physics and electrical engineering.

## Shaded Green Squares On Screen

On his laptop screen, Maheswaran displayed visual tools that teams could use to tweak lineups and position players for favorable outcomes. One showed a basketball court covered with shaded green squares. The darkest squares show the most likely spots where a rebound would fall depending on the shot taken. Another showed players' success rates in pick-and-roll combinations.

Even the biggest supporters of this type of math admit that these insights should be only one part of a team's decision-making. Traditionally, teams looked at game films and evaluations of players.
But the system Maheswaran and Chang have licensed to four NBA teams through their start-up company, Second Spectrum, could influence the way their clients play. It might even help them construct their list of players. The Golden State Warriors used similar analytics last season when their defense yielded a staggeringly high percentage on three-pointers. Assistant general manager Kirk Lacob said the team checked its defensive rotations, lineups and fatigue metrics and made tweaks accordingly. It worked: teams no longer shredded the Warriors' perimeter defense.
"Did it make 100 percent of the difference, 50 percent of the difference, 20 percent of the difference?" said Lacob, whose team uses data from a California company called MOCAP Analytics. "I don't know the answer. The most important thing is it did help us identify a problem and then eventually correct it." Statistical analysis in the NBA has lagged roughly a decade behind its use in Major League Baseball. One reason is that baseball is slower and easier to analyze. Basketball analytics are mostly based on technology that is still emerging.

## Six Tiny Cameras In Rafters

Golden State, Dallas, Boston, San Antonio, Houston and Oklahoma City were the first NBA teams to use the motion-tracking cameras, developed by STATS LLC, starting with the 2010-11 season. Last season 15 teams used the system. The NBA recently decided to pay for every team to have the system. That would allow a complete data set to be available league-wide, and selected information could be distributed to fans via NBA TV and NBA.com.
It all starts with six tiny cameras placed in the rafters of each NBA arena. They will record the movement of every player, referee and the ball 25 times a second. The data is electronically transmitted to STATS to be categorized into passes, dribbles, shots and rebounds, among other groupings.

Teams can access relatively simple information such as the number of passes into the post in 60 to 90 seconds while games are in progress. More complicated information will be available after the game once the data is processed.

Several teams, including the Los Angeles Clippers, have also hired employees to help sift through the information. "Every team is going to have their own formula that they will create that works for their team in scouting and everything," Clippers coach Doc Rivers said. Los Angeles Lakers assistant Kurt Rambis said a thick packet of data may yield only a handful of numbers coaches pass on to players.
"You can't give players a boatload of information and expect them to implement it out on the floor," Rambis said.

## Geek-Fatigue Factor

Players are conflicted about the value of data - like, which players prefer to shoot after just two dribbles. Said Clippers point guard Chris Paul: "If I just guard him and after two dribbles, I stop, and he takes a third and I say, 'Hey, man, you're only supposed to take two dribbles,' then what?"

There's also the geek-fatigue factor. Lakers center Chris Kaman said he was often overloaded with stats last season when he played for Dallas.
"It got a little bit annoying," he said, "hearing about it all the time - this number and that number, and every day the coach was talking about numbers." Such as? "Points per possession, per second half, per first quarter ... this guy guarding this guy in this game or these five guys did good against these guys but not these guys. There's everything."

Including analytics related to injuries. The Lakers will be able to track Kobe Bryant's accelerations and decelerations upon his return from a torn Achilles tendon, as well as how much load he's putting on his legs during games. That information could help the team's trainers develop practice plans that keep him spry for the rest of the season.

Analytics can also show teams information that could be used in contract talks.
Maheswaran, 39, and Chang, 35, hope more teams leave the number crunching to them.
The duo has worked together since 2005, eventually forming the Computational Behavior Group at USC. They have completed projects for the Department of Defense and the National Science Foundation involving the movement of vehicles. Chang says that it's great that they can go from "detecting enemy targets and tracking them to tracking our favorite players on the court."

SO WHAT DO YOU THINK - HOW DO WE USE MATH IN OUR LIVES? SOUND OFF AND COMMENT BELOW!

| DO-NOW | How would you teach someone to solve this problem? Write a short <br> explanation and then solve. <br> $11.657+12.2896=$ |
| :--- | :--- |
| Homework <br> Reminder | "For the things we have to learn before we can do them, we learn by doing them." <br> - Aristotle |
| Check-In | How are you feeling today? <br> What concepts do you feel you have mastered? What concepts do you want to practice more? |

## A Mixed Number is a Sum?

How can we break down each mixed number below into two separate rational numbers?
$-2^{2 / 5}$
$2 \%$

is the same as
$\qquad$

Why is this helpful to break down mixed numbers?

