

Lesson Title: Parallel and Perpendicular Lines**Alg 6.1****Utah State Core Standard and Indicators** Algebra Content Standard 2.3 Process Standards 1-5**Summary**

In this activity, students will figure out an equation and a graph for a lines which are parallel and perpendicular.

Enduring Understanding

The slopes of parallel and perpendicular lines help tell the stories of linear functions on graphs and in equations.

Essential Questions

What story do parallel and perpendicular lines tell?
How do you read the story from graphs and equations?

Skill Focus

- Manipulating equations and graphs of parallel and perpendicular lines to find unknown information.

Vocabulary Focus

“students need to know parallel, perpendicular, right angle, slope-intercept form (what it is and how to use it) and point-slope form (what it is and how to use it).”

Assessment ideas:

- Use a traditional test with one example for parallel and one example for perpendicular similar to the worksheets.
- Students write a “Show All You Know” assessment about parallel and perpendicular equations and their graphs. They should be sure to answer all the essential questions and include numeric data, equations, graphs and stories. Evaluate using a teacher/class created rubric.
- The partner test in activity 3.5 also covers parallel and perpendicular.

Materials: Computers, Calculators, Graph worksheet—access link for 6.1graph**Launch ideas:**

“We will use the note card activity as a demonstration for our launch. We will also discuss the essential questions.”

Explore ideas:

“The teacher will demonstrate the note card activity, lead a discussion on the differences and similarities of parallel and perpendicular lines and equations, have clear expectations, and keep students on task. The students will need to use their prior knowledge and apply it to the lesson, compare and discuss the differences and similarities of parallel and perpendicular lines.”

Summarize ideas:

“Students will create three equations – two that are parallel and one that is perpendicular to the first two and explain how they know that they are either parallel or perpendicular.”

Apply

Directions: As part of Alg 6.1, we suggest incorporating the activity ‘Exploring Slopes of Parallel and Perpendicular Lines from Navigating through Geometry in Grades 6-8.

In this activity students figure out an equations and graphs for a lines which are parallel or perpendicular to another. They should be given the opportunity to figure this out for themselves by graphing and by using algebra. The idea is NOT to teach it from the front of the room but let students grapple with the ideas. The teacher should circulate asking probing questions and perhaps giving out important hints. When students discover hints and other groups are struggling, allow groups to teach each other.

In addition to using the “by hand” approach which follows use the activity ‘Slopes of Parallel and Perpendicular Lines’ found in Exploring Geometry with Geometer’s Sketchpad.

Questions to ask along the way:

- What do you know about parallel lines and their equations?
- Knowing what you do about parallel line equations, what would you expect about equations of perpendicular lines?
- How can you find an equation when you know an equation of a parallel or perpendicular line just one data point of the new equation?

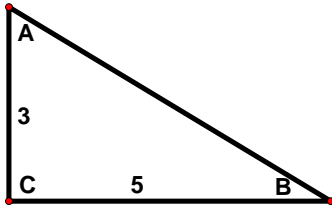
Alg 6.1a

Discovering Perpendicular Slopes

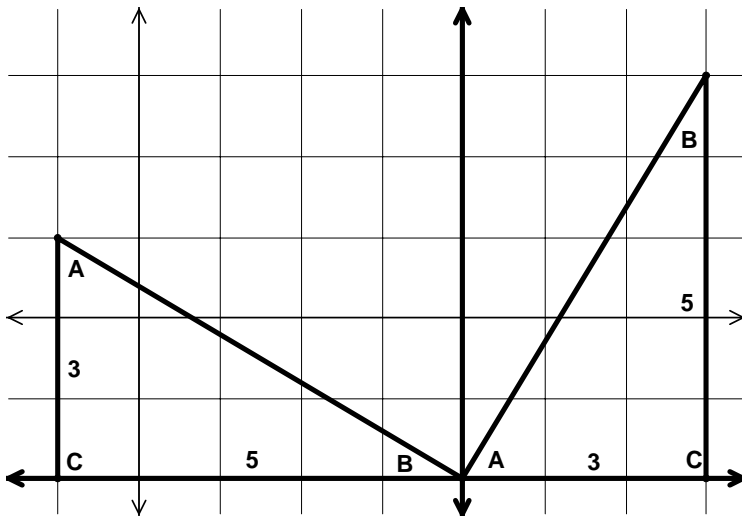
Instructions for Teacher

Materials: Graph paper worksheet (see attached link), 3 x 5 cards, a straight edge, scissors.

