GRADE 7 · UNIT 3 · LESSON 5

Real-World Problems

Adding and Subtracting

MA.7.NSO.2.3

I can solve real-world problems by adding and subtracting rational numbers.

Four lessons of practice. Now the words come back.

The arithmetic is the easy part of today.

Deciding what to subtract from what is the work.

Warm-Up

On your own. Number your paper 1 to 4.

Your account starts the week with $84.50. Three things happen, in this order:

−$22.75 **+$40.00** **−$61.30**

1. Balance after the first change?
2. Balance after the second change?
3. Balance after the third change?
4. Which change moved the balance the most?

Notes

I. Money In, Money Out

A. **credit** — money added to an account — written as a positive number

B. **debit** — money taken out of an account — written as a negative number

C. Running balance: start with the beginning balance, then add every change in order.

1. The ending balance of one step is the starting balance of the next.

Notes

II. Change Means Final Minus Beginning

A. **change = final value − beginning value**

1. The order is not optional. This is Lesson 2 inside a story.

B. Positive change means up. Negative change means down.

C. True for elevation, temperature, a bank balance and a stock price.

An elevation goes from 88.2 ft below sea level to 56.3 ft below sea level:

−56.3 − (−88.2) = +31.9 ft

Positive, so it went UP — the hiker climbed 31.9 feet.

Notes

III. Departure from the Average

A. **departure from the average** — the actual value minus the average value

B. Negative departure is below average. Positive is above.

C. **actual = average + departure**

D. **average = actual − departure**

1. Both come from the same sentence, rearranged.

Notes

IV. Check the Answer Against the Story

A. **Check the sign.** Does up or down match what the words said?

B. **Check the size.** Is the answer roughly what you would have guessed?

   1. A balance that started near $500 does not end at $5,000.

C. If either check fails, you have the right numbers in the wrong order.

Example 1

A checking account. Find the ending balance.

Starting balance	$412.80		$412.80
Transaction 1	−$96.45		
Transaction 2	+$150.00		
Transaction 3	−$208.90		

Three transactions. What goes in the middle column?

Not the answers yet — the expression you would write.

Example 1

A checking account. Find the ending balance.

Starting balance	$412.80		$412.80
Transaction 1	−$96.45	412.80 + (−96.45)	$316.35
Transaction 2	+$150.00		
Transaction 3	−$208.90		

A debit is added, because it is already negative.

Example 1

A checking account. Find the ending balance.

Starting balance	$412.80		$412.80
Transaction 1	−$96.45	412.80 + (−96.45)	$316.35
Transaction 2	+$150.00	316.35 + 150.00	$466.35
Transaction 3	−$208.90		

$316.35 was the ending balance. Now it is the starting balance.

Example 1

A checking account. Find the ending balance.

Starting balance	$412.80		$412.80
Transaction 1	−$96.45	412.80 + (−96.45)	$316.35
Transaction 2	+$150.00	316.35 + 150.00	$466.35
Transaction 3	−$208.90	466.35 + (−208.90)	**$257.45**

$257.45. Started near $400, ended near $250, and three plausible transactions happened.

Example 2

Departure from the average. Two questions, one sentence.

Find the actual

The average is 78.4°F.

The departure is −3.6°F.

Find the average

The actual is 66.2°F.

The departure is −5.9°F.

Same relationship both times. Which one is missing?

One of these adds the departure. The other subtracts it. Decide which, before computing.

Example 2

Departure from the average. Two questions, one sentence.

Find the actual

The average is 78.4°F.

The departure is −3.6°F.

78.4 + (−3.6) = 74.8°F

Below average, so the day was cooler.

Find the average

The actual is 66.2°F.

The departure is −5.9°F.

Missing the actual, so add the departure.

Below average by 3.6, so 3.6 cooler than 78.4.

Example 2

Departure from the average. Two questions, one sentence.

Find the actual

The average is 78.4°F.

The departure is −3.6°F.

78.4 + (−3.6) = 74.8°F

Below average, so the day was cooler.

Find the average

The actual is 66.2°F.

The departure is −5.9°F.

66.2 − (−5.9) = 72.1°F

The average is HIGHER than the day was.

Whiteboards · Question 1 of 9

Boards up on three.

A balance of $12.50.

Then a transaction of −$40.75.

