

BARTLETT

NAME

DATE

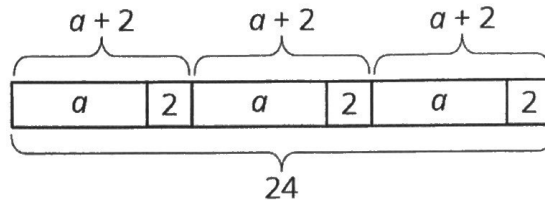
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Unit 6, Lesson 11: Using Equations to Solve Problems

Let's use tape diagrams, equations, and reasoning to solve problems.

5 mins Don't solve

11.1: Remember Tape Diagrams



1. Write a story that could be represented by this tape diagram.

A baker puts a cookies in 3 boxes, then adds two more cookies to each box. All together, there are 24 cookies.

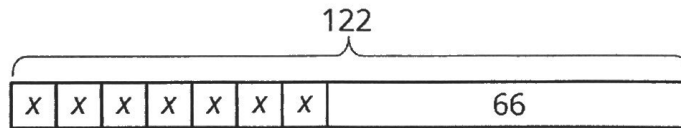
2. Write an equation that could be represented by this tape diagram.

$24 = 3(a + 2)$ $24 = 3a + 6$ $18 = 3a$ $a = 6$

11.2: At the Fair

10 mins

1. Tyler is making invitations to the fair. He has already made some of the invitations, and he wants to finish the rest of them within a week. He is trying to spread out the remaining work, to make the same number of invitations each day. Tyler draws a diagram to represent the situation.



a. Explain how each part of the situation is represented in Tyler's diagram:

How many total invitations Tyler is trying to make.

122 total invitations.

How many invitations he has made already.

66 have been made

How many days he has to finish the invitations.

It took 7 days to finish

7 boxes with an equal amount, x .

Strategies

- 1. Reason Numerically. No diagram.*
- 2. Create tape diagrams. Reason Numerically.*
- 3. Write an equation & distribute*
- 4. Write an equation & divide.*

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b. How many invitations should Tyler make each day to finish his goal within a week? Explain or show your reasoning.

8 invitations.

$$\begin{array}{r} 0122 \\ -66 \\ \hline 56 \end{array}$$

$$\begin{array}{r} 8 \\ 7 \overline{)56} \\ -56 \\ \hline 0 \end{array}$$

c. Use Tyler's diagram to write an equation that represents the situation. Explain how each part of the situation is represented in your equation.

$$7x + 66 = 122$$

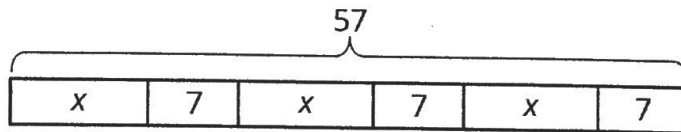
He makes the same amount of x each of 7 days, so $7x =$ the number made in 7 days. Add 66 he already made & the total is 122.

d. Show how to solve your equation.

$$\begin{array}{r} 7x + 66 = 122 \\ -66 \quad -66 \\ \hline \end{array}$$

$$\frac{7x + 0}{7} = \frac{56}{7} \quad \boxed{x = 8}$$

2. Noah and his sister are making prize bags for a game at the fair. Noah is putting 7 pencil erasers in each bag. His sister is putting in some number of stickers. After filling 3 of the bags, they have used a total of 57 items.



a. Explain how the diagram represents the situation.

There are 3 groups of x stickers & 3 groups of 7 erasers. All together there are 57 items.

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b. Noah writes the equation $3(x + 7) = 57$ to represent the situation. Do you agree with him? Explain your reasoning.

Yes, Noah's equation says that 3 groups of $x + 7$ gives a total of 57 items.

c. How many stickers is Noah's sister putting in each prize bag? Explain or show your reasoning.

12 stickers.

Each group of $x + 7$ represents $\frac{1}{3}$ of 57, or 19 items. So, x equals 12.

$$\frac{3(x+7)}{3} = \frac{57}{3}$$

$$\begin{array}{r} (x+7) = 19 \\ -7 \quad -7 \\ \hline x = 12 \end{array}$$

Honors only. ③ A family of 6 is going to the fair. They have a coupon for \$1.50 off each ticket. If they pay \$46.50 for all their tickets, how much does a ticket cost without the coupon? Explain or show your reasoning. If you get stuck, consider drawing a diagram or writing an equation.