Have students work in pairs. Give each pair a piece of graph paper (see associated link) and a 3 x 5 card. Have students draw and then cut their 3 x 5 card diagonally. Label as shown below.



Using the 1 inch grid paper, landscape view, have students trace their triangles on the graph paper as shown below.



Ask the students to answer the questions at the bottom of the graph paper. The teacher might lead the students to fill in the drawing above by drawing two more triangles (recreating two 3 x 5 cards). This will demonstrate the square corner formed by the intersection of the two hypotenuses.

Alg 6.1b

Parallel and Perpendicular Lines

Parallel Lines

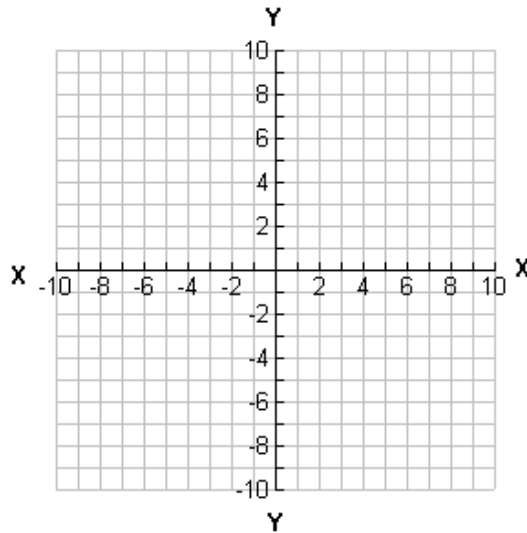
In this activity you will figure out an equation and a graph for a line which is parallel to another.

1. Graph 2 parallel lines.

line a: $y = 2x - 3$.

