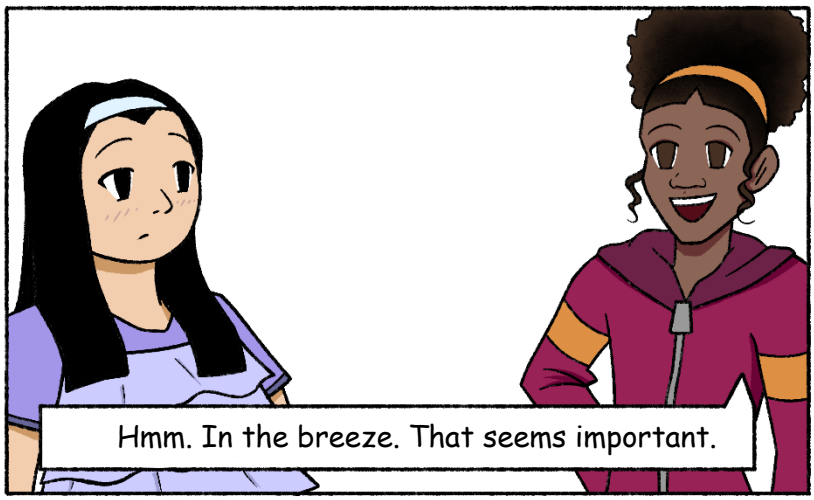
Lesson 10: Eye on the Prize

After hanging around in the gift shop for a while, the group was able to find Clue #3:

> *Impressive. You are as smart as can be – you found Clue #3!*
> *Your final stop is at the tallest ride in the park.*
> *It's under a half mile by the shortest path you can walk.*
> *Here you will find people blowing in the breeze, up higher than the trees.*
> *(Hint: Think of a spinning mobile for people)*

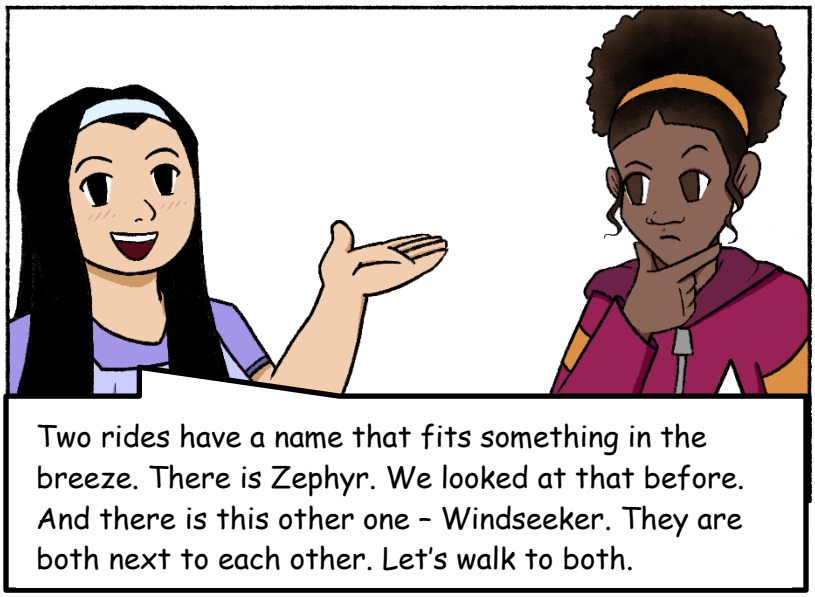
Kayla realizes that wherever Clue #3 leads, it is the last stop on their search.
The gift shop where Gabriel purchased the mobile is on International Street. It is located right above the "I" in the word INTERNATIONAL on the park map.