## Think - Pair - Share - Do $-13 \frac{5}{7}+6-\frac{2}{7}$

## HOW MANY DIFFERENT WAYS CAN YOU BRAINSTORM TO SOLVE THIS PROBLEM?

Think: Record your ideas and notes here!

Pair: Summarize the ideas of your partner(s) here!

Share: what ideas from your other classmates were interesting to you?

DO! Try to solve the problem above using one of the strategies you summarized above!

| $-13 \frac{5}{7}+6-\frac{2}{7}$ |  |
| :--- | :--- |
|  | (Optional) Step 1: Rewrite subtraction as addition. |
|  | Step 2: Break down the mixed number. Reorder the terms (addition is commutative!) |
|  | Step 4: Simplify by combining the fractions. Simplify by combining the whole numbers. |

## Try it Out!

$$
2+-3 / 4 \quad-3+15 / 6 \quad-\frac{4}{7}-\left(-9 \frac{3}{5}\right)
$$

## Extending our Thinking...

What value of x will make the equation below true?

$$
-\frac{7}{8}+x=0
$$

What value of z will make the equation below true?

$$
\left(-\frac{1}{2}-\frac{2}{5}\right)+Z=0
$$

## Balance in Math

Let's Practice! - Task Cards

## Adding and Subtracting Fractions \& Mixed Numbers Task Cards

Record your answers to each task card here. Show ALL of your work on the next page.

| Task Card \#1: | Task Card \#2: |
| :---: | :---: |
| Final Answer: | Final Answer: |
| Justification/Explanation: | Justification/Explanation: |
| Task Card \#3: | Task Card \#4: |
| Final Answer: | Final Answer: |
| Justification/Explanation: | Justification/Explanation: |
| Task Card \#5: | Task Card \#6: |
| Final Answer: |  |
| Justification/Explanation: | Final Answer: |
|  | Justification/Explanation: |
| Task Card \#7: | Task Card \#8: |
| Final Answer: | Final Answer: |
| Justification/Explanation: | Justification/Explanation: |



| DO-NOW | Which one doesn't belong? Why? <br> Finished? <br> Try to think of an answer for all four! |
| :---: | :---: |
| Homework Reminder | Shade in this box if you turned in your homework. <br> "For the things we have to learn before we can do them, we learn by doing them." <br> - Aristotle |
| Check-In | How are you feeling today? <br> What concepts do you feel you have mastered? What concepts do you want to practice more? |

Strategies for Solving Problems

## SOLVINGStEPS

## STEP I: UNDERSTAND THE PROBLEM.

STEP 2: MAKE A PLAN.

STEP 3: SOLVE IT.

STEP 4: CHECK IT.
$\mathrm{B}-$
$\mathrm{U}-$
$\mathrm{C}-$
$\mathrm{K}-$
S

# nutrkerless WORD PROBLEM SORT 

ADDITION How do you know these are odaltion problems?

SUBTRACTION
How do you know these are subtraction problems?

MULTIPLICATION
How do you know these are multiplcation problems?

DIVISION
How do you know these are division problems?

1. Suppose a seventh grader's birthday is today, and she is 12 years old. How old was she $3^{1 / 2}$ years ago?
2. Samantha owes her father $\$ 7$. She just got paid $\$ 5.50$ for babysitting. If she gives that money to her dad, how much will she still owe him?
3. At the start of a trip, a car's gas tank contains 12 gallons of gasoline. During the trip, the car consumes $10^{1 / 8}$ gallons of gasoline. How much gasoline is left in the tank?

## Try it out!

A fish was swimming $3^{1 / 2}$ feet below the water's surface at 7:00 a.m. Four hours later, the fish was at a depth that is $5^{1 / 4}$ feet below where it was at 7:00 a.m. What rational number represents the position of the fish with respect to the water's surface at 11:00 a.m.?

