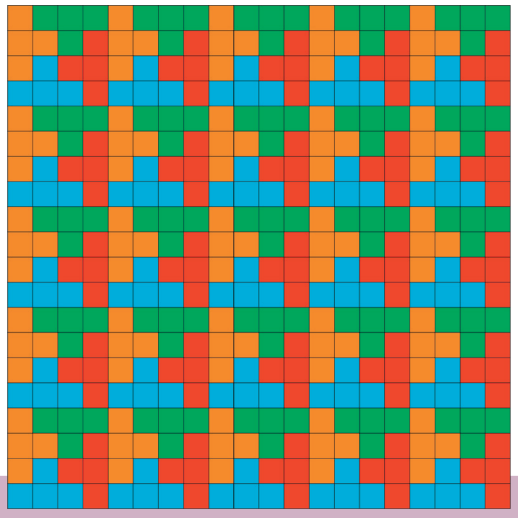
Core Knowledge® MATHEMATICS

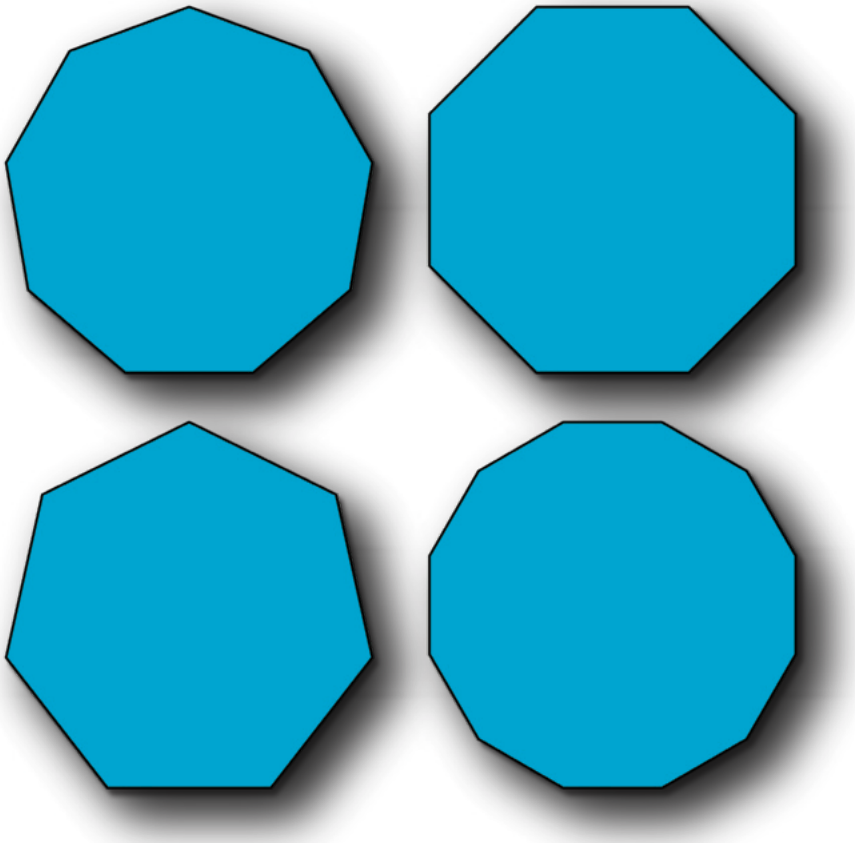
Putting It All Together



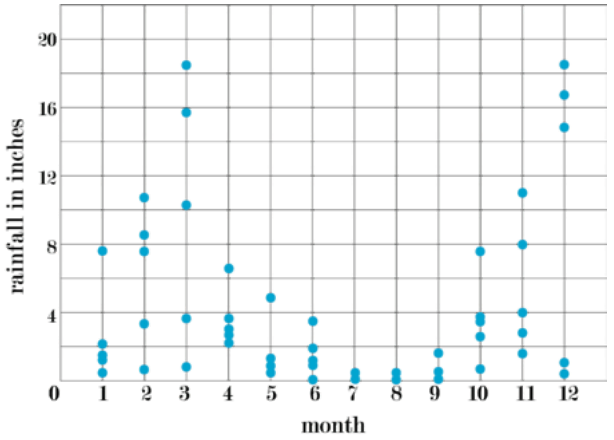
Polygon Patternss

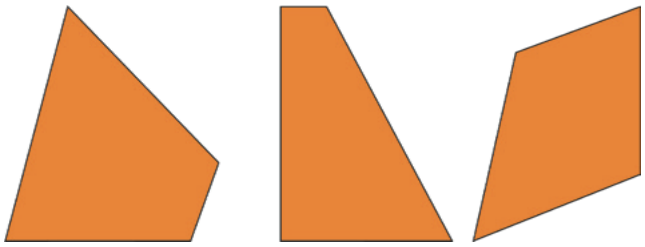
Student Workbook

