

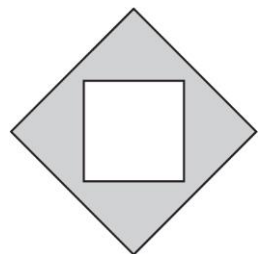
3-1

1. **FIGHTERS** Two fighter aircraft fly at the same speed and in the same direction leaving a trail behind them. Sketch and describe the relationship between these two trails.

2. **ESCALATORS** An escalator at a shopping mall runs up several levels. The escalator railing can be modeled by a straight line running past horizontal lines that represent the floors. Sketch a model of an escalator running past 3 floors

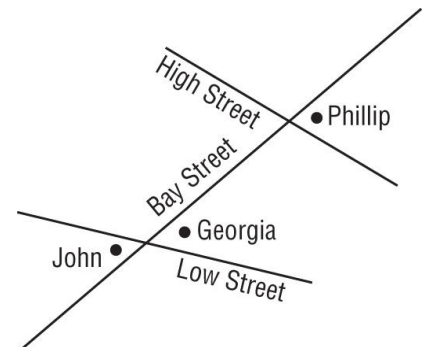
Describe the relationships of these lines.

3. **DESIGN** Carol designed the picture frame shown below. How many pairs of parallel segments are there among various edges of the frame?



4. **NEIGHBORHOODS** John, Georgia, and Phillip live nearby each other as shown in the map.

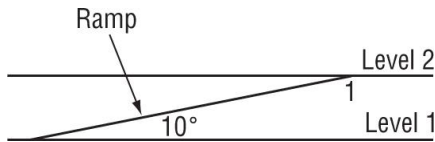
- a. Connor lives at the angle that forms an alternate interior angle with Georgia's residence. Add Connor to the map.
- b. Quincy lives at the angle that forms a consecutive interior angle with Connors' residence. Add Quincy to the map.



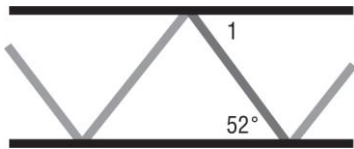
c. Describe how their corner angles relate to each other in terms of alternate interior, alternate exterior, corresponding, consecutive interior, or vertical angles.

3-2

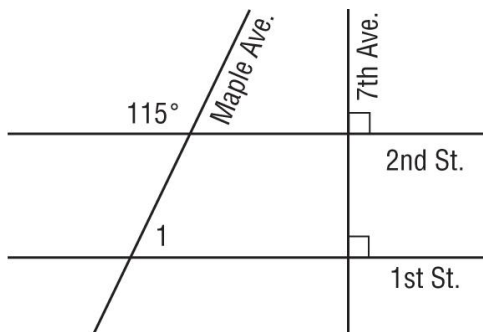
1. **RAMPS** A parking garage ramp rises to connect two horizontal levels of a parking lot. The ramp makes a 10° angle with the horizontal. What is the measure of angle 1 in the figure?



2. **BRIDGES** A double decker bridge has two parallel levels connected by a network of diagonal girders. One of the girders makes a 52° angle with the lower level as shown in the figure. What is the measure of angle 1?



3. **CITY ENGINEERING** Seventh Avenue runs perpendicular to both 1st and 2nd Streets, which are parallel. However, Maple Avenue makes a 115° angle with 2nd Street. What is the measure of angle 1?

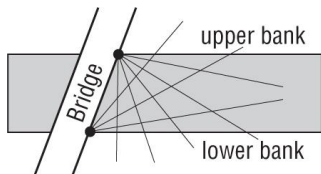


4. PODIUMS A carpenter is building a podium. The side panel of the podium is cut from a rectangular piece of wood.



The rectangle must be sawed along the dashed line in the figure. What is the measure of angle 1?

5. SECURITY An important bridge crosses a river at a key location. Because it is so important, robotic security cameras are placed at the locations of the dots in the figure. Each robot can scan x degrees. On the lower bank, it takes 4 robots to cover the full angle from the edge of the river to the bridge. On the upper bank, it takes 5 robots to cover the full angle from the edge of the river to the bridge.



a. How are the angles that are covered by the robots at the lower and upper banks related? Derive an equation that x satisfies based on this relationship.

b. How wide is the scanning angle for each robot? What are the angles that the bridge makes with the upper and lower banks?

