

Just in Time Quick Check
Standard of Learning G.PC.2
Strand: Polygons and Circles

Standard of Learning G.PC.2

The student will verify relationships and solve problems involving the number of sides and measures of angles of convex polygons.

Students will demonstrate the following Knowledge and Skills:

- a) Solve problems involving the number of sides of a regular polygon given the measures of the interior and exterior angles of the polygon.
- b) Justify the relationship between the sum of the measures of the interior and exterior angles of a convex polygon and solve problems involving the sum of the measures of the angles.
- c) Justify the relationship between the measure of each interior and exterior angle of a regular polygon and solve problems involving the measures of the angles.

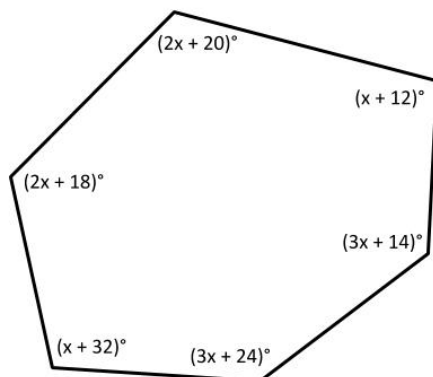
Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: 7.MG.3, G.PC.1

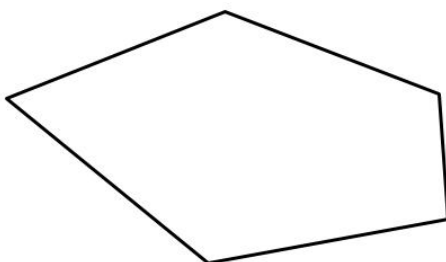
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1. A convex polygon is shown. What is the value of x ?



2. Explain your thinking.
- a) What is the difference between the sum of the exterior angles of a convex hexagon and the sum of the exterior angles of a convex decagon?

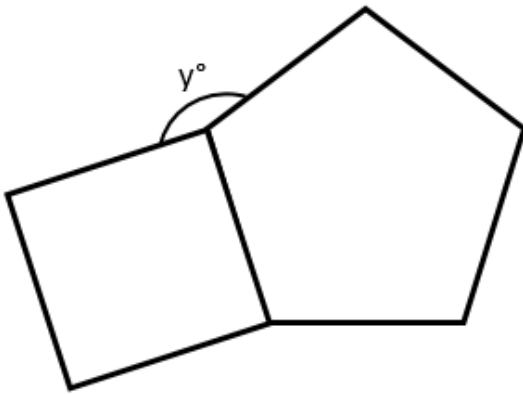
 - b) What is the difference between the sum of the interior angles of a regular octagon and the sum of the exterior angles of a regular octagon?
3. Kelvin would like to find the sum of the interior angles in a pentagon. Kelvin thinks that if he can divide the pentagon into triangles, he can find the total interior angle sum.
- a) How many non-overlapping triangles can be formed by drawing all possible diagonals from one vertex of a pentagon? Use the diagram to draw them.



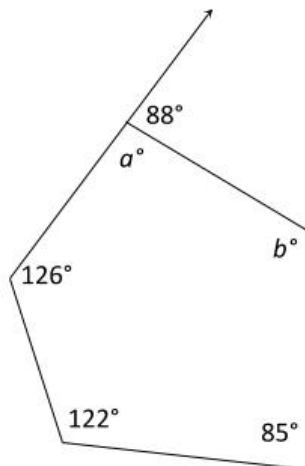
- b) Use what you know about the angle measures in each triangle to find the sum of the interior angles of a pentagon.

4. Juanita has a regular polygon with 15 sides. Juanita knows how to find the sum of the interior angles but is not sure how to find the measure of just one interior angle. Describe how Juanita could use the sum of the measures of the interior angles to find the measure of one of the interior angles.

5. Given a regular quadrilateral and a regular pentagon with a shared side, determine the value of y . Explain your thinking.



6. Determine the values of a and b in the figure. Explain your thinking.



7. A convex polygon has an interior angle sum of 2520° . How many sides does the convex polygon have? Explain your thinking.
8. The measure of each exterior angle of a regular polygon is 18° .
- a) What is the sum of the exterior angles of this regular polygon?

