

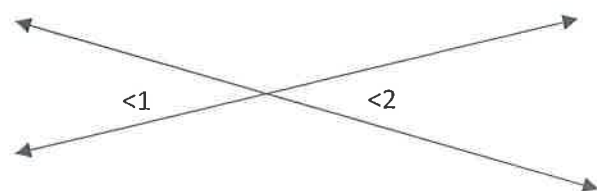
3.1 – 3.2 Polygons and Quadrilaterals

Objectives:

- A. I can define *polygon*.
- B. I can define and use reflectional and rotational symmetry.
- C. I can define regular polygon, center of a regular polygon, central angle of a regular polygon, and axis of symmetry.
- D. I can define quadrilateral, parallelogram, rhombus, rectangle, square and trapezoid.
- E. I can identify the properties of quadrilaterals and the relationships among the properties.

Warm-UP!

1. Which of the following statements is true about the figure?



- a. $\angle 1$ and $\angle 2$ form a linear pair.
- b. $\angle 1$ and $\angle 2$ are parallel.
- c. $m\angle 1 = m\angle 2$
- d. $m\angle 1$ is greater than $m\angle 2$

2. If today is Monday, then I have salad for lunch.

a. Can you make a conclusion about what you will eat for lunch today?

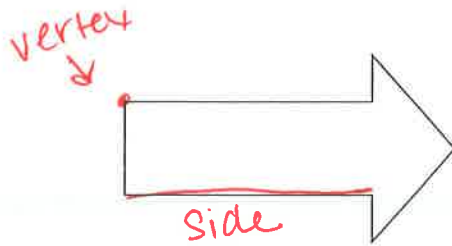
I have salad for lunch

b. Write the converse of the conditional above – is the converse true?

False, if I eat a salad it doesn't become Monday.

POLYGONS AND SYMMETRY:

Figures formed by 3 or more segments that meet at endpoints are Polygons.



Segments of the figure are Sides.

Endpoints of the figure are vertices.

Polygons that have equal angles are equiangular polygons.

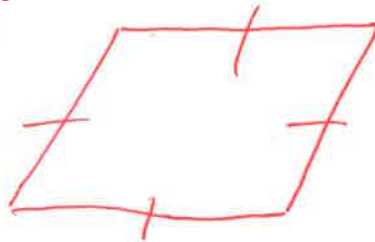
Draw one and mark the congruent angles:



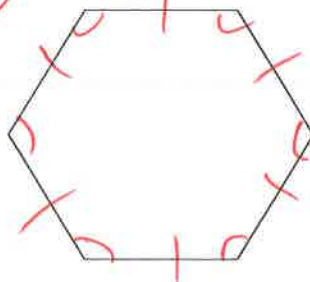
doesn't have to be right angles - just equal

Polygons that have equal sides are equilateral polygons.

Draw one and mark the congruent sides:



A regular polygon is both equiangular and equilateral.



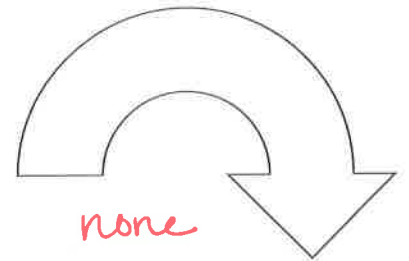
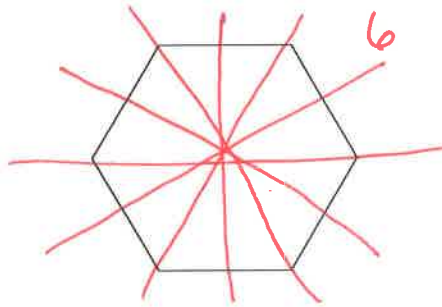
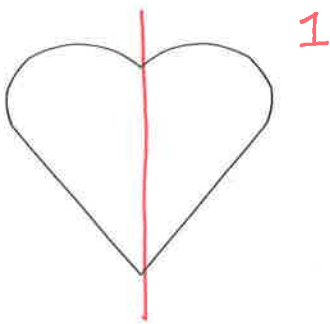
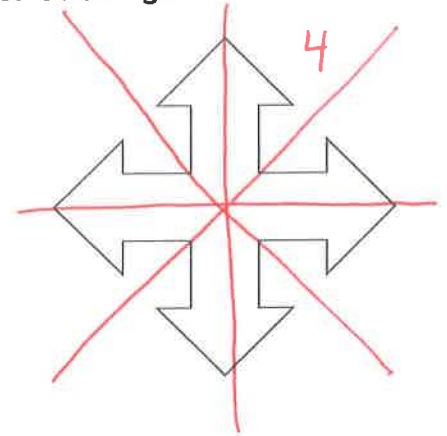
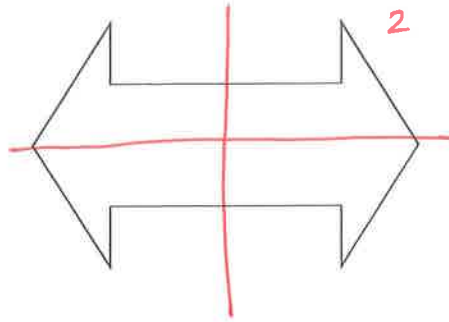
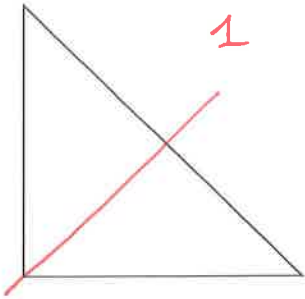
central angle from consecutive vertices

The point equidistant from all vertices is the center of the regular polygon

From that point, central angles can be formed.

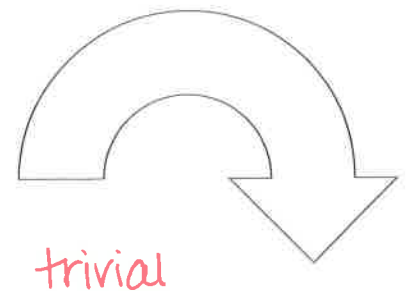
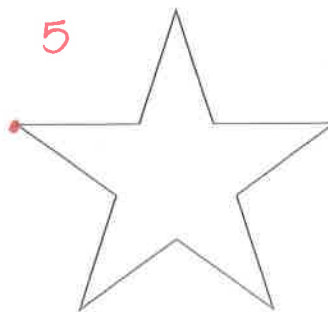
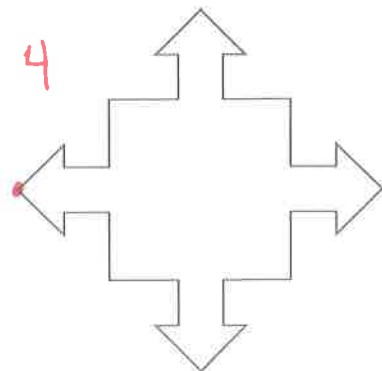
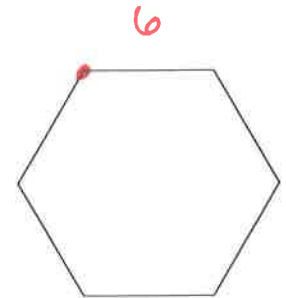
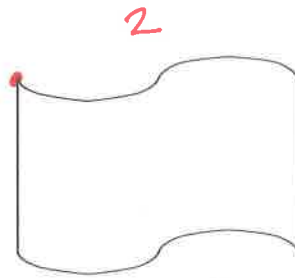
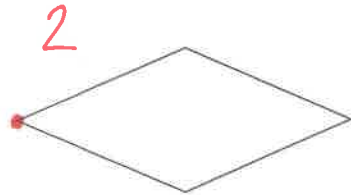
Reflectional Symmetry in a Polygon

Find the AXES OF SYMMETRY (draw and write the number) for each figure.



Rotational Symmetry in a Polygon

Find the ORDER for each figure.

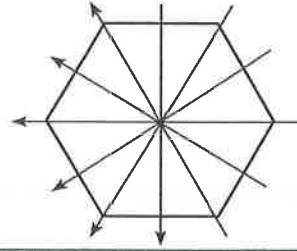




Lines of symmetry

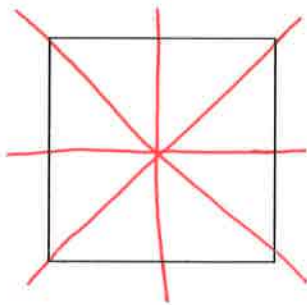
How many lines of symmetry does this figure have?

6



Six lines can be drawn each of which divide the figure exactly in half.

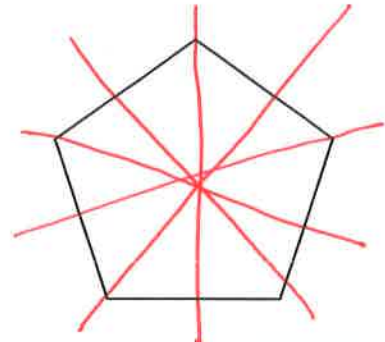
How many lines of symmetry do these figures have?



