Unit 5 Summary

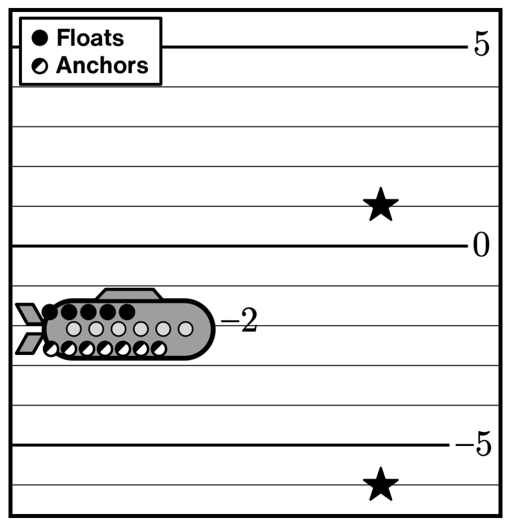
Prior Learning	Grade 7, Unit 5	Later in Grade 7	Grade 8 & HS
Grades 3–5 • Fraction and decimal operations Grade 6 • Negative numbers • Solving equations	• Operations with positive and negative numbers • Applying operations	Unit 6 • Solving equations with positive and negative numbers	• Rational and irrational numbers • Square roots and cube roots

Adding and Subtracting

We can think of adding and subtracting numbers as adding and removing floats and anchors.

For example, to get the submarine from -2 to 1, you can add three floats or remove three anchors. To get from -2 to -6, you can either remove four floats or add four anchors.

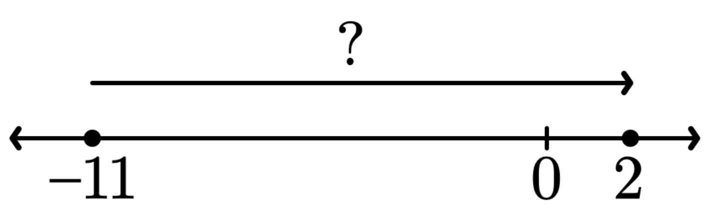
Start	Action	Final Value
-2	Add 3 floats	$-2 + 3 = 1$
-2	Remove 3 anchors	$-2 - (-3) = 1$
-2	Add 4 anchors	$-2 + (-4) = -6$
-2	Remove 4 floats	$-2 - 4 = -6$



We can also think of adding and subtracting numbers as movement on a number line.

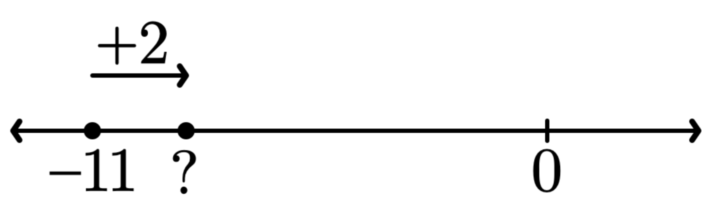
$2 - (-11)$ is another way of asking: *What is the distance from* -11 *to* 2*?*

$2 - (-11) = 13$



$(-11) + 2$ is another way of asking: *What is the point on the number line* that is 2 *to the right of* -11*?*

$(-11) + 2 = -9$



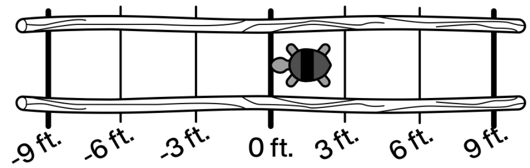
Multiplying and Dividing

One way to imagine multiplying positive and negative numbers is to use distance, rate, and time.

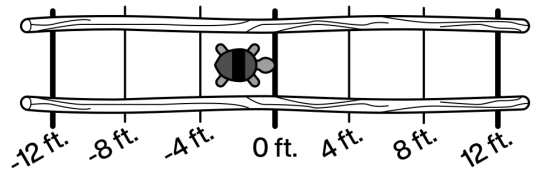
For example, this turtle starts at 0 feet and travels west at a rate of -3 feet per second.

In 2 seconds it will be at $(-3) \cdot 2 = -6$ feet.

2 seconds ago, the turtle was at $(-3) \cdot (-2) = 6$ feet.



A second turtle travels east. 3 seconds ago it was at -12 feet, so its rate is $\frac{-12}{-3} = 4$ feet per second.



Applications With Positive and Negative Numbers

Positive and negative numbers are useful in a variety of real-world situations.

A utility company charges $\$0.19$ per kilowatt-hour of energy that a customer uses.

