Activity Overview
In this activity, students draw figures in one- and two-point perspective and compare and contrast the two types of drawings. They then create an isometric drawing and compare it to their drawings in perspective.

Topic: 3-Dimensional Geometry
- Construct 3–dimensional prisms and pyramids.
- Record the number of faces, edges, and vertices of prisms.

Teacher Preparation and Notes
- Perspective drawings can be taught at any time in a geometry curriculum, but are most appropriate after lessons on parallel and perpendicular lines, three-dimensional figures, and dilations.
- Throughout the activity, students use many drawing and construction tools, such as the **Segment**, **Parallel**, and **Perpendicular** tools. In this document, the first use of a tool is by name and accompanied by its location within the menu structure. For subsequent uses, the tool may be mentioned by name or its function, and the menu location is omitted.
- This activity is designed to have students explore individually or in pairs.
- **To download the Cabri Jr. files and student worksheet, go to education.ti.com/exchange and enter "10033" in the keyword search box.**

Suggested Related Activities
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.
- Building 3-D Initials with a Vanishing Point (TI-Nspire technology) — 9252
- Geometry: Isometric Grids and 3D Shapes (TI-Nspire technology) — 12187
- How hot or cold does it really feel? (TI-89 Titanium) — 3486
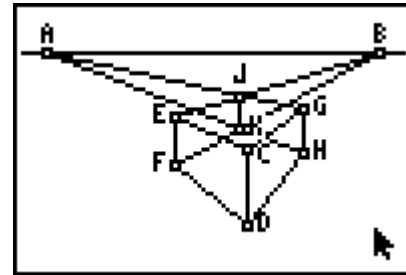
This activity includes screen captures taken from the TI-84 Plus Silver Edition. It is also appropriate for use with the TI-83 Plus and TI-84 Plus but slight variances may be found within the directions.

Compatible Devices:
- TI-84 Plus Family

Software Application:
- Cabri™ Jr.

Associated Materials:
- PerspectiveDrawings_Student.pdf
- PerspectiveDrawings_Student.doc
- RECPRISM.8xv
- TRIPRISM.8xv
- TWOPERSP.8xv
- SODRAW.8xv

Click HERE for Graphing Calculator Tutorials.

Problem 1 – One-Point Perspective

Students will open the *Cabri Jr.* file *RECPRISM* and find a vanishing point *A* along the horizon and a rectangle *BCDE*.

They are to use the **Segment** tool from the **F2** menu to draw $\overline{AB}$ and $\overline{AC}$. These two segments (and any other segment that joins a vertex of the prism to the vanishing point) are hereafter referred to as *vanishing segments*.

Next, they will create $\overline{FG}$ such that *F* is between *A* and *B*, *G* is between *A* and *C*, and $\overline{FG} \parallel \overline{BC}$ (Refer to the diagram at the right).

To do this, they will need to do the following:

- Place a point *F* on $\overline{AB}$. (**F2 > Point > Point On**)

- Construct a line through *F* parallel to $\overline{BC}$.
  (**F3 > Parallel**)

- Plot point *G* at the intersection of the parallel line and $\overline{AC}$. (**F2 > Point > Intersection**)

- Hide the line. (**F5 > Hide/Show > Object**)

- Draw $\overline{FG}$.

Students can now hide the vanishing segments, $\overline{AB}$ and $\overline{AC}$, and draw $\overline{BF}$ and $\overline{CG}$. The front and top faces of the rectangular prism have been constructed.

Ask students if they are satisfied that this drawing completely represents a rectangular prism. Have them drag point *A* (press ALPHA to grab the point) to either the far left or far right and ask students what is wrong with the drawing. (The rectangular prism does not have a face on either side.)

To complete the prism, students next need to construct $\overline{AD}$ and $\overline{AE}$. Then, using the **Perpendicular** tool (**F3 > Perp.**), construct two lines perpendicular to $\overline{FG}$ —one through *F* and the other through *G*. The vertical "back" edges $\overline{GH}$ and $\overline{FJ}$ may then be created by plotting the intersection points, hiding the perpendicular lines, and constructing the segments as needed.

