NAME Bartlett DATE PERIOD

Unit 4, Lesson 7: One Hundred Percent

Let's solve more problems about percent increase and percent decrease.

Pair-Share
Whole class

5 mins.

7.1: Notice and Wonder: Double Number Line

original quantity of 100% is 10

cups of chocolate milk: 0, 1, 5, 10, 15, 20, 25, 30, 35

0%, 10%, 50%, 100%, 150%, 200%, 250%, 300%, 350%

What do you notice? What do you wonder? (E.g.)

Notice

- If 100% is amount needed, you need 10 cups of chocolate milk
- A cup is 10% of a quantity

Wonder

- If the number lines say how much chocolate milk is needed, could we use them to double or triple the recipe?
- What would it mean to have negative numbers on the lines?

7.2: Double Number Lines

15 mins. 5 min. Independent 5 min. w/ (or alone) Partner

For each problem, complete the double number line diagram to show the percentages that correspond to the original amount and to the new amount.

always going to correspond to 100%

1. The gas tank in dad's car holds 12 gallons. The gas tank in mom's truck holds 50% more than that. How much gas does the truck's tank hold?

18 gallons

gas (gallons): 0, 6, 12 +6 = 18

0%, 50%, 100% +50% = 150%

$(1.5) \cdot 12 = C$

2. At a movie theater, the size of popcorn bags decreased 20%. If the old bags held 15 cups of popcorn, how much do the new bags hold?

12 cups

popcorn (cups): 0, 3, 6, 9, 12, 15 −3 = 12, 18

0%, 20%, 40%, 60%, 80%, 100% −20% = 80%, 120%

$(0.80) \cdot 15 = C$

ME DATE PERIOD

3. A school had 1,200 students last year and only 1,080 students this year. What was the percentage decrease in the number of students?

10% decrease

number of people	0	120	240	360	480	600	720	840	960	1080	1200
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

$a \cdot (1,200) = 1,080$

4. One week gas was $1.25 per gallon. The next week gas was $1.50 per gallon. By what percentage did the price increase?

20% increase

price of gas (dollars)	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2
	0%	20%	40%	60%	80%	100%	120%	140%	160%

$a \cdot (1.25) = 1.50$

5. After a 25% discount, the price of a T-shirt was $12. What was the price before the discount?

$16

price of shirt (dollars)	0	4	8	12	16	20
	0%	25%	50%	75%	100%	125%

$(0.75) \cdot b = 12$

6. Compared to last year, the population of Boom Town has increased 25%. The population is now 6,600. What was the population last year?

5,280 people

number of people	0	1320	2,640	3,960	5,280	6,600
	0%	25%	50%	75%	100%	125%

$(1.25) \cdot b = 6,600$

Each equation is written using this structure: A% of B is C

Multiply

A% × B = C

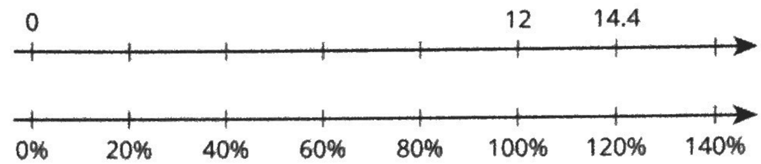
7.3: Representing More Juice

Two students are working on the same problem:

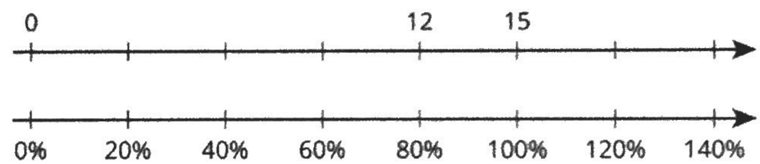
A juice box has 20% more juice in its new packaging. The original packaging held 12 fluid ounces. How much juice does the new packaging hold?

CORRECT

- Here is how Priya set up her double number line.



- Here is how Clare set up her double number line.



Q: If package has more than started w/, is that more or less than 100%?

Do you agree with either of them? Explain or show your reasoning.

Priya is correct, because if the juice box is getting 20% more than what it starts with that means it will be more than the full capacity (which is 100%). So the original amount is 100%. and the new amount is 120%.