Polygons



Plotting the Weather





Tessellations

Function of Latitude

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Putting It All Together

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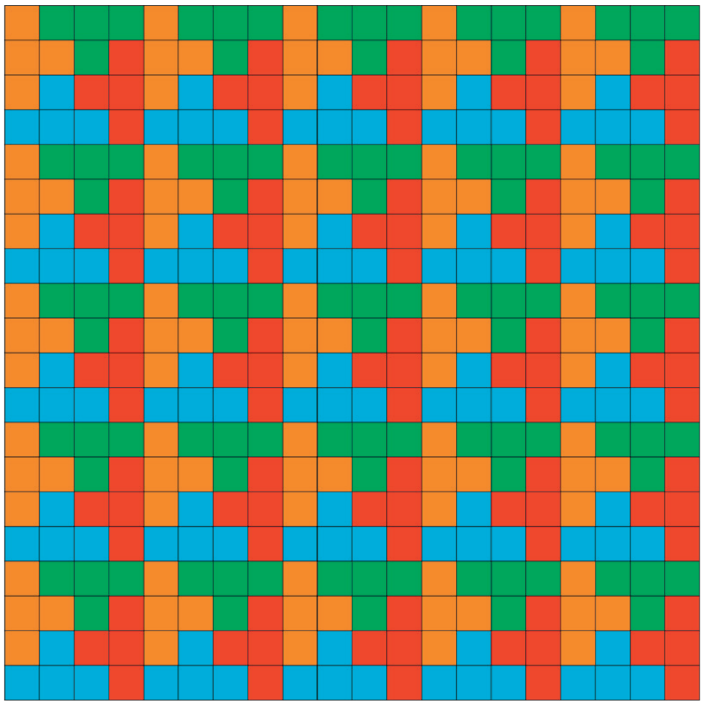


