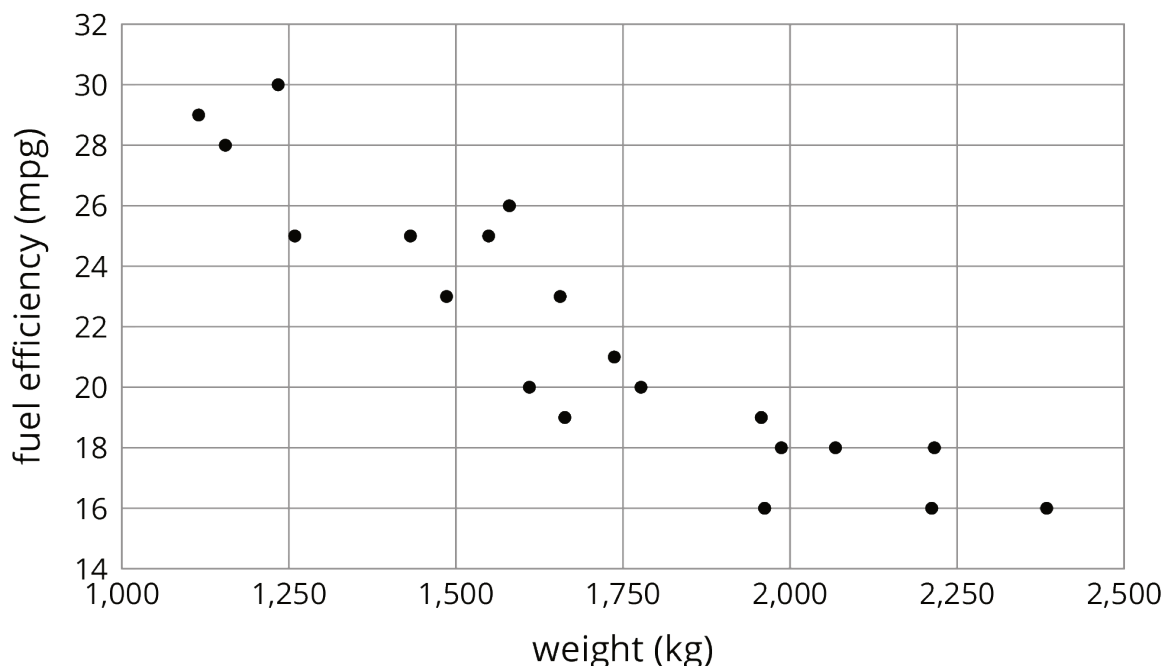


Lesson 4: Fitting a Line to Data

Let's look at the scatter plots as a whole.

4.1: Predict This

Here is a scatter plot that shows weights and fuel efficiencies of 20 different types of cars.



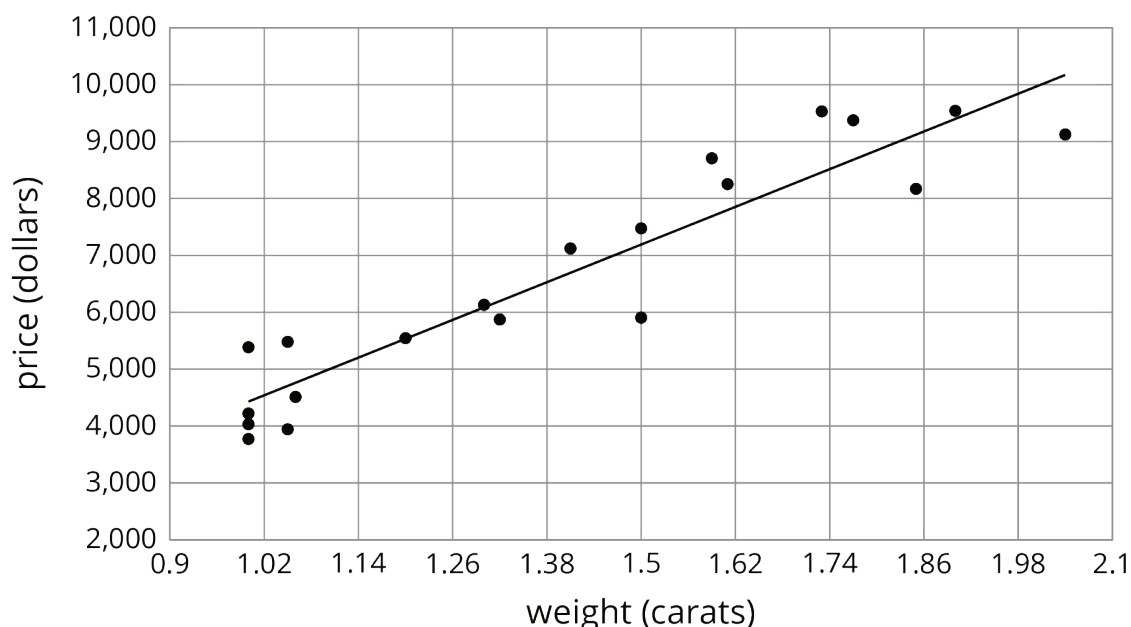
If a car weighs 1,750 kg, would you expect its fuel efficiency to be closer to 22 mpg or to 28 mpg? Explain your reasoning.

