## GEOMETRY BOOKLET Sec 4



Angles \& Congruency
Mrs. Nassif

Classify each angle pair as complementary, supplementary, or adjacent. You can have more than one answer.
1.

2.

3.

4.

5.


-
6.


Find the missing angle measure. DO NOT USE A PROTRACTOR!!
7.

10.

11.
12.


$\qquad$

## Adiacent Angles



Example 1:
$\angle \mathrm{ACD}$ is adjacent to $\angle$ $\qquad$ .

## Vertical Angles

$\angle 1$ and $\qquad$ are vertical.
$\angle 2$ and $\qquad$ are vertical.

Vertical Angles are $\qquad$
Example 2: If $\angle 2=25^{\circ}$, what is $\mathrm{m} \angle 3$ ? $\qquad$

## Complementary Angles



Example 3: What is the complementary angle to $47^{\circ}$ ?
 $-47=$ $\qquad$ )

Subtract the given angle from $\qquad$ to figure out the $\qquad$ angle

## Supplementary Angles



Example 4: What is the supplementary angle to $107^{\circ}$ ? $\qquad$ $-107=$ $\qquad$ )

Name the relationship: complementary, supplementary, adjacent, or vertically opposite angles.
1)

3)

7)


Find the measure of angle $b$.

10)

12)

14)

18)


Name the angle in 2 ways.
1)

3)

4)

5)

6)


Find the value of $x, a, b$.
(g)
(h)

(i)

(j)

(k)

(I)


(n)


## (o)


2. (a) For each triangle, find the angles marked $a$ and $b$.
(i)


(iii)

(b) What do you notice about the angle marked $b$ and the other two angles given in each problem?
(c) Find the size of the angle $b$ in each problem below without working out the size of any other angles.


## Angles in a Triangle

Find the measure of each angle indicated.
1)

2)

3)

4)

5)

7)

6)

8)


10)

11)

12)

13)

16)


## Finding the missing angle

Find the value of the letter indicated.

$E F G H$ is a rectangle
$o=\quad p=$

$\mathrm{q}=$


Name $\qquad$

## All About Angles - Review

 What type of angle? Name the angle.
2. $X$


Find the complement of each angle measure.
3) $22^{\circ}$ $\qquad$ 4) $84^{\circ}$
5) $18^{\circ}$

Find the supplement of each angle measure.
6) $15^{\circ}$ $\qquad$
7) $110^{\circ}$ $\qquad$
8) $153^{\circ}$ $\qquad$

Use the diagram to find each angle measure.

$$
\begin{aligned}
9) & <1= \\
10) & <2= \\
11) & <3=
\end{aligned}
$$



12
WXYZ is a rectangle.


Angle $\mathrm{XWY}=36^{\circ}$.
Work out the size of angle WYZ, giving a reason for your answer.

## All About Angles- Review

Use the figure to answer the questions.

1) Name two complementary angles.
$\qquad$
2) Name two adjacent acute angles.

3) Name two vertical angles.

$$
\Varangle K O P \text { and }
$$


4) Name two supplementary angles.
$\not \subset K O P$
and $\qquad$

Use the figure and word bank to answer the questions.

2) $\qquad$ is a right angle.
3) <QOT and < TOS are $\qquad$ angles.
4) The measure of $<$ ROS $=$ $\qquad$ -.
5) $\qquad$ and $\qquad$ are vertical angles.
6) $\qquad$ and $\qquad$ are complementary angles.
7) $<S O R$ is $\qquad$ to $<$ QOR.


## Parallel lines cut by a transversal

Line $\qquad$ is parallel to line $\qquad$ -
$\overrightarrow{E F}$ is a $\qquad$

## Corresponding Angles

$\angle 1$ corresponds to $\angle$ $\qquad$ .
$\angle 2$ corresponds to $\angle$ $\qquad$
$\angle 3$ corresponds to $\angle$ $\qquad$ $-$
$\angle 4$ corresponds to $\angle$ $\qquad$ .