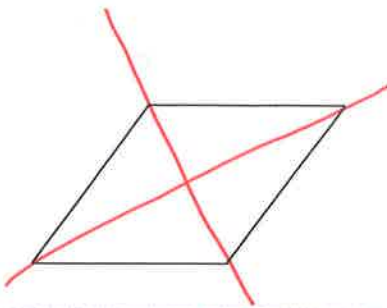
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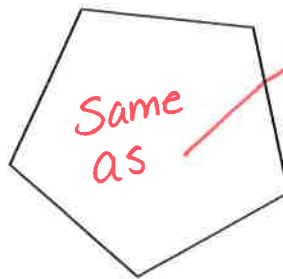
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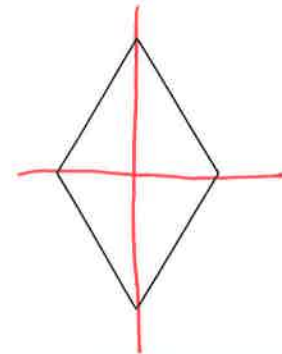
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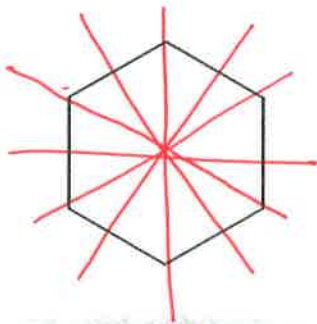
2



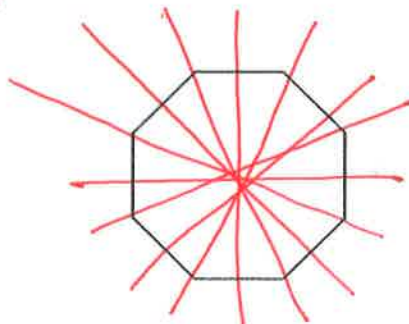
Same as



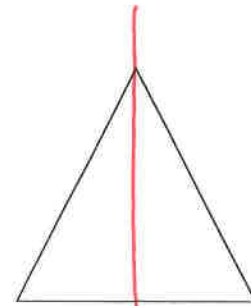
2



6



8

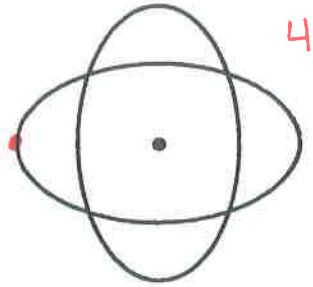


1

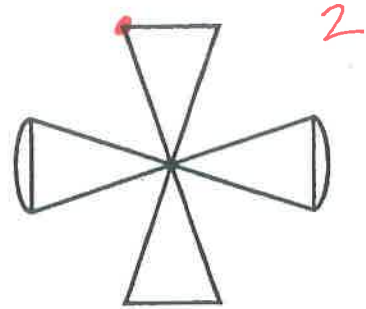
Rotational Symmetry

Determine the order for the following shapes.

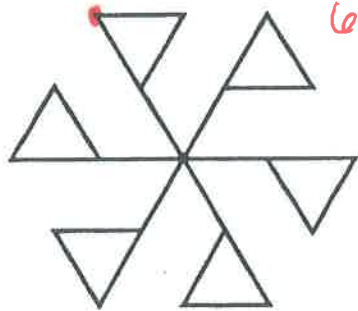
(1)



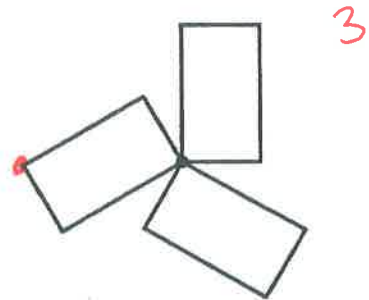
(3)



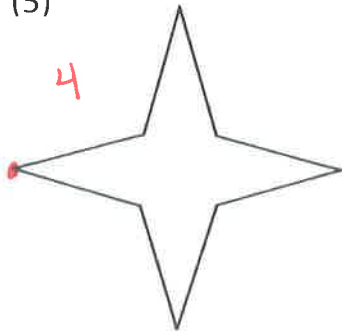
(2)



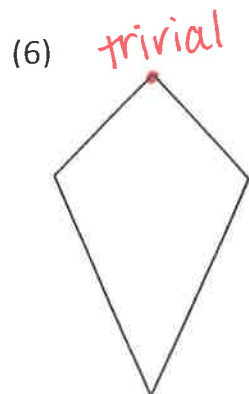
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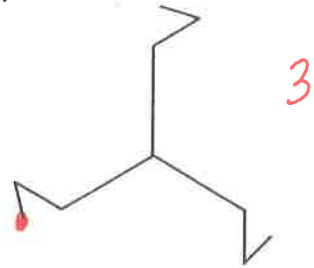
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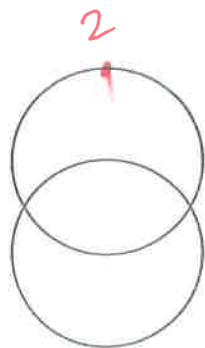
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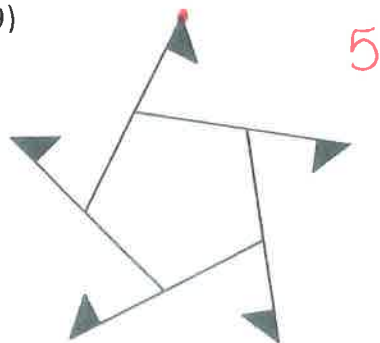
(7)



(8)



(9)



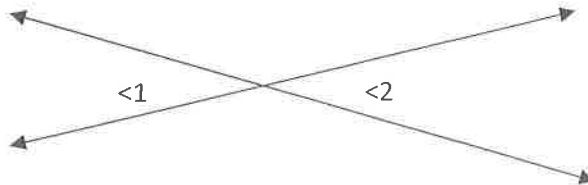
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Warm-UP!

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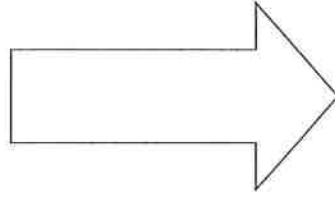


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Segments of the figure are

_____.

Endpoints of the figure are

_____.

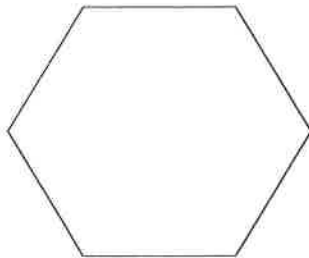
Polygons that have equal angles are _____ polygons.

Draw one and mark the congruent angles:

Polygons that have equal sides are _____ polygons.

Draw one and mark the congruent sides:

A regular polygon is both _____ and _____.

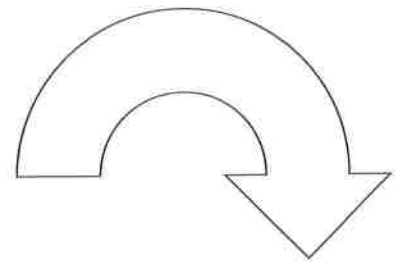
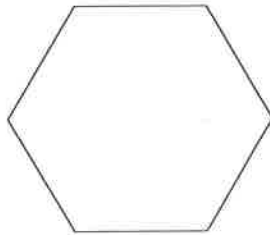
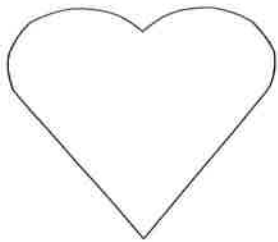
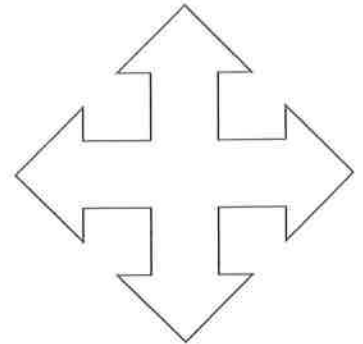
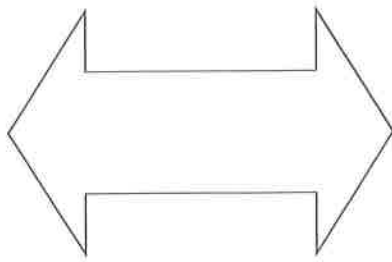
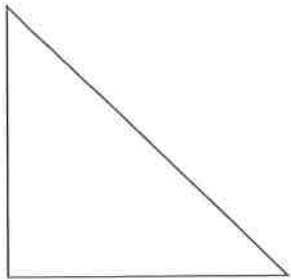


The point equidistant from all vertices is the _____.

From that point, _____ can be formed.