4.2: Shine Bright

Here is a table that shows weights and prices of 20 different diamonds.

weight (carats)	actual price (dollars)	predicted price (dollars)
1	3,772	4,429
1	4,221	4,429
1	4,032	4,429
1	5,385	4,429
1.05	3,942	4,705
1.05	4,480	4,705
1.06	4,511	4,760
1.2	5,544	5,533
1.3	6,131	6,085
1.32	5,872	6,195
1.41	7,122	6,692
1.5	7,474	7,189
1.5	5,904	7,189
1.59	8,706	7,686
1.61	8,252	7,796
1.73	9,530	8,459
1.77	9,374	8,679
1.85	8,169	9,121
1.9	9,541	9,397
2.04	9,125	10,170

The scatter plot shows the prices and weights of the 20 diamonds together with the graph of $y = 5,520x - 1,091$.



The function described by the equation $y = 5,520x - 1,091$ is a *model* of the relationship between a diamond's weight and its price.

This model *predicts* the price of a diamond from its weight. These predicted prices are shown in the third column of the table.

1. Two diamonds that both weigh 1.5 carats have different prices. What are their prices?
How can you see this in the table? How can you see this in the graph?

2. The model predicts that when the weight is 1.5 carats, the price will be \$7,189. How can you see this in the graph? How can you see this using the equation?

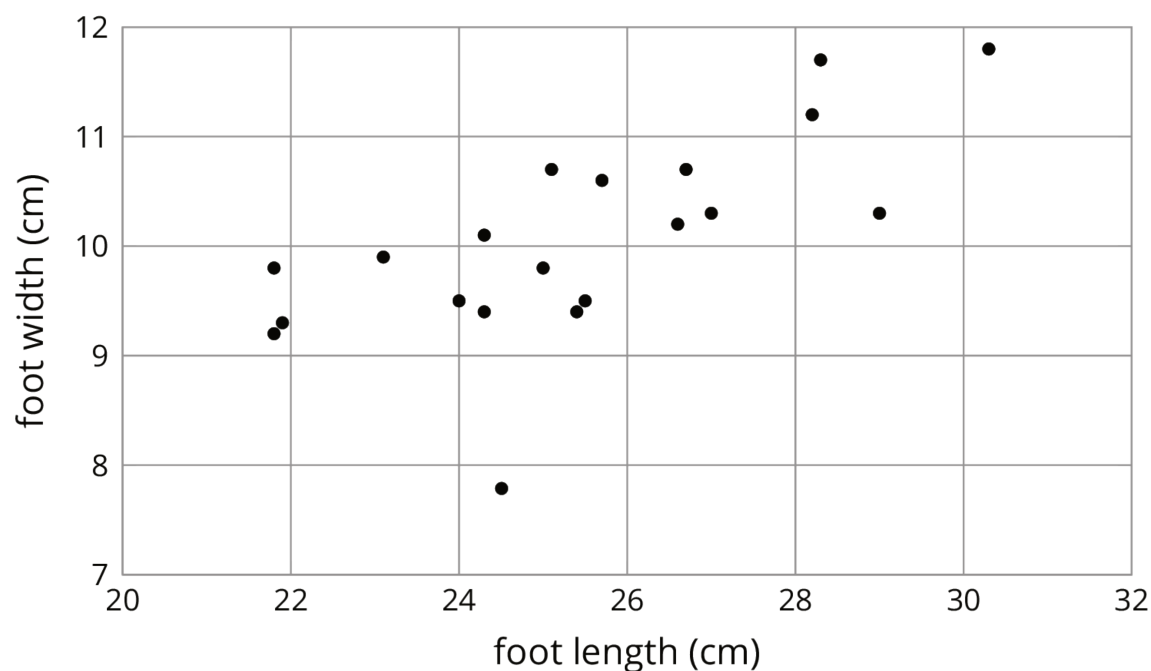
3. One of the diamonds weighs 1.9 carats. What does the model predict for its price?
How does that compare to the actual price?

4. Find a diamond for which the model makes a very good prediction of the actual price.
How can you see this in the table? In the graph?

5. Find a diamond for which the model's prediction is not very close to the actual price.
How can you see this in the table? In the graph?