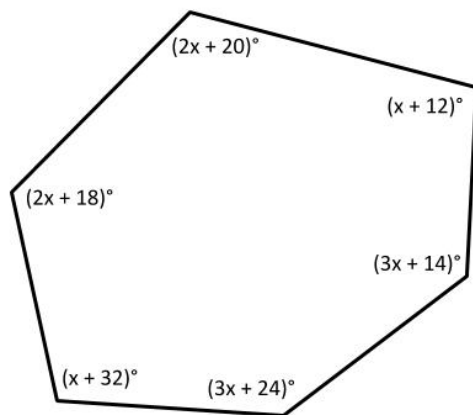
 - b) Determine the number of sides in this regular polygon. Explain how you used the exterior angle measure to find the number of sides.
9. Sabrina would like to create a collage for art class in the shape of a regular polygon with an interior angle that measures 156° .
- a) What is the measure of one exterior angle of this regular polygon?

 - b) How many sides are in the regular polygon used in her collage? Explain how you used the interior and exterior angle measures of the regular polygon to find the number of sides.

G.PC.2 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. A convex polygon is shown. What is the value of x ?



A common error a student may make is to write an equation where the sum of the measures of the interior angles is set equal to 360° . This may indicate that a student has confused the sum of the exterior angles with the sum of the interior angles of a convex hexagon. Students may benefit from analyzing the interior angle sum as a pattern that increases by 180 with each added side.

2. Explain your thinking.
- a) What is the difference between the sum of the exterior angles of a convex hexagon and the sum of the exterior angles of a convex decagon?

A common error in student thinking is that the sum of the exterior angles of a convex polygon is dependent on the number of sides in the polygon. This misconception makes it likely that students will try to use an incorrect formula rather than just using the constant sum of 360° . Students may benefit from analyzing a wide variety of examples of convex polygons using the exterior angle sum theorem either through a dynamic geometry tool or through a class jigsaw activity.

- b) What is the difference between the sum of the interior angles of a regular octagon and the sum of the exterior angles of a regular octagon?

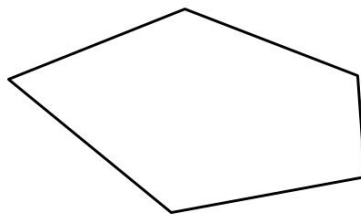
An error that some students may make is to find the difference between one interior angle and one exterior angle of the regular octagon. This may indicate that the student understands how to find the measures of an interior and exterior angle of a regular octagon but fails to find the difference of the sum of the interior angles and the sum of the exterior angles. To help students make connections, teachers could review the relationship between the measure of one interior angle to the sum of all the interior angles of a regular octagon:

Connect: $8x = 1080$ to $\frac{180(n-2)}{n}$, where x is the measure of one interior angle of the octagon and $n =$ number of sides.

Teachers could also review the relationship between the measure of one exterior angle to the sum of all exterior angles of a regular octagon:

Connect: $8x = 1080$ to $\frac{180(n-2)}{n}$ and $8y = 360$ to $\frac{360}{n}$, where y is measure of one exterior angle of the octagon and n is the number of sides.

3. Kelvin would like to find the sum of the interior angles in a pentagon. Kelvin thinks that if he can divide the pentagon into triangles, he can find the total interior angle sum.
- a) How many non-overlapping triangles can be formed by drawing all possible diagonals from one vertex of a pentagon? Use the diagram to draw them.



A common misconception that some students have is assuming that the number of triangles will be equivalent to the number of sides. This misconception indicates that students will likely misuse or incorrectly remember the formula for the sum of the interior angles as $180n$ instead of $180(n - 2)$. Students may benefit from determining the number of triangles as part of a pattern that increases by 1 with every side length that is added.

- b) Use what you know about the angle measures in each triangle to find the sum of the interior angles of a pentagon.

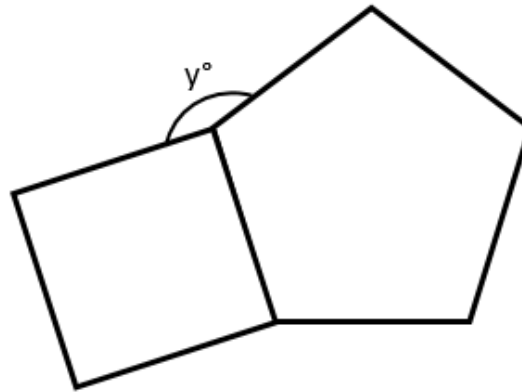
A common error is that even after determining the number of triangles correctly, a student may still apply the interior angle sum theorem incorrectly by using either $180n$ or $360(n - 2)$. This error indicates that the student does not understand and connect to the conceptual basis of the interior angle sum theorem. One strategy would be to have students work through a small subset of polygons, draw in the non-overlapping triangles from one vertex and use the triangle angle sum to generalize how to find the sum of the interior angles of a convex polygon.

4. Juanita has a regular polygon with 15 sides. Juanita knows how to find the sum of the interior angles but is not sure how to find the measure of just one interior angle. Describe how Juanita could use the sum of the measures of the interior angles to find the measure of one of the interior angles.

