


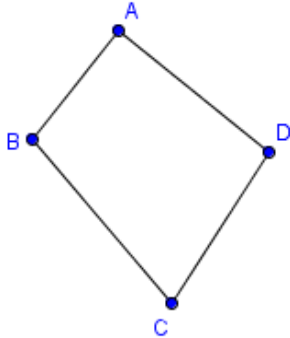


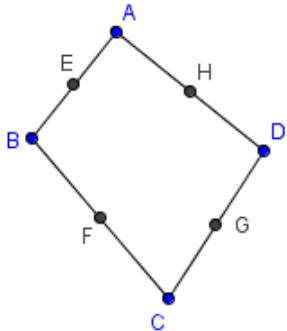


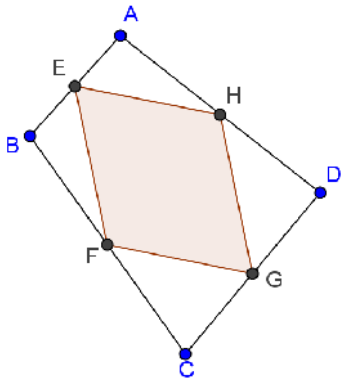





Constructing a Quadrilateral

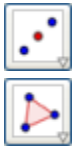
	<p>1. Click the New Point button, and then click four distinct places on drawing pad forming the vertices of a quadrilateral.</p>
	<p>2. If the labels of the points are not displayed, click the Move button, right-click each point and click <i>Show label</i> from the context menu. (The <i>context menu</i> is the pop-up menu that appears when you right click an object.)</p>
	<p>3. Select the Segment between two points button and click point A and click point B to construct \overline{AB}. Repeat until $ABCD$ is formed. Your drawing should look like the figure below.</p> 

Investigation: Quadrilaterals in Quadrilaterals

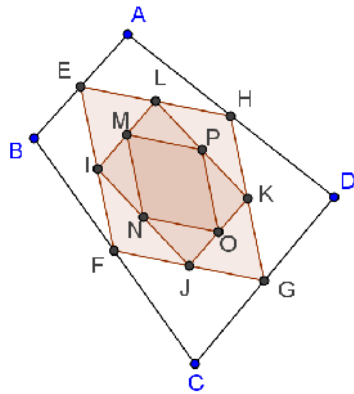
	<p>4. To determine the midpoint of each side of the quadrilateral, click the inverted triangle at the bottom right of the New Point button and choose Midpoint or Center tool from the list. Click the segments in the following order: \overline{AB}, \overline{BC}, \overline{CD}, and \overline{AD}.</p>
	<p>5. Select the Move button, right click the midpoints and click <i>Show label</i> from the context menu. Your drawing should look like the figure below.</p> 
	<p>6. Move the vertices of the quadrilateral. What do you observe?</p>

	<p>7. Connect the midpoints of the quadrilateral using the Polygon tool. To do this, click the Polygon tool and click the points in the following order: Point E, point F, point G, point H and then point E again to close the polygon.</p> 
	<p>8. Move the vertices of the quadrilateral. What do you observe about the figure?</p>
	<p>9. What conjecture can you make based on your observation?</p>
	<p>10. Does your conjecture hold when $ABCD$ is concave?</p>
	<p>11. Draw the diagonals of $ABCD$.</p>
	<p>12. Measure the length of each diagonal and the length of each side of $EFGH$ using the Distance or Length tool. Select the Distance or Length button, and then click each segment you need to measure.</p>
	<p>13. Turn on the grid in the View menu. Use the grid as a guide to investigate the following:</p> <ol style="list-style-type: none"> Describe $EFGH$ when the diagonals are perpendicular. Describe $EFGH$ when the diagonals are congruent. Describe $EFGH$ when the diagonals are both perpendicular and congruent.
	<p>14. Hide the diagonals of $ABCD$ by right-clicking each segment and clicking <i>Show Object</i>. Hide the measures of the sides of $EFGH$ by right-clicking each side and clicking <i>Show Label</i>.</p>





15. Construct the midpoints of $EFGH$ and use them to construct quadrilateral $IJKL$. Construct the midpoint of $IJKL$ and use them to construct quadrilateral $MNOP$. How are $MNOP$ and $EFGH$ related?