\$9.25

Divide \$46.50 by 6 to get \$7.75, to find what they paid for each ticket, then add \$1.50. Or 6 * 1.50 is what they saved, or 9, so add the 9 back to 46.50, then divide by 6.

$$\frac{6(t - 1.50)}{6} = \frac{46.50}{6}$$

$$t - 1.50 = 7.75 \quad t = 9.25$$

11.3: Running Around

10 mins. 1 problem for each group
Priya, Han, and Elena, are members of the running club at school.

a ① Priya was busy studying this week and ran 7 fewer miles than last week. She ran 9 times as far as Elena ran this week. Elena only had time to run 4 miles this week.

$$\begin{array}{r} 6t - 9 = 46.50 \\ 6t = 55.50 \\ t = 9.25 \end{array}$$

a ② (a) How many miles did Priya run last week?

43 miles.

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2. Elena wrote the equation $\frac{1}{9}(x - 7) = 4$ to describe the situation. She solved the equation by multiplying each side by 9 and then adding 7 to each side. How does her solution compare to the way you found Priya's miles?

Multiply by 9 $\frac{1}{9}(x-7) = 4 \cdot 9$
 $x-7 = 36$
 $x = 43$

3. One day last week, 6 teachers joined $\frac{5}{7}$ of the members of the running club in an after-school run. Priya counted a total of 31 people running that day. How many members does the running club have?

35 members $\frac{5}{7}x + 6 = 31$

4. Priya and Han plan a fundraiser for the running club. They begin with a balance of -80 because of expenses. In the first hour of the fundraiser they collect equal donations from 9 parents, which brings their balance to -44. How much did each parent give?

\$4 $-80 + 9x = -44$

5. The running club uses the money they raised to pay for a trip to a canyon. At one point during a run in the canyon, the students are at an elevation of 128 feet. After descending at a rate of 50 feet per minute, they reach an elevation of -472 feet. How long did the descent take?

12 minutes $128 - 50x = -472$

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Unit 6, Lesson 12: Solving Problems about Percent Increase or Decrease

Let's use tape diagrams, equations, and reasoning to solve problems with negatives and percents.

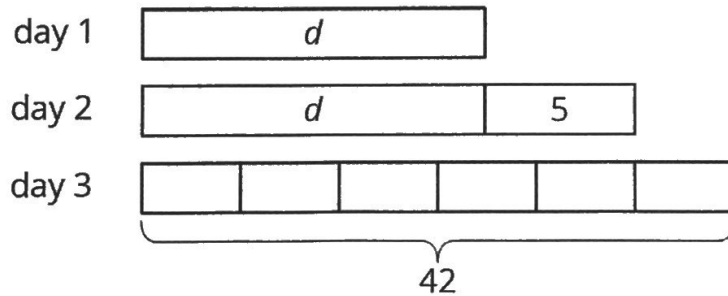
5 mins.
12.1: 20% Off

An item costs x dollars and then a 20% discount is applied. Select **all** the expressions that could represent the price of the item after the discount.

- X 1. $\frac{20}{100}x$
- ② $x - \frac{20}{100}x$
- ③ $(1 - 0.20)x$
- ④ $\frac{100-20}{100}x$
- ⑤ $0.80x$
- X 6. $(100 - 20)x$

12.2: Walking More Each Day

5 mins.
 1. Mai started a new exercise program. On the second day, she walked 5 minutes more than on the first day. On the third day, she increased her walking time from day 2 by 20% and walked for 42 minutes. Mai drew a diagram to show her progress.



$\frac{20}{100} \cdot (d+9)$

Explain how the diagram represents the situation.

The last day is day 2 plus $\frac{1}{5}$ (or 20%) of day 2.
 Day 2 is 5 more than Day 1.

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$$\frac{6}{5}(d+5) = 42$$

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2. Noah said the equation $1.20(d+5) = 42$ also represents the situation. Do you agree with Noah? Explain your reasoning.

Yes, she walked 42 minutes on Day 3, which is the same as 20% ^(equal to) more than 5 ^(1.20 times) more than Day 1. ^(d+5)

3. Find the number of minutes Mai walked on the first day. Did you use the diagram, the equation, or another strategy? Explain or show your reasoning.

