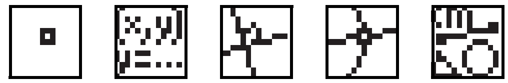
EXPLORATIONS™

Activity 5

Objective

- To explore the coordinate system

Cabri® Jr. Tools



Points in the Coordinate Plane

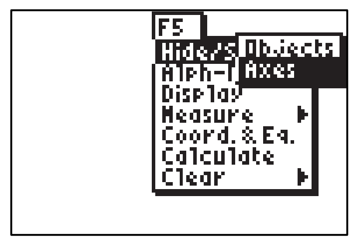
Introduction

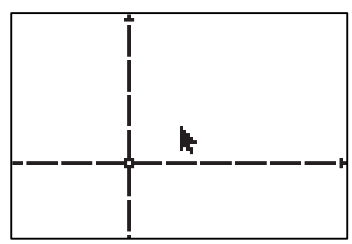
This activity uses the Cabri Jr. application to explore the coordinate system.

Construction

Show the coordinate axes, and create a point in the first quadrant.

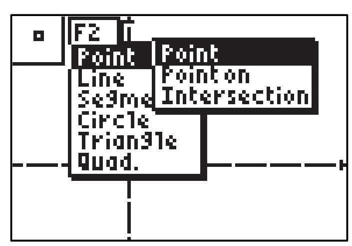
1. Open the **Display Tools Menu**, and then highlight **Hide/Show**. Press ▸ to view the **Hide/Show Menu**. Highlight **Axes**. Press ENTER to display the coordinate axes.



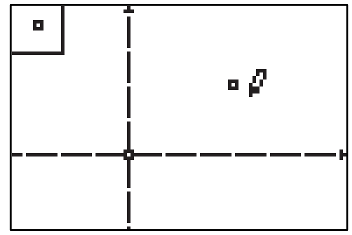


2. Open the **Drawing Tools Menu**, and then highlight **Point**. Press ▸ to view the **Point Menu**. Highlight **Point**, and press ENTER.

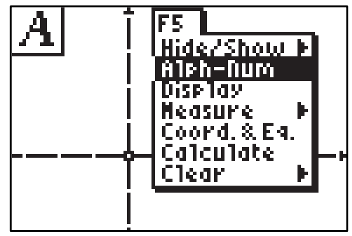
Note: *The tool icon at the top left of the screen indicates that the* **Point** *tool is active.*



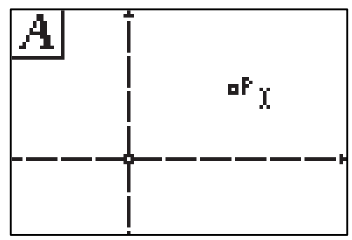
3. Move the cursor to the first quadrant and press ENTER to anchor a point there.



4. Open the **Display Tools Menu**, and then highlight **Alpha-Num**. Press ENTER.

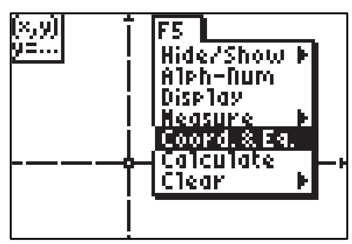


5. Move the cursor to the point. The point blinks when the cursor is close enough to the point to select it. Press ENTER to create a label for this point. Enter *P* by pressing 8 (note that A-LOCK is on), and then press ENTER to complete the label. Press CLEAR to exit the tool.

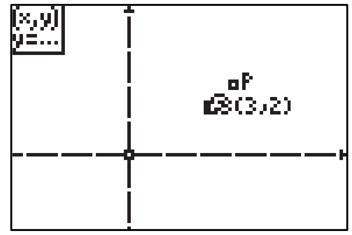


Display the coordinates of the point, and drag it around the screen.

6. Open the **Display Tools Menu**, and then highlight **Coord. & Eq**. Press ENTER.



7. Move the cursor to point *P* and press [ENTER].

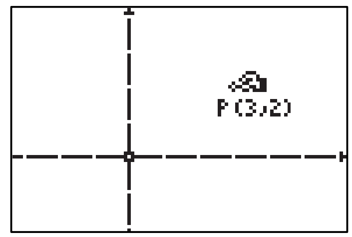


Note: *The point blinks when the cursor is close enough to select it.*

Note: *Be careful to grab the point itself, not the label* P.