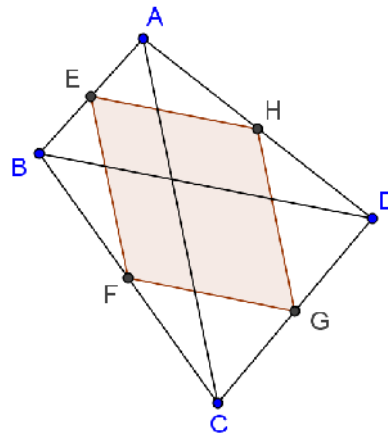


Prove that the figure formed by joining the midpoints of a quadrilateral is a parallelogram. (Hint: Use the Triangle Midsegment Theorem)



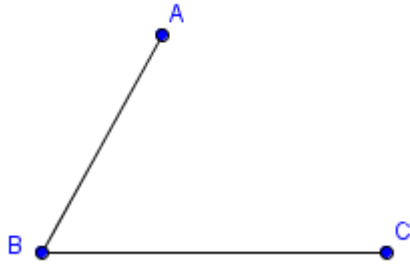


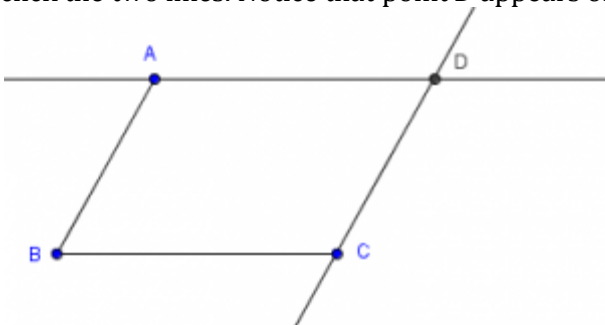



Proof:

Given:



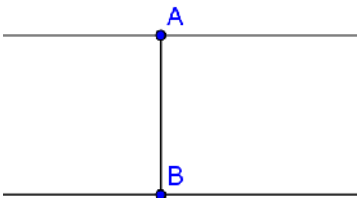


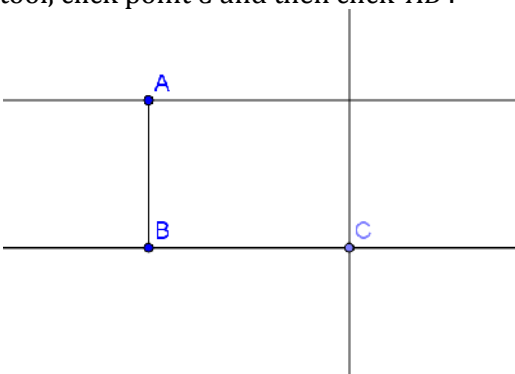



Show:





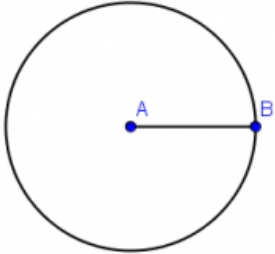


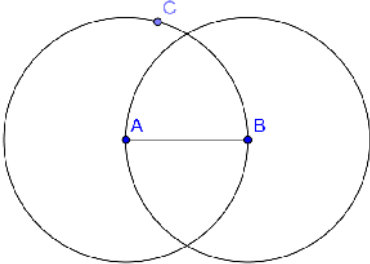


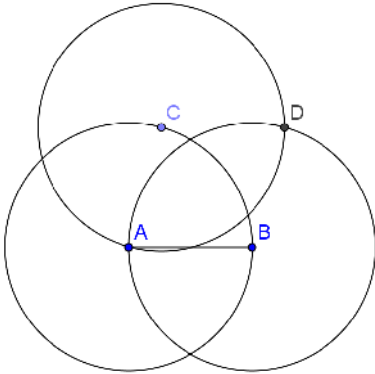

Constructing a Parallelogram

	<p>1. To show labels of new points only during construction, click the <i>Options</i> menu, click <i>Labeling</i>, and then click <i>New Points Only</i>.</p>
	<p>2. Select the New Point tool, and click three different locations on the drawing pad to create points <i>A</i>, <i>B</i> and <i>C</i>.</p>
	<p>3. Select the Segment between Two Points tool, select point <i>A</i> and select point <i>B</i> to construct \overline{AB}. Now, construct \overline{BC}.</p> 
	<p>4. Now, we will construct two lines: the line parallel to \overline{AB} passing through point <i>C</i> and the line parallel to \overline{BC} passing through point <i>A</i>. To construct a line passing through point <i>C</i> parallel to \overline{AB}, select the Parallel Line tool, select \overline{AB} and then click point <i>C</i>. Now, construct the second line.</p>
	<p>5. Next, we intersect the two lines. Select the Intersect Two Objects tool, and then click the two lines. Notice that point <i>D</i> appears on the intersection of the two lines.</p> 
	<p>6. Next, we hide the two lines. To hide \overline{AD}, right click the line and select <i>Show Object</i> to uncheck it from the context menu. Next, hide the other line.</p>
	<p>7. Now, use the Segment Between Two Points tool to connect points <i>A</i> and <i>D</i>. Connect point <i>C</i> and <i>D</i>.</p>
	<p>8. Move the points in your figure. What do you observe?</p>
	<p>9. Describe the quadrilateral formed by joining the midpoints of each side of the parallelogram. Be as precise as possible.</p>



