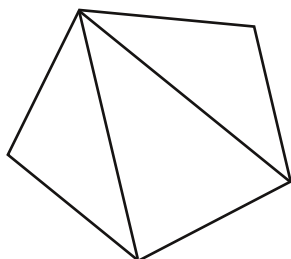


# Interior Angles of Polygons

Where did Poly go? I don't know...

The interior angles of polygons starts with triangles... Oh no, not more triangles... Well, just for an explanation...

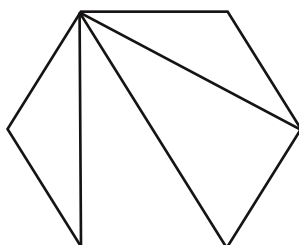
Pentagon



How many sides? \_\_\_\_\_

How many triangles? \_\_\_\_\_

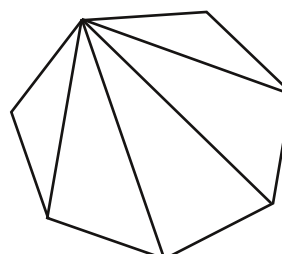
Hexagon



How many sides? \_\_\_\_\_

How many triangles? \_\_\_\_\_

Heptagon



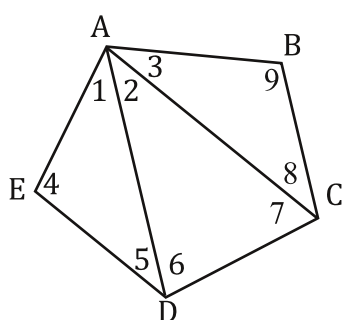
How many sides? \_\_\_\_\_

How many triangles? \_\_\_\_\_

Now, if I have a polygon with  $n$  (some number of) sides, how many triangles are in the polygon?

I'll give you this one... it's  $n-2$ .

Now look at this one...



Okay, now stay with me here.... The measure of the interior angles of this pentagon is  $m\angle EAB + m\angle ABC + m\angle BCD + m\angle CDE + m\angle DEA$ .

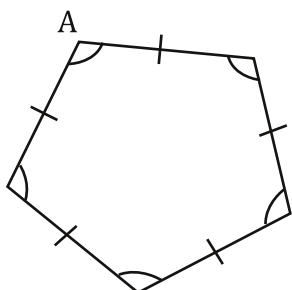
The  $m\angle EAB = m\angle 1 + m\angle 2 + m\angle 3$  and  $m\angle ABC = m\angle 9$ ,

$m\angle BCD = m\angle 7 + m\angle 8$ ,  $m\angle CDE = m\angle 1 + m\angle 2$ , and  $m\angle DEA = m\angle 4$ .

So, that means that the sum of the measure of the interior angles of the pentagon is equal to the sum of the measures of the interior angles of all of the triangles! How many triangles are there?  $n-2$  of course!  $n=5$  because that's how many sides there are so there are  $5-2$  or 3 triangles (as you can see). That means the sum of the interior angles of the pentagon is  $3 \cdot 180^\circ$ , which is  $540^\circ$ . That gives us this formula...

$$\text{Sum of the interior angles of any polygon} = (n-2)180.$$

Regular polygons.... A regular polygon is actually quite a special thing. The word regular means equiangular and equilateral. Huh? In plain ole' English, that means a regular polygon's angles are all the same measurement, and its sides are all the same length. Like this...



If this polygon's interior angles all add to  $540^\circ$ , how could we find the measure of one angle, say angle A? Divide it by 5! (since there are 5 angles).

$m\angle A = 540^\circ / 5 = 108^\circ$ . So, that leads to a new formula...

$$\text{One interior angle of a REGULAR polygon with } n \text{ sides} = \frac{(n-2)180^\circ}{n}$$

Let's check out some examples...

Ex. 1. What is the sum of the interior angles of a hexagon?

$$n=6 \text{ and } (n-2)180^\circ \text{ so } (6-2)180=4*180=720^\circ$$

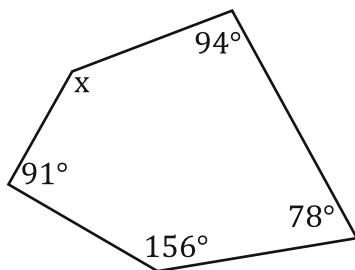
Ex. 2. What is measure of one interior angle of a regular hexagon?

$$n=6 \text{ and } \frac{(n-2)180^\circ}{n} \text{ so } \frac{(6-2)180}{6} = \frac{4*180}{6} = \frac{720^\circ}{6} = 120^\circ$$

Ex. 3. How many sides does a polygon have if the sum of its interior angles = 2,340°?

$$\begin{array}{r} (n-2)180=2,340^\circ \\ (n-2)180=2,340^\circ \\ \hline 180 \quad 180 \\ n-2=13 \\ +2 \quad +2 \\ n=15 \text{ sides} \end{array}$$

Ex. 4. Find the missing angle...