Move the cursor to a desired location and press [ENTER] to anchor the coordinates. Press [CLEAR] to exit the **Coordinate and Equations** tool.

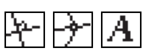
8. Move the cursor to point *P* and press [ENTER] to grab it.



Note: *The pointer changes to an outlined arrow when it is near an available object.*

Note: *Be careful to grab the point itself, not the label* P.

Use the cursor keys to drag the point to all four quadrants and observe any changes in the coordinates. When finished, press [CLEAR] to exit.

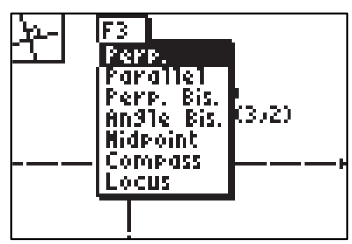
 *Construct lines through* P *perpendicular to the axes.*

To use the **Perpendicular** tool, you must do the following:

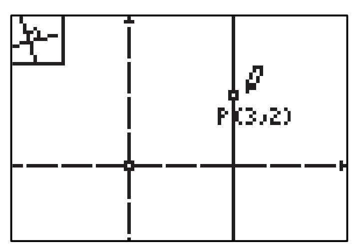
- Select the point through which the perpendicular line will be drawn.
- Select the line or segment to which the new line will be perpendicular.

The order of the selection does not matter.

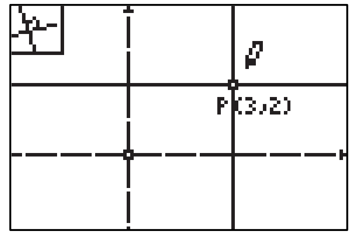
9. Open the **Construction Tools Menu** and highlight **Perp**. Press [ENTER].



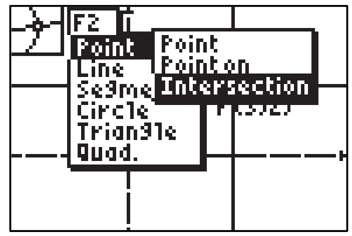
10. Move the cursor to the *x*-axis and press [ENTER]. Move the cursor to point *P* and press [ENTER]. A line is drawn through *P* perpendicular to the *x*-axis.



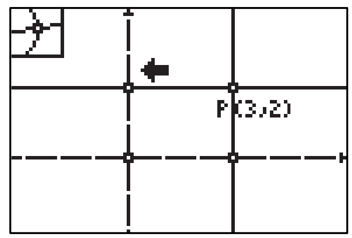
11. Move the cursor to the *y*-axis, and press ENTER. Move the cursor to point *P* and press ENTER. A line is drawn through *P* perpendicular to the *y*-axis.



12. Open the **Drawing Tools Menu**, and then highlight **Point**. Press ► to view the **Point Menu**. Highlight **Intersection** and press ENTER.

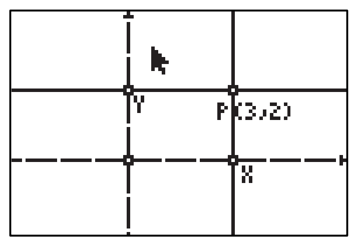


13. Move the cursor to the intersection of the vertical line with the *x*-axis, and press ENTER to create an intersection point there. Move the cursor to the intersection of the horizontal line with the *y*-axis, and press ENTER to create an intersection point there.



14. Use the **Alpha-Numeric** tool to label these points *X* and *Y* respectively (**X** is above STO►, **Y** is above 1).

Note: *If necessary, press* ALPHA *to grab and move the labels to a more convenient location.*

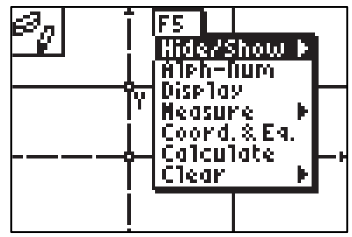


 *Hide the perpendiculars and construct and measure the length of segments* PX *and* PY.

