



### Problem 1 – Investigating the coordinates of points

Move to page 1.2 and place and label points  $P$  and  $Q$  anywhere in the coordinate plane as directed by your teacher. Use the **Coordinates and Equations** tool to label each point with its coordinates.

Select **MENU > Actions > Redefine** to place point  $P$  on the  $x$ -axis and point  $Q$  on the  $y$ -axis. Drag the points on their respective axes and answer the following questions.

- Explain what is common to all points on the  $x$ -axis.
  
- Explain what is common to all points on the  $y$ -axis.

Now show the grid by selecting **MENU > View > Show Grid**. Redefine points  $P$  and  $Q$  to grid points to show integer values for the coordinates. As directed by your teacher, drag point  $P$  around the coordinate system until you can complete the statements below using the words *positive* or *negative*.

- A point is in Quadrant 1 (top right) when its  $x$ -coordinate is \_\_\_\_\_ and its  $y$ -coordinate is \_\_\_\_\_.
- A point is in Quadrant 2 (top left) when its  $x$ -coordinate is \_\_\_\_\_ and its  $y$ -coordinate is \_\_\_\_\_.
- A point is in Quadrant 3 (bottom left) when its  $x$ -coordinate is \_\_\_\_\_ and its  $y$ -coordinate is \_\_\_\_\_.
- A point is in Quadrant 4 (bottom right) when its  $x$ -coordinate is \_\_\_\_\_ and its  $y$ -coordinate is \_\_\_\_\_.

Next follow your teacher's directions to construct perpendiculars through point  $P$  to each axis and measure each distance. Drag point  $P$  and explore.

- What is this relationship between the coordinates of point  $P$  and the distances to each axis?

### Problem 2 – Investigating lines, equations, and slopes

Listen as your teacher explains how to draw a line through points  $P$  and  $Q$ , and label the line with its equation and slope. Look for relationships between the slope and equation as you change the line by grabbing and dragging point  $P$ , and then by grabbing and dragging the line itself.

- When dragging the line by point  $P$ , what is the relationship of the slope and the equation?
- When dragging the line itself, what is changing in the equation?
- Drag point  $Q$  to the  $y$ -axis (or redefine it to the  $y$ -axis). What is the relationship between point  $Q$  and the equation of the line?

### Problem 3 – Investigating the slopes of parallel and perpendicular lines

On page 3.1, drag the lines by points  $P$  and  $Q$  and examine the slopes.

- What can you say about the slopes of two parallel lines?

On page 3.2, again drag the lines to investigate the relationship between the slopes.

- What can you say about the slopes of two perpendicular lines?

Finally, you will use the **Calculate** tool (**MENU > Actions > Calculate**) to see what happens when the slopes of two perpendicular lines are multiplied together.

Create a text box (**MENU > Actions > Text**) in an empty area on the graph, and type “ $a*b$ ” (or any other two variables). Next, select the **Calculate** tool and hover the cursor over the text box you just created. Press **(enter)** and move the cursor a little. You will now be prompted for the values to use for  $a$  and  $b$ ; simply click on each of the slopes at the bottom of the screen. Move the product near the original expression.

Now, change the lines by grabbing and dragging point  $P$ .

- What do you observe about the product of the slopes?