

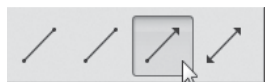
Exterior Angles in a Polygon

An exterior angle of a polygon is formed when one of the sides is extended. Exterior angles lie outside a convex polygon. In this investigation you'll discover the sum of the measures of the exterior angles in a convex polygon.

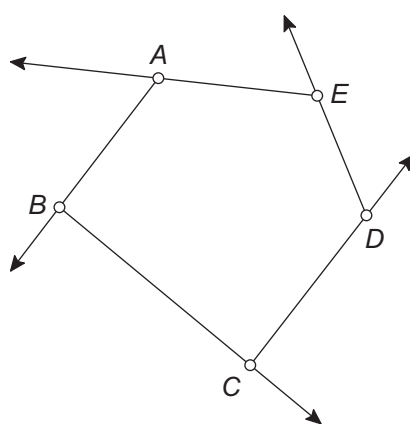
Do this investigation with a triangle, a quadrilateral, or a pentagon. Plan together with classmates at nearby computers to investigate different polygons so that you can compare your results. The activity here shows a pentagon. Don't let that throw you if you're investigating a triangle or a quadrilateral—the basic steps are the same.

SKETCH AND INVESTIGATE

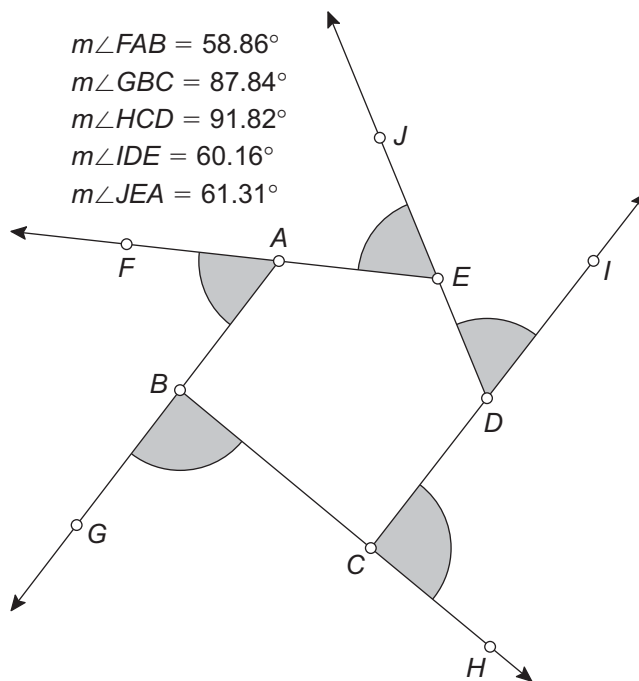
Press and hold the pointer on the **Segment** tool; then drag right to choose the **Ray** tool.



1. Use the **Ray** tool to construct a polygon with each side extended in one direction. Be sure to construct the polygon without creating any extra points. Your initial sketch should have the same number of points (vertices) as sides. If your polygon didn't end up convex, drag a vertex to make it convex.



Steps 1 and 2



Steps 3 and 4



2. Use the **Text** tool to label the vertices of the polygon.



3. Create an angle marker in each external angle by dragging the **Marker** tool counterclockwise from one side of the angle to the other.



4. Select all the angle markers and choose **Measure | Angles**.

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continued

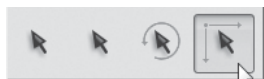


Choose **Calculate** from the Number menu to open the Calculator. Click a measurement to enter it into a calculation.

Double-click a point to mark it as a center.

In the Edit menu, choose **Select All**. Then click each measurement to deselect it.

Press and hold the pointer on the **Arrow** tool, and then drag right to choose the **Dilate Arrow** tool.



EXPLORE MORE

In the Edit menu, choose **Preferences** and go to the Units panel. In the Angle Units pop-up menu, choose **directed degrees**.

5. Calculate the sum of the exterior angles.

6. Drag different vertices of your polygon and observe the angle measures and their sum. Be sure the polygon stays convex.

7. Compare your observations with those of classmates who did this investigation with different polygons.

Q1 Write a conjecture about the sum of the measures of the exterior angles in any polygon.

Follow the steps below for another way to demonstrate this conjecture.

8. Mark any point in the sketch as a center for dilation.

9. Select everything in the sketch except for the measurements.

10. Change your **Arrow** tool to the **Dilate Arrow** tool and use it to drag any part of the construction toward the marked center. Keep dragging until the polygon is nearly reduced to a single point.

Q2 Write a paragraph explaining how this demonstrates the conjecture you made in Q1.

11. Investigate the sum of the exterior angle measures in concave polygons. For this investigation, you may want to measure angles in directed degrees. The sign of an angle measured in directed degrees depends on whether the angle is marked in a clockwise or counterclockwise direction.

