

Student Guide

Angles in Polygons

Questions 1–16 (SG pp. 396–401)

1.\* Answers will vary. Students may reply that polygons are made of line segments connected at endpoints, and that each endpoint meets the endpoint of only one other side with no overlap.

2–6. Steps should produce an angle sum that is as close to a straight angle as shown:



7–8. Sum of angles should be close to  $180^\circ$ .

**Angles in Polygons**

**What is a Polygon?**  
These shapes are polygons.

These shapes are *not* polygons.

1. What makes a shape a polygon?

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**Adding the Angles of a Triangle**  
To investigate the angles in a triangle, complete the following questions.

2. Use a pencil and ruler to draw a triangle on a sheet of blank paper. Make sure the triangle covers at least one fourth of the paper. Mark the vertices with dots as shown in the example.

3. Measure the three angles of the triangle with your protractor. Write the angle measures inside the triangle. Cut out the triangle.

4. Tear off the three angles as shown in the example.

5. Place the three angles next to each other with the vertices and edges touching each other as shown.

6. Describe the angle that is formed when all three angles are placed together this way.

7. Add the angle measures of each angle in your triangle. What is the sum of the three angles?

8. Compare your results for Questions 6 and 7 with at least two other students' results. How do your results compare?

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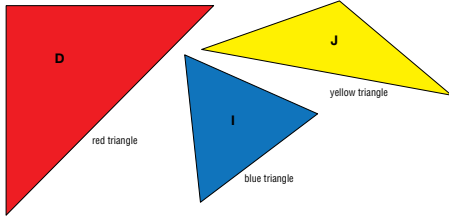
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\*Answers and/or discussion are included in the lesson.

# Answer Key • Lesson 5: Angles in Polygons

9. Measure (or use shortcuts) to find the measures of the angles in the three Power Polygons™ below. Fill in a table like the one below to find the sums of the angles of those triangles.



Triangle	Angle Measures			Sum of Angles
Red Triangle (D)				
Blue Triangle (I)				
Yellow Triangle (J)				

10. A. Write a rule about the sum of the angles in a triangle.  
 B. Do you think the rule is true for every triangle? Explain your thinking.

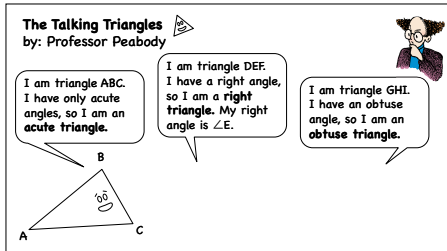
The students in Mrs. Dewey's class answered Question 7 using their own triangles. Nila found the sum of the angles in her triangle to be  $180^\circ$ . When Romesh added the angles in his triangle, the sum was  $179^\circ$ . Ana's sum was  $182^\circ$ .

11. Why do you think the three students' measurements were different from each other?  
 12. Think about the kinds of angles that make up the 180 degrees in a triangle.  
 A. Can a triangle have all acute angles? If so, show an example.  
 B. Can a triangle have all right angles? More than one right angle? Show or tell how you know.  
 C. Can a triangle have more than one obtuse angle? Show or tell how you know.

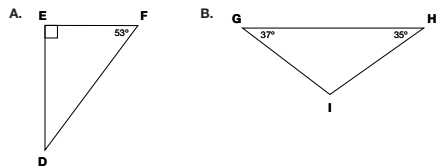
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Professor Peabody forgot to finish drawing the triangles in his cartoon below.



13. A. Do you agree that triangle ABC is an acute triangle? How do you know?  
 B. Use a ruler to make a sketch of the two missing triangles on a separate sheet of paper. Label the vertices with the correct letters.  
 14. Can an obtuse triangle have a right angle? Explain.  
 15. Find the missing degree measures for the triangles below. Do not measure the angles.



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\*Answers and/or discussion are included in the lesson.

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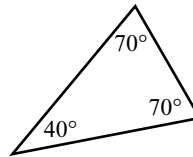
9. Angle measures and sums should be close to the following:

Triangle	Angle Measures			Sum of Angles
Red Triangle (D)	$45^\circ$	$45^\circ$	$90^\circ$	$180^\circ$
Blue Triangle (I)	$60^\circ$	$60^\circ$	$60^\circ$	$180^\circ$
Yellow Triangle (J)	$30^\circ$	$30^\circ$	$120^\circ$	$180^\circ$

10. A–B. Answers will vary, but should include the result that the sum of the angles in any triangle is  $180^\circ$ .

11.\* Errors are likely in measurement.

12. A. Yes.

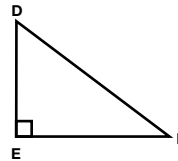


B. No, two right angles have a sum of  $180^\circ$  already. The triangle cannot be completed with a third angle.

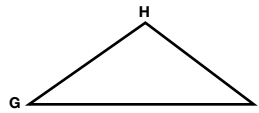
C.\* No. Similar reasoning to Part B.