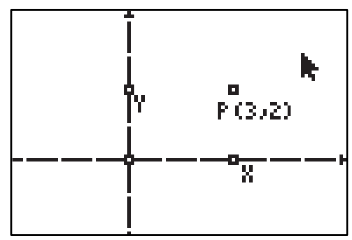
When using the **Hide/Show** tool, notice the following:

- The pointer changes to an eraser when it is near an available object to hide.
- After pressing ENTER, the object is displayed with dotted lines until the pointer is moved away.
- To show objects previously hidden, move the pointer to the location of the object. The pointer changes to a pen when it is close enough to a hidden object. Press ENTER to show the object.

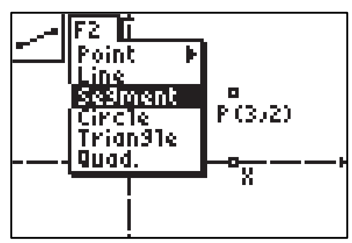
15. Open the **Display Tools Menu**, and then highlight **Hide/Show**. Press ENTER.



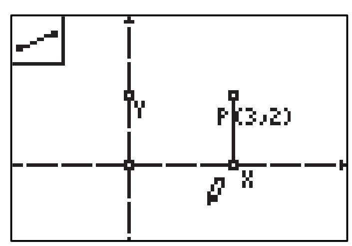
16. Use the **Hide/Show** tool to hide the perpendicular lines. Move the cursor to the object you wish to hide and press ENTER. When you have finished, press CLEAR to exit the tool.



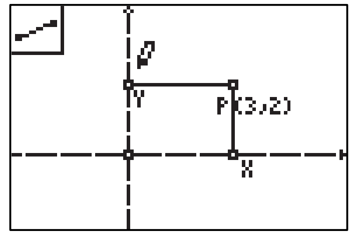
17. Open the **Drawing Tools Menu**, and then highlight **Segment**. Press ENTER.



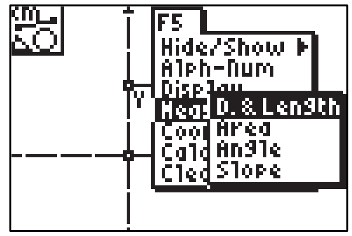
18. Move the cursor to point *P* and press ENTER to anchor the first endpoint of a segment there. Move the cursor to point *X* and press ENTER to anchor the second endpoint of a segment there.



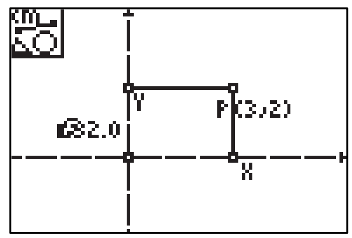
19. Repeat step **18** to create a segment with endpoints *P* and *Y*.



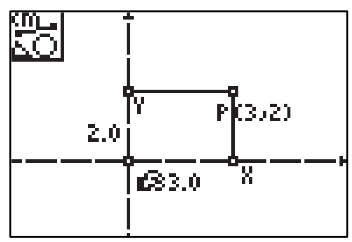
20. Open the **Display Tools Menu**, and then highlight **Measure**. Press ► to view the **Measure Menu**. Highlight **D. & Length**. Press ENTER.



21. Move the cursor to $\overline{PX}$ and press ENTER. Press ENTER again to anchor the measurement.



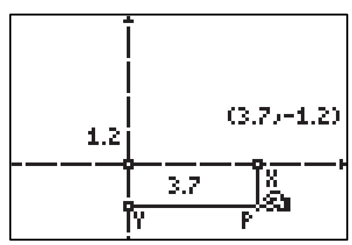
22. Repeat step **21** to measure the length of $\overline{PY}$. When finished, press CLEAR to exit the **Distance & Length** tool.



