GRADE 7 · UNIT 3 · LESSON 6

Real-World Problems
Multiplying and Dividing

MA.7.NSO.2.3

I can solve real-world problems by multiplying and dividing rational numbers.

Yesterday the words told you to add or subtract.

Today they will not tell you anything.

Deciding whether to multiply or divide is the whole lesson.

Warm-Up

On your own. Number your paper 1 to 4.

A drill goes down 2.5 feet every hour.

1. How deep is the hole after 6 hours? Write the answer as a negative number.
2. How many hours does it take the drill to reach −60 feet?
3. Which of those two needed multiplication, and which needed division?
4. How could you tell from the words, without doing any arithmetic?

Notes

I. Rate Problems

A. **rate** — how much something changes per unit — per hour, per mile, per pound

B. **total change = rate × time**

C. **time = total change ÷ rate**

1. Whichever one is missing tells you which operation to use.

D. A rate that goes down is negative. Longer at that rate means a more negative total.

Notes

II. A Fraction of a Value

A. “Drops by a fraction” means multiply by what is **left**.

1. Drops by three-fourteenths, so eleven-fourteenths is left.

B. “Grows by a fraction” means multiply by **one plus** that fraction.

1. Marked up by two-fifths means multiplied by seven-fifths.

A car loses three-fourteenths of its value, so what it keeps is:

$$1 - \frac{3}{14} = \frac{11}{14}$$

Notes

III. Two Steps in a Row

A. Do one step, write down what the answer means, then do the next.

    1. “$14,425.71 is the value after one year” — label it, or you will lose it.

B. The answer to step one is the starting number for step two.

C. **Do not round in the middle. Round once, at the end.**

    1. Rounding early is how a correct method produces a wrong answer.

Notes

IV. Multiply or Divide?

A. Ask what the question is **missing**, not what words it uses.

   1. Florida's standards name keyword hunting as a misconception. It fails here.

B. Finding a total from a rate and a time? Multiply.

C. Finding how many of something fit? Divide.

D. Then estimate: should the answer be bigger or smaller than what you started with?

Example 1

Ramon paid $18,360 for a car. It loses 3/14 of its value in year one, then 2/9 of that in year two.

Does the car keep 3/14 of its value, or 11/14?

It LOSES three-fourteenths. Nothing has been computed yet.

Example 1

Ramon paid $18,360 for a car. It loses 3/14 of its value in year one, then 2/9 of that in year two.

Step 1	Year one: the car KEEPS eleven-fourteenths. Do not compute it yet.	$18360 \times \frac{11}{14}$

Left as a product on purpose. Notes III: do not round in the middle.

Example 1

Ramon paid $18,360 for a car. It loses 3/14 of its value in year one, then 2/9 of that in year two.

Step 1	Year one: the car KEEPS eleven-fourteenths. Do not compute it yet.	$18360 \times \frac{11}{14}$
Step 2	Year two: it keeps seven-ninths of that. Still nothing rounded.	$18360 \times \frac{11}{14} \times \frac{7}{9}$

Two years, one expression, nothing rounded yet.

Example 1

Ramon paid $18,360 for a car. It loses 3/14 of its value in year one, then 2/9 of that in year two.

Step 1	Year one: the car KEEPS eleven-fourteenths. Do not compute it yet.	$18360 \times \frac{11}{14}$
Step 2	Year two: it keeps seven-ninths of that. Still nothing rounded.	$18360 \times \frac{11}{14} \times \frac{7}{9}$
Step 3	Eleven-fourteenths times seven-ninths is eleven-eighteenths.	$18360 \times \frac{11}{18}$

$11,220

11/14 × 7/9 = 77/126 = 11/18, and 18,360 ÷ 18 = 1,020.

Example 2

A drilling rig is at −147.5 feet. It drills 2.5 feet deeper every hour.

How long has it been running?

Given the depth, asked for the time.
So divide.

How many MORE hours to reach −250 feet?

Which is missing — the total, or the time?

Then read the second question twice. It is not asking the same thing.

Example 2

A drilling rig is at −147.5 feet. It drills 2.5 feet deeper every hour.

How long has it been running?

Given the depth, asked for the time.
So divide.

$$-147.5 \div (-2.5) = 59$$

59 hours.