A common error that some students may make is to divide the sum of the measures of all the interior angles by 13 (using $n - 2$) to find the measure of one angle. This may indicate that students may not recognize how many angles are in a given polygon. Students with this

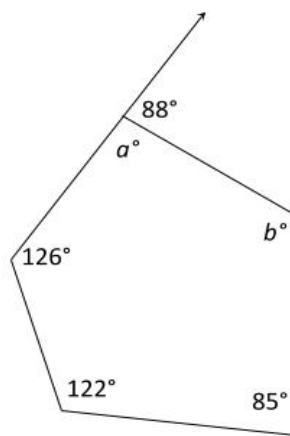
misconception may find it helpful to go back to a more familiar case, such as a triangle or a quadrilateral, to emphasize the equivalent relationship between the number of sides and number of angles in a polygon. A secondary strategy would be to discuss using the exterior angle sum theorem to find an interior angle.

5. Given a regular quadrilateral and a regular pentagon with a shared side, determine the value of y . Explain your thinking.



The most common error may occur when students do not remember how to find the measure of an interior angle of a regular polygon correctly. Most students will be able to find the interior angle of the quadrilateral as 90 degrees, but these same students may have difficulty finding the interior angle of a pentagon. Some students may attempt to divide 360 by 5 to find this angle. Another common error that some students may make is not recognizing that the sum of the angle measures of y° , 90° , and 108° is 360° . Teachers could use dynamic software to emphasize that angles at a vertex must have a sum of 360° .

6. Determine the values of a and b in the figure. Explain your thinking.



A common error that students may make is not to recognize that determining the value of a requires them to use the given exterior angle measure. This error may indicate that students need additional practice identifying linear pair relationships. Students may benefit from seeing a wide variety of examples of linear pairs, especially in combination with other types of geometric figures. Students who find the value of a correctly may still have difficulty finding the value of b if they aren't able to find the sum of the angles of a pentagon correctly. Teachers may also wish to give students the opportunity to manipulate different types of polygons with interior and exterior angles labeled on dynamic software.

7. A convex polygon has an interior angle sum of 2520° . How many sides does the convex polygon have? Explain your thinking.

A common error that students may make when calculating the number of sides is only dividing the sum of the interior angle measures by 180 and not adding two to the result. This indicates that the student may not conceptualize how the polygon interior angles sum theorem is derived. Students may benefit from a demonstration of how to check their answer and instruction that includes the polygon interior angle sum theorem as an equation rather than just an expression.

8. The measure of each exterior angle of a regular polygon is 18° .

- a) What is the sum of the exterior angles of this regular polygon?

A common misconception some students may have is to think that they need to know the number of sides in the polygon before they can determine the sum of the exterior angles. This may indicate that students do not recognize that the sum of the exterior angles is a constant value of 360° . Students would benefit from analyzing a wide variety of convex polygons and explore the relationship to the exterior angle sum either through a dynamic geometry tool or through a class jigsaw activity.

- b) Determine the number of sides in this regular polygon. Explain how you used the exterior angle measure to find the number of sides.

A common error that students may make is to misinterpret the problem and try to use $n = 18$ in the polygon interior angle sum theorem. This may indicate that students do not understand what n represents. A strategy that may benefit students is to have them work through a small subset of regular polygons, calculating the measure of each exterior angle. The teacher could then use the same set of problems as examples when calculating the number of sides. This method would allow the teacher to emphasize the relationship between the process of calculating the measure of one exterior angle and the process of calculating the number of sides.

9. Sabrina would like to create a collage for art class in the shape of a regular polygon with an interior angle that measures 156° .

- a) What is the measure of one exterior angle of this regular polygon?

A common misconception students may have is failing to recognize interior and exterior angles as linear pairs. This indicates that students have difficulty with scenarios that require the use of linear pairs. Teachers should have students practice with a wide variety of polygons with interior and exterior angle labeled, either by using dynamic geometry tools to measure angles or using a class jigsaw activity with protractors.

- b) How many sides are in the regular polygon used in her collage? Explain how you used the interior and exterior angle measures of the regular polygon to find the number of sides.

A common error that students may make is not being able to use the given interior angle of a regular polygon to determine the number of sides. A student who is struggling with this question type may not have the algebraic understanding to be able to set up and solve this equation correctly. Students who can set up the equation $156 = \frac{180(n-2)}{n}$ correctly may benefit from additional review of isolating a variable. For many students, however, instructions about the alternative strategy of using the exterior angle of 24° to determine the number of sides of the regular polygon may be helpful.