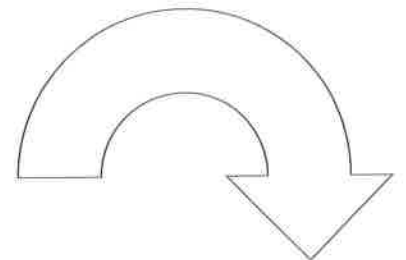
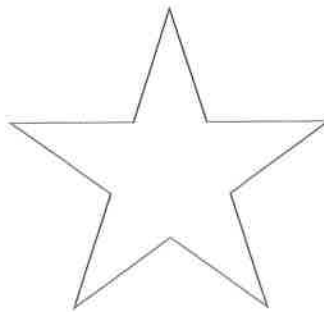
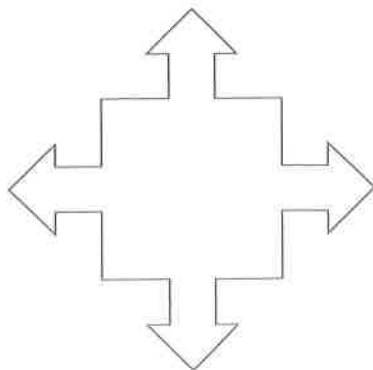
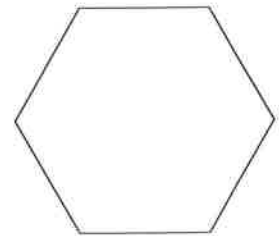
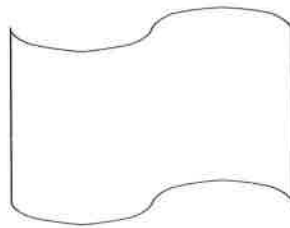
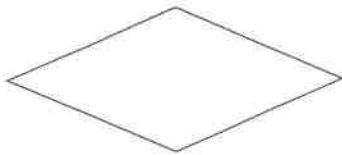
Reflectional Symmetry in a Polygon

Find the AXES OF SYMMETRY (draw and write the number) for each figure.



Rotational Symmetry in a Polygon

Find the ORDER for each figure.

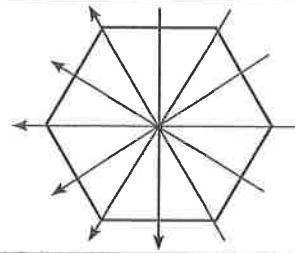




Lines of symmetry

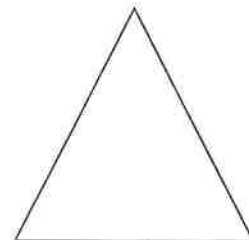
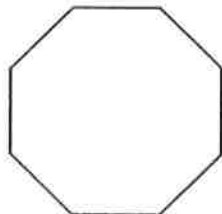
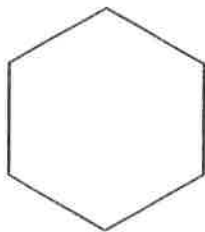
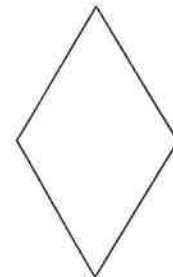
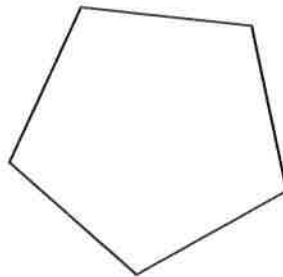
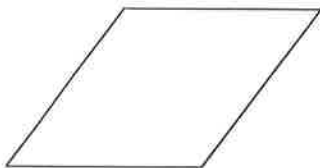
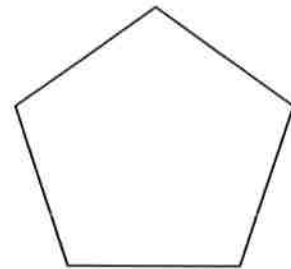
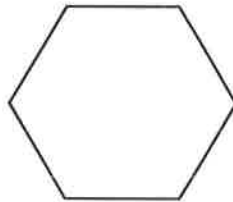
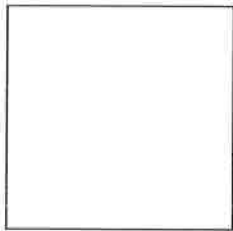
How many lines of symmetry does this figure have?

6



Six lines can be drawn each of which divide the figure exactly in half.

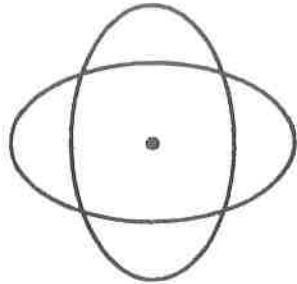
How many lines of symmetry do these figures have?



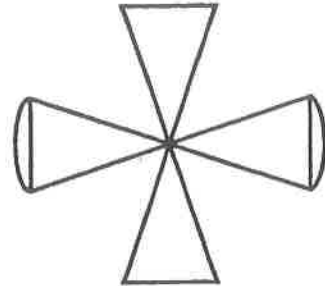
Rotational Symmetry

Determine the order for the following shapes.

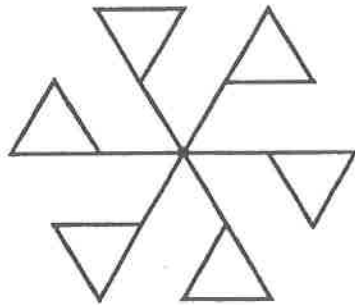
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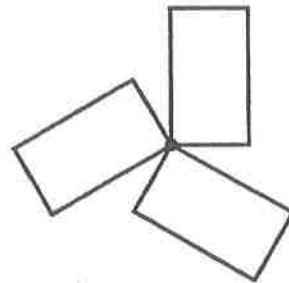
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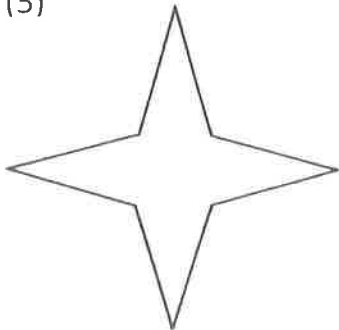
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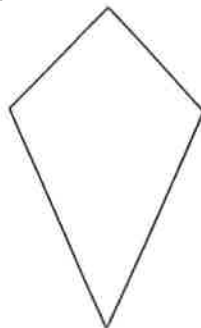
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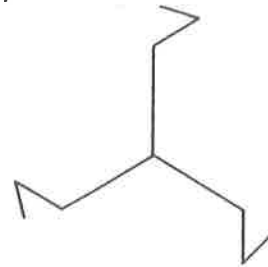
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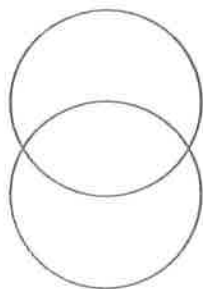
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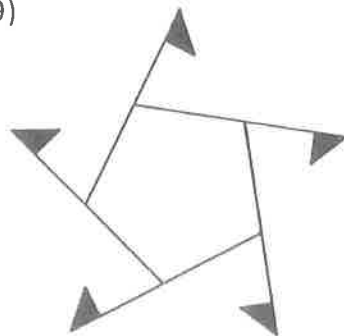
(7)



(8)



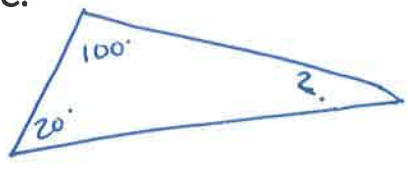
(9)



3.2 Triangle Sum Theorem

Just Numbers:

Looks like:



How do I solve?

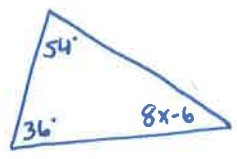
add = 180

Work:

$$\begin{array}{r} 20 + 100 + x = 180 \\ 120 + x = 180 \\ -120 \quad -120 \\ \hline x = 60 \end{array}$$

Solve for x:

Looks like:



How do I solve?

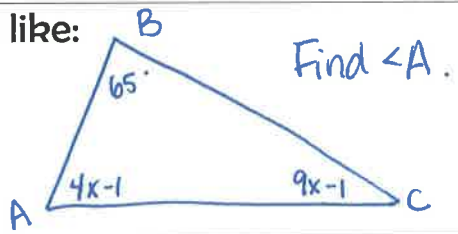
add = 180

Work:

$$\begin{array}{r} 54 + 36 + 8x - 6 = 180 \\ 84 + 8x = 180 \\ -84 \quad -84 \\ \hline 8x = 96 \\ \frac{8x}{8} = \frac{96}{8} \\ x = 12 \end{array}$$

Find the measure of an angle:

Looks like:



How do I solve?

add = 180 THEN plug x into the corner where that angle is

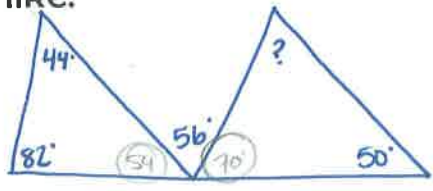
Work:

$$\begin{array}{r} 4x - 1 + 9x - 1 + 65 = 180 \\ 13x + 63 = 180 \\ -63 \quad -63 \\ \hline 13x = 117 \\ \frac{13x}{13} = \frac{117}{13} \\ x = 9 \end{array}$$

$\angle A = 4x - 1$
 $\angle A = 4(9) - 1$
 $\angle A = 36 - 1$
 $\angle A = 35$

"Mountain" Problems:

Looks like:



How do I solve?

- Start in Δ with 2 angles, find 3rd.
- Solve the straight line
- Solve the last Δ for the 3rd angle.

