

Chapter **39**

WORD PROBLEMS WITH EQUATIONS AND INEQUALITIES

Often, we encounter real-life situations that we can solve with an equation or inequality.

EXAMPLE: Josh is trying to weigh his dog. Because the dog keeps running away, he decides to hold the dog and step on the scale. The total weight is **175** pounds. Josh knows that he weighs **151** pounds. How much does his dog weigh?

To solve, we must translate the given situation into a mathematical equation or inequality:



1. Determine what operations are occurring.

THINK: WHAT INFO DO I KNOW?

Josh's weight + dog's weight = total weight

2. What is your unknown quantity? This becomes your variable.

THINK: WHAT INFO **DON'T** I KNOW?

The unknown quantity is the **dog's weight**, which we'll call "**d**."

3. Write your equation or inequality.

$$151 + d = 175$$

4. Now, solve your equation or inequality.

$$151 + d = 175$$

$$\cancel{151} - \cancel{151} + d = 175 - 151$$

$$d = 24$$

DON'T FORGET TO CHECK YOUR WORK BY PLUGGING YOUR ANSWER INTO THE ORIGINAL EQUATION.

The dog weighs **24** pounds.

In word problems, look for key words:
"is" usually means =
"is greater than" usually means >
"is less than" usually means <
"at least" usually means \geq
"at most" usually means \leq

EXAMPLE: A clothing salesperson earns a base salary of **\$800** per month, plus a commission of **20%** on sales. How much must the salesperson sell each month if she wants to earn at least **\$1,200** per month?

1. What info do I know? The base salary of **\$800** + **20%** commission on sales must be greater than or equal to **\$1,200**.

2. What is the unknown? The sales, which we'll call "**S**."

3. $800 + 0.2s \geq 1,200$

4. $\cancel{800} - \cancel{800} + 0.2s \geq 1,200 - 800$

$$\frac{\cancel{0.2}s}{\cancel{0.2}} \geq \frac{400}{\cancel{0.2}}$$

$$s \geq 2,000$$



The salesperson must sell at least **\$2,000** to earn at least **\$1,200** per month.

EXAMPLE: Julian needs an average of at least 90 points in order to earn an "A" in his history class. So far, his test scores are 92, 86, and 88. What is the lowest grade Julian can score on his next test in order to earn an "A"?

Here's what we know: In order to find an average, you must add up all of the numbers and then divide by how many numbers there are (in this case, there are four numbers). Also, 90 is the lowest that we need the average to be, so the inequality sign must be "greater than or equal to." Additionally, we know the first three test scores, but not the fourth, so we'll call that one " f ."

$$\frac{92 + 86 + 88 + f}{4} \geq 90$$

$$\cancel{4} \frac{266 + f}{\cancel{4}} \geq 90 \cancel{4} \quad (\text{Multiply both sides by } 4.)$$

$$\cancel{266} - \cancel{266} + f \geq 360 - 266 \quad \text{Subtract } 266 \text{ from each side.}$$

$f \geq 94$ Julian needs to score a 94 or higher on his next test in order to earn an "A" in the class.

Don't forget to check your work and ask: Is this reasonable?
In this case, yes! Because he got two scores in the 80s,
he'll need two scores in the 90s to keep the average at **90**
(or higher).





CHECK YOUR KNOWLEDGE

1. Jeremy spends $\$84$ on a bat and a skateboard. The bat costs $\$33$. How much does the skateboard cost?
2. Lucy goes to a department store and spends $\$90$ on clothing. She buys a dress for $\$30$, a hat for $\$12$, and also buys a jacket. How much does the jacket cost?
3. Delilah wants to purchase a used car that costs $\$7,200$. She has $\$900$ and can save $\$450$ per month. How many months will it take her to save $\$7,200$?
4. Robert tutors two students, Andy and Sue. Andy pays Robert $\$70$ per month. Sue pays Robert $\$50$ per month. How many months will Robert have to tutor until he earns $\$600$?
5. A car salesperson earns a base salary of $\$1,400$ per month plus a commission of 5% on sales. How much must the salesperson sell in order to earn at least $\$4,500$ per month?
6. Ling makes a base salary of $\$800$ per month plus a commission of 15% on sales. How much must Ling sell in order to earn $\$5,000$ per month?

7. Latrell wants to keep his test average in his science class at 85 or higher. So far, he has earned scores of 85, 76, 94, and 81 on his tests. What score must he get on his next test to keep his average at 85 or higher?
8. A construction team is building several buildings. They want the average time spent on each building to be 15 hours or less. So far, they have spent the following times for the first 4 buildings: 17 hours, 10 hours, 19 hours, 13 hours. How many hours should they spend building the fifth building in order to match their goal of an average of 15 hours or less?
9. In order to lose weight, Gerry calculates that he can consume at most 2,300 calories per day. For breakfast, he eats 550 calories. For a snack, he eats 220 calories, and for lunch, he eats 600 calories. How many calories can he eat for the rest of the day and not exceed his limit?
10. Larry is giving interviews to different news reporters and can spend up to 2 hours doing all of the interviews. He spends 35 minutes with Channel 1 News and then spends 45 minutes with Channel 7 News. If Channel 5 wants to interview him, how much time can Larry spend with them and not go over his time limit?

CHECK YOUR ANSWERS



1. The skateboard costs \$51.
2. \$48
3. It will take Delilah 14 months (or 1 year and 2 months) to save \$7,200.
4. 5 months
5. The salesperson must sell at least \$62,000.
6. Ling must sell at least \$28,000.
7. Latrell must score at least 89.
8. They need to spend 16 hours or less.
9. Gerry can eat less than or equal to 930 calories.
10. Larry can spend less than or equal to 40 minutes.