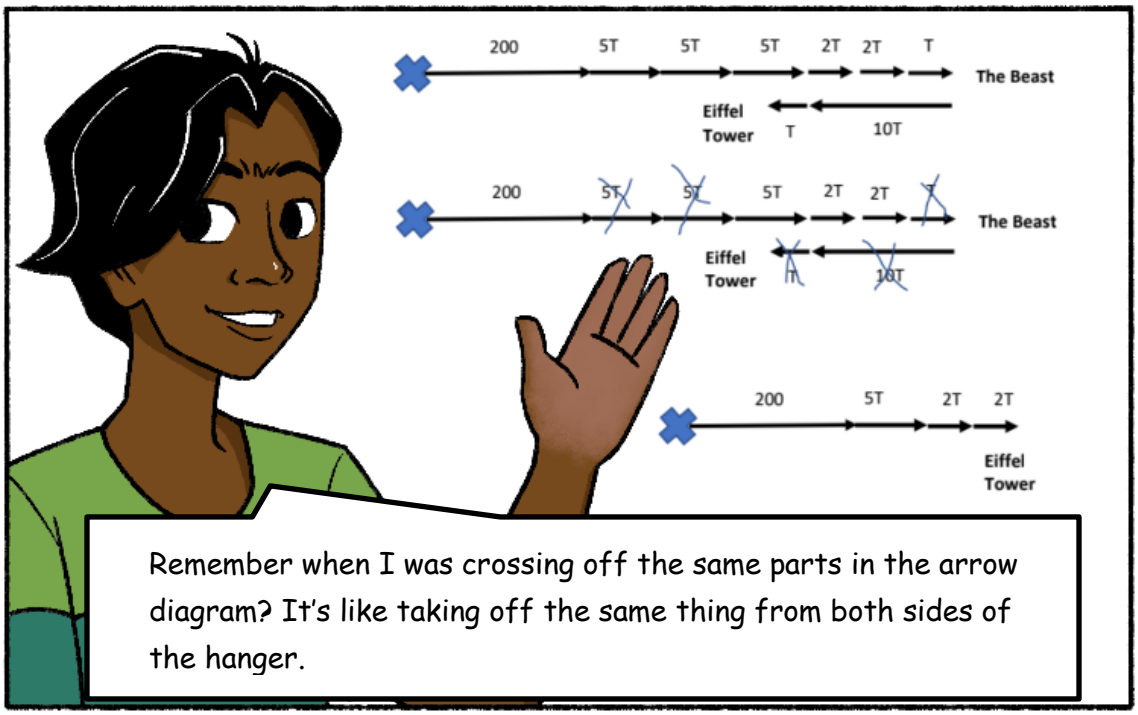
1. Find the gift shop on a digital or paper copy of the park map.

Kayla suggests that maybe the ride name is part of the riddle.

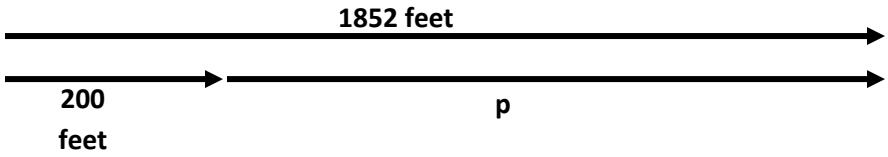
Alexa agrees and suggests two rides to walk to, and they are close to each other.



On the walk to Zephyr, Gabriel and Sam talk about arrow diagrams and hanger models, and how they used these to describe algebraic expressions, equations, and inequalities.
Gabriel realizes something and says, “Arrows and hangers. They kind of do the same thing.”
Gabriel pulls a paper out of his pocket and shows Sam, “Remember when I was crossing the same parts off with the arrow diagram.



Sam disagreed. “Nah, I don’t think so. I think the work with hangers is more like when we used the arrow diagrams that looked like this:



Gabriel responded, “But that’s what I’m saying!”

2. Are they both right? Or are Sam and Gabriel noticing different things? Whose arrow diagram, Sam’s or Gabriel’s, are most like the hanger model? Explain.

As they approach Zephyr, they quickly realize that there is no way that Zephyr is the tallest ride in the park. The ride behind it is clearly taller.