What is the new balance?

A balance is allowed to be negative. That is what overdrawn means.

Whiteboards · Question 1 of 9

Answer.

Add the transaction — it is already negative.

12.50 + (−40.75). Different signs; 40.75 is farther from zero.

−$28.25

Whiteboards · Question 2 of 9

Boards up on three.

An elevation goes from −312.6 ft to −180.4 ft.
What is the change in elevation?

Write the subtraction before you write the answer.

Whiteboards · Question 2 of 9

Answer.

change = final − beginning: $-180.4 - (-312.6)$

Add the opposite: $-180.4 + 312.6$

Positive, so the elevation went UP.

+132.2 ft, a climb

Whiteboards · Question 3 of 9

Boards up on three.

An elevation goes from 45.8 ft to −22.3 ft.

What is the change in elevation?

Same rule. This one crosses sea level.

Whiteboards · Question 3 of 9

Answer.

change = final − beginning: $-22.3 - 45.8$

Add the opposite: $-22.3 + (-45.8)$

Negative, so the elevation went DOWN.

−68.1 ft, a drop

Whiteboards · Question 4 of 9

Boards up on three.

The average is 78.4°F.

The departure is −3.6°F.

What was the actual temperature?

Which one is missing? That decides add or subtract.

Whiteboards · Question 4 of 9

Answer.

$$\text{actual} = \text{average} + \text{departure}$$

$$78.4 + (-3.6)$$

A negative departure means below average.

74.8 °F

Whiteboards · Question 5 of 9

Boards up on three.

The actual was 66.2°F.

The departure is −5.9°F.

What was the average?

The answer is bigger than 66.2. Work out why before you commit.

Whiteboards · Question 5 of 9

Answer.

$$\text{average} = \text{actual} - \text{departure}$$

$$66.2 - (-5.9) = 66.2 + 5.9$$

The day was below normal, so normal is warmer.

72.1 °F

Whiteboards · Question 6 of 9

Boards up on three.

Devon found the change from −312.6 ft to −180.4 ft like this:

−312.6 − (−180.4) = −132.2 ft

and said the hiker went DOWN 132.2 feet.

The table says he climbed. What went wrong?

His arithmetic is perfect. Look at the order.

Whiteboards · Question 6 of 9

Answer.

He computed beginning − final, not final − beginning.

Right distance, wrong sign — and perfect arithmetic.

Only the story catches it: −180.4 is ABOVE −312.6.

+132.2 ft, a climb

Whiteboards · Question 7 of 9

Boards up on three.

Two days of departure from the average:

Monday −1.10°F Friday −2.37°F

What is the change in departure, Monday to Friday?

A −3.47 °F B −2.37 °F C −1.27 °F D +1.27 °F

Write the subtraction before you write the answer.

Whiteboards · Question 7 of 9

Answer.

change = final − beginning: $-2.37 - (-1.10)$

Add the opposite: $-2.37 + 1.10$

Both days were below average; Friday was further below.

C. −1.27°F

Whiteboards · Question 8 of 9

Boards up on three.

A stretch of the hike begins 56.3 feet below sea level and ends 87.1 feet below sea level. What is the change in elevation?

A −143.4 ft **B** −30.8 ft **C** +30.8 ft **D** +143.4 ft

Write each elevation as a signed number first.

Answer.

$$-87.1 - (-56.3)$$

Add the opposite: $-87.1 + 56.3$

Negative, so the hiker went further down.

B. −30.8 ft, a drop

Whiteboards · Question 9 of 9

Boards up on three.

Sun −2.80 Mon −1.10 Tue −1.70 Wed 1.62

Thu 2.23 Fri −2.37 Sat 3.35

Add all seven. Show your two subtotals, then the answer.

Negatives on one line, positives on the next. Work first, answer second.

Whiteboards · Question 9 of 9

Answer.

negatives: $-2.80 - 1.10 - 1.70 - 2.37 = -7.97$

positives: $1.62 + 2.23 + 3.35 = 7.20$

$-7.97 + 7.20$

−0.77°F in total, so cooler

IXL

Last five minutes.

Open IXL and start today's skills.

Work on paper where the question needs work. The answer box does not show it.

Whatever you do not finish is tonight's practice.

The skills for today are posted in Google Classroom.