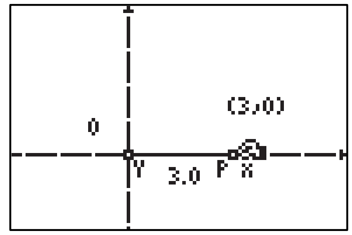
Drag point P *around the screen, and observe the results.*

23. Move the cursor to point *P* and press ALPHA to grab it. Use the cursor keys to drag the point to all four quadrants, and observe the changes in the coordinates and the measured distances.

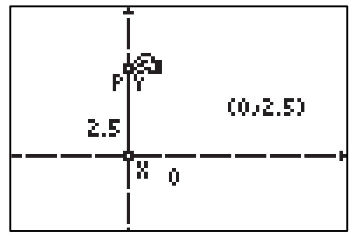
Note: *Be careful to grab the point itself, not the label* P.



24. Drag point *P* onto the *x*-axis. Drag point *P* along the *x*-axis. Explain how the *x*- and *y*-coordinates of the point change.



25. Repeat the same procedure for point *P* on the *y*-axis. When you have finished, press [CLEAR] to exit.



Data Collection and Analysis

Name ______________________

Date ______________________

Questions and Conjectures

1. Explain how the coordinates of point *P* change as *P* is dragged into different quadrants of the coordinate plane.

2. Explain the relationship between the perpendicular distances from point *P* to the axes and the coordinates of point *P*.

3. How do the *x*- and *y*-coordinates of point *P* change as *P* is dragged on the *x*-axis?

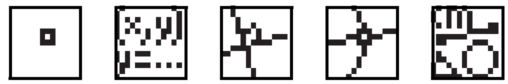
4. How do the *x*- and *y*-coordinates of point *P* change as *P* is dragged on the *y*-axis?

Teacher Notes

Objective

- To explore the coordinate system

Cabri® Jr. Tools



Activity 5

Points in the Coordinate Plane

Construction Notes

The coordinates of point *P* will change interactively as students drag the point around the screen. This is a good introductory activity for students who are new to the coordinate system. Students can establish definitions and coordinate sign patterns for the four quadrants through experimentation. In addition, students develop important technology skills. They learn how to access the coordinate axes, draw and label points, show coordinates, and drag an object around the screen using the 4-way directional arrows.

When students use the **Distance & Length** tool to measure the distance from a point to one of the axes, the measurement given is the perpendicular distance. Students may not realize that there is a one-to-one correspondence between the distance from the point to the axes and the absolute value of the coordinates of point *P* as it is dragged around the screen. Since distance is never negative, when either coordinate of *P* is negative, the distance is the absolute value. This situation can serve as an opener for a discussion of the concept of absolute value as the distance from the point to the axis, or from the point to the origin if the point *P* is positioned on one of the axes.

The result of dragging point *P* onto the *x*-axis is that its *y*-coordinate becomes zero. Students should notice that *all* of the points on the *x*-axis have a *y*-coordinate of zero. This is an important concept for understanding zeros of functions and other graphical concepts. Repeating the same exercise with point *P* on the *y*-axis shows the same property for the *x*-coordinate and foreshadows the important concept of a *y*-intercept.

Answers to Questions and Conjectures

1. Explain how the coordinates of point *P* change as *P* is dragged into different quadrants of the coordinate plane.

   When *P* is in the first quadrant, the coordinates are both positive. When *P* is in the second quadrant, the *x*-coordinate is negative and the *y*-coordinate is positive. When *P* is in the third quadrant, the coordinates are both negative. When *P* is in the fourth quadrant, the *x*-coordinate is positive and the *y*-coordinate is negative.

2. Explain the relationship between the perpendicular distances from point *P* to the axes and the coordinates of point *P*.

   The perpendicular distance from point *P* to the *y*-axis is the absolute value of the *x*-coordinate. The perpendicular distance from point *P* to the *x*-axis is the absolute value of the *y*-coordinate.

3. How do the *x*- and *y*-coordinates of point *P* change as *P* is dragged on the *x*-axis?

   When *P* is on the *x*-axis, the *y*-coordinate is always zero and the *x*-coordinate changes.

4. How do the *x*- and *y*-coordinates of point *P* change as *P* is dragged on the *y*-axis?

   When *P* is on the *y*-axis, the *x*-coordinate is always zero and the *y*-coordinate changes.