Work:

$$\begin{array}{r} 82 + 44 + x = 180 \\ 126 + x = 180 \\ -126 \quad -126 \\ \hline x = 54 \end{array}$$

$$\begin{array}{r} 54 + 56 + x = 180 \\ 110 + x = 180 \\ -110 \quad -110 \\ \hline x = 70 \end{array}$$

$$\begin{array}{r} 70 + 50 + x = 180 \\ 120 + x = 180 \\ -120 \quad -120 \\ \hline x = 60 \end{array}$$

FINAL ANSWER

Name _____

Block _____ Date _____

3.2 Triangle Sum Theorem

Just Numbers:

Looks like:
How do I solve?
Work:

Solve for x:

Looks like:
How do I solve?
Work:

Find the measure of an angle:

Looks like:
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“Mountain” Problems:

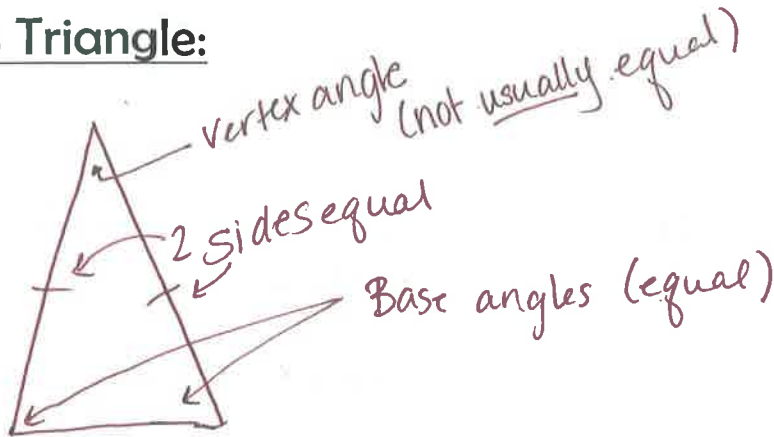
Looks like:
How do I solve?
Work:

Name Key

Block _____ Date _____

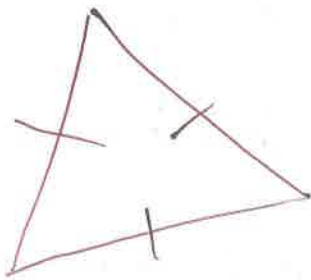
3.3 Isosceles & Equilateral Triangles

Isosceles Triangle:



- 2 equal sides
- 2 equal angles

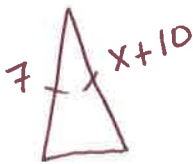
Equilateral Triangle:



- all sides equal
- all angles equal

① Missing sides:

Looks like:



How do I solve?

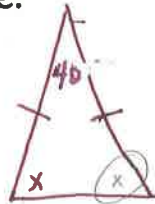
put an equals sign between

Work:

$$\begin{array}{r}
 7 = x + 10 \\
 -10 \quad -10 \\
 \hline
 -3 = x
 \end{array}$$

③ Missing "bottom" angle:

Looks like:



How do I solve?

- Put another x in the other bottom angle
- add = 180

Work:

$$\begin{array}{r}
 40 + x + x = 180 \\
 40 + 2x = 180 \\
 -40 \quad -40 \\
 \hline
 2x = 140 \\
 \frac{2}{2} \quad \frac{2}{2} \\
 \hline
 x = 70
 \end{array}$$

② Missing "top" angle:

Looks like:



How do I solve?

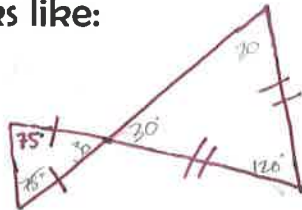
- Put the same # in the other bottom angle
- add = 180

Work:

$$\begin{array}{r}
 40 + 40 + x = 180 \\
 80 + x = 180 \\
 -80 \quad -80 \\
 \hline
 x = 100
 \end{array}$$

④ Complicated problem:

Looks like:



How do I solve?

- Start with the Δ with a number in it.
- Solve like other examples
- Remember vertical angles & straight lines

Work:

$$\begin{array}{r}
 75 + 75 + x = 180 \\
 150 + x = 180 \\
 -150 \quad -150 \\
 \hline
 x = 30
 \end{array}
 \qquad
 \begin{array}{r}
 30 + 30 + x = 180 \\
 60 + x = 180 \\
 -60 \quad -60 \\
 \hline
 x = 120
 \end{array}$$

Name _____

Block _____ Date _____

3.3 Isosceles & Equilateral Triangles

Isosceles Triangle:

Equilateral Triangle:

Missing sides:

Looks like:
How do I solve?
Work:

Missing "bottom" angle:

Looks like:
How do I solve?
Work:

Missing "top" angle:

Looks like:
How do I solve?
Work:

Complicated problem:

Looks like:
How do I solve?
Work:

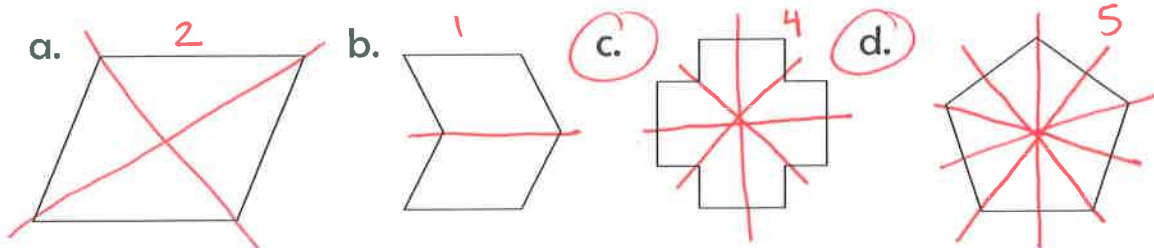
3.3 – 3.4 Parallel Lines and Transversals

Objectives:

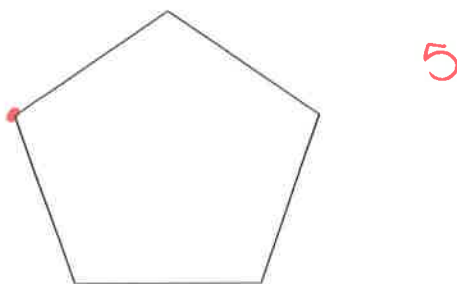
- A. I can define *transversal*, *alternate interior angles*, *alternate exterior angles*, *same-side interior angles*, and *corresponding angles*.
- B. I can make conjectures and prove theorems by using postulates and properties of parallel lines and transversals.
- C. I can prove that lines are parallel by using theorems and postulates.

Warm-UP!

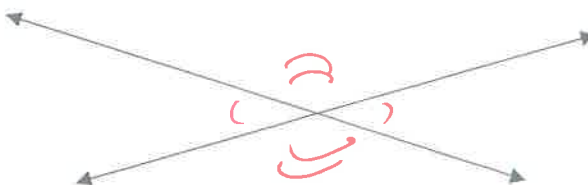
1. Which of the following figures have more than 3 axis of symmetry?



2. What is the order of the following figure?

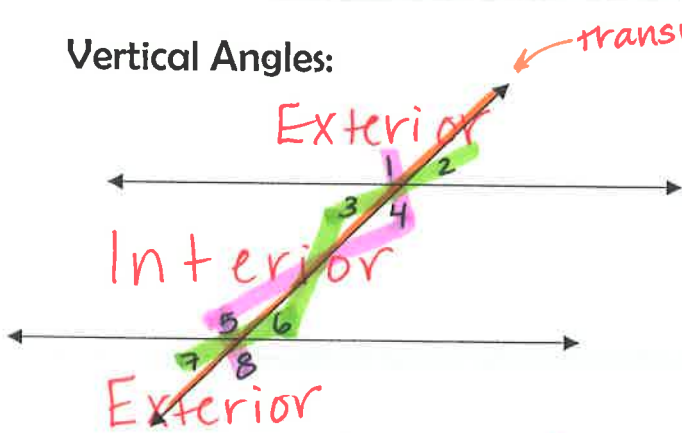


3. Mark the vertical angles in this figure as congruent.



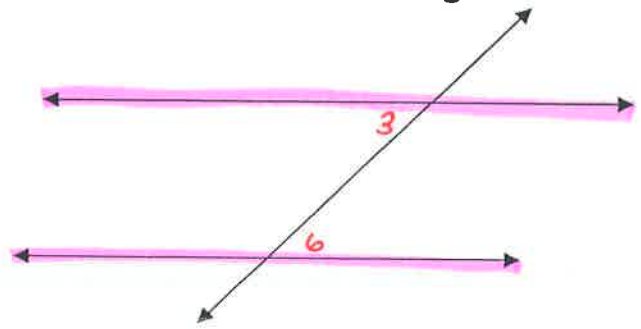
PARALLEL LINES AND TRANSVERALS

Vertical Angles:



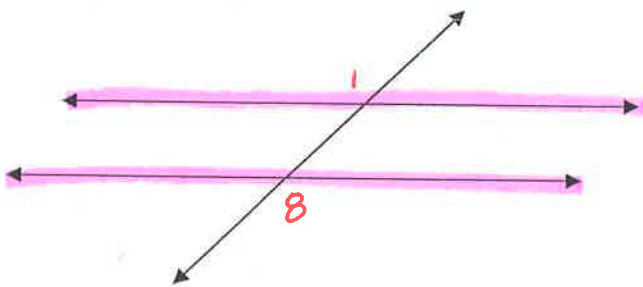
Vertical Angle pairs (#s): *equal*
 1 & 4 5 & 8
 2 & 3 6 & 7