Putting It All Together

Student Workbook

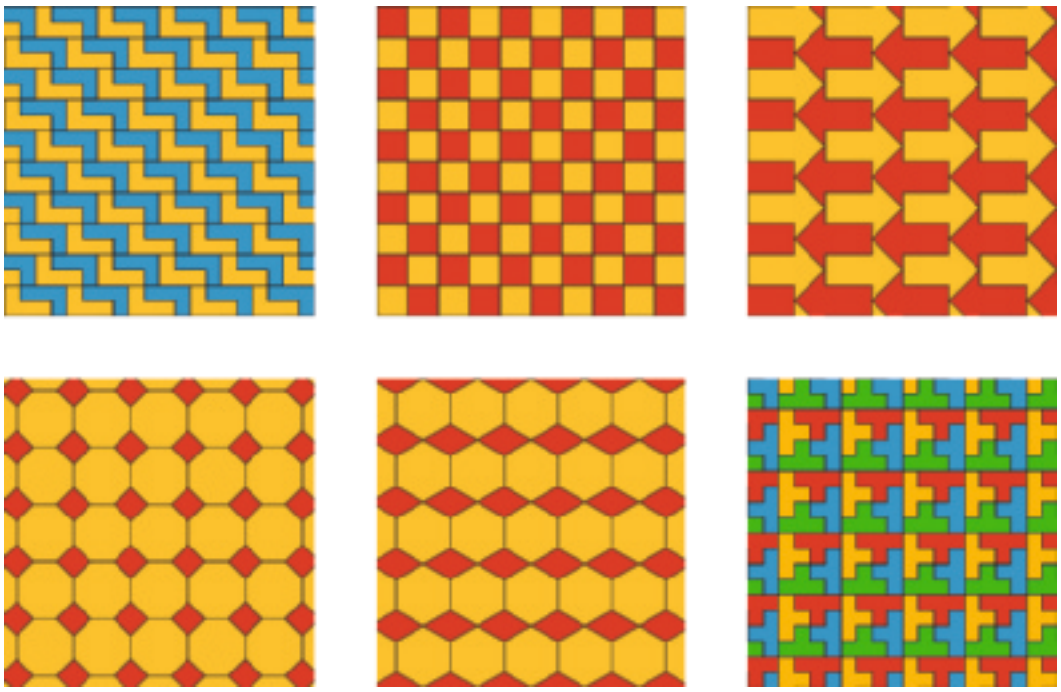
Core Knowledge Mathematics™

Lesson 1: Tessellations of the Plane

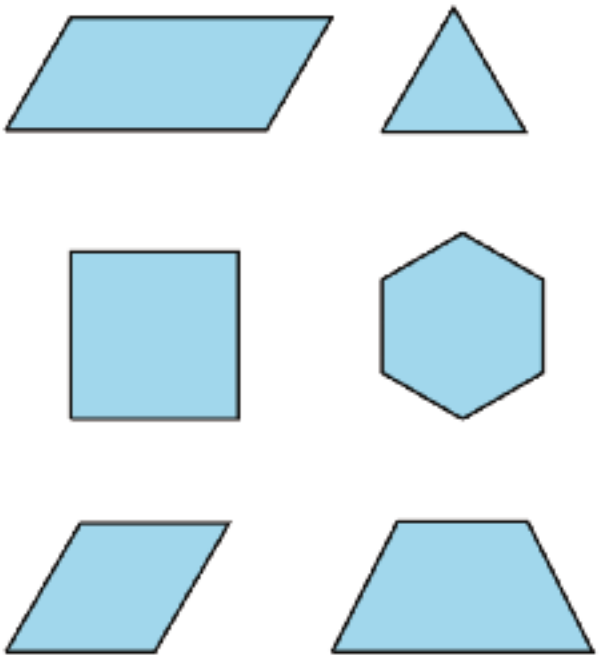
Let's explore geometric patterns!

1.1: Notice and Wonder: Polygon Patterns

What do you notice? What do you wonder?



1.2: Tessellations



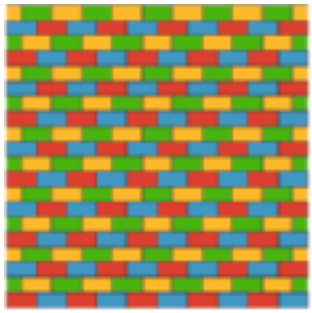
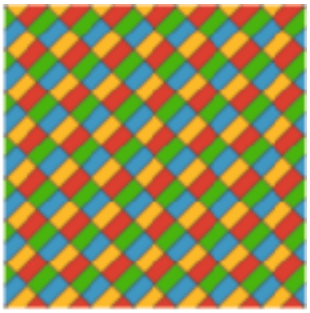
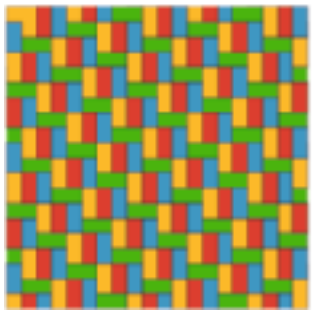
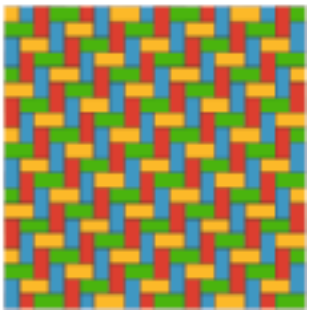
1. Pick one of the shapes. Create a **tessellation** by tracing copies of your shape. Make sure to use the same shape as your partner.

2. Compare your tessellation to your partner's. How are they similar? How are they different?

3. If possible, make a third tessellation of the plane with your shape (different from the ones you and your partner already created). If not possible, explain why it is not possible.

1.3: Describing a Tessellation

1. Pick one of the figures and describe the tessellation. Your partner will identify which tessellation you are describing. Then trade roles so your partner describes the tessellation and you identify the figure.

2. You and your partner each have a card with a tessellation. Describe what is on your card so that your partner can produce the tessellation (this should be done so that you cannot see your partner's work until it is complete).