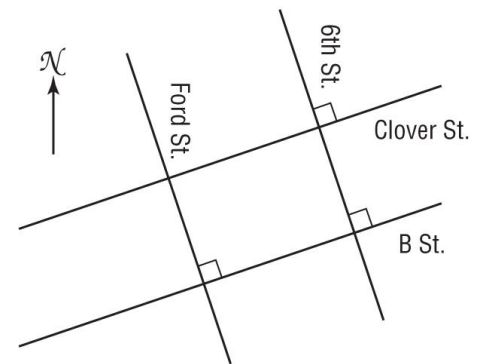
3-2

1. HIGHWAYS A highway on-ramp rises 15 feet for every 100 horizontal feet traveled. What is the slope of the ramp?

2. DESCENT An airplane descends at a rate of 300 feet for every 5000 horizontal feet that the plane travels. What is the slope of the path of descent?

- 3. ROAD TRIP** Jenna is driving 400 miles to visit her grandmother. She manages to travel the first 100 miles of her trip in two hours. If she continues at this rate, how long will it take her to drive the remaining distance?
- 4. WATER LEVEL** Before the rain began, the water in a lake was 268 inches deep. The rain began and after four hours of rain, the lake was 274 inches deep. The rain continued for one more hour at the same intensity. What was the depth of the lake when the rain stopped?

5. CITY BLOCKS The figure shows a map of part of a city consisting of two pairs of parallel roads. If a coordinate grid is applied to this map, Ford Street would have a slope of -3 .



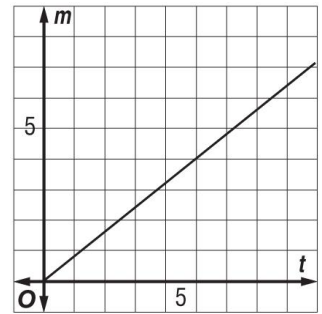
- a. The intersection of B Street and Ford Street is 150 yards east of the intersection of Ford Street and Clover Street. How many yards south is it?
- b. What is the slope of 6th Street? Explain.
- c. What are the slopes of Clover and B Streets? Explain.
- d. The intersection of B Street and 6th Street is 600 yards east of the intersection of B Street and Ford Street. How many yards north is it?

3-4

- 1. GROWTH** At the same time each month over a one year period, John recorded the height of a tree he had planted. He then calculated the average growth rate of the tree. The height h in inches of the tree during this period was given by the formula $h = 1.7t + 28$, where t is the number of months. What are the slope and y -intercept of this line and what do they signify?

- 2. DRIVING** Ellen is driving to a friend's house. The graph shows the distance (in miles) that Ellen was from home t minutes after she left her house.

Write an equation that relates m and t .



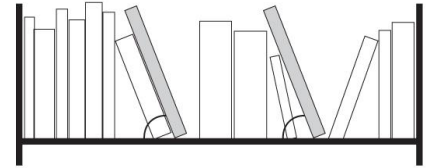
- 3. COST** Carla has a business that tests the air quality in artist's studios. She had to purchase \$750 worth of testing equipment to start her business. She charges \$50 to perform the test. Let n be the number of jobs she gets and let P be her net profit. Write an equation that relates P and n . How many jobs does she need to make \$750?
- 4. PAINT TESTING** A paint company decided to test the durability of its white paint. They painted a square all white with their paint and measured the reflectivity of the square each year. Seven years after being painted, the reflectivity was 85%. Ten years after being painted, the reflectivity dropped to 82.9%. Assuming that the reflectivity decreases steadily with time, write an equation that gives the reflectivity R (as a percentage) as a function of time t in years. What is the reflectivity of a fresh coat of their white paint?
- 5. ARTISTRY** Gail is an oil painter. She paints on canvases made from Belgian linen. Before she paints on the linen, she has to prime the surface so that it does not absorb the oil from the paint she uses. She can buy linen that has already been primed for \$21 per yard, or she can buy unprimed linen for \$15 per yard, but then she would also have to buy a jar of primer for \$30.
- Let P be the cost of Y yards of primed Belgian linen. Write an equation that relates P and Y .
 - Let U be the cost of buying Y yards of unprimed linen and a jar of primer. Write an equation that relates U and Y .
 - For how many yards would it be less expensive for Gail to buy the primed linen?

3-5

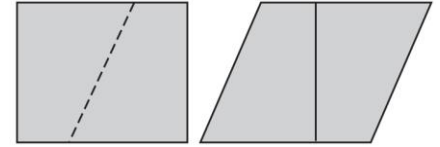
- 1. RECTANGLES** Jim made a frame for a painting. He wants to check to make sure that opposite sides are parallel by measuring the angles at the corners and seeing if they are right angles. How many corners must he check in order to be sure that the opposite sides are parallel? Explain.

2. BOOKS The two gray books on the bookshelf each make a 70° angle with the base of the shelf.

What more can you say about these two gray books?

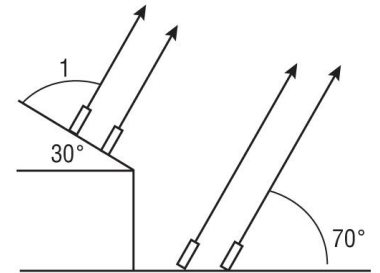


3. PATTERNS A rectangle is cut along the slanted, dashed line shown in the figure. The two pieces are rearranged to form another figure. Describe as precisely as you can the shape of the new figure. Explain.



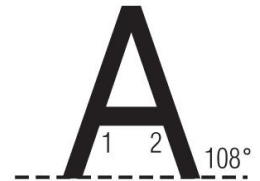
4. FIREWORKS A fireworks display is being readied for a celebration. The designers want to have four fireworks shoot out along parallel trajectories. They decide to place two launchers on a dock and the other two on the roof of a building.

To pull off this display, what should the measure of angle 1 be?



5. SIGNS Harold is making a giant letter “A” to put on the rooftop of the “A is for Apple” Orchard Store. The figure shows a sketch of the design.

a. What should the measures of angles 1 and 2 be so that the horizontal part of the “A” is truly horizontal?



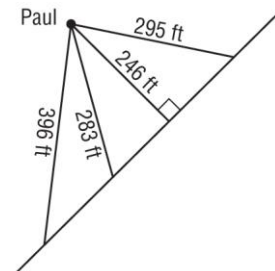
b. When building the “A,” Harold makes sure that angle 1 is correct, but when he measures angle 2, it is not correct. What does this imply about the “A”? Explain.

3-6

1. DISTANCE What does it mean if the distance between a point P and a line ℓ is zero? What does it mean if the distance between two lines is zero?

2. DISTANCE Paul is standing in the schoolyard. The figure shows his distance from various classroom doors lined up along the same wall.

How far is Paul from the wall itself?

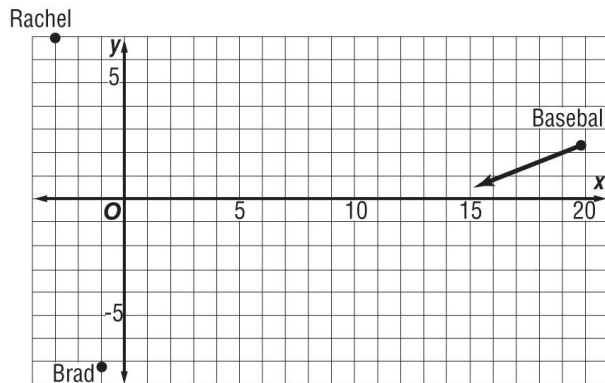


3. SEASHELLS Mason is standing on the seashore. He believes that if he makes a wish and throws a seashell back into the ocean, his wish will come true. Mason is standing at the origin of a coordinate plane and the shoreline is represented by the graph of the line $y = 1.5x + 13$. Each unit represents 1 meter. How far does Mason need to be able to throw the seashell to throw one into the ocean? Round your answer to the nearest centimeter.

4. SUPPORTS Two support beams are modeled by the lines $y = 2x + 10$ and $y = 2x + 15$. What is the distance between these two lines?

5. RESCUE Rachel sees a baseball heading straight for her friend Brad. Brad has no idea that he is about to be hit by a baseball.

Rachel decides to run and intercept the baseball. Rachel is located at $(-3, 7)$. Brad is at $(-1, -6.25)$. The baseball is currently at $(20, 2.5)$ and closing fast.



a. What is the equation of the line that passes through Brad and the baseball?

b. If Rachel runs along the path of shortest distance to intercept (i.e., along the line perpendicular to the trajectory of the baseball), what are the coordinates of the point where she will end up when she is between Brad and the baseball?

c. What is the shortest distance that Rachel must run in order to get between her friend and the baseball?