## Practice

POSTER \#__ ANSWER___ POSTER \#___ ANSWER__

POSTER \#__ ANSWER__ POSTER \#__ ANSWER__

| POSTER \#__ ANSWER ____ |  |
| :---: | :---: |
|  |  |
|  |  |
|  |  |




| DO-NOW |  |  |
| :---: | :---: | :---: |
|  | Person A | Person B |
|  | What is the distance between -4 and 5? | What is the distance between 5 and -4 ? |
|  |  |  |
|  | What is the distance between -5 and -3 ? | What is the distance between -3 and -5 ? |
|  |  |  |
|  | What is the distance between 7 and -1 ? | What is the distance between -1 and 7 ? |
|  | $\stackrel{+0!!!!!+!!!!!!!!!!!!!!}{\text { a }}$ |  |
| Homework | Shade in this box if you turned in your homework. <br> "For the things we have to learn before we can do them, we learn by doing them." <br> - Aristotle |  |
|  |  |  |
| Check-In | How are you feeling today? |  |
|  | What concepts do you feel you have mastered? What concepts do you want to practice more? |  |

## Notes and Thoughts

Explore... Think About It: In life, at any given moment, will it always be realistic to use a number line to find the distance between two rational numbers?

Is it the most efficient way to calculate the distance between the two points?
What represents the distance between a number and zero on the number line?

Absolute Value Bars


Just as with parentheses, absolute value symbols serve as grouping symbols: the expression inside the bars must be evaluated and expressed as either zero or a positive quantity before the bars may be dropped.

If the distance between 5 and o can be calculated using $|5-0|$, or $|5|$, do you think we might be able to calculate the distance between -4 and 5 using absolute value? Take a minute to see if it works with these questions from the Do Now.

What is the distance between -4 and 5 ?

$\qquad$
Use the absolute value to answer each of the following questions. Check your work by counting on the number line.
a. What is the distance between o and -8 ?

b. What is the distance between -2 and $-1 / 2$ ?

c. What is the distance between -6 and -10 ?


## Change in vs. Distance:

is always $\qquad$ .

Change in $\qquad$ or $\qquad$ may be $\qquad$ depending on whether it is increasing or decreasing (going up or down).

What strategies can you utilize to find the distance between points on the number line?

Is there a rule or formula that we can use?

## Change in vs. Distance: Practice Identifying Sign

Determine whether each answer will be positive or negative and EXPLAIN. DO NOT solve.

1. A rock climber descends from an elevation of 180 feet above sea level to an elevation of 30 feet above sea level. What total distance did the rock climber travel?

## POSITIVE or NEGATIVE

2. A rock climber descends from an elevation of 180 feet above sea level to an elevation of 30 feet above sea level. Find the rock climber's change in elevation.

## POSITIVE or NEGATIVE

3. The same rock climber climbs from his current position of 30 feet above sea level to a new height of 240 feet above sea level. Find the rock climbers new change in elevation.

## POSITIVE or NEGATIVE

## Guided Examples:

You Draw it!

1. A hiker starts hiking at the beginning of a trail at a point which is 200 feet below sea level. She hikes to a location on the trail that is $\mathbf{5 8 0}$ feet above sea level and stops for lunch. What is the vertical distance between $\mathbf{2 0 0}$ feet below sea level and $\mathbf{5 8 0}$ feet above sea level?
2. After lunch, the hiker hiked back down the trail from the point of elevation, which is 580 feet above sea level, to the beginning of the trail, which is 200 feet below sea level. What is the vertical distance between 580 feet above sea level and 200 feet below sea level?
3. The distance between a negative number and a positive number is $121 / 2$. What could the two numbers be?

| Try it out! | Show your work! |
| :--- | :--- |
| a. Find the distance between -7 and -4. <br> b. Find the change in temperature if the temperature rises from $-18^{\circ} \mathrm{F}$ <br> to $15^{\circ} \mathrm{F}$. |  |
| c. Would your answer for part (b) be different if the temperature |  |
| dropped from $15^{\circ} \mathrm{F}$ to $-18^{\circ} \mathrm{F}$ ? Explain. |  |
| d. What is the change in elevation from 140 feet above sea level to 40 |  |
| feet below sea level? Explain. - |  |

## Summarizing Our Knowledge

What rules can you think of for adding and subtracting rational numbers? What will always be true?
Show and explain using words and pictures!

## Math Fun Facts

If you write out pi to two decimal places, backwards it spells "pie". T he Spiral Shapes of Sunflowers follow a Fibonacci Sequence.