Are you ready for more?

Clare's diagram could represent a percent decrease. Describe a situation that could be represented with Clare's diagram.

% decrease.

ME

DATE PERIOD

Unit 4, Lesson 8: Percent Increase and Decrease with Equations

1 = 100%

Let's use equations to represent increases and decreases.

5 mins.

8.1: From 100 to 106

How do you get from one number to the next using multiplication or division?

- From 100 to 106 $\times (1.06)$
- From 100 to 90 $\times (0.90)$
- From 90 to 100 $\div (0.90)$
- From 106 to 100 $\div (1.06)$

8.2: Interest and Depreciation

3 mins. Independent, partner, whole class

10 mins.

$1.06x$

$(1+0.06)x$

$x + 0.06x$

1. Money in a particular savings account increases by about 6% after a year. How much money will be in the account after one year if the initial amount is a) \$100? b) \$50? c) \$200? d) \$125? e) x dollars? If you get stuck, consider using diagrams or a table to organize your work.

e) $1.06x$ or $1\frac{6}{100}x$ or $1\frac{3}{50}x$ etc.

a) \$106 because $100 \cdot (1.06) = 106$

b) \$53 because if 6% of 100 is 6, then 6% of 50 is 3. $50+3=53$

c) \$212 because if 6% of 100 is 6, then 6% of 200 is 12. $200+12=212$

d) \$132.50. ~~\$25 ... If we deposit~~ If we deposit \$25, after one year we would have \$26.50, because it is half of the amount we would have if we deposited \$50 (b). If we deposit \$125, we have \$132.50 because $106 + 26.50 = 132.50$

2. The value of a new car decreases by about 15% in the first year. How much will a car be worth after one year if its initial value was a) \$1,000? b) \$5,000? c) \$5,020? d) x dollars? If you get stuck, consider using diagrams or a table to organize your work.

a) \$850. After one year, the car is worth 85% of original because $100-15=85$. $1{,}000 \cdot (0.85) = 850$.

b) \$4,250 since $5{,}000 \cdot (0.85) = 4{,}250$

c) \$4,267 since $5{,}020 \cdot (0.85) = 4{,}267$

d) $0.85x$ or $\frac{85}{100}x$ or $\frac{17}{20}x$ etc.

or $x - 0.15x$ or $(1-0.15)x$

5 mins. 2 min Indep. think/work 2 min pair share whole discussion

.3: Matching Equations

Match an equation to each of these situations. Be prepared to share your reasoning.

1. The water level in a reservoir is now 52 meters. If this was a 23% increase, what was the initial depth?

   $1.23x = 52$

2. The snow is now 52 inches deep. If this was a 77% decrease, what was the initial depth?

   $0.23x = 52$

#2 $0.23x = 52$ #1 $1.23x = 52$

X $0.77x = 52$ X $1.77x = 52$

Are you ready for more?

An astronaut was exploring the moon of a distant planet, and found some glowing goo at the bottom of a very deep crater. She brought a 10-gram sample of the goo to her laboratory. She found that when the goo was exposed to light, the total amount of goo increased by 100% every hour.

1. How much goo will she have after 1 (a) hour? After 2 (b) hours? After 3 (c) hours? After n (d) hours?

   a) 20 grams c) 80 grams

   b) 40 grams d) $10 \cdot 2^n$

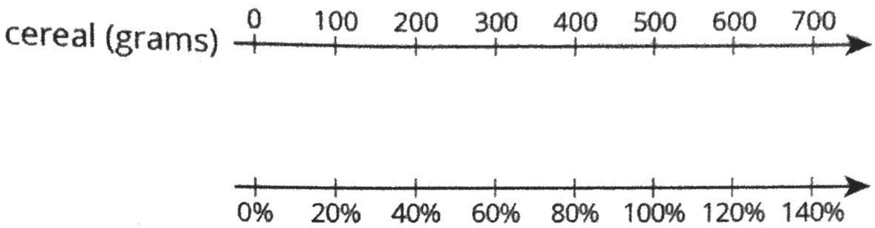
2. When she put the goo in the dark, it shrank by 75% every hour. How many hours will it take for the goo that was exposed to light for n hours to return to the original size?