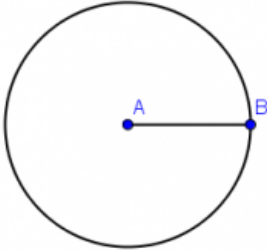


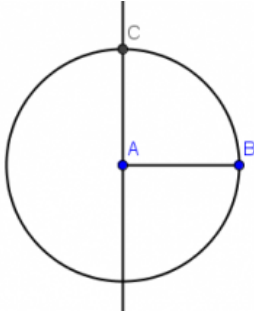



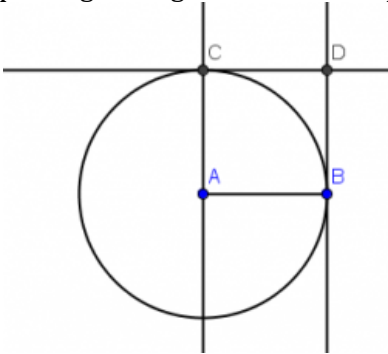
Constructing a Rectangle


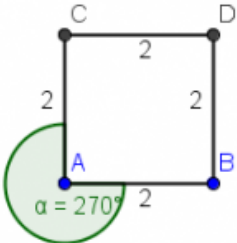
	<p>1. Construct \overline{AB}.</p>
	<p>2. We will construct two lines that are both perpendicular to \overline{AB}, one passing through A and the other through B. To do this, click the Perpendicular Line tool, click point A and click \overline{AB}. To construct another line, click point B then click \overline{AB}.</p> 
	<p>3. Next, we will construct a point on the line passing through point B. To do this, click the New Point tool, and then click the line passing through B.</p>
	<p>4. Now, to create a line parallel to \overline{AB}, passing through point C, click the Parallel line tool, click point C and then click \overline{AB}.</p> 
	<p>5. Using the intersect tool, we will construct the intersection of the line passing through C (parallel to AB) and the line passing through A. To do this, click the Intersect Two Objects tool and click the two lines mentioned.</p>
	<p>6. We will hide the three lines and connect the points with the segment tool to construct our rectangle. To do this, click the Show/Hide Object tool and click the three lines. Notice that the lines are highlighted. Click Move tool to hide the lines.</p>
	<p>7. Using the Segment between Two Points tool to connect the points to construct the rectangle.</p>
	<p>8. Describe the quadrilateral formed by joining the midpoints of each side of the rectangle. Be as precise as possible.</p>

Constructing a Rhombus





	<p>1. Construct \overline{AB}.</p>
	<p>2. Construct a circle with center A passing through B. To do this, select the Circle with Center through Point tool, click point A, followed by point B.</p> 
	<p>3. Construct point C on the circle.</p>
	<p>4. Construct a second circle centered at B, passing through point A.</p> 
	<p>5. Construct a third circle centered at C, passing through point A.</p>
	<p>6. Construct point D at the intersection of these two circles.</p> 
	<p>7. Hide the circles and use the Segment between Two Points tool to finish the construction of the rhombus.</p>
	<p>9. Describe the quadrilateral formed by joining the midpoints of each side of the rhombus. Be as precise as possible.</p>