13. A. Yes. Explanations will vary.  
 Possible explanation: All the angles are less than  $90^\circ$ .

B. Possible right triangle:



Possible obtuse triangle:



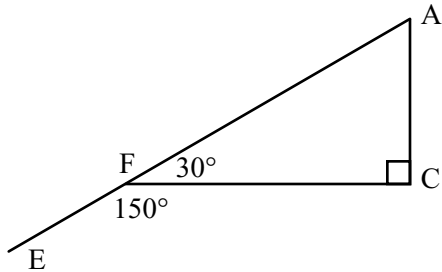
14. No. The sum of the obtuse angle and a right angle is already greater than the sum of all three angles in a triangle,  $180^\circ$ .

15. A.\*  $\angle D = 37^\circ$

B.  $\angle I = 108^\circ$

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16. A.  $\angle A = 60^\circ$ ; Possible explanation:  
 $\angle D + \angle E + \angle A = 180^\circ$   
 so  $90^\circ + 30^\circ + 60^\circ = 180^\circ$
- B.  $\angle AGB = 30^\circ$ ; Possible explanation:  
 $\angle A + \angle G + \angle B = 180^\circ$ ;  
 $60^\circ + \angle G + 90^\circ = 180^\circ$ ;  
 so  $\angle AGB = 30^\circ$ .
- C.  $\angle AFC = 30^\circ$ ; Possible explanation:  
 $\angle A = 60^\circ$ ,  $\angle C = 90^\circ$ , so  $\angle F = 30^\circ$ ,
- D.  $\angle EFC = 150^\circ$ ; Possible explanation:  
 $\overline{AE}$  makes a straight angle. I know  
 $\angle AFC = 30^\circ$ , so  $180^\circ - 30^\circ = 150^\circ$ .



- E. Polygon EFCD =  $180^\circ$ . Possible explanation:  $90^\circ + 90^\circ + 30^\circ + 150^\circ = 360^\circ$ .

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Homework

Questions 1–8 (SG pp. 401–404)

- B, D, F, and H are polygons.
- A has a curved side.  
 C has two segments with unconnected ends.  
 E has two segments that touch other segments at three points.  
 G has curved sides.
- A.  $13^\circ$   
 B.  $54^\circ$   
 C.  $69^\circ$   
 D.  $131^\circ$
- Hexagon LMNOPQ is not regular. The angles are not all equal.  $\angle P$  and  $\angle M$  are acute.  $\angle L$ ,  $\angle N$ ,  $\angle O$ , and  $\angle Q$  are obtuse.

16. Find the missing degree measures in the triangles below. Do not measure the angles. Show or tell how you calculated the measure of each angle.

- What is the measure of  $\angle A$ ?
- What is the measure of  $\angle AGB$ ?
- What is the measure of  $\angle AFC$ ?
- What is the measure of  $\angle EFC$ ?
- Look at polygon EFCD. What is the sum of all the angles?

Use the *Add and Subtract Angles* pages in the *Student Activity Book* to practice finding unknown angle measurements.

**Homework**

- Which of these shapes are polygons?
- Which are not polygons? Explain why each is not a polygon.

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3. Without a protractor, find the measure of each missing angle. Name the missing angle with your measurement.

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4. Is hexagon LMNOPQ regular? Why or why not?

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# Answer Key • Lesson 5: Angles in Polygons

5. A. Find a right triangle in the picture above. Name your triangle using the letters of the triangle's three vertex points.  
 B. Find an acute triangle in the picture above.  
 C. Find an obtuse triangle in the picture above.  
 D. Can you find more examples of right, acute, and obtuse angles in the picture? Name as many of each as you can.

6. Find the missing angle measures in the triangles below. Do not measure the angles.

A. B. C.

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5. A. Right triangles: triangles BCA and BCE  
 B. Acute triangles: triangle AED, BAD, and ACD  
 C. Obtuse triangles: triangles AEB, DEC, and BCD  
 D. Additional examples will vary.
6. A.  $23^\circ$   
 B.  $55^\circ$   
 C.  $85^\circ$
7.  $70^\circ$
8. A.  $90^\circ$   
 B.  $90^\circ$   
 C.  $90^\circ$   
 D.  $90^\circ$   
 E.  $30^\circ$   
 F.  $30^\circ$   
 G.  $60^\circ$

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7. Without using a protractor, find the measure of  $\angle DBA$ .

8. Find the measurements for all the angles in the figure. Do not use your protractor.

A.  $\angle T$   
 B.  $\angle V$   
 C.  $\angle TSV$   
 D.  $\angle TUV$   
 E.  $\angle VSU$   
 F.  $\angle SUT$   
 G.  $\angle SUV$

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