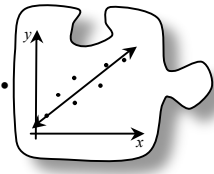
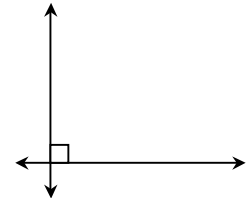


7.3.2 What if the lines are perpendicular?

Slopes of Parallel and Perpendicular Lines



In Lesson 7.1.5, you found that the slopes of parallel lines are equal because lines with the same steepness grow at the same rate. What about the slopes of perpendicular lines (lines that form a right angle)? Today you will answer this question and then use parallel and perpendicular lines to find the equations of other lines.



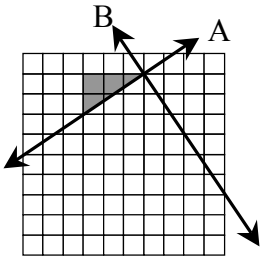
Perpendicular lines form a right angle.

7-91. SLOPES OF PERPENDICULAR LINES

To investigate the slopes of perpendicular lines, you will need some graph paper and a ruler or straightedge. You will also need a piece of transparency and an overhead pen (or tracing paper).

- First place the transparency over the graph paper. Use the grid lines and ruler to draw two perpendicular lines, like the ones shown above. Label one line A and the other line B.
- Now turn your transparency so that line A has a slope of $\frac{2}{3}$, as shown in the diagram at right. What is the slope of line B? Verify your results with your teammates and place your results in a table like the one shown at right. [$-\frac{3}{2}$]

Slope of Line A	Slope of Line B
$\frac{2}{3}$	


- Now collect data for at least three more pairs of perpendicular lines. For example, if line A has a slope of 2, what is the slope of the line perpendicular to it (line B)? What if line A has a slope of $-\frac{1}{4}$? Add each pair to your table from part (a). Share any patterns you find with your teammates. [**Answers vary.**]
- Use inductive reasoning (using patterns) to find the relationship of the slopes of perpendicular lines. That is, based on your data, how do the slopes of perpendicular lines seem to be related? If you have two perpendicular lines, how can you get the slope of one from the other? [**They are opposite reciprocals.**]
- Test your conjecture from part (d). First find the slope of the line perpendicular to a line with slope $\frac{3}{5}$ without using graph paper. Then test it with graph paper. [**The perpendicular slope is $-\frac{5}{3}$.**]

7-92. Use what you discovered about the slopes of parallel and perpendicular lines to find the equation of each line described below.

- a. Find the equation of the line that goes through the point $(2, -3)$ and is perpendicular to the line $y = -\frac{2}{5}x + 6$. [$y = \frac{5}{2}x - 8$]
- b. Find the equation of the line that is parallel to the line $-3x + 2y = 10$ and goes through the point $(4, 7)$. [$y = \frac{3}{2}x + 1$]

7-93. Line L is perpendicular to the line $6x - y = 7$ and passes through the point $(0, 6)$. Line M is parallel to the line $y = \frac{2}{3}x - 4$ and passes through the point $(-3, -1)$. Where do these lines intersect? Explain how you found your solution. [**line L:** $y = -\frac{1}{6}x + 6$; **line M:** $y = \frac{2}{3}x + 1$; **point of intersection:** $(6, 5)$]

7-94. EXTENSION

Suppose the rule for line A is $y = \frac{6}{5}x - 10$. Line A is parallel to line B, which is perpendicular to line C. If line D is perpendicular to line C and perpendicular to line E, what is the slope of line E? **Justify** your conclusion. [**Lines A and E are perpendicular, so the slope of line E is $-\frac{5}{6}$.**]

7-95. In your Learning Log, summarize what you have learned today. Be sure to explain the relationship between the slopes of perpendicular lines and describe how to get the slope of one line when you know the slope of a line perpendicular to it. Title this entry “Slopes of Perpendicular Lines” and include today’s date.