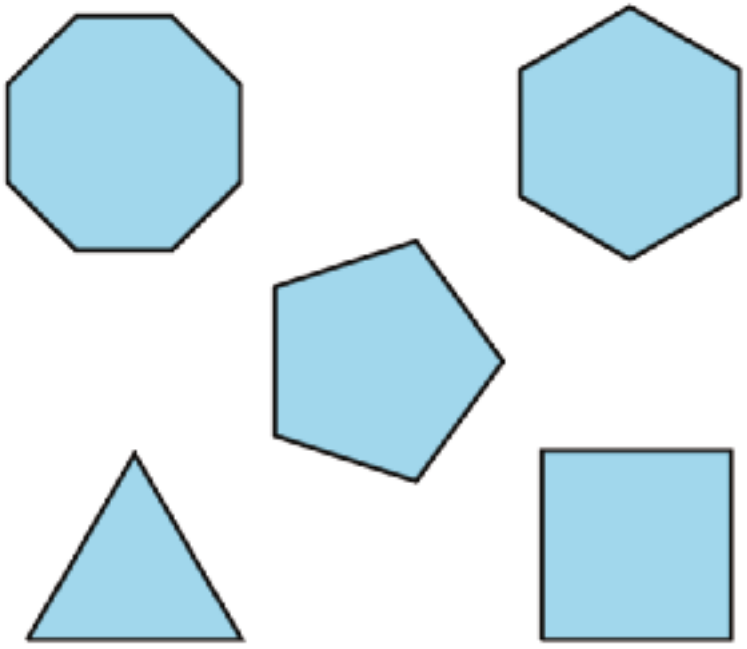
3. Check together to see if your partner's tessellation agrees with your card and discuss any differences.
4. Change roles so your partner describes a tessellation, which you attempt to produce.
5. Check the accuracy of your construction and discuss any discrepancies.

Lesson 2: Regular Tessellations

Let's make some regular tessellations.

2.1: Regular Tessellations

1. For each shape (triangle, square, pentagon, hexagon, and octagon), decide if you can use that shape to make a regular tessellation of the plane. Explain your reasoning.



2. For the polygons that do not work, what goes wrong? Explain your reasoning.

2.2: Equilateral Triangle Tessellation

1. What is the measure of each angle in an equilateral triangle? How do you know?

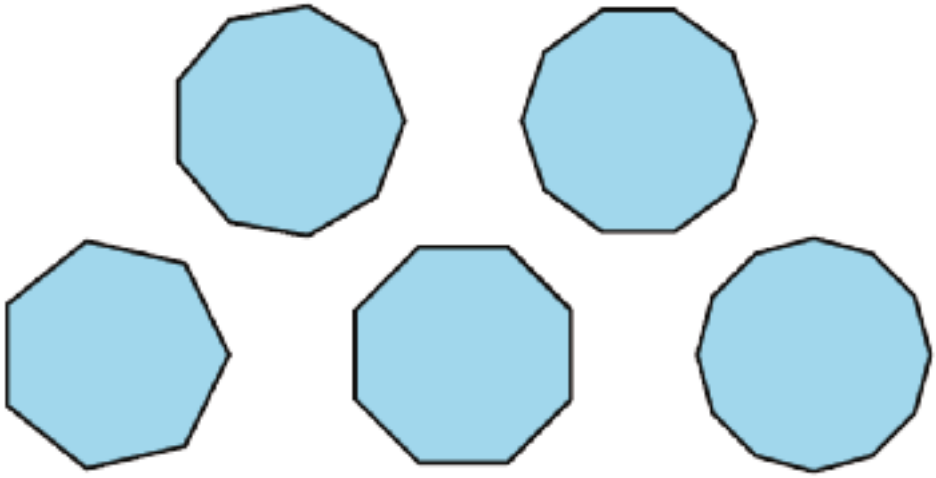
2. How many triangles can you fit together at one vertex? Explain why there is no space between the triangles.

3. Explain why you can continue the pattern of triangles to tessellate the plane.

4. How can you use your triangular tessellation of the plane to show that regular hexagons can be used to give a regular tessellation of the plane?