Alternate Interior angles:



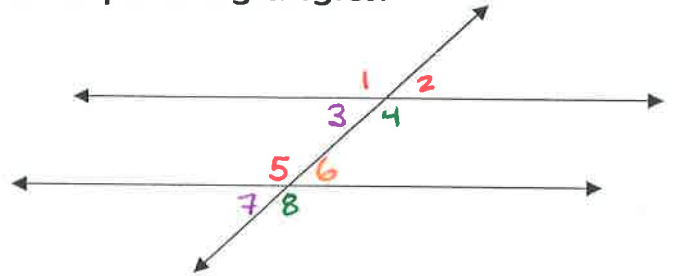
Alternate Interior Pairs: *equal*
 3 & 6
 4 & 5

Alternate Exterior Angles:



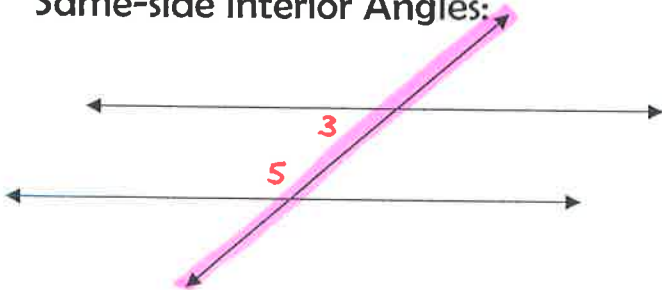
Alternate Exterior Pairs: *equal*
 1 & 8
 2 & 7

Corresponding angles:



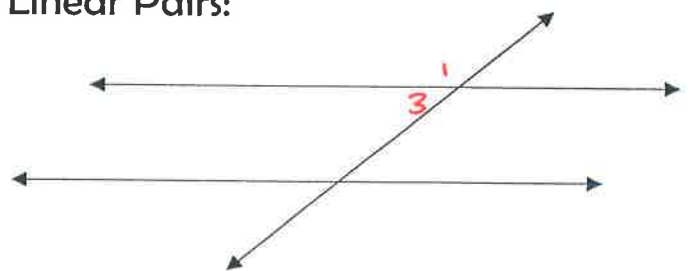
Corresponding Angle Pairs: *in the same spot! equal*
 1 & 5 3 & 7
 2 & 6 4 & 8

Same-side Interior Angles:



Same-side interior Pairs: *add to 180°*
 3 & 5
 4 & 6

Linear Pairs:



Linear Pairs: *add to 180°*
 1 & 3 2 & 4 5 & 6 6 & 8
 1 & 2 3 & 4 5 & 7 7 & 8

Answers to Parallel Lines & Transversals Practice

- | | | | |
|-----------------------|-----------------------|-------------------------|-----------------------|
| 1) corresponding | 2) corresponding | 3) adjacent linear pair | 4) alternate interior |
| 5) alternate exterior | 6) same-side interior | 7) 127° | 8) 130° |
| 9) 80° | 10) 67° | 11) 86° | 12) 72° |
| 13) 58° | 14) 53° | 15) 116° | 16) 50° |
| 17) 78° | 18) 89° | 19) 12 | 20) 9 |
| 21) -6 | 22) 3 | 23) 53° | 24) 115° |
| 25) 78° | 26) 110° | 27) 123° | 28) 50° |
| 29) 120° | 30) 83° | 31) -10 | 32) 8 |
| 33) 9 | 34) -5 | | |

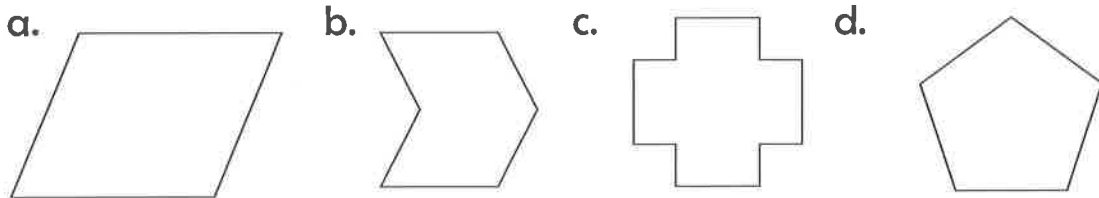
3.3 – 3.4 Parallel Lines and Transversals

Objectives:

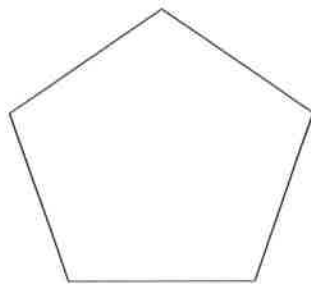
- A. I can define *transversal*, *alternate interior angles*, *alternate exterior angles*, *same-side interior angles*, and *corresponding angles*.
- B. I can make conjectures and prove theorems by using postulates and properties of parallel lines and transversals.
- C. I can prove that lines are parallel by using theorems and postulates.

Warm-UP!

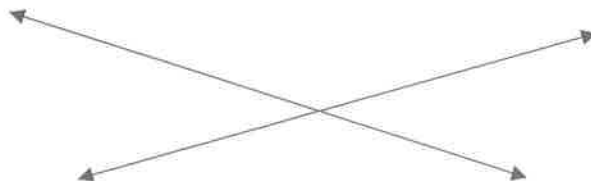
1. Which of the following figures have more than 3 axis of symmetry?



2. What is the order of the following figure?

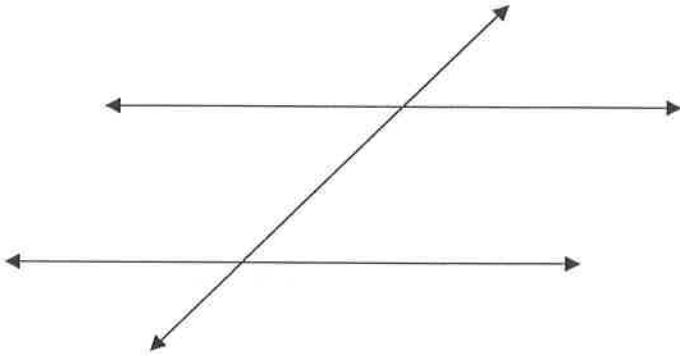


3. Mark the vertical angles in this figure as congruent.



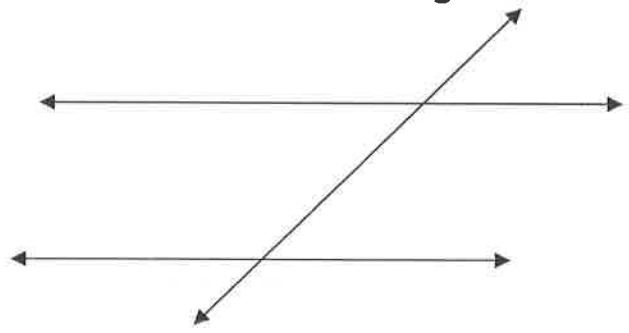
PARALLEL LINES AND TRANSVERSALS

Vertical Angles:



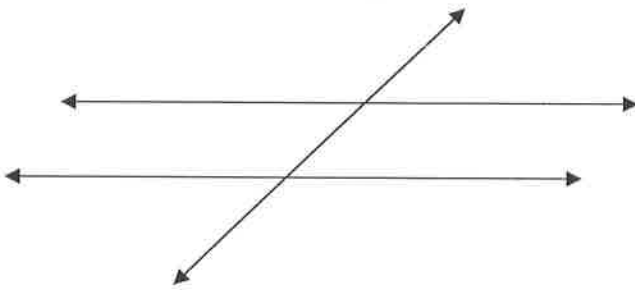
Vertical Angle pairs (#s):

Alternate Interior angles:



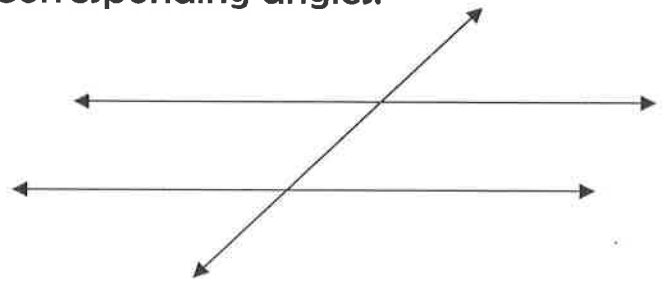
Alternate Interior Pairs:

Alternate Exterior Angles:



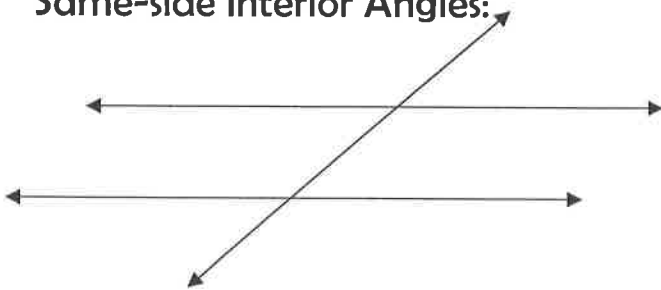
Alternate Exterior Pairs:

Corresponding angles:



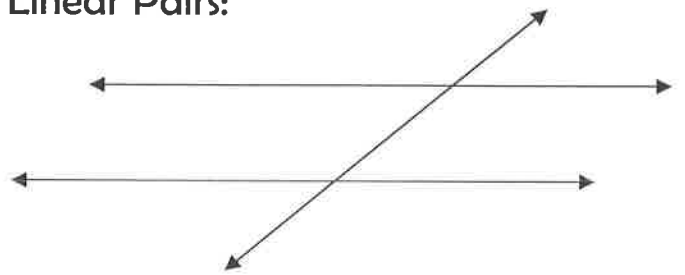
Corresponding Angle Pairs:

Same-side Interior Angles:



Same-side interior Pairs:

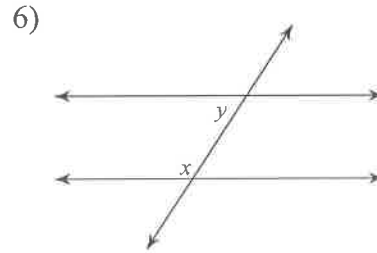
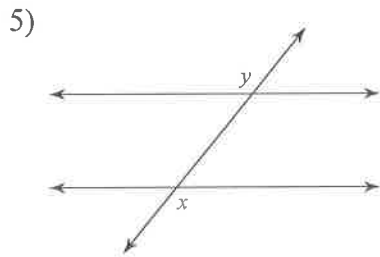
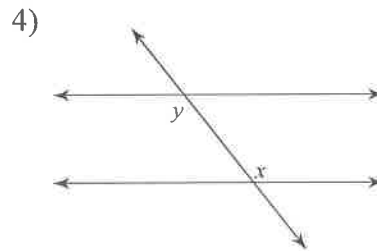
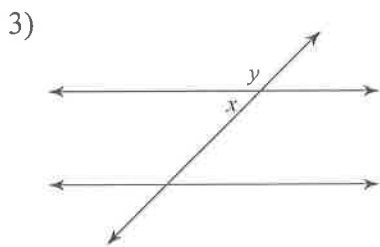
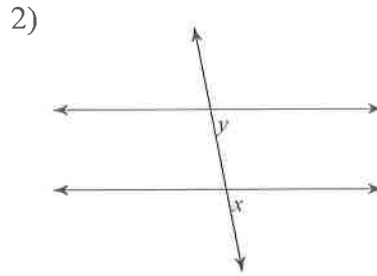
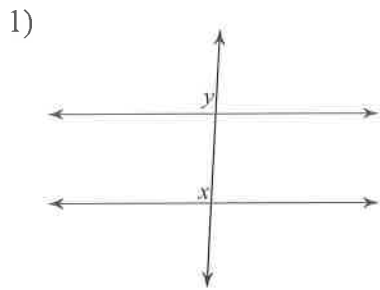
Linear Pairs:



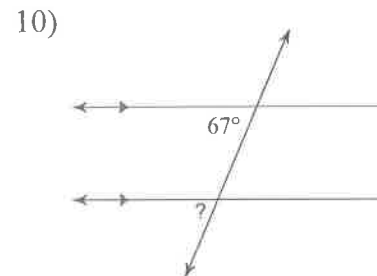
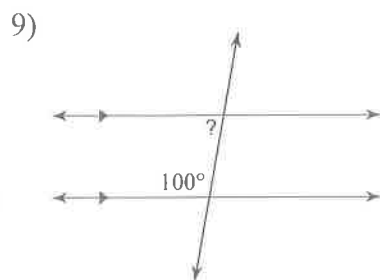
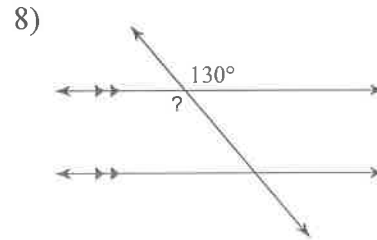
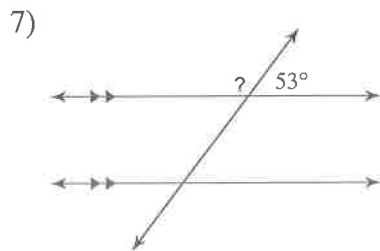
Linear Pairs:

Parallel Lines & Transversals Practice

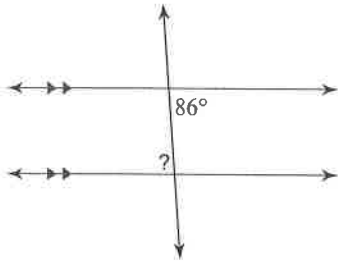
Identify each pair of angles as corresponding, alternate interior, alternate exterior, same-side interior, vertical, or linear pair.



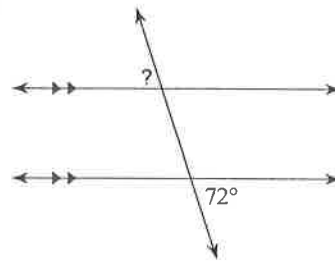
Find the measure of each angle indicated.



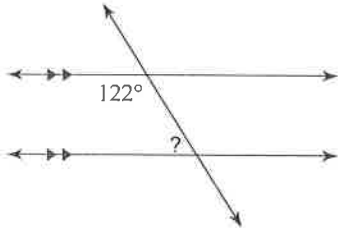
11)



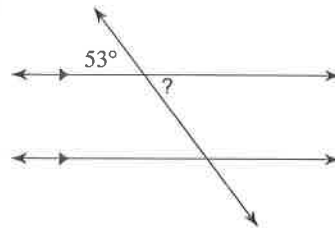
12)



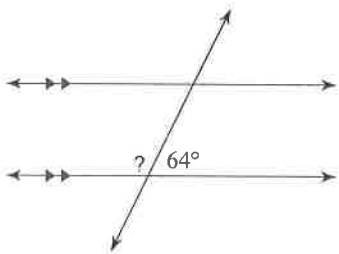
13)



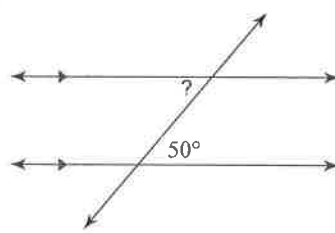
14)



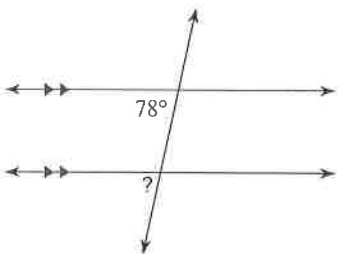
15)



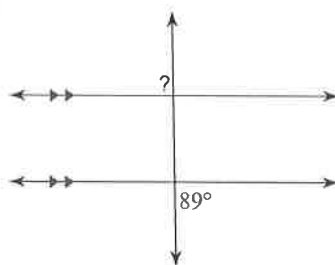
16)



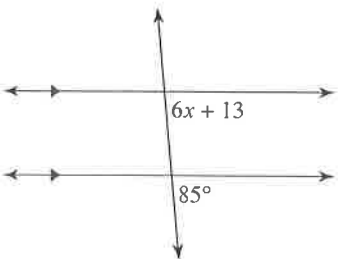
17)



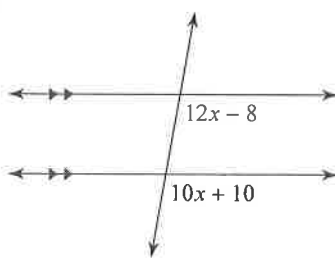
18)

**Solve for x.**

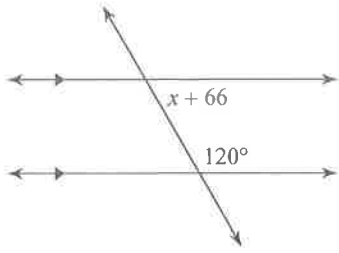
19)



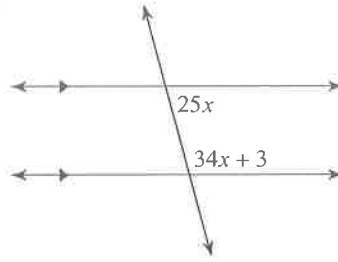
20)



21)

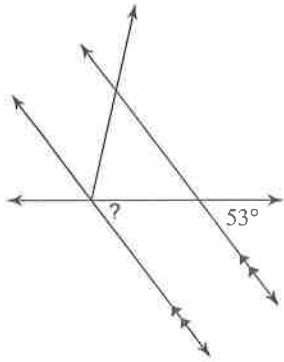


22)

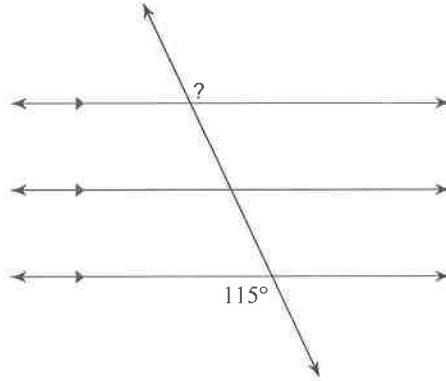


Find the measure of each angle indicated.

