Math Objectives

- Students will be able to recognize that the distance between two parallel lines is constant.
- Students will identify segments that represent the distance between two points, a point and a line, and parallel lines.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).
- Students will attend to precision (CCSS Mathematical Practice).

Vocabulary

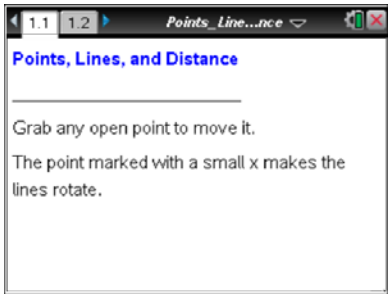
- parallel lines
- perpendicular lines
- distance
- coinciding points

About the Lesson

- This lesson involves working with parallel lines and identifying distances between various points and lines.
- As a result, students will:
  - Manipulate points and segments to determine that the distance between a point and a line is the length of the shortest segment from the point to the line.
  - Manipulate lines to make them parallel, then move a segment and observe that the measured distance between the two lines is constant.
  - Use informal deductive language to construct arguments about the distance between points and lines.

TI-Nspire™ Navigator™ System

- Screen Capture
- Quick Poll
- Live Presenter



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing ctrl G.

Lesson Materials:

Student Activity

Points_Lines_and_Distance_Student.pdf

Points_Lines_and_Distance_Student.doc

TI-Nspire document

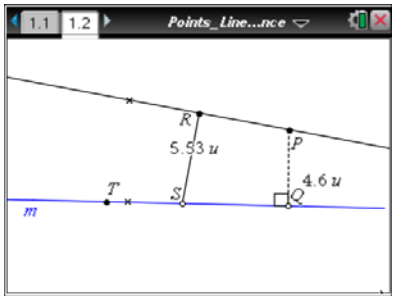
Points_Lines_and_Distance.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the cursor until it becomes a hand (☜) getting ready to grab the point. Press ctrl ☜ to grab the point and close the hand (✊).

Move to page 1.2.



1. Grab and move point *Q*. What do you notice about the length of $\overline{PQ}$ as it moves?

   Answer: It changes. When lines *n* and *m* are farther apart, the length is greater than when they are closer together.

2. What is the same and what is different about $\overline{PQ}$ and $\overline{RS}$?

   Answer: They both connect lines *n* and *m*. They are different lengths. $\overline{PQ}$ is always perpendicular to line *m*. Moving point *S* changes the angle between $\overline{RS}$ and line *m*.

3. a. Grab and move point *Q* until point *P* coincides with point *R*. Record the measures of $\overline{PQ}$ and $\overline{RS}$.

   Teacher Tip: Students may press esc to release all current selections and in preparation to grab another object.

   b. Grab and move point *S*. Will $\overline{RS}$ ever be shorter than $\overline{PQ}$? Why or why not?

   Answer: No. The shortest distance from the coinciding points (*P* and *R*) to line *m* is the perpendicular distance.

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Send students a Yes/No Quick Poll to collect their responses to #3b. Use Live Presenter to have a student demonstrate moving point S to show that $\overline{RS}$ will never be shorter than $\overline{PQ}$.

4. Grab and move point *S* until it coincides with point *Q*. What is the measure of $\angle TSR$? How do you know?

   Answer: $\angle TSR$ is a right angle (90°). Since $\overline{PQ}$ and $\overline{RS}$ coincide, $\angle TSR \cong \angle TQP$. Since $\angle TQP$ is a right angle, $\angle TSR$ must be a right angle.

5. What does $\overline{PQ}$ represent?

   Answer: $\overline{PQ}$ represents the shortest distance between point *P* and line *m*.

The distance from a point to a line is the length of the segment from the point perpendicular to the line.

6. Explain why $\overline{RS}$ is not always the distance from point *R* to line *m*.

   Answer: Because $\overline{RS}$ is not always perpendicular to line *m*.

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Use Screen Capture to determine on which screens $\overline{RS}$ is the distance from point R to line *m*.

7. a. What has to be true for $\overline{PQ}$ to be the distance from point *Q* to line *n*?
   Answer: $\overline{PQ}$ must be perpendicular to line *n*.

   b. Grab and move the X on line *m* until $\overline{PQ}$ is the distance from point *Q* to line *n*. What is true about lines *m* and *n* when $\overline{PQ}$ is the distance from point *Q* to line *n*? How do you know?
   Answer: Lines *n* and *m* are parallel. If $\overline{PQ}$ is the distance from point *Q* to line *n* and also the distance from point *P* to line *m*, it must be perpendicular to both lines. If a line segment is perpendicular to two lines, the lines must be parallel.

8. Determine if the statements below are always (A), sometimes (S), or never (N) true. Provide an explanation for your answers. Move lines *m* and *n* and points *Q* and *S*, as necessary.

Statement	A, S, N	Explanation
The distance between lines *m* and *n* is constant.	S	Only when the lines are parallel.
RS is the distance from point *R* to line *m.*	S	Only when $\overline{RS}$ is perpendicular to line *m.*
When *m* || *n*, $\overline{PQ}$ is longer than $\overline{RS}$.	N	Because it is perpendicular, the length of $\overline{PQ}$ is the shortest distance between the lines.
If *m* || *n*, the distance between lines *m* and *n* will be constant.	A	This is what we have observed. Parallel lines are everywhere equidistant.
If *m* is not parallel to *n*, $\overline{PQ}$ is the distance between lines *m* and *n*.	N	Distance between lines that are not parallel cannot be measured. Only distance from one point on a line to the other line can be determined.
In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.	A	Have the students move the figures until the lines are both perpendicular to $\overline{PQ}$ and see that they are parallel.

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Send an Always/Sometimes/Never Quick Poll to collect students' responses to the statements in question 8. Have students explain their answers.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- The distance between parallel lines is constant.
- How to identify the distance between 2 points, a point and a line, and 2 parallel lines.

Assessment

Explain the differences among the distance between 2 points, a point and a line, and 2 lines.