Alexa turns to Sam and asks, “What are you two arguing about?”

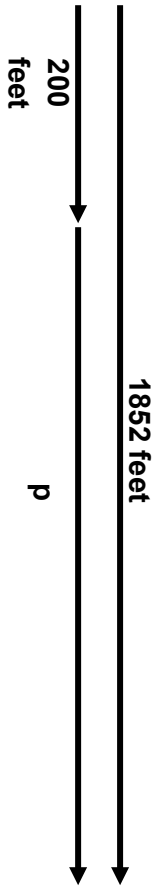
Sam replied, “Nah. It’s all good. We both think the arrow diagrams are like the hangers. But I think the lengths of the arrows need to be equal. Gabriel doesn’t.”

“Yeah, I guess that is different,” says Alexa.

Kayla notices something about Sam’s arrow diagram and rotates it. “Hey, look at this!” Alexa says with a smile.

“That kind of looks like a hanger,” Alexa adds.

Gabriel asks, “But can you take off the same objects like a hanger?”



3. Draw a balanced hanger model that fits Alexa’s vertical arrow model. Use the same variable, **p**, but use numbers in shapes that you choose that allow you to “remove the same thing” from both sides of the hanger.

4. Use your hanger model to find the value of **p**.

5. What is different about your hanger model and Gabriel’s arrow model that he used for the Eiffel Tower, on the previous page?

6. For the equation **z** + 17 ½ = 20, draw an

   a. Arrow diagram

   b. Hanger model

7. For the equation 8**x** = 40, draw an

    a. Arrow diagram

    b. Hanger model

8. Show how you can use the hanger model and the arrow diagram to find the value of the variable, **x**.

9. Which method do you prefer to use to find the value of **x**?

    a) the arrow diagram

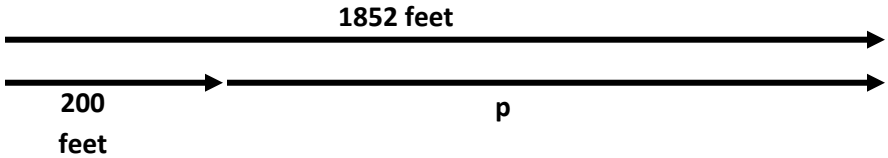
    b) hanger model, or

    c) some other method

In mathematics, we often have many tools and strategies to choose to make sense of and solve problems. Thinking about the pros and cons (or the "fors and againsts") of each strategy is an important part of doing mathematics.

There is one other strategy that we need to explore, and that is the using the codes to solve equations and inequalities. Each of the codes is like a shorthand, or abbreviation, for the hanger model and arrow diagram.

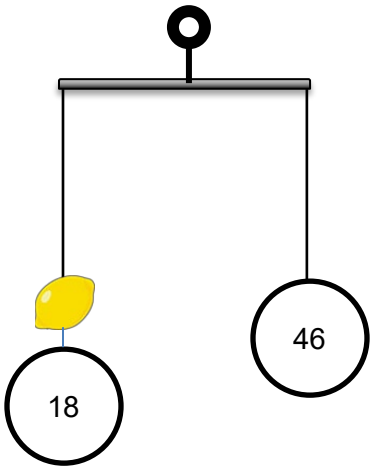
The code for this arrow diagram is: 1852 = 200 + p



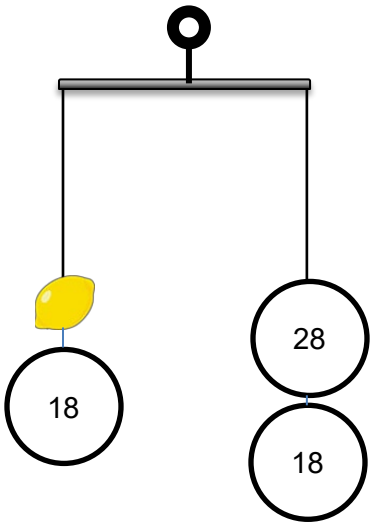
The hanger model you drew in Problem 3 should either be the same code, or an **equivalent equation**. That is, the code for the hanger model you drew could be