2.3: Regular Tessellation for Other Polygons

1. Can you make a regular tessellation of the plane using regular polygons with 7 sides? What about 9 sides? 10 sides? 11 sides? 12 sides? Explain.



2. How does the measure of each angle in a square compare to the measure of each angle in an equilateral triangle? How does the measure of each angle in a regular 8-sided polygon compare to the measure of each angle in a regular 7-sided polygon?

3. What happens to the angles in a regular polygon as you add more sides?

4. Which polygons can be used to make regular tessellations of the plane?

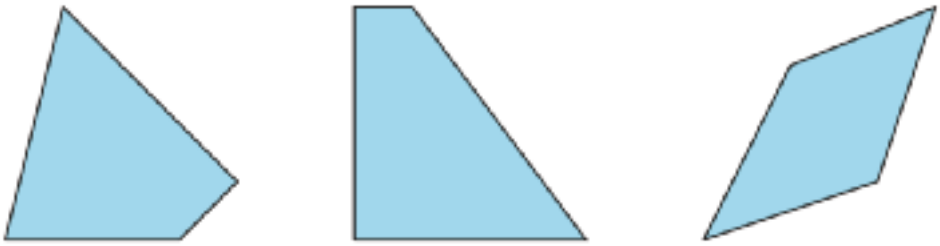
Lesson 3: Tessellating Polygons

Let's make tessellations with different polygons.

3.1: Triangle Tessellations

Your teacher will assign you one of the three triangles. You can use the picture to draw copies of the triangle on tracing paper. Your goal is to find a tessellation of the plane with copies of the triangle.

3.2: Quadrilateral Tessellations



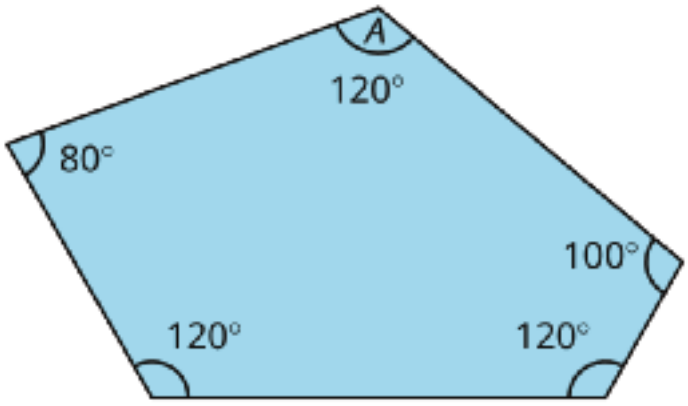
1. Can you make a tessellation of the plane with copies of the trapezoid? Explain.

2. Choose and trace a copy of one of the other two quadrilaterals. Next, trace images of the quadrilateral rotated 180 degrees around the midpoint of each side. What do you notice?

3. Can you make a tessellation of the plane with copies of the quadrilateral from the previous problem? Explain your reasoning.

3.3: Pentagonal Tessellations

1. Can you tessellate the plane with copies of the pentagon? Explain why or why not. Note that the two sides making angle A are congruent.



Pause your work here.

2. Take one pentagon and rotate it 120 degrees clockwise about the vertex at angle A, and trace the new pentagon. Next, rotate the pentagon 240 degrees clockwise about the vertex at angle A, and trace the new pentagon.

3. Explain why the three pentagons make a full circle at the central vertex.

4. Explain why the shape that the three pentagons make is a hexagon (that is, the sides that look like they are straight really are straight).

Lesson 4: What Influences Temperature?

Let's see if we can predict the weather.

4.1: Temperature Changes

What factors or variables can influence the outside temperature?

- Make a list of different factors.
- Write a sentence for each factor describing how changing it could change the temperature.

Example: One factor is time of day. Often, after sunrise, the temperature increases, reaches a peak in the early afternoon, and then decreases.

4.2: Is Temperature a Function of Latitude?

1. Andre and Lin are wondering if temperature is a function of latitude.

   Andre says, "I think it is, as long as we fix the time when we are measuring the temperature."

   Lin says, "But what if you have two places with the same latitude? Look at this weather map for Washington State. Seattle and Spokane have the same latitude but different temperatures right now."
   What do Andre and Lin mean?

2. Andre and Lin are discussing whether it is possible to define latitude and temperature in a way that makes sense to talk about temperature as a function of latitude. They are considering different options. What are some advantages and disadvantages of each option?