They also give a credit of $-\$0.17$ for every kilowatt-hour of electricity that a customer with a solar panel generates.

This family used $\frac{180.5}{0.19} = 950$ kWh of electricity.

They also generated $\frac{-136.85}{-0.17} = 805$ kWh.

Bill

	Kilowatt Hours (kWh)	Charge/ Credit per kWh	Total Charge/ Credit
Electricity Used		$\$0.19$	$\$180.50$
Electricity Generated		$-\$0.17$	$-\$136.85$
Total Due			

The total due for this bill is $180.5 + (-136.85) = 43.65$ dollars.

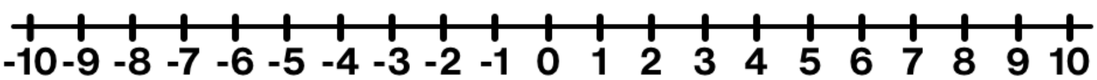
Try This at Home

Adding and Subtracting

1. Select all of the expressions that have the same value as $3 + (-5)$.

☐ $-3 + (-5)$ ☐ $5 - 3$ ☐ $-5 + 3$ ☐ $3 - 5$

2. Use the number line to show the value of $3 + (-5) =$ _____.



Determine the value of the variable that makes each equation true.

3.1 $-2 + a = 5$

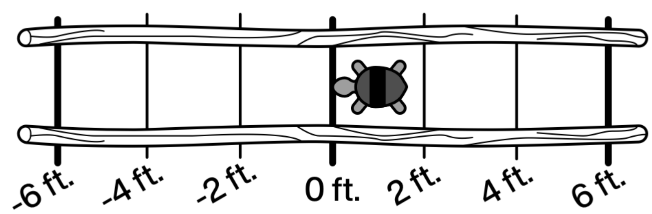
3.2 $7.5 - b = 12$

3.3 $\frac{2}{3} + c = -\frac{4}{3}$

Multiplying and Dividing

A turtle is traveling west at a rate of -2 feet per second. Right now the turtle's position is at 0 feet.

4.1 Calculate $(-2) \cdot 5$. What does this tell us about the turtle's journey?



Match each expression to a question for which it could help answer.

4.2 $-2 \cdot 5$

4.3 $-2 \cdot (-5)$

4.4 $\frac{5}{-2}$

Questions
When was the turtle at 5 feet?
Where will the turtle be in 5 minutes?
Where was the turtle 5 minutes ago?

desmos

Unit 7.5, Family Resource

Applications With Positive and Negative Numbers

Each year in September, the Arctic sea ice reaches its annual minimum levels. The table below shows minimums for various years, measured in square kilometers.[1]

Year	Arctic Sea Ice Minimums (square kilometers)
1980	7 670 000
1990	6 140 000
2000	6 250 000
2010	4 870 000
2019 (latest available data)	4 320 000

5. During which decade did the Arctic sea ice minimum change the most?

6. What was the approximate change in square kilometers of ice during this decade? Show whether the change was positive or negative.

7. What was the average rate of change of ice each year during this decade?

[1] "Arctic Sea Ice Minimum," Global Climate Change: Vital Signs of the Planet, https://climate.nasa.gov/vital-signs/arctic-sea-ice/

desmos

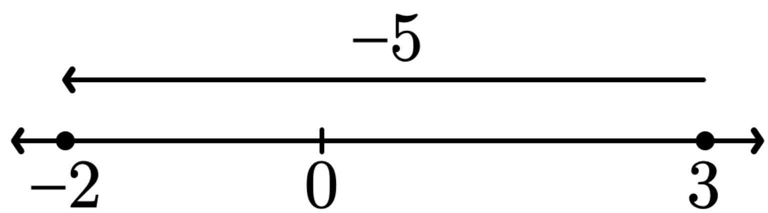
Unit 7.5, Family Resource

Solutions:

1. ✓ $-5 + 3$

   ✓ $3 - 5$

2.



3.1 $a = 7$

3.2 $b = -4.5$

3.3 $c = -2$

4.1 -10. *Explanations vary*. This number tells us that the turtle's position in 5 seconds will be -10 feet.

4.2 Where will the turtle be in 5 minutes?

4.3 Where was the turtle 5 minutes ago?

4.4 When was the turtle at 5 feet?

5. The Arctic summer sea ice changed the most from 1980 to 1990.

6. $6\ 140\ 000 - 7\ 670\ 000 = -1\ 530\ 000$ square kilometers.

7. On average, Between 1980 and 1990, the ice changed by $\frac{6\ 140\ 000 - 7\ 670\ 000}{10} = -153\ 000$ square kilometers per year.