Constructing a Square




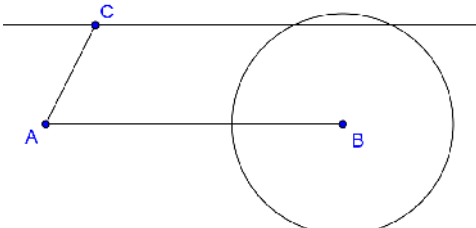

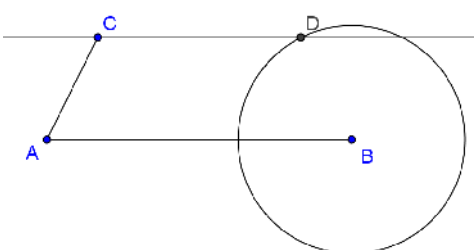

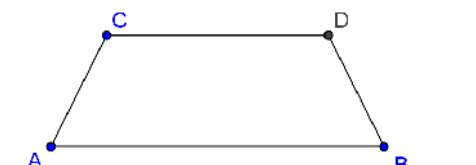
	<p>1. Construct \overline{AB}.</p>
	<p>2. Construct a circle with center A passing through B. To do this, select the Circle with Center through Point tool, click point A, followed by point B.</p> 
	<p>3. To construct a line perpendicular to \overline{AB} and passing through A, click the Perpendicular line tool, click \overline{AB} then click point A.</p>
	<p>4. To intersect the circle and the line, use the New Point tool and click one of the intersections. If the label of the third point is not shown, right click the point, then click <i>Show label</i>.</p> 
	<p>5. Next, we construct a line parallel to \overline{AB}, passing through C. To do this, select the Parallel line tool, click \overline{AB} (not the points), then click point C.</p>
	<p>6. Now, we construct a line parallel to \overline{AC} and passing through point B. To do this, with the Parallel line tool still active, click \overline{AC} then click point B.</p>
	<p>7. To construct the fourth vertex, select the Intersect Two Objects tool, click the line passing through B and the line perpendicular to it.</p> 

	<p>8. Next we hide all the objects except the four points and \overline{AB}. To do this, right click the objects that we are going to hide, and then uncheck <i>Show Object</i> from the context menu.</p>
	<p>9. To complete the square, connect points <i>A</i> and <i>C</i>, points <i>C</i> and <i>D</i>, and points <i>D</i> and <i>B</i> with the Segment between Two Points tool.</p>
	<p>10. To verify that the quadrilateral that we created is indeed a square, right click each side and click <i>Object Properties</i>. In the <i>Object Properties</i> window, select the <i>Basic</i> tab. Be sure that the <i>Show label</i> check box is checked and choose <i>Value</i> from the <i>Show label</i> drop down list box.</p>
	<p>11. To measure $\angle A$, click the Angle tool, and click the vertices in the following order: point <i>C</i>, point <i>A</i> and then point <i>B</i> (or <i>B</i>, then <i>A</i>, then <i>C</i>).</p> <div style="text-align: center;">  </div> <p>In case the angle formed is a reflex angle, right click the symbol (the green sector), click Object Properties from the context menu. In the <i>Basic</i> tab of the <i>Object Properties</i> window, uncheck the <i>Allow Reflex Angle</i> check box, then click the Close button.</p>
	<p>12. Describe the quadrilateral formed by joining the midpoints of each side of the square. Be as precise as possible.</p>




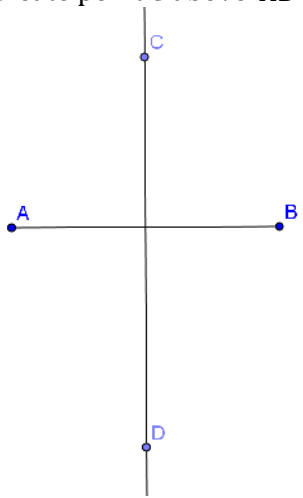

Constructing a Trapezoid

	<p>1. Create three noncollinear points <i>A</i>, <i>B</i>, and <i>C</i>. Construct \overline{AB} and \overline{AC}.</p>
	<p>2. Construct a line passing through point <i>C</i> and parallel to \overline{AB}.</p>
	<p>3. Create point <i>D</i> on the line.</p>
	<p>4. Hide the line and construct segments \overline{CD} and \overline{BD}.</p>
	<p>5. Describe the quadrilateral formed by joining the midpoints of each side of the square. Be as precise as possible.</p>

Constructing an Isosceles Trapezoid

	<p>1. Create three noncollinear points A, B, and C. Construct \overline{AB} and \overline{AC}.</p>
	<p>2. Construct a line parallel to \overline{AB}, passing through point C.</p> 
	<p>3. Select the Compass tool. To set the radius, click on point C followed by point A. Then click on point B to construct a circle centered at B with radius AC.</p> 
	<p>4. Mark point D, the point of intersection of the circle and the line such that $\angle B$ is an acute angle.</p> 
	<p>5. Hide the circle and the line, and construct \overline{BD} and \overline{CD}.</p> 
	<p>6. Describe the quadrilateral formed by joining the midpoints of each side of the square. Be as precise as possible.</p>

Constructing a Kite

	<p>1. Construct \overline{AB}.</p>
	<p>2. Select the Perpendicular Bisector tool and click on \overline{AB} to construct the perpendicular bisector of \overline{AB}.</p>
	<p>3. Create point C above \overline{AB} and create point D below \overline{AB}.</p> 
	<p>4. Hide \overline{CD} and \overline{AB}. Construct \overline{AC}, \overline{CD}, \overline{BD}, and \overline{AD}.</p>
	<p>5. Describe the quadrilateral formed by joining the midpoints of each side of the square. Be as precise as possible.</p>