   Here are the options:

   a. Finding the temperature right now in cities with different latitudes.

b. Finding the daily high temperature in cities that have different latitudes.

c. Finding the average high temperature in a specific month, for example, September in cities that have different latitudes.

d. Finding the average yearly temperature in cities that have have different latitudes.

4.3: Is There an Association Between Latitude and Temperature?

Lin and Andre decided that modeling temperature as a function of latitude doesn't really make sense. They realized that they can ask whether there is an *association* between latitude and temperature.

1. What information could they gather to determine whether temperature is related to latitude?

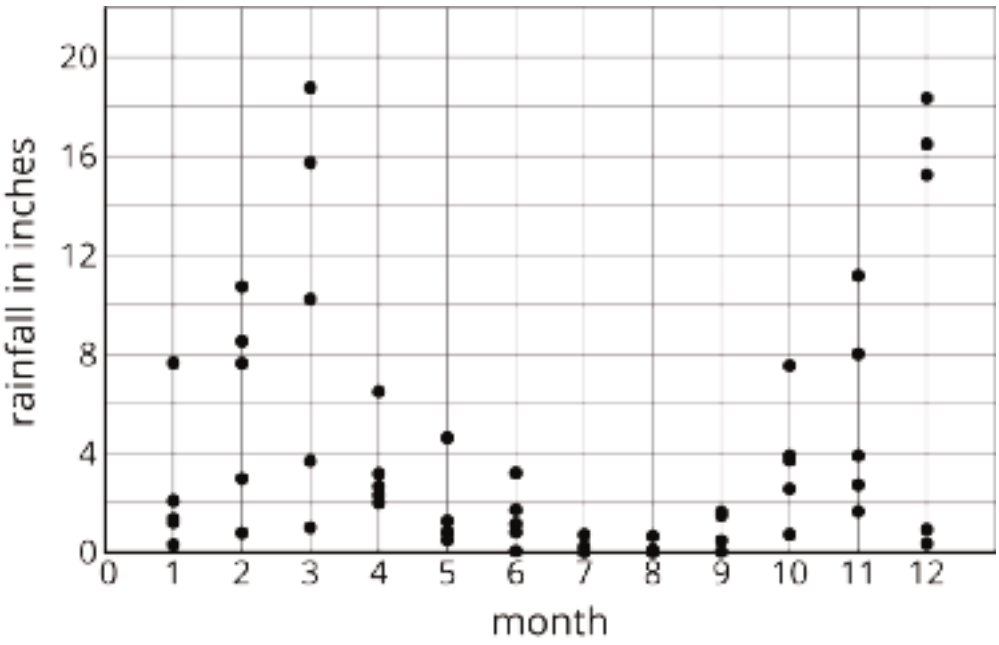
2. What should they do with that information to answer the question?

Lesson 5: Plotting the Weather

Let's construct a model.

5.1: California Rain

What do you notice? What do you wonder?



5.2: Data Snooping

The table shows the average high temperature in September for cities with different latitudes. Examine the data in the table.

city	latitude (degrees North)	temperature (degrees Fahrenheit)
Atlanta, GA	33.38	82
Portland, ME	43.38	69
Boston, MA	42.22	73
Dallas, TX	32.51	88
Denver, CO	39.46	77
Edmonton, AB	53.34	62
Fairbanks, AK	64.48	55
Juneau, AK	58.22	56
Kansas City, MO	39.16	78
Lincoln, NE	40.51	77
Miami, FL	25.45	88
Minneapolis, MN	44.53	71
New York City, NY	40.38	75
Orlando, FL	28.26	90
Philadelphia, PA	39.53	78
San Antonio, TX	29.32	89
San Francisco, CA	37.37	74
Seattle, WA	47.36	69
Tampa, FL	27.57	89
Tucson, AZ	32.13	93
Yellowknife, NT	62.27	50