line b: through $(0,4)$

$y = \underline{\hspace{2cm}}$

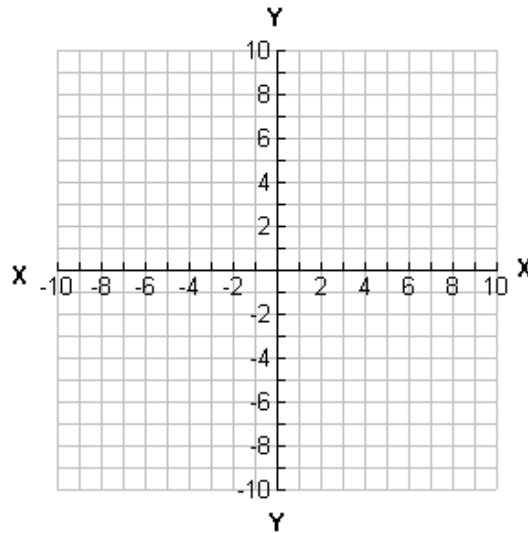


2. Graph 2 parallel lines.

line a: $y = -4x + 1$

line b: through $(0, -5)$

$y = \underline{\hspace{2cm}}$

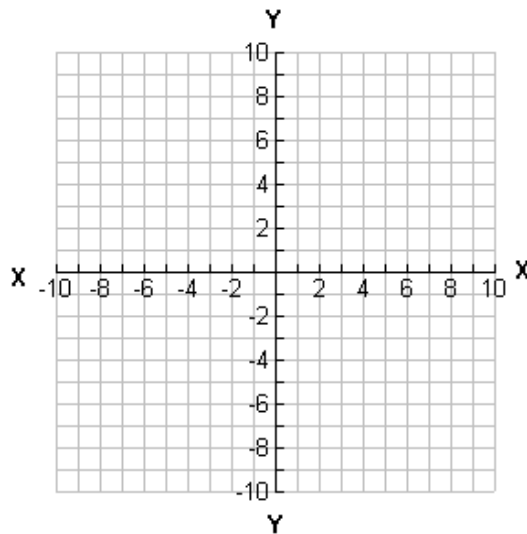


3. Graph 2 parallel lines.

line a: $y = 1/2x + 4$

line b: through $(0,7)$

$y = \underline{\hspace{2cm}}$

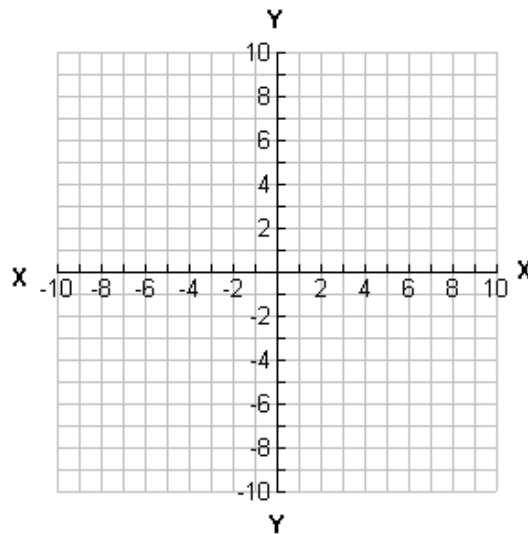


4. Graph 2 parallel lines.

line a: $y = 4x$

line b: through $(3,-3)$

$y = \underline{\hspace{2cm}}$



5. Figure out how to use algebra to find the equation of a line parallel to $y = -3x + 7$ which goes through $(2,3)$

line a: $y = -3x + 7$

line b: $y = \underline{\hspace{2cm}}$

6. Use algebra to find the equation of a line parallel to $y = 1/3x + 2$ which passes through $(-6,2)$

line a: $y = 1/3x + 2$

line b: $y = \underline{\hspace{2cm}}$

Perpendicular Lines

7. Graph 2 perpendicular lines

line a: $y = 4x + 9$

line b: Use a right angle to graph the perpendicular line which passes through $(4,-7)$.

Equation: $\underline{\hspace{2cm}}$

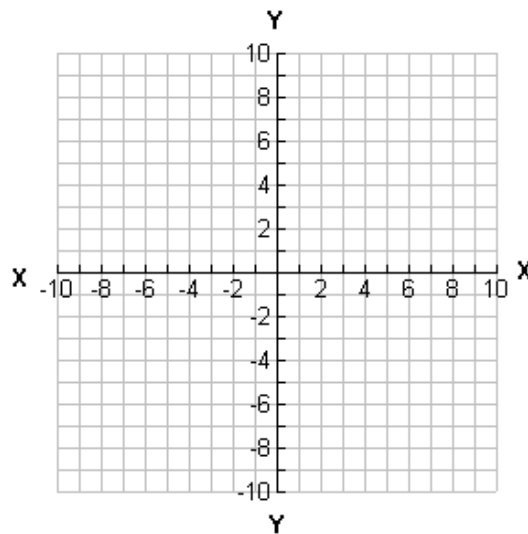
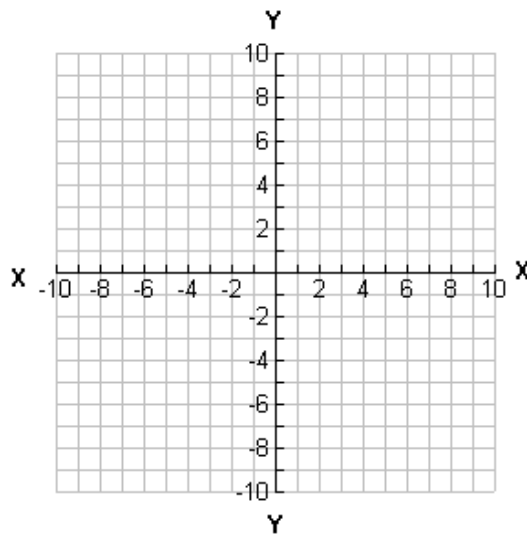
8. Graph 2 perpendicular lines

line a: $-3x = 2y + 8$

rewrite as $y = \underline{\hspace{2cm}}$

line b: a perpendicular line which passes through $(3,7)$

Equation: $\underline{\hspace{2cm}}$



9. What is the trick for the slopes of perpendicular lines?

10. If you know the trick for the slopes of perpendicular lines, figure out how to find the equation of a line perpendicular to $y = \frac{3}{4}x + 2$ which passes through $(3,7)$.

Use algebra. Don't use a graph. line a: $y = \frac{3}{4}x + 2$ line b: $y = \underline{\hspace{2cm}}$

What will you do to find out if the following pairs of lines are parallel or perpendicular?

11. line a: $y = \frac{3}{4}x + 1$
line b: $6x + 3y = 18$

12. line a: $4x - 2y = -6$
line b: $-6x + y = -4(x-2)$

13. Solve using algebra. Find the equation which is perpendicular to $y = \frac{2}{3}x - 5$ and goes through $(2,5)$.

14. Find the equation which is perpendicular to $y = -5x + 2$ and goes through $(10,-4)$.