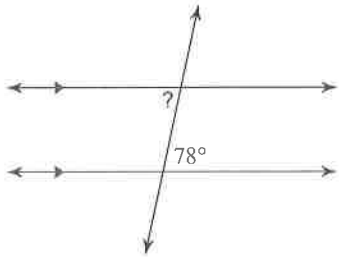
23)



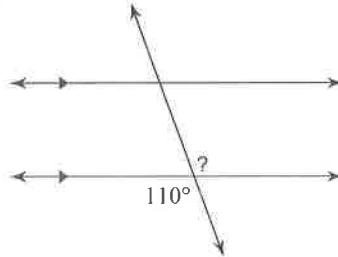
24)



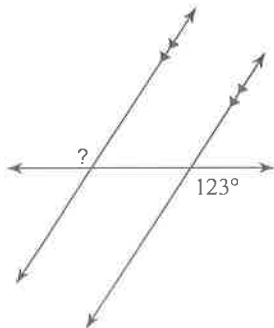
25)



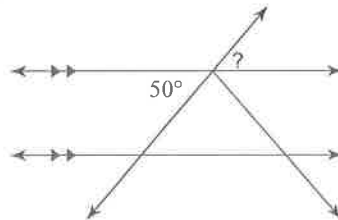
26)



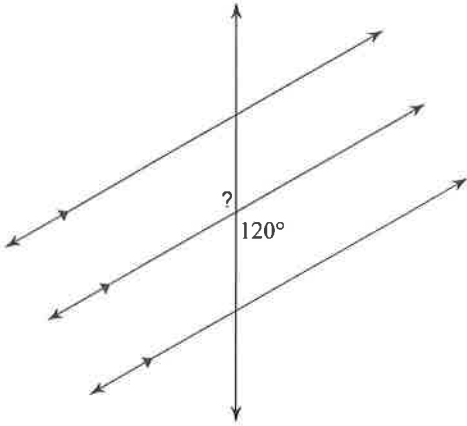
27)



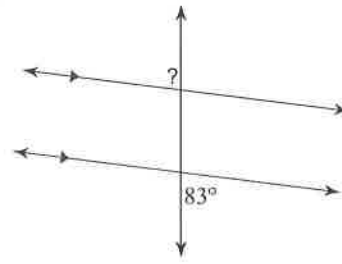
28)



29)

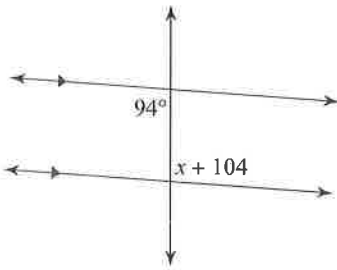


30)

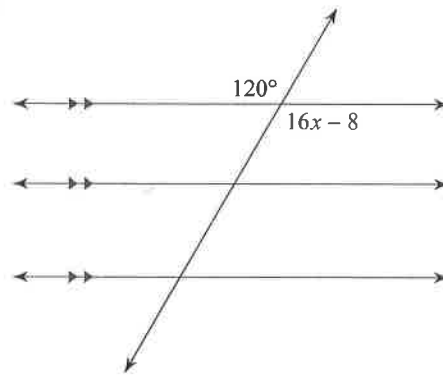


Solve for x .

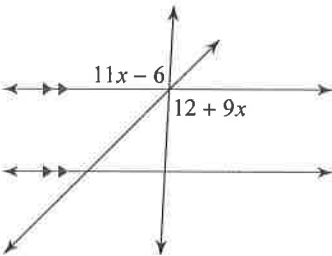
31)



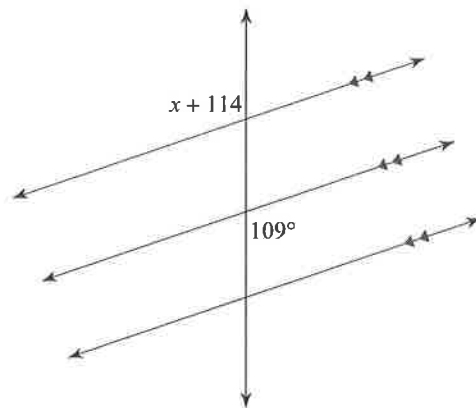
32)



33)



34)



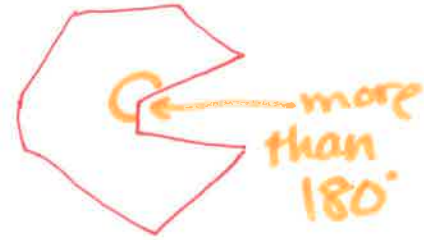
3.5 – 3.6 Angles in Polygons

Convex and Concave Polygons

Convex: a polygon in which each interior angle has a measure less than 180°

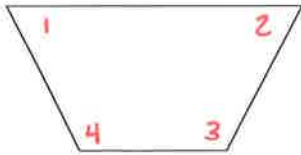


Concave: a polygon in which at least one interior angle has a measure more than 180°



Interior Angles

Mark the interior angles



Complete the Chart

Polygon	Number of Sides	Sum of the Angles	If Regular, Each Angle Measure
Triangle	3	180°	60°
Quadrilateral	4	360°	90°
Pentagon	5	540°	108°
Hexagon	6	720°	120°

Equation for the Sum of the Interior Angles

$$180(n-2)$$

$n = \#$ of sides

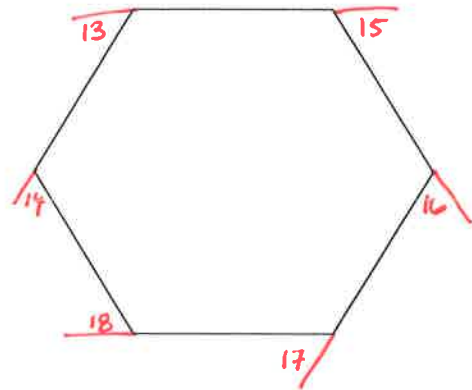
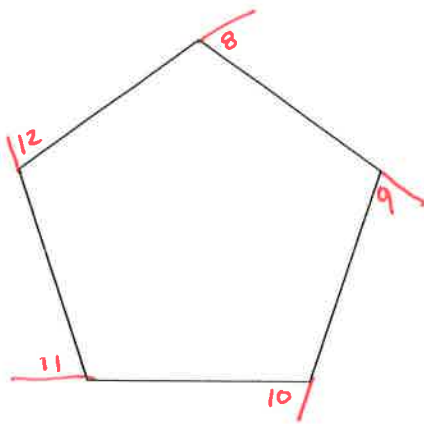
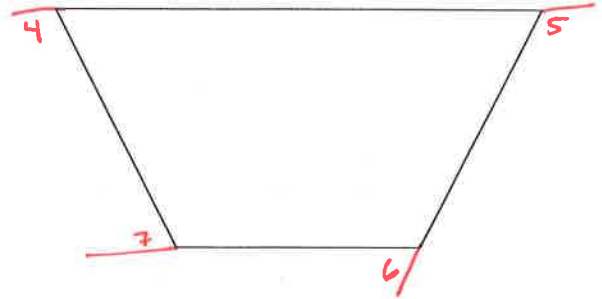
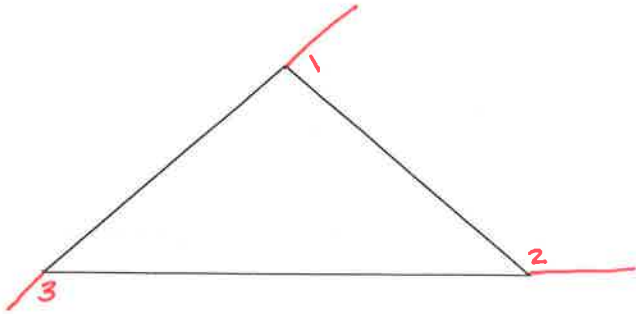
Equation for Each Angle if Regular

$$\frac{180(n-2)}{n}$$

Exterior Angles

Mark the exterior angles

Note: An interior angle added to its exterior angle totals 180° .



Polygon	Number of Sides	Sum of the Exterior Angles	Each exterior angle (if regular)
Triangle	3	360°	120°
Quadrilateral	4	360°	90°
Pentagon	5	360°	72°
Hexagon	6	360°	60°

Equation for the Sum of the Exterior Angles

always 360°

Each exterior angle

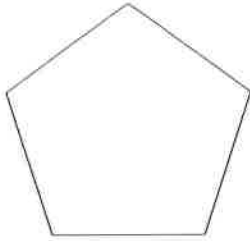
$$\frac{360}{n}$$

$n = \# \text{ of sides}$

Practice 3.5-3.6 Angles in Polygons

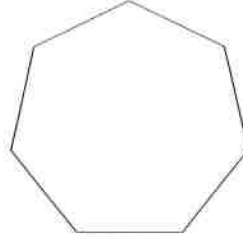
Find the interior angle sum for each polygon. Round your answer to the nearest tenth if necessary.

1)



540°

2)



900°

3) regular 13-gon

1980°

4) regular decagon

1440°

5) regular 15-gon

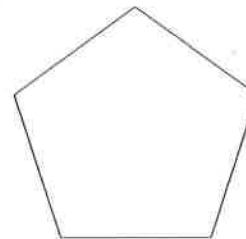
2340°

Find the exterior angle sum for each polygon. Round your answer to the nearest tenth if necessary.

6) regular 13-gon

360°

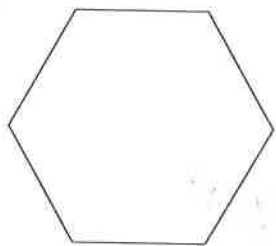
7)



360°

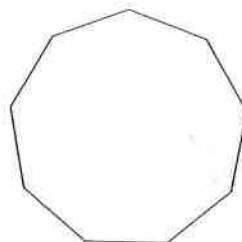
Find the measure of one interior angle in each polygon. Round your answer to the nearest tenth if necessary.

8)



120°

9)



140°

10) regular 19-gon

161.1°

11) regular 22-gon

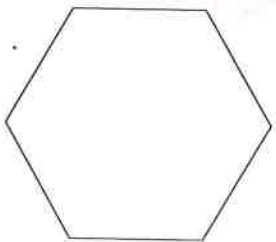
163.6°

12) regular 17-gon

158.8°

Find the measure of one exterior angle in each polygon. Round your answer to the nearest tenth if necessary.

13)



60°

14) regular 14-gon

25.7°

15) regular 13-gon

27.7°

Find the requested measure(s).

16) Find the sum of the interior angles of a 26 sided polygon.

4320°

$$\underline{180(26-2)}$$

17) Find the measure of each interior angle of a regular polygon with 12 sides.

150°

$$\frac{180(12-2)}{12} =$$

18) What is the interior angle measure at an exterior angle of 126°?

54°



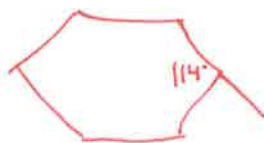
19) Find the measure of each interior angle of a regular polygon with 28 sides.

167.14°

$$\frac{180(28-2)}{28} =$$

20) Find the measure of the exterior angle at an interior angle of 114°.

66°



21) Find the sum of the exterior angles of a polygon with 14 sides.

360°

22) Find the measure of each a) interior and b) exterior of a regular nonagon.

$$a) \frac{180(9-2)}{9} = 140$$

$$b) \frac{360}{9} = 40$$

adds to 180°

Find the number of sides.

23) How many sides does a regular polygon have if each interior angle is 144° ?

$$\frac{180(n-2)}{n} = \frac{144}{1}$$

Cross multiply

$$180(n-2) = 144n$$

$$180n - 360 = 144n$$

$$\begin{array}{r} 180n - 360 \\ -180n \quad -180n \\ \hline -360 = -36n \end{array}$$

$$\begin{array}{r} -360 = -36n \\ \hline -36 \quad -36 \\ \hline n = 10 \\ \text{(decagon)} \end{array}$$

24) Find the number of sides of a polygon if the sum of the interior angles is 2880° .

$$180(n-2) = 2880$$

$$180n - 360 = 2880$$

$$\begin{array}{r} 180n - 360 \\ +360 \quad +360 \\ \hline 180n = 3240 \end{array}$$

$$\begin{array}{r} 180n = 3240 \\ \hline 180 \quad 180 \\ \hline n = 18 \end{array}$$

25) How many sides does a regular polygon have if each exterior angle is 18° ?

$$\frac{360}{n} = \frac{18}{1}$$

$$\frac{18n}{18} = \frac{360}{18}$$

$$n = 20$$

26) How many sides does a regular polygon have if each exterior angle is 15° ?

$$\frac{360}{n} = \frac{15}{1}$$

$$\frac{360}{15} = \frac{15n}{15}$$

$$n = 24$$

3.5 – 3.6 Angles in Polygons

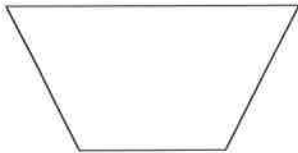
Convex and Concave Polygons

Convex:

Concave:

Interior Angles

Mark the interior angles



Complete the Chart

Polygon	Number of Sides	Sum of the Angles	If Regular, Each Angle Measure
Triangle			
Quadrilateral			
Pentagon			
Hexagon			

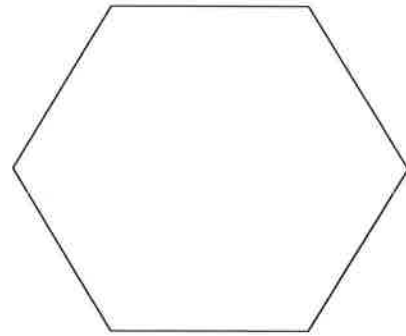
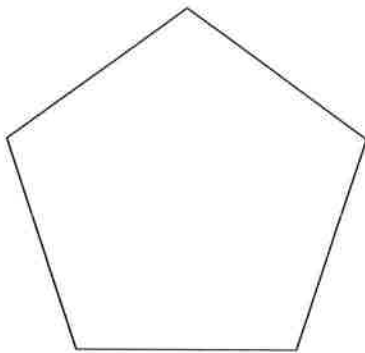
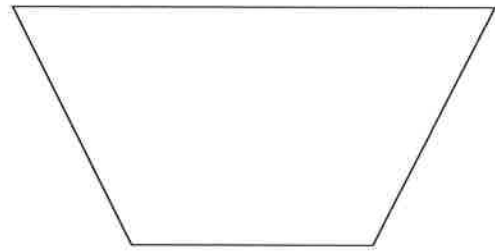
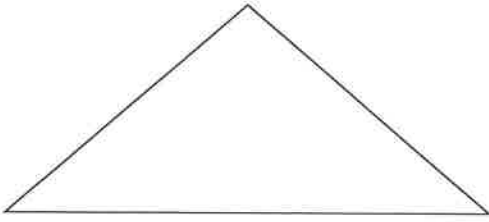
Equation for the Sum of the Interior Angles

Equation for Each Angle if Regular

Exterior Angles

Mark the exterior angles

Note: An interior angle added to its exterior angle totals 180° .



Polygon	Number of Sides	Sum of the Exterior Angles	Each exterior angle (if regular)
Triangle			
Quadrilateral			
Pentagon			
Hexagon			

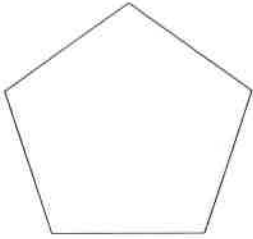
Equation for the Sum of the Exterior Angles

Each exterior angle

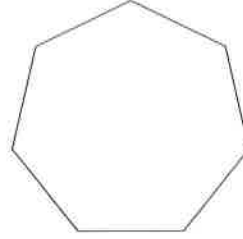
Practice 3.5-3.6 Angles in Polygons

Find the interior angle sum for each polygon. Round your answer to the nearest tenth if necessary.

1)



2)



3) regular 13-gon

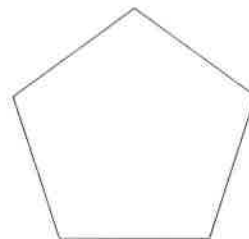
4) regular decagon

5) regular 15-gon

Find the exterior angle sum for each polygon. Round your answer to the nearest tenth if necessary.

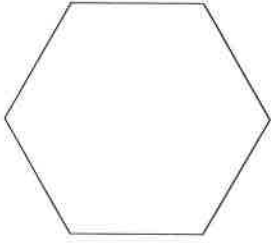
6) regular 13-gon

7)

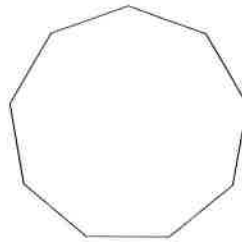


Find the measure of one interior angle in each polygon. Round your answer to the nearest tenth if necessary.

8)



9)



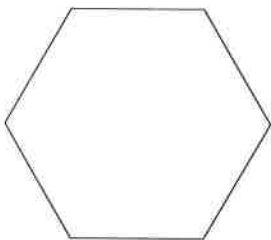
10) regular 19-gon

11) regular 22-gon

12) regular 17-gon

Find the measure of one exterior angle in each polygon. Round your answer to the nearest tenth if necessary.

13)



14) regular 14-gon

15) regular 13-gon

Find the requested measure(s).

16) Find the sum of the interior angles of a 26 sided polygon.

17) Find the measure of each interior angle of a regular polygon with 12 sides.

18) What is the interior angle measure at an exterior angle of 126° ?

19) Find the measure of each interior angle of a regular polygon with 28 sides.

20) Find the measure of the exterior angle at an interior angle of 114° .

21) Find the sum of the exterior angles of a polygon with 14 sides.

22) Find the measure of each a)interior and b)exterior of a regular nonagon.

Find the number of sides.

23) How many sides does a regular polygon have if each interior angle is 144° ?

24) Find the number of sides of a polygon if the sum of the interior angles is 2880° .

25) How many sides does a regular polygon have if each exterior angle is 18° ?

26) How many sides does a regular polygon have if each exterior angle is 15° ?