To show all six edges, students should draw a segment connecting *H* and *J*. Once all of the vanishing segments are hidden, students will find they need to also construct segments $\overline{DH}$ and $\overline{EJ}$.
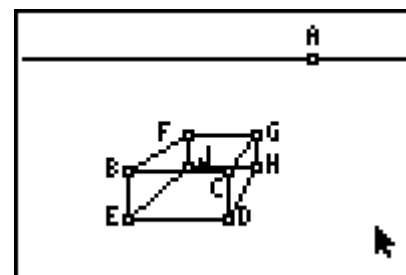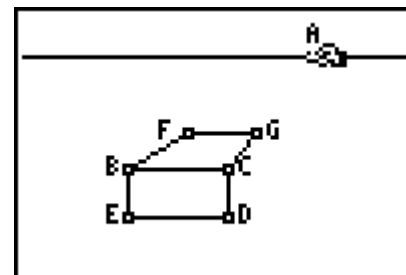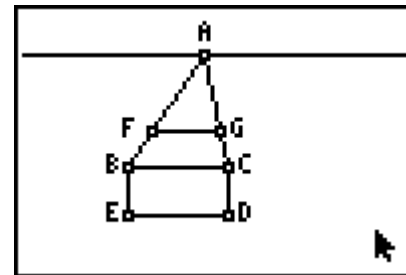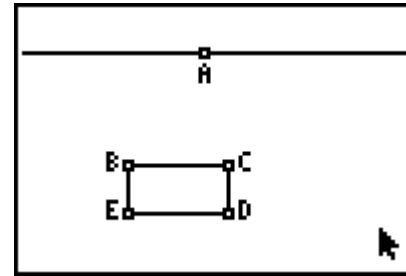
Depending on the topics you have recently covered in class, you can now have students identify parallel, intersecting, and skew lines; count faces, vertices, and edges; or discuss the similarity of rectangles *BCDE* and *FGHJ*.

When students have finished exploring their prisms, they may wish to hide or dash the edges that would not be visible if the figure were not transparent. The appearance of the edges may be altered using the **Display** tool (**F5 > Display**).

Students are to open **TRIPRISM** and create a triangular prism in one-point perspective on their own. They should use the same process as was used for the rectangular prism. Be sure to circulate around the room and assist students as needed.

Allow students a few minutes to explore the figure by dragging point *A* along the horizon or dragging an edge. Vertices *B*, *C*, and *D* can also be dragged on this figure.
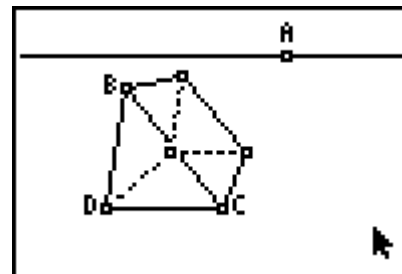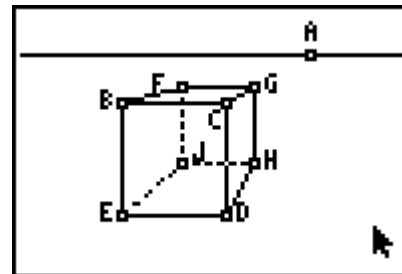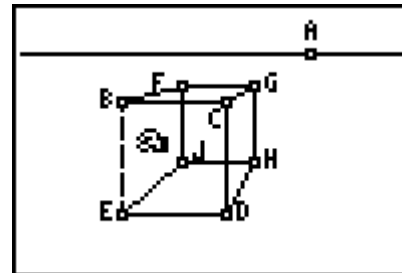
Problem 2 – Two-Point Perspective

The Cabri Jr. file **TWOPERSP** contains two vanishing points, *A* and *B*, signifying this rectangular prism will be drawn in two-point perspective. The file also contains a vertical line segment, $\overline{CD}$, which will be the front edge of the prism.