Step 1. Count the sides...

$$n=5$$

Step 2. Find the sum of the interior angles...

$$\begin{array}{r} (n-2)180^\circ \\ (5-2)180 \\ 3*180 \\ 540^\circ \end{array}$$

$$94^\circ + 78^\circ + 156^\circ + 91^\circ + x = 540^\circ$$

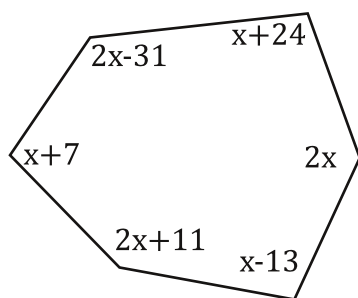
$$419^\circ + x = 540^\circ$$

$$-419^\circ \quad -419^\circ$$

$$x = 121^\circ$$

Step 3. Set up an equation and solve...

Ex. 5. Solve for x...



Step 1. Count the sides...

$$n=6$$

Step 2. Find the sum of the interior angles...

$$\begin{array}{r} (n-2)180^\circ \\ (6-2)180 \\ 4*180 \\ 720^\circ \end{array}$$

$$x+7+2x-31+x+24+2x+x-13+2x+11=720^\circ$$

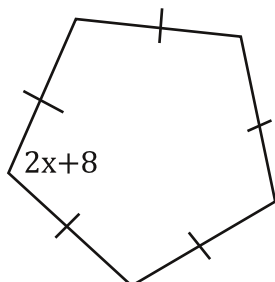
$$9x-2=720^\circ$$

$$+2 \quad +2^\circ$$

$$\frac{9x=722^\circ}{9 \quad 9}$$

$$x=80.22$$

Ex. 6. Solve for x...



Step 1. Count the sides...

$$n=5$$

Step 2. Find the angle measure...

$$\begin{array}{r} (n-2)180^\circ \\ \hline n \\ (5-2)180 \\ \hline 5 \\ 108^\circ \end{array}$$

Step 3. set up an equation and solve...

$$\begin{array}{r} 2x+8=108 \\ -8 \quad -8 \\ \hline 2x=100 \\ \hline 2 \quad 2 \\ x=50 \end{array}$$

Answer each question...

1. What is the sum of the interior angles of an Octagon?

3. What is the sum of the interior angles of a Dodecagon? (12sides)

5. What is the sum of the interior angles of a 13-gon?

7. What is the sum of the interior angles of a quadrilateral?

2. What is the sum of the interior angles of a Decagon?

4. What is the sum of the interior angles of a Nonagon? (9sides)

6. What is the sum of the interior angles of a 19-gon?

8. What is the sum of the interior angles of a Heptagon? (7sides)

---

Bubble all the correct answers from above. Don't bubble incorrect answers.

1,980    360    1,220    1,350    900    3,060    1,280    1,260    1,880    1540    1,080    1,440    1,800    720

Answer each question...

9. What is the measure of one interior angle of a regular Octagon?

11. What is the measure of one interior angle of a regular quadrilateral? What other name is there for a regular quadrilateral?

13. What is the measure of one interior angle of a regular Decagon?

15. What is the measure of one interior angle of a regular 11-gon?

10. What is the measure of one interior angle of a regular Nonagon?

12. What is the measure of one interior angle of a regular 19-gon?

14. What is the measure of one interior angle of a regular Heptagon?

16. What is the measure of one interior angle of a regular Dodecagon?

---

Bubble all the correct answers from above. Don't bubble incorrect answers.

148.93    128.57    144    135    161.05    157.69    147.27    139    140    150    160    137.93    90    70

17. How many sides does a polygon have if the sum of its interior angles =  $900^\circ$ ?

What kind of polygon is this?

19. How many sides does a polygon have if the sum of its interior angles =  $3,060^\circ$ ?

What kind of polygon is this?

21. How many sides does a polygon have if the sum of its interior angles =  $3,240^\circ$ ?

What kind of polygon is this?

23. How many sides does a polygon have if the sum of its interior angles =  $3,780^\circ$ ?

What kind of polygon is this?

18. How many sides does a polygon have if the sum of its interior angles =  $1,080^\circ$ ?

What kind of polygon is this?

20. How many sides does a polygon have if the sum of its interior angles =  $3,420^\circ$ ?

What kind of polygon is this?

22. How many sides does a polygon have if the sum of its interior angles =  $2,160^\circ$ ?

What kind of polygon is this?

24. How many sides does a polygon have if the sum of its interior angles =  $2,340^\circ$ ?

What kind of polygon is this?