Answer the questions below.

| 1. What is absolute value? | 2. Which character matches <br> the symbolic representation <br> below and why? <br> $\|70\|=70$ | 3. Which character matches <br> the symbolic representation <br> below and why? <br> $\|-30\|=30$ |
| :--- | :--- | :--- |
| 4. What is the distance from <br> the diver to the helicopter? | 5. Using math symbols show <br> the distance from the highest <br> glacier to the sea level. | 6. Using math symbols show <br> the distance from the killer <br> whale to sea level. |
| 7. What is the distance from <br> the highest glacier to the <br> killer whale? | 8. The absolute value of the helicopter is the same as the <br> absolute value of the sunken submarine. Explain this <br> statement using symbols and words. |  |

Write your final answer in the boxes above. Show and explain ALL work here:

| 1. | 2. |
| :--- | :--- | :--- |
| 3. | 4. |
| 5. | 6. |
| 7. | 8. |
|  |  |

When it comes to numbers, there are quite literally infinite levels that can be reached and in turn there are also infinite numbers of facts that relate to numbers in one way or another. Here we're going to focus on the terrific 26, a number that always solves a Rubik's cube or the age many famous figures met their end.
$\star$ The $26^{\text {th }}$ state to join the U.S. was Michigan.
Ł In 1853 Proserpina or Asteroid 26, named after the Roman goddess was discovered.
$\star$ It takes 26 moves or less to solve a Rubik's Cube.
$\star$ In Windows Alt Codes, Alt + 26 produces the "right arrow" or $\rightarrow$ symbol.
$\star$ Twenty-Six is a 2003 novel by Leo McKay, Jr.
$\star$ An Australian Alternative Rock band exists called 26.
$\star$ There are 26 red cards and 26 black cards in a deck of cards.
$\star$ In a human foot there are 26 bones.
$\star$ At 26 years old, males can no longer be drafted into the United States military.
$\star 26$ is known as the "joke throw" in darts and is reached by throwing 20, 5 \& 1 after trying for a treble 20.
$\star 26$ is the atomic number of iron.
^ A 26 face device is known as a rhombicuboctahedron.
$\star$ Lincoln's assassin; John Wilkes Booth was killed aged 26.
$\star$ The original blond bombshell Jean Harlow died aged 26.
$\star$ On $26^{\text {th }}$ June 1977 in Indianapolis, Elvis Presley performed his last ever concert.
$\star$ According to CureEpilepsy.org, 1 in 26 Americans will develop epilepsy during their life.
$\star$ The $26^{\text {th }}$ amendment or "Old Enough to Fight, Old Enough to Vote" amendment, passed on $10^{\text {th }}$ March 1971 was a huge change to youth responsibly and values, giving all those over 18 the right to vote.
$\star$ Walt Disney has won the most Oscars ever, this stands at 26.
$\star$ This is page 26 of your workbook!
$\star$ Theodore Roosevelt was the $26^{\text {th }}$ president of the U.S. In the bosonic string theory, there are 26 space time dimensions.
$\star$ Opal is the gift for a couple's $26^{\text {th }}$ wedding anniversary.
Ł In 2026 Heinz von Foerster predicts that a level of technological singularity will be reached, an almost equal par between man and machine.

* In Italian; 'precipitevolissimevolmente' has 26 letters and is the equivalent of the English ASAP.
$\star$ It takes an average person 13 seconds to count from 1 to 26.
$\star$ There are 26 ganglions in the sympathetic system of the body.


## 

## Workbook Reflection

Answer the question as completely as possible, using evidence from what we have learned this unit. Justify your response with examples and evidence from throughout the packet.

Describe the difference between a change in temperature and a change in distance. Which can be negative? Why?

Choose your favorite of the following methods of solving real-world scenario problems. Explain why you like to use it!

- Number Lines
- Draw a Model
- BUCKS/Understand-Plan-Solve-Check
$\square$
What lesson most challenged your thinking?

To what extent do you feel confident in your skills from Unit 1?

Flip through your packet, and look to see if you shaded the box every day for turning in your homework. How many days did you shade it in?

| Lesson 6 | Lesson 7 | Lesson 8 | Lesson 9 |
| :--- | :--- | :--- | :--- |

If you didn't finish it each night, consider why $\rightarrow$

Would you like to come in during lunch or recess for support?