$\overline{CD}$ is constructed so that dragging point *C* changes the segment's length and dragging point *D* translates the segment.

Next, students will then use the **Segment** tool to draw the vanishing segments $\overline{AC}$, $\overline{AD}$, $\overline{BC}$, and $\overline{BD}$. Then they should use the **Point On**, **Parallel**, **Intersection**, **Hide/Show**, and **Segment** tools (as they did in Problem 1) to construct the vertical edges, $\overline{EF}$ and $\overline{GH}$, of the left and right faces.

The top and bottom edges of those faces, $\overline{CE}$, $\overline{CG}$, $\overline{DF}$, and $\overline{DH}$ may be drawn as well.
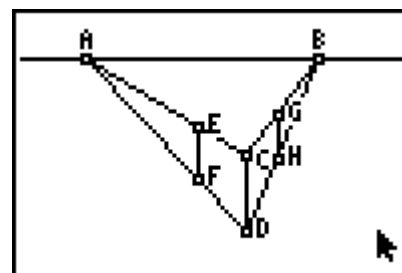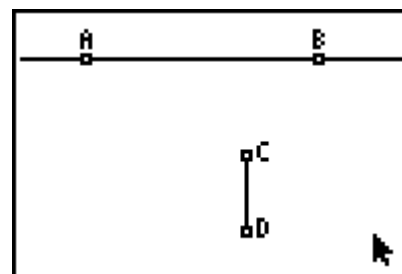
Students should now hide the four vanishing segments, and then draw four more: from *E* and *F* to *B* and from *G* and *H* to *A*.

The intersection of the upper two vanishing segments and that of the lower two vanishing segments should be plotted and a segment drawn between them to form the last vertical edge, $\overline{JK}$.

The vanishing segments may then be hidden so that students can draw the remaining edges of the prism.

As before, allow students some time to drag edges, vertices, and vanishing points, observing how the prism changes as they do so. (Dragging $\overline{CD}$ is very interesting!) Again, students can either hide or dash any "hidden edges."
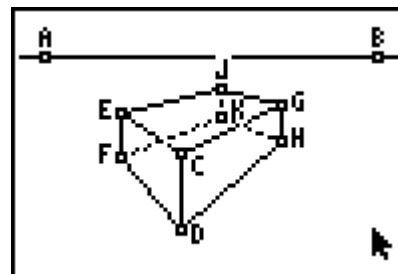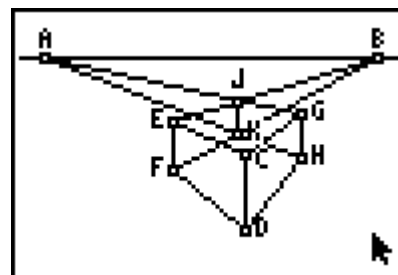
Problem 3 – An Isometric Drawing

Using **ISODRAW**, students will construct an isometric drawing of a rectangular prism. The three segments shown represent the three "front" edges of the prism, and each of the angles the segments form measures 120°. Students should first use the **Parallel**, **Intersection**, **Hide/Show**, and **Segment** tools to construct $\overline{AE}$, $\overline{CF}$, $\overline{DE}$, and $\overline{DF}$, as shown in the diagram to the right.

They may then use the same sequence of tools once more to construct the remaining edges: $\overline{AG}$, $\overline{CG}$, $\overline{EH}$, $\overline{FH}$, and $\overline{GH}$.

After completing the isometric drawing, students should compare it to the perspective drawings from Problems 1 and 2. As a similarity, students may identify that right angles "in real-life" do not actually measure 90° in the drawings. As a difference, all parallel lines "in real-life" are parallel in an isometric drawing, whereas in perspective drawings, *some* parallel lines actually "meet" at the vanishing point.