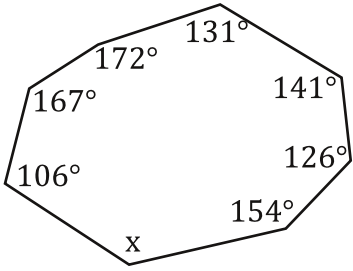
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Bubble all the correct answers from above. Don't bubble incorrect answers.

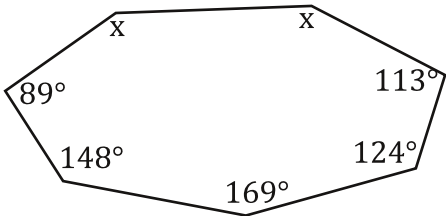
23    20    5    8    9    7    22    21    18    19    12    15    16    14

For these.... find the missing angle or angles.

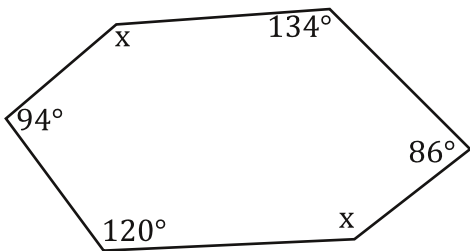
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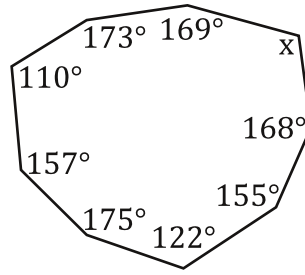
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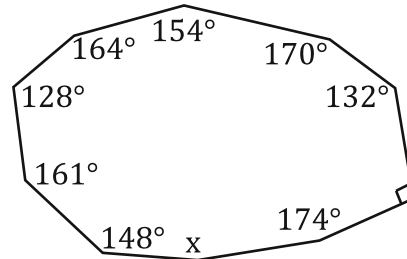
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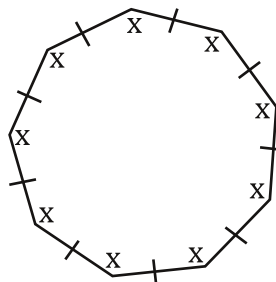
26.



28.



30.

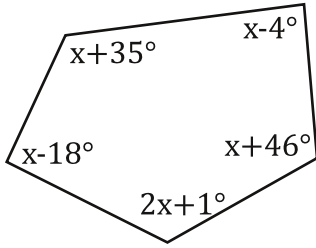


Bubble all the correct answers from above. Don't bubble incorrect answers.

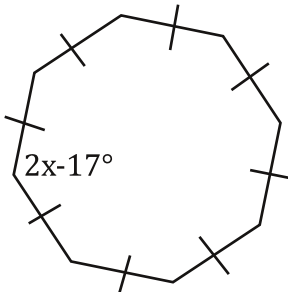
- 324.59  
  84  
  44.3  
  143  
  128.5  
  119  
  168  
  140  
  83  
  31

For these... solve for x.

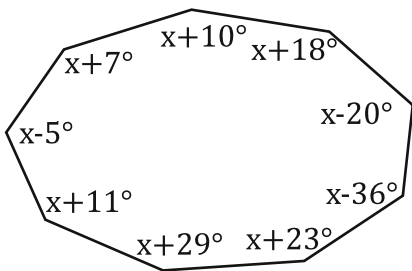
31.



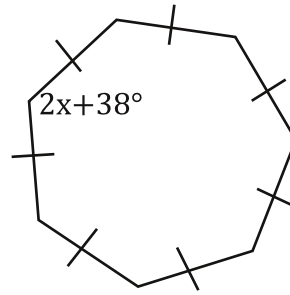
33.



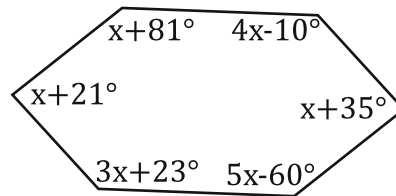
35.



32.



34.



$$\begin{aligned} n &= 6 \\ (n-2)180^\circ & \\ (6-2)180 & \\ 4*180 & \\ 720^\circ & \end{aligned}$$

$$x+81+4x-10+x+35+5x-60+3x+23+x+21=720^\circ$$

$$15x+90=720^\circ$$

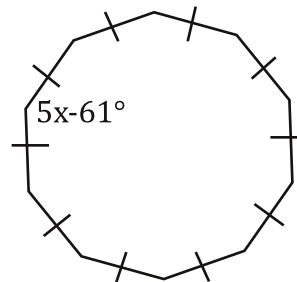
$$-90 \quad -90^\circ$$

$$\underline{15x} = \underline{630^\circ}$$

$$\underline{15} \quad \underline{15}$$

$$x=42^\circ$$

36.



Bubble all the correct answers from above. Don't bubble incorrect answers.

- 113  
  45.29  
  47.32  
  41  
  135.89  
  47  
  42  
  76  
  123.5  
  110