   $\frac{n}{2}$ hours. A 75% decrease is $\frac{1}{4}$ as much, so for every hour, the % decrease is 25% of new amount. For example, after 2 hours, there will be 40 grams of goo. ~~after~~

NAME DATE PERIOD

Lesson 7 Summary

We can use a double number line diagram to show information about percent increase and percent decrease:



The initial amount of cereal is 500 grams, which is lined up with 100% in the diagram. We can find a 20% *increase* to 500 by adding 20% of 500:

$$\begin{aligned} 500 + (0.2) \cdot 500 &= (1.20) \cdot 500 \\ &= 600 \end{aligned}$$

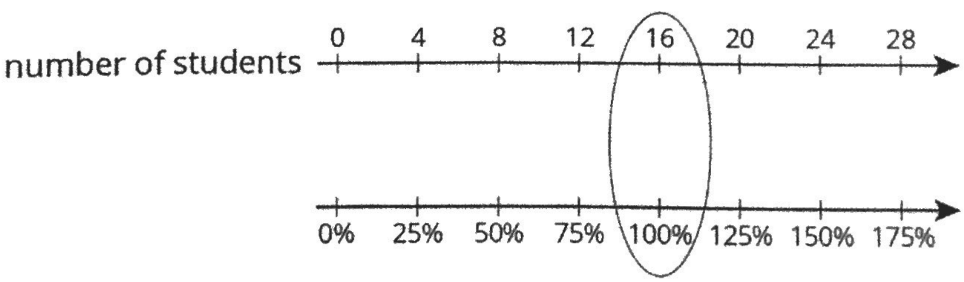
In the diagram, we can see that 600 corresponds to 120%.

If the initial amount of 500 grams is *decreased* by 40%, we can find how much cereal there is by subtracting 40% of the 500 grams:

$$\begin{aligned} 500 - (0.4) \cdot 500 &= (0.6) \cdot 500 \\ &= 300 \end{aligned}$$

So a 40% decrease is the same as 60% of the initial amount. In the diagram, we can see that 300 is lined up with 60%.

To solve percentage problems, we need to be clear about what corresponds to 100%. For example, suppose there are 20 students in a class, and we know this is an increase of 25% from last year. In this case, the number of students in the class *last* year corresponds to 100%. So the initial amount (100%) is unknown and the final amount (125%) is 20 students.



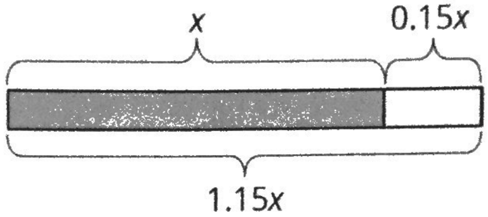
Looking at the double number line, if 20 students is a 25% increase from the previous year, then there

were 16 students in the class last year.

NAME DATE PERIOD

Lesson 8 Summary

We can use equations to express percent increase and percent decrease. For example, if y is 15% more than x,

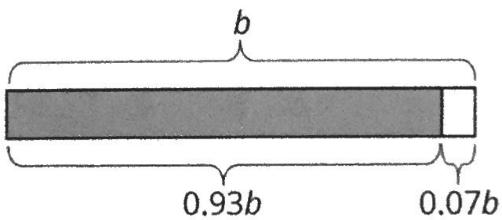


we can represent this using any of these equations:

$y = x + 0.15x$ $\qquad$ $y = (1 + 0.15)x$ $\qquad$ $y = 1.15x$

So if someone makes an investment of x dollars, and its value increases by 15% to $1250, then we can write and solve the equation $1.15x = 1250$ to find the value of the initial investment.

Here is another example: if a is 7% less than b,



we can represent this using any of these equations:

$a = b - 0.07b$ $\qquad$ $a = (1 - 0.07)b$ $\qquad$ $a = 0.93b$

So if the amount of water in a tank decreased 7% from its starting value of b to its ending value of 348 gallons, then you can write $0.93b = 348$.

Often, an equation is the most efficient way to solve a problem involving percent increase or percent decrease.