$$200 + 1652 = 200 + p$$

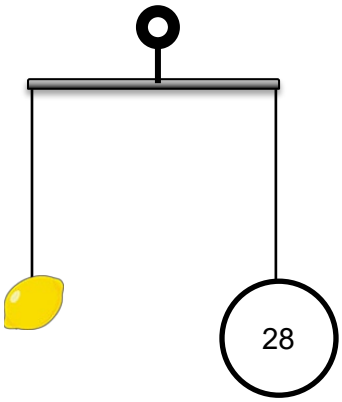
10. For the hanger model and its code, describe what happens in each step.



L + 18 = 46

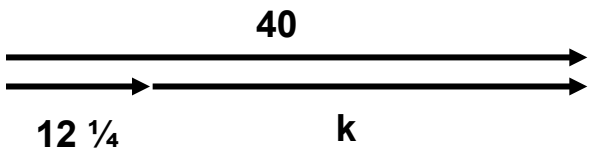


L + 18 = 28 + 18

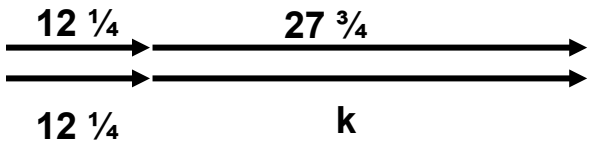


L = 28

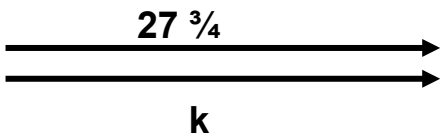
11. For this arrow diagram and its code, describe what happens in each step.



$40 = 12\frac{1}{4} + k$



$12\frac{1}{4} + 27\frac{3}{4} = 12\frac{1}{4} + k$



$27\frac{3}{4} = k$

When we work with arrow diagrams that have the same length for both sets of arrows, the code is an equation.

For the hanger models, it is easier to see when the objects on both sides are equal (equations) or unequal (inequalities).

In Problems 10 and 11, you found L and k by removing (or subtracting) the same thing from both sides. Since the variables L and k were connected to other values by addition, we used the **inverse operation** – subtraction – to remove the same thing from both sides.
Inverse operations undo each other. For example, if I add 12 + 7 to get 19, I can subtract 7 from 19 to get back to my original number, 12.

Knowing inverse operations are the key to solving arrow diagrams, hanger models, equations, and inequalities.

Inverse operations undo each other.
Addition and subtraction are inverse operations.
Multiplication and division are inverse operations.

We can solve many types of codes that are equations and inequalities by using inverse operations.

12. Look at the following codes in the table below.
    a) Identify the operation that connects the variable with a number.
    b) What is the inverse operation you would use to solve each code? (The first example is completed for you already.)

Code	Operation connecting variable to a number	Inverse operation used to solve code
i) 12a = 60	Multiply a and 12	Divide by 12
ii) 100 = b + 25		
iii) c ÷ 5 = 2		
iv) 13 = d – 12		
v) 15 = 3e		
vi) 10 = f ÷ 20		

13. Write a summary of how you would find the value of the variable with a(n)

    a) arrow diagram

    b) hanger model

    c) code

14. Describe the pros and cons of using each method to find the value of a variable.

Summary

The group of friends continues their walk to Windseeker, which they can see off in the distance.

Sam says, “Geez! That is definitely the tallest ride here!”

As they approach the line for Windseeker they notice the following sign on a touch screen.

Congratulations seekers from near and far!
The end of your search has come.
Match the license plates to the correct park rides and a Golden Pass can be won!

15. In your groups, go to the following link to see if you can match all the plates to the correct rides:

    Match the License Plates Contest

16. What do you think the numbers at the end of the license plates stand for?