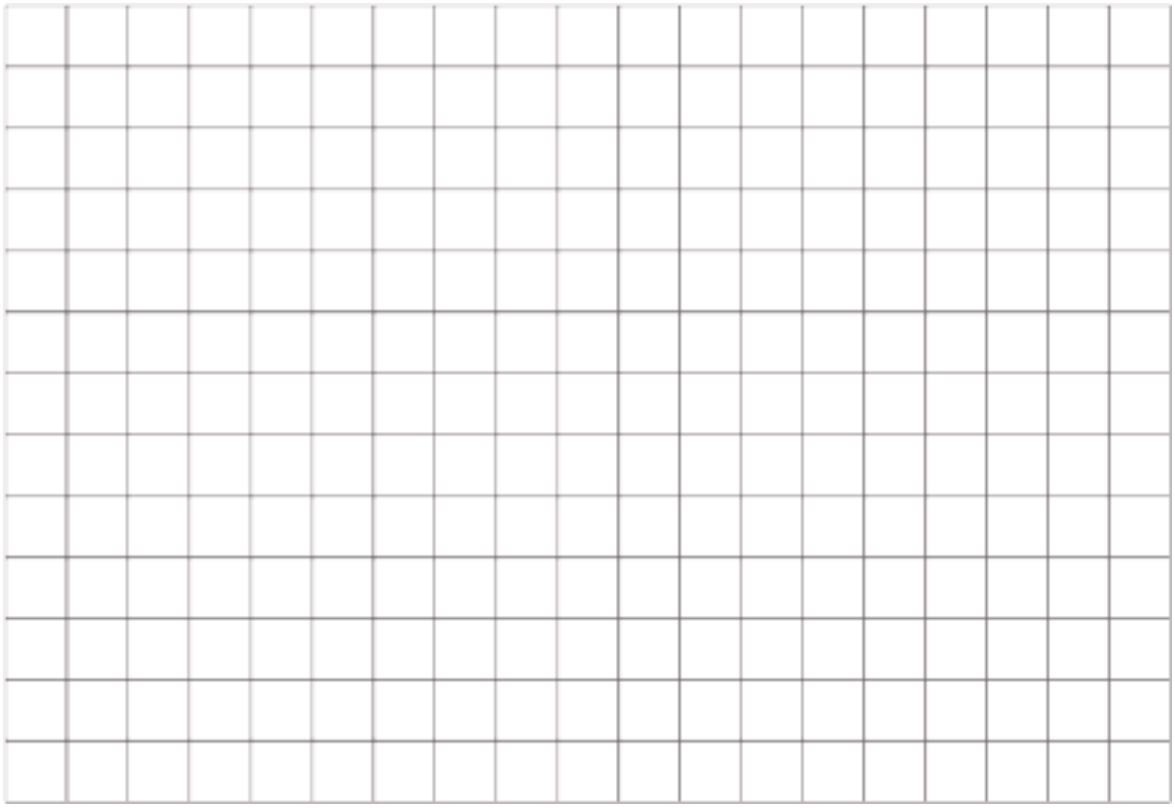
1. What information does each row contain?

2. What is the range for each variable?

3. Do you see an association between the two variables? If so, describe the association.

5.3: Temperature vs. Latitude

1. Make a scatter plot of the data.



2. Describe any patterns of association that you notice.

3. Draw a line that fits the data. Write an equation for this line.

Lesson 6: Using and Interpreting a Mathematical Model

Let's use a model to make some predictions.

6.1: Using a Mathematical Model

In the previous activity, you found the equation of a line to represent the association between latitude and temperature. This is a *mathematical model*.

1. Use your model to predict the average high temperature in September at the following cities that were not included in the original data set:

    a. Detroit (Lat: 42.14)

    b. Albuquerque (Lat: 35.2)

    c. Nome (Lat: 64.5)

    d. Your own city (if available)

2. Draw points that represent the predicted temperatures for each city on the scatter plot.

3. The actual average high temperature in September in these cities were:
    - Detroit: 74°F
    - Albuquerque: 82°F
    - Nome: 49°F
    - Your own city (if available):

    How well does your model predict the temperature? Compare the predicted and actual temperatures.

4. If you added the actual temperatures for these four cities to the scatter plot, would you move your line?

5. Are there any outliers in the data? What might be the explanation?

6.2: Interpreting a Mathematical Model

Refer to your equation for the line that models the association between latitude and temperature of the cities.

1. What does the slope mean in the context of this situation?

2. Find the vertical and horizontal intercepts and interpret them in the context of the situation.

3. Can you think of a city or a location that could not be represented using this same model? Explain your thinking.

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