Readiness: Scuba Diving

AUTHOR INTENT
Scuba diving is a real-world activity where each diver has to be responsible for their own safety. The safety of the divers relies on mathematics. The math reviewed in the problems presented in this Readiness lesson includes the use of fractions, integers, and absolute values. Students will add and subtract fractions to prepare for the lessons Adding Integers, Adding Rational Numbers, Subtracting Integers, and Subtracting Rational Numbers. The topics of absolute value and comparing integers prepare students for the lesson Distance on a Number Line.

Example 1
Students consider the water pressure that a diver experiences as he or she descends. The pressure is given as a fraction of an atmosphere. The fractions in the subtraction problem do not have common denominators. Students must rewrite the fractions as equivalent fractions with a common denominator and then subtract to find the increase in pressure in terms of an atmosphere.

Example 2
Students must visualize a diver on a boat and the diver beneath the ocean’s surface to find the total vertical distance that the diver travels. Students use absolute value to find the distance, but are also given a visual of the distance using a number line.

Example 3
The problem presents a list of the events that a diver experiences during a particular dive. Students use a number line to plot points that represent the events and compare the location of the points.

INTRO (5 MIN)
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Let’s Discuss
Scuba diving requires a want-to-be-diver to complete a series of weekly classes and pass a test to become certified. You can lead the discussion to answer the questions by asking students why a person would be interested in a sport for which he or she must receive extensive training.

Discuss with students the types of numbers involved with scuba diving, such as ascension rates, water pressures, air supply levels, or anything else about scuba diving safety. Explain that if a diver does not pay attention to these numbers, he or she may quickly find himself or herself in a dangerous, possibly life threatening, situation.

Team Work
The teams should discuss the map given at the beginning of the activity and be certain that all team members understand how to read such a map. The rectangle with the white diagonal is the PADI flag. PADI stands for Professional Association of Diving Instructors and is the leading scuba diving training organization in the world. On the map, the locations of diving sites are marked by the PADI flag.
LEARN: ADDING AND SUBTRACTING FRACTIONS (3 MIN)

Questions for Understanding

Before solving the problem
• What is atmospheric pressure? [The atmosphere is a layer of gases which surrounds the entire Earth. Atmospheric pressure is the downward pressure of the weight of the atmosphere above you.]
• What is water pressure? [It is the downward pressure of the weight of the water above you. You experience water pressure in addition to the pressure of the atmosphere.]

While solving the problem
• Why can you multiply the numerator and denominator of each fraction? Why does it not change the value of the fraction? [Any number over itself equals 1 and multiplying any number by 1 does not change its value. So you can multiply the numerator and denominator of the fraction by the same number and it does not change the value of the fraction.]

Error Prevention
Be sure students are using a common denominator. An answer of \( \frac{9}{8} \) or \( 1 \frac{1}{8} \) suggests that the student subtracted the numbers in the numerator and subtracted the numbers in the denominators.

Additional Example
At 11 ft below the surface: water pressure = \( \frac{1}{3} \) atmosphere

At 50 ft below the surface: water pressure = \( \frac{50}{33} \) atmospheres

What is the difference in pressures at 11 feet below the surface and 50 feet below the surface? \( \frac{13}{11} \) atmospheres

LEARN: FINDING ABSOLUTE VALUES (4 MIN)

Questions for Understanding

While solving the problem
• How many feet does the diver travel to reach the surface of the water once the diver jumps? [3]
• How many feet does the diver travel to reach the desired depth in the water? [25]
• For both distances questioned above, was the diver traveling in the same direction? [yes]

After solving the problem
• Why was it necessary to use absolute value to solve this problem? [Because the diver was traveling in the same direction, he started from a positive location and ended at a negative location relative to the surface of the water. The distances are both positive, even though the position of one of the depths is negative.]

Additional Example
A diver steps off the deck of a boat 2 ft above the ocean’s surface and descends to a depth of 82 ft. What vertical distance does the diver travel? [84 ft]
LEARN: COMPARING AND ORDERING INTEGERS (3 MIN)

Questions for Understanding

While solving the problem
• How does using a number line help to order the integers? [When the numbers are placed on a number line, the order from least to greatest is shown visually as the numbers from left to right.]

After solving the problem
• When the diver is back on the boat after the dive, what position represents his location? [3 ft]

Additional Example
If during this dive, the diver stopped at a depth of 15 ft to adjust some his equipment, where does this event go in the order of the events? [between −12 and −20 on the number line]

CLOSE (5 MIN)

Bring the two teams together to wrap up the lesson. You might choose a representative from each team to fill in the team report for the activity. Check that the information in each table is filled in correctly. If not, question students about how they came up with their information.

On the second screen, details about diver safety and a diver’s log are given. This information provides students more opportunities to review the skills of adding and subtracting fractions, finding absolute values, and comparing integers.
Restaurant Math

TEAM K ACTIVITY (20 MIN) __________________________________________

In the first part of the activity, students review a map to find the location of several sunken ships off the coast of North Carolina that are popular diving locations. Students will use the depths given on the map to solve problems later in the activity. In the second part of the activity, students order and compare various depths that specific activities took place.

Solution Notes
Four wreck locations are given on the map, but students will use only two of the locations in this activity.

For Questions 1 – 3, the location of the diver is given in the direction line. Students must use this value along with the values from the map to solve these problems.

In Question 4, only one of the fractions will have to be rewritten because 33 is a multiple of 11.

For Question 5, students must use the information given in Question 4 about the pressure experienced in the first dive.

In Question 6, there are six lines in the table, but the answer will only include five integers. Students need to realize that they do not have to repeat the integer 5 when listing the numbers from least to greatest.

Error Prevention
Students need to think of the locations given above the ocean’s surface as positive numbers and the locations given below the ocean’s surface as negative numbers.

TEAM G ACTIVITY (20 MIN) __________________________________________

As in the Team K Activity, in the first part of the activity includes a map of ship wrecks off the coast of North Carolina. Only one of the wrecks used in this activity is the same as the wrecks used by Team K.

This activity reviews the same skills as the Team K Activity, but uses a dive with a deeper depth.

Solution Notes
For Questions 1 – 3, the location of the diver is given in the direction line. Students must use this value along with the values from the map to solve these problems.

Question 5 requires students to use the information given in Question 4 about the pressure experienced in the second dive.

In Question 6, there are six lines in the tables, but the answer will only include five integers. Students need to realize that they do not have to repeat the integer 6 when listing the numbers from least to greatest.

Error Prevention
For Question 4, only one of the numbers in the subtraction problem is a fraction. Students will need to remember that a whole number can be written as a fraction. In this case the whole number is 1. Because \( \frac{5}{3} \) has a denominator of 3, the fraction for 1 is written as \( \frac{3}{3} \).