30 minutes.
 Diagram: $42 \div 6 = 7$
 $7 \cdot 5 = 35$
 $35 - 5 = \boxed{30}$
 Equation 1: $\frac{1.2(d+5)}{1.2} = \frac{42}{1.2}$
 $d+5 = 35$
 $d = \boxed{30}$
 Equation 2: $\frac{6}{5}(d+5) = 42$
 $d+5 = 42 \cdot \frac{5}{6}$
 $d+5 = 35$
 $d = \boxed{30}$

SKIP

4. Mai has been walking indoors because of cold temperatures. On Day 4 at noon, Mai hears a report that the temperature is only 9 degrees Fahrenheit. She remembers the morning news reporting that the temperature had doubled since midnight and was expected to rise 15 degrees by noon. Mai is pretty sure she can draw a diagram to represent this situation but isn't sure if the equation is $9 = 15 + 2t$ or $2(t+15) = 9$. What would you tell Mai about the diagram and the equation and how they might be useful to find the temperature, t , at midnight?

12.3: A Sale on Shoes

10 mins one problem per table group.

1. A store is having a sale where all shoes are discounted by 20%. Diego has a coupon for \$3 off of the regular price for one pair of shoes. The store first applies the coupon and then takes 20% off of the reduced price. If Diego pays \$18.40 for a pair of shoes, what was their original price before the sale and without the coupon?

\$26. I wrote the equation $0.8(x-3) = 18.40$
 $x-3 = \frac{18.40}{0.8} + 3$
 $x-3 = 23 + 3$
 $x = \boxed{26}$

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2. Before the sale, the store had 100 pairs of flip flops in stock. After selling some, they notice that $\frac{3}{5}$ of the flip flops they have left are blue. If the store has 39 pairs of blue flip flops, how many pairs of flip flops (any color) have they sold?

35 pairs of flip flops. $\frac{3}{5}(100 - x) = 39$

$$\begin{array}{r} 100 - x = 65 \\ - 100 \quad - 100 \\ \hline -x = -35 \end{array}$$

$x = 35$

3. When the store had sold $\frac{2}{9}$ of the boots that were on display, they brought out another 34 pairs from the stock room. If that gave them 174 pairs of boots out, how many pairs were on display originally?

180 pairs of boots.

~~$\frac{2}{9}x + 34 = 174$~~

$$\begin{array}{r} x + 34 = 174 \\ - 34 \quad - 34 \\ \hline x = 140 \end{array}$$

$x = 180$

~~$\frac{2}{9}x = 140 \cdot \frac{9}{7}$~~

4. On the morning of the sale, the store donated 50 pairs of shoes to a homeless shelter. Then they sold 64% of their remaining inventory during the sale. If the store had 288 pairs after the donation and the sale, how many pairs of shoes did they have at the start?

850 pairs of shoes.

$$\frac{0.36(x - 50)}{0.36} = \frac{288}{0.36}$$

$$\begin{array}{r} x - 50 = 800 \\ + 50 \quad + 50 \\ \hline x = 850 \end{array}$$

Are you ready for more?

A coffee shop offers a special: 33% extra free or 33% off the regular price. Which offer is a better deal? Explain your reasoning.

33% off the regular price is a better deal.

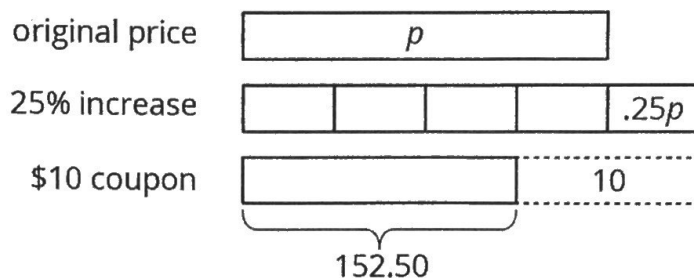
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Lesson 12 Summary

We can solve problems where there is a percent increase or decrease by using what we know about equations. For example, a camping store increases the price of a tent by 25%. A customer then uses a \$10 coupon for the tent and pays \$152.50. We can draw a diagram that shows first the 25% increase and then the \$10 coupon.



The price after the 25% increase is $p + .25p$ or $1.25p$. An equation that represents the situation could be $1.25p - 10 = 152.50$. To find the original price before the increase and discount, we can add 10 to each side and divide each side by 1.25, resulting in $p = 130$. The original price of the tent was \$130.

Lesson 11 Summary

Many problems can be solved by writing and solving an equation. Here is an example:

Clare ran 4 miles on Monday. Then for the next six days, she ran the same distance each day. She ran a total of 22 miles during the week. How many miles did she run on each of the 6 days?

One way to solve the problem is to represent the situation with an equation, $4 + 6x = 22$, where x represents the distance, in miles, she ran on each of the 6 days. Solving the equation gives the solution to this problem.

$$4 + 6x = 22$$

$$6x = 18$$

$$x = 3$$