4.3: The Agony of the Feet

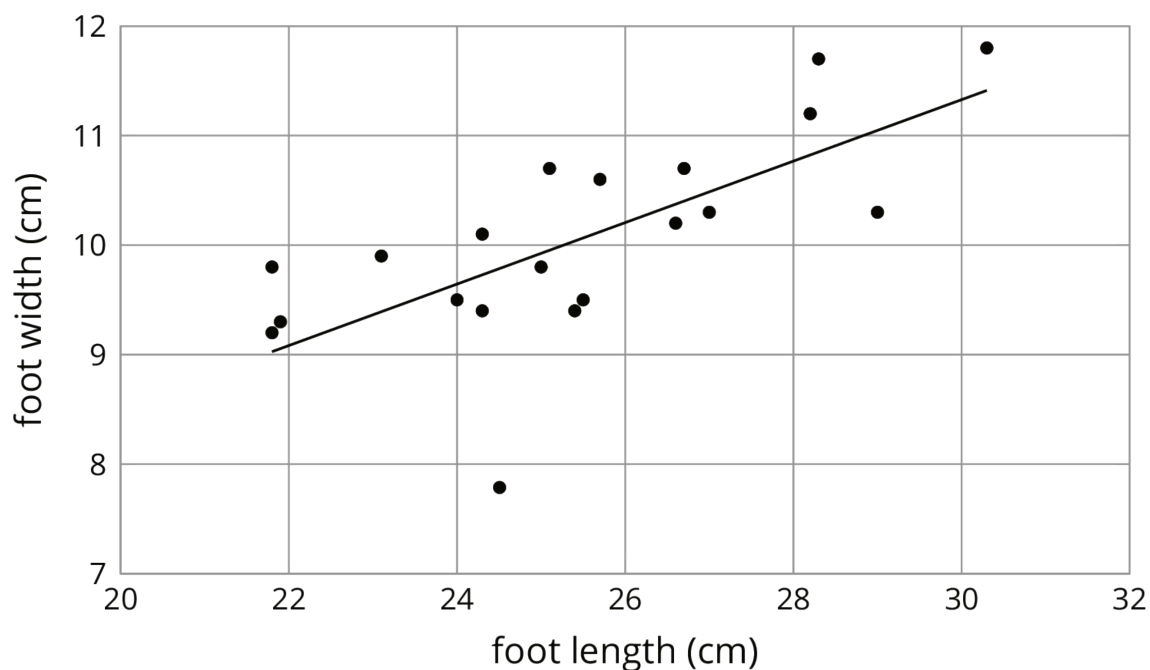
Here is a scatter plot that shows lengths and widths of 20 different left feet.



1. Estimate the widths of the longest foot and the shortest foot.

2. Estimate the lengths of the widest foot and the narrowest foot.

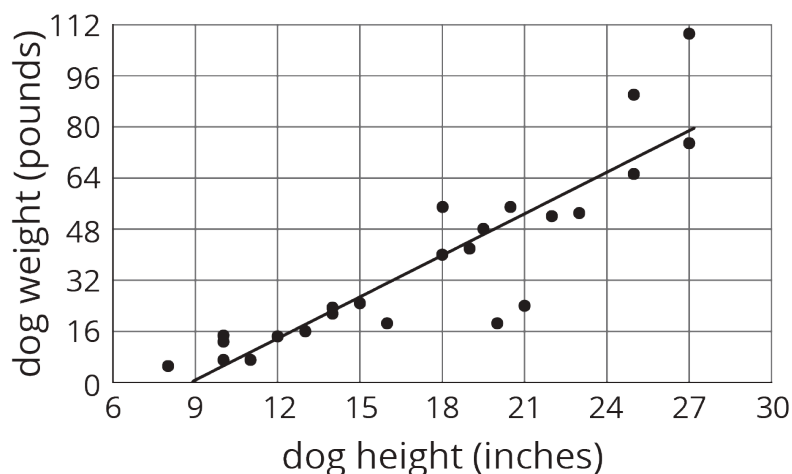
3. Here is the same scatter plot together with the graph of a model for the relationship between foot length and width.



Circle the data point that seems weird when compared to the model. What length and width does that point represent?

Lesson 4 Summary

Sometimes, we can use a linear function as a model of the relationship between two variables. For example, here is a scatter plot that shows heights and weights of 25 dogs together with the graph of a linear function which is a model for the relationship between a dog's height and its weight.



We can see that the model does a good job of predicting the weight given the height for some dogs. These correspond to points on or near the line. The model doesn't do a very good job of predicting the weight given the height for the dogs whose points are far from the line.

For example, there is a dog that is about 20 inches tall and weighs a little more than 16 pounds. The model predicts that the weight would be about 48 pounds. We say that the model *overpredicts* the weight of this dog. There is also a dog that is 27 inches tall and weighs about 110 pounds. The model predicts that its weight will be a little less than 80 pounds. We say the model *underpredicts* the weight of this dog.

Sometimes a data point is far away from the other points or doesn't fit a trend that all the other points fit. We call these **outliers**.