Corresponding angles are $\qquad$ -


Example 5: If $\angle 8=115^{\circ}$, what is $\mathrm{m} \angle 4$ ? $\qquad$

## Alternate Interior Angles

Angles 3, 4, 5, and 6 are interior angles (angles that lie 'inside' of two parallel lines). Interior angles that lie $\qquad$ the parallel lines and on of a transversal are alternate interior angles.
$\angle 3$ and $\angle 6$ are one pair of alternate interior angles.
$\angle 4$ and $\angle 5$ are the second pair of alternate interior angles.
Example 6: If $\angle 5=100^{\circ}$, what is the measure of $\angle 4$ ? $\qquad$

## Alternate Exterior Angles

Angles 1,2,7, and 8 are exterior angles (angles that lie 'outside' of two parallel lines). Exterior angles that lie on the $\qquad$ the parallel lines and on of a transversal are pairs of alternate exterior angles.
$\angle 1$ and $\angle 8$ are one pair of alternate exterior angles.
$\angle 2$ and $\angle 7$ are a second pair of alternate exterior angles.
Example 7: If $\angle 1=70^{\circ}$, what if the measure of $\angle 8$ ? $\qquad$

Practice: Answer the following questions using the figure below.


1. Name a transversal. $\qquad$
2. Name the four pairs of corresponding angles.
3. Name the two pairs of alternate interior angles. $\qquad$
4. Name the two pairs of alternate exterior angles. $\qquad$
5. Name four pairs of vertical angles. $\qquad$
6. Name 8 pairs of supplementary angles. $\qquad$
7. If $\angle 5=63^{\circ}$, then find the measure of each of the missing angles.
$\qquad$ $\angle 2=$ $\qquad$
$\angle 4=$ $\qquad$
$\angle 7=$
$\angle 8=$ $\qquad$

Identify each pair of angles as corresponding, alternate interior, alternate exterior, or supplementary

2)

3)

5)

7)



8)

9)

10)


Find the measure of each angle indicated.
11)

13)

$\longrightarrow+100^{\circ}{ }^{\longrightarrow}$
15)

17)
12)

18)


## Find the measure of the indicated angle

1) 


2)

3)

5)

7)

10)


## Exercises

1. Find the angles marked in each diagram, giving reasons for your answers.
(a)

(b)

(c)

(d)

(e)

(f)


(h)




(1)


(n)

(o)

2. Find the size of the angles marked $a, b, c$, etc. in each of the diagrams below.
(a)

(c)

(e)

(g)

(b)

(d)

(f)

(h)

(j)


Use the geometric properties and theorems you have learned to solve for x in each diagram and write the property or theorem you use in each case.
1.

4.

7.

10.

13.

2.

5.

8.

11.

14.

16.

19.

20.

17.

3.

6.

9.

12.

15.

18.

21.

3. By considering each diagram, write down an equation and find the value of $x$.
(a)

(c)

(e)

(b)

(d)

(f)

(f)

4. Which of the lines shown below are parallel?

5. The diagram shows the path of a pool ball as it bounces off cushions on opposite sides of a pool table.

(a) Find the angles $a$ and $b$.
(b) If, after the second bounce, the path is parallel to the path before the first bounce, find $c$ and $d$.
6. A workbench is standing on a horizontal floor. The side of the workbench is shown.


The legs $A B$ and $C D$ are equal in length and joined at $E . A E=E C$
(a) Which two lines are parallel?

Angle ACD is $50^{\circ}$.
(b) Work out the size of angle BAC giving a reason for your answer.
7. In the diagram, $\mathrm{XY}=\mathrm{ZY}$ and ZY is parallel to XW .

(a) Write down the size of angle $p$.
(b) Calculate the size of angle $q$. Give a reason for your answer.
(c) Give a reason why angle $q=$ angle $r$.
$\qquad$

## A. Parallel Lines

1. Use the figure below and the following word bank to fill in the blanks.

A. Alternate Interior Angles
B. Supplementary
C. Corresponding Angles
D. Vertical Angles
E. Alternate Exterior Angles
$\angle 4$ and $\angle 5$ are called $\qquad$ angles, and are $\qquad$
$\angle 3$ and $\angle 5$ are called $\qquad$ angles, and are $\qquad$
$\angle 1$ and $\angle 7$ are called $\qquad$ angles, and are $\qquad$
$\angle 3$ and $\angle 7$ are called $\qquad$ angles, and are $\qquad$
$\angle 5$ and $\angle 6$ are called $\qquad$ angles, and are $\qquad$
$\angle 1$ and $\angle 3$ are called $\qquad$ angles, and are $\qquad$

Find the $m \angle 1$ and $m \angle 2$.
3.

4.

5.

$\square$ $m \angle 1=$ $\qquad$ $\mathrm{m} \angle 2=$ $\qquad$
$\mathrm{m} \angle 1=$ $\qquad$
$\qquad$

$\square$
7.



True/False:
10. Two complementary angles MUST be adjacent.
11. If two lines intersect, vertical angles are two angles that are adjacent. $\qquad$
12. Two supplementary angles always form a linear pair. $\qquad$
Find the measures of the missing angles:

14.


$$
x=\quad y=
$$

$\qquad$ $z=$ $\qquad$
$a=$ $\qquad$
$b=$ $\qquad$
$c=$ $\qquad$
Find the value of $x$ for each of the following:
15.

$x=$

8.

10.

11.


## Solve for $\boldsymbol{x}$.

19) 


20)

21)

23)



22)

Find the measure of the angle indicated in bold.

26)

28)

3. The diagram below shows a rectangle with its diagonals drawn in.


Find the sizes of all the other angles.
4. Find the angles marked with letters in each of the following diagrams. In each diagram the lines all lie inside a rectangle.
(a)

(b)

(c)

(d)

5. Find the angles marked with letters in each quadrilateral below.
(a)


(c)

(d)


6. A swing is built from two metal frames as shown below.


The lengths of $A B$ and $A E$ are the same and the lengths of $A C$ and $A D$ are the same. Find the sizes of the angles $a, b, c, d, e$ and $f$.
7. The diagram shows a wooden frame that forms part of the roof of a house.


Find the sizes of the angles $a, b, c, d, e$ and $f$.

## Information

The word 'geometry' is derived from the Greek words, ge (earth) and metrein (to measure). Euclid's masterpiece, 'The Elements', survived as the basic textbook for over 2000 years. The geometry we are studying in this unit is sometimes referred to as Euclidean geometry.

1) Complementary angles add up to $\qquad$ degrees.
2) Supplementary angles add up to $\qquad$ degrees.
3) The complement of a $36^{\circ}$ angle is $\qquad$ degrees.
4) The supplement of a $125^{\circ}$ angle is $\qquad$ degrees.
5) The number of degrees in a straight line is $\qquad$ .
6) The measure of one complementary angle is $56^{\circ}$. What is the measure of the other complementary angle? $\qquad$
7) The supplement of a $95^{\circ}$ angle is $\qquad$ degrees.
8) The complement of a $27^{\circ}$ angle measures —_ degrees.
9) The supplement of a $45^{\circ}$ angle measures —_ degrees.
10) The supplement of a $102^{\circ}$ angle measures —_ degrees.
11) The sum of the measures of the angles in a triangle is $\qquad$ degrees.
12) Two angles in a triangle add up to $140^{\circ}$. What does the third angle measure?
13) The complement of a $30^{\circ}$ is $\qquad$ degrees.
14) The sum of the measures of the angles in a rectangle is $\qquad$ degrees.
15) The sum of three of the angles of a rectangle is $270^{\circ}$. What is the measure of the fourth angle?
16) The measure of one angle of a square is ——degrees.
17) A right angle measures $\qquad$ degrees.
18) The complement of a $62^{\circ}$ angle measures —__ degrees.
19) The sum measure of the angles of a nombus is $\qquad$ degrees.
20) The complement of a $40^{\circ}$ angle is $\qquad$ ${ }^{\circ}$.
21) The supplement of a 58 degree angle is —_ degrees.
22) The complement of a $47^{\circ}$ angle measures -_ degrees.
23) The measure of the vertex angle of an isosceles triangle is $70^{\circ}$. Find the measure of one of the base angles. $\qquad$ degrees
24) The supplement of a $75^{\circ}$ angle is $\qquad$ degrees.
25) The complement of a $23^{\circ}$ angle is $\qquad$ degrees.
26) The supplement of a $98^{\circ}$ angle is ___ degrees.
27) The angle vertically opposite to $45^{\circ}$ measures
28) Two angles in a triangle add up to $110^{\circ}$. What does the third angle measure? $\qquad$
29) A trianole with 2 eoual sides is called $\qquad$。
30) The measure of the vertex angle of an isosceles triangle is $80^{\circ}$. Find the measure of one of the base angles. $\qquad$ degrees.
31) A quadrilateral with 4 eoual angles is called a $\qquad$
32) The supplement of an $89^{\circ}$ angle is $\qquad$ degrees.
33) The complement of a $19^{\circ}$ angle is $\qquad$
34) A triangle with 3 different
Sides is called
35) A pair of complementary angles have a measure of $x$ and $2 x$. Find $x . x=$ $\qquad$ degrees.
36) A pair of supplementary angles have a measure of $x$ and $2 x$. Find $x$. $x=$ $\qquad$ degrees

Name: $\qquad$

# Congruent Triangles 

Are the 2 triangles congruent? By which rule?

3)

5)

7)

9)

2)

4)

6)

8)

10)


State what additional information is required in order to know that the triangles are congruent for the reason given.
11) SAS

13) SSS

15) SAS

17) SAS

12) SAS

14) SSS

16) SSS

18) SAS


State if the two triangles are congruent. If they are, state how you know.
1)

3)

5)

7)

9)

2)

4)

6)

10)


State what additional information is required in order to know that the triangles are congruent for the reason given.
11) ASA

12) ASA

13) ASA

15) SAS

17) ASA

14) ASA

16) SAS

18) 5 AS


State if the two triangles are congruent. If they are, state how you know.
1)

2)

3)

5)

4)

7)

8)

10)


State what additional information is required in order to know that the triangles are congruent for the reason given.
11) ASA
12) SAS



14) ASA

15) SAS

17) SSS


## 16) ASA


18) SAS



State if the two triangles are congruent. If they are, state how you know.

2)

3)

5)

6)

9)

8)

)
10)


State what additional information is required in order to know that the triangles are congruent for the reason given.
11) $S S S$

13)


15) $S A S$

17)

12) ASA

14)

ASA
16)

18)

$\qquad$

# Congruent Triangles 

Are the 2 triangles congruent? By which rule?



$\qquad$ Y/N? Statement:

Y/N? Statement: $\qquad$ Y/N? Statement:
 $\mathrm{Y} / \mathrm{N}$ ? Statement: _ Y/N? Statement: $\qquad$
Y/N? Statement: $\qquad$

9.

$\mathrm{Y} / \mathrm{N}$ ? Statement: $\qquad$ Y/N? Statement: $\qquad$ $\mathrm{Y} / \mathbb{N}$ ? Statement: $\qquad$
10.


$Y / N$ ? Statement: $\qquad$
12.

$\qquad$
Y/N? Statement:

14.
 Y/N? Statement:

$\qquad$
$\qquad$ $\mathrm{Y} / \mathrm{N}$ ? Statement:

