Welcome to UMTYMP Geometry!

Vincent Hall Room 6

Instructor: Andrea Butler

A little about me, a little about you!

Name Cards:

First name, last initial

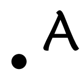
What school/district/city you live in

What interests you? (what do you like to do outside of school?)

A point is a location. It has neither shape nor size.

Named by: a capital letter

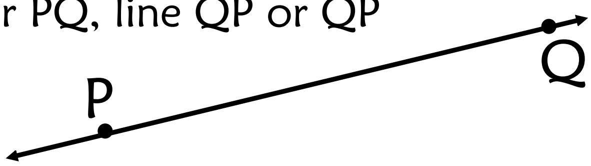
Example Point A



A line is made up of points and has no thickness or width. There is exactly one line through any two points.

Name by...... the letters representing two points on the line or a lowercase letter.

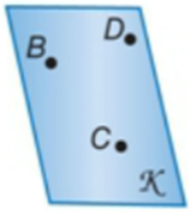
Example.....line m, line PQ or $\overleftrightarrow{PQ}$, line QP or $\overleftrightarrow{QP}$



A plane — is a flat surface made up of points that extends infinitely in all directions. There is exactly one plane through any three points not on the same line.

Name by.... — a capital script letter or by the letters naming three points that are not all on the same line.

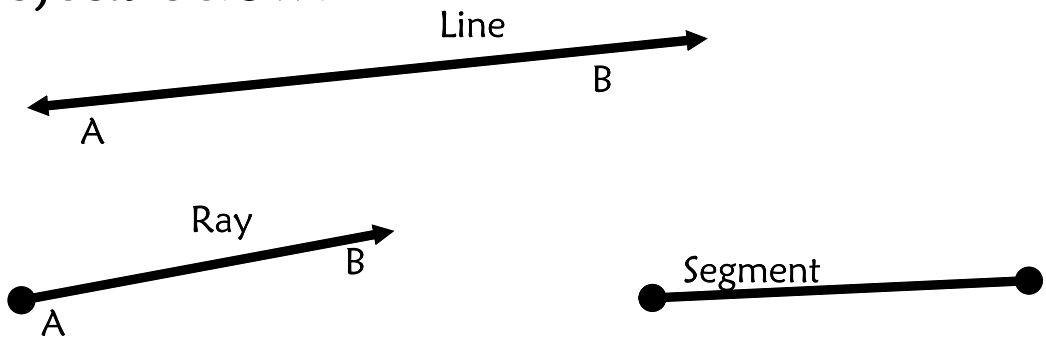
Example — Plane K, Plane BDC



Collinear- Points that lie on the same line.

Coplanar- Points that lie on the same plane.

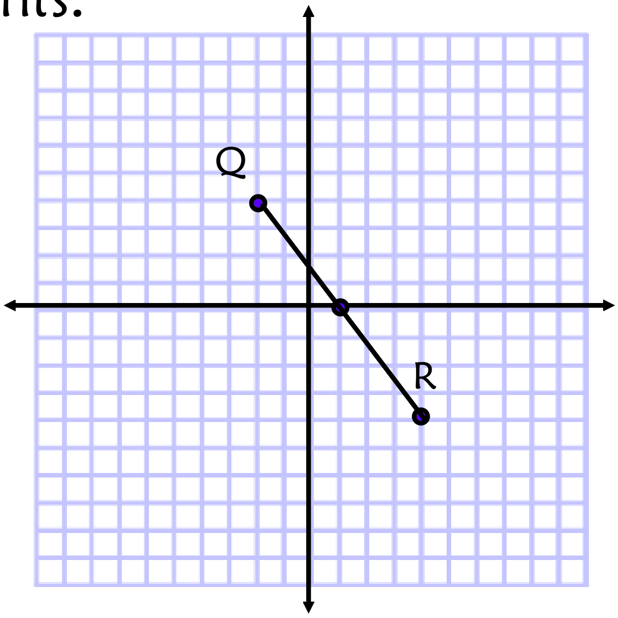
What are the differences between the three objects below?



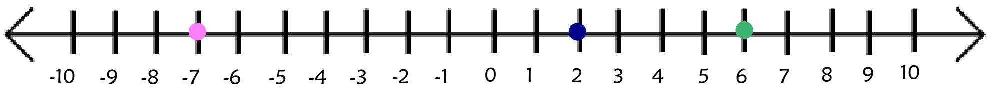
Segment- A measurable part of a line that consists of two points, called endpoints, and all of the points.

Ray- The set of all points that start at and endpoint and continue in one direction forever.

Draw and label a figure for the following situation. $\overline{QR}$ on a coordinate plane contains Q(-2, 4) and R(4, -4). Add point T so that T is collinear with these points.



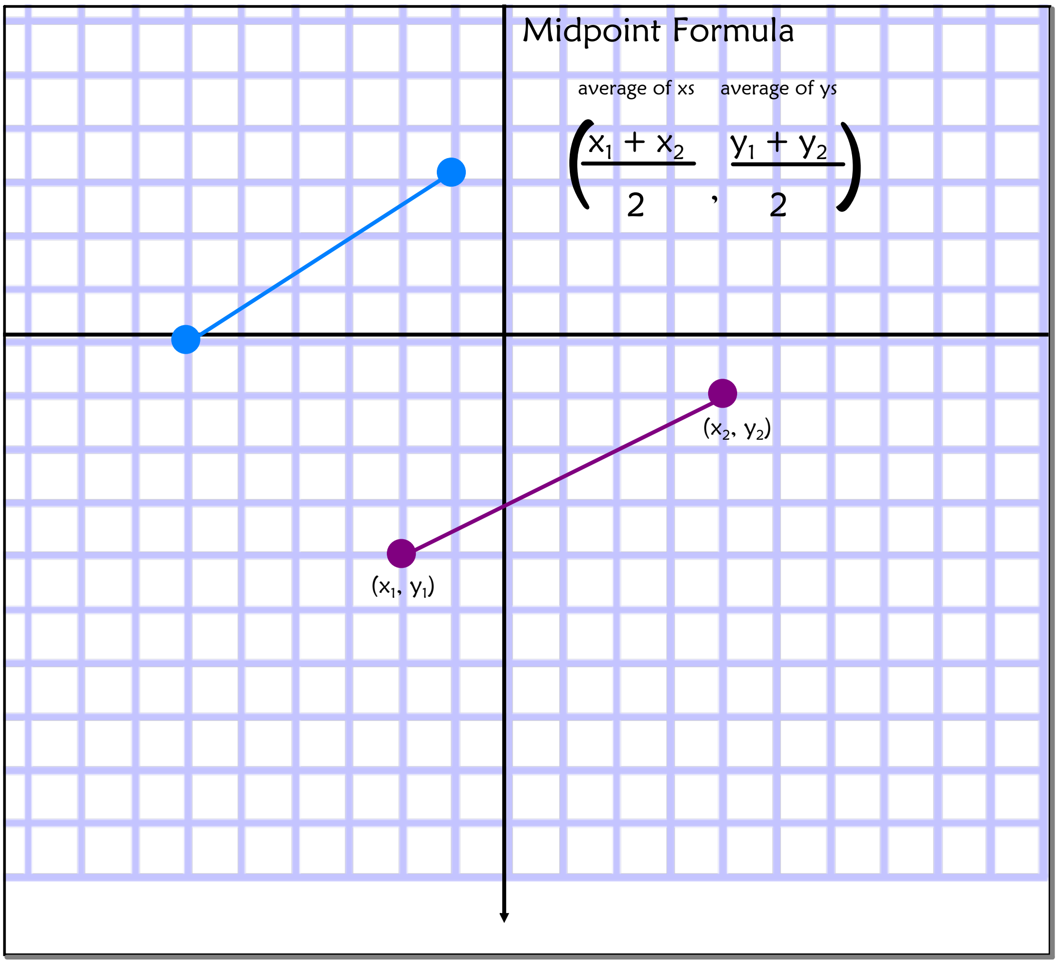
Midpoint: the point halfway between the two endpoints

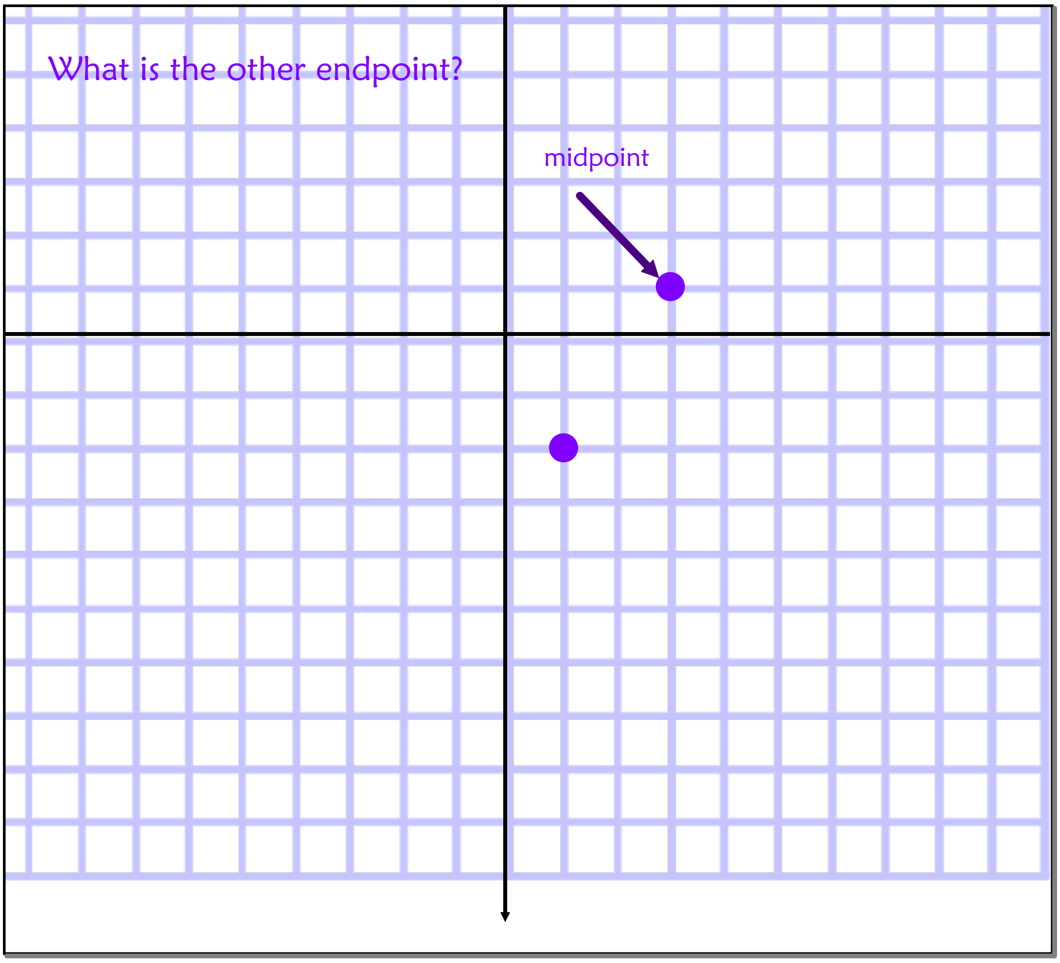


What is the midpoint of the blue and green points?