How many MORE hours to reach −250 feet?

59 hours to get where it already is.

Two negatives divided give a positive — and time is never negative.

Example 2

A drilling rig is at −147.5 feet. It drills 2.5 feet deeper every hour.

How long has it been running?

Given the depth, asked for the time.
So divide.

$$-147.5 \div (-2.5) = 59$$

59 hours.

How many MORE hours to reach −250 feet?

Find the distance still to go first:
−250 − (−147.5) = −102.5

$$-102.5 \div (-2.5) = 41$$

41 MORE hours.

Whiteboards · Question 1 of 9

Boards up on three.

A submarine descends 18.5 ft each minute.

How far does it go in 12 minutes?

Multiply or divide?

One word. Do not compute it.

Whiteboards · Question 1 of 9

Answer.

The rate and the time are both given.

The total is missing: total = rate × time.

multiply

Whiteboards · Question 2 of 9

Boards up on three.

A submarine descends 18.5 ft each minute.

How long to reach −259 ft?

Multiply or divide?

Same submarine. Same words. Read what is missing.

Whiteboards · Question 2 of 9

Answer.

The rate and the total are both given.

The time is missing: time = total ÷ rate.

divide

Whiteboards · Question 3 of 9

Boards up on three.

A drone climbs 42.5 ft per minute.

How high is it after 8 minutes?

Include the unit.

Whiteboards · Question 3 of 9

Answer.

Total = rate × time: 42.5×8

A climb, so the answer is positive.

340 ft

Whiteboards · Question 4 of 9

Boards up on three.

A diver descends at −16.2 ft per minute.
How long to reach −81 ft?

Two negatives. What sign is the time?

Whiteboards · Question 4 of 9

Answer.

Time = total ÷ rate: $-81 \div (-16.2)$

Two negatives, so positive. Time always is.

5 minutes

Whiteboards · Question 5 of 9

Boards up on three.

A $240 bike loses one-sixth of its value.
What is it worth now?

Multiply by what is LEFT, not by what was lost.

Answer.

It loses 1/6, so it keeps:

Multiply by what is left.

$$240 \times \frac{5}{6} = 200$$

Whiteboards · Question 6 of 9

Boards up on three.

A $45 jacket is marked up by two-fifths. What is the new price?

This one goes UP. Multiply by one plus the fraction.

Answer.

Marked UP, so it is worth more than $45.

One plus two-fifths is seven-fifths:

$$45 \times \frac{7}{5} = 63$$

Whiteboards · Question 7 of 9

Boards up on three.

The temperature is −8.8°C. Over the next 3 weeks it rises an average of 3.2°C each week. What is the temperature at the end of the 3 weeks?

A −18.4 °C **B** −0.8 °C **C** 0.8 °C **D** 9.6 °C

Find the total change first. Then add it to where you started.

Whiteboards · Question 7 of 9

Answer.

Total change: $3 \times 3.2 = 9.6$

Start plus change: $-8.8 + 9.6$
A rise, so the answer moves up the number line.

C. 0.8°C

Whiteboards · Question 8 of 9

Boards up on three.

A penguin dives to a fish at an elevation of −10.3 ft. It takes 2/5 of a minute. What is the penguin's rate of change of elevation, in feet per minute?

A −25.75 ft/min **B** −5.15 ft/min **C** −4.12 ft/min **D** 25.75 ft/min

A rate of change is signed. Dividing by a fraction makes it larger in SIZE.

Whiteboards · Question 8 of 9

Answer.

rate = change ÷ time: $-10.3 \div 2/5$

Dividing by 2/5 is multiplying by 5/2.

$-10.3 \times 5/2 = -25.75$

A. −25.75 feet per minute

Whiteboards · Question 9 of 9

Boards up on three.

Tanner's plane is at 3,740 feet 8.8 minutes after takeoff and climbs at a constant rate. When will it reach a cruising altitude of 34,000 feet?

Two steps. Find the rate per minute first, then use it. Show both.

Whiteboards · Question 9 of 9

Answer.

Rate: 3,740 ÷ 8.8 = 425 feet per minute

Time: 34,000 ÷ 425
That is minutes after takeoff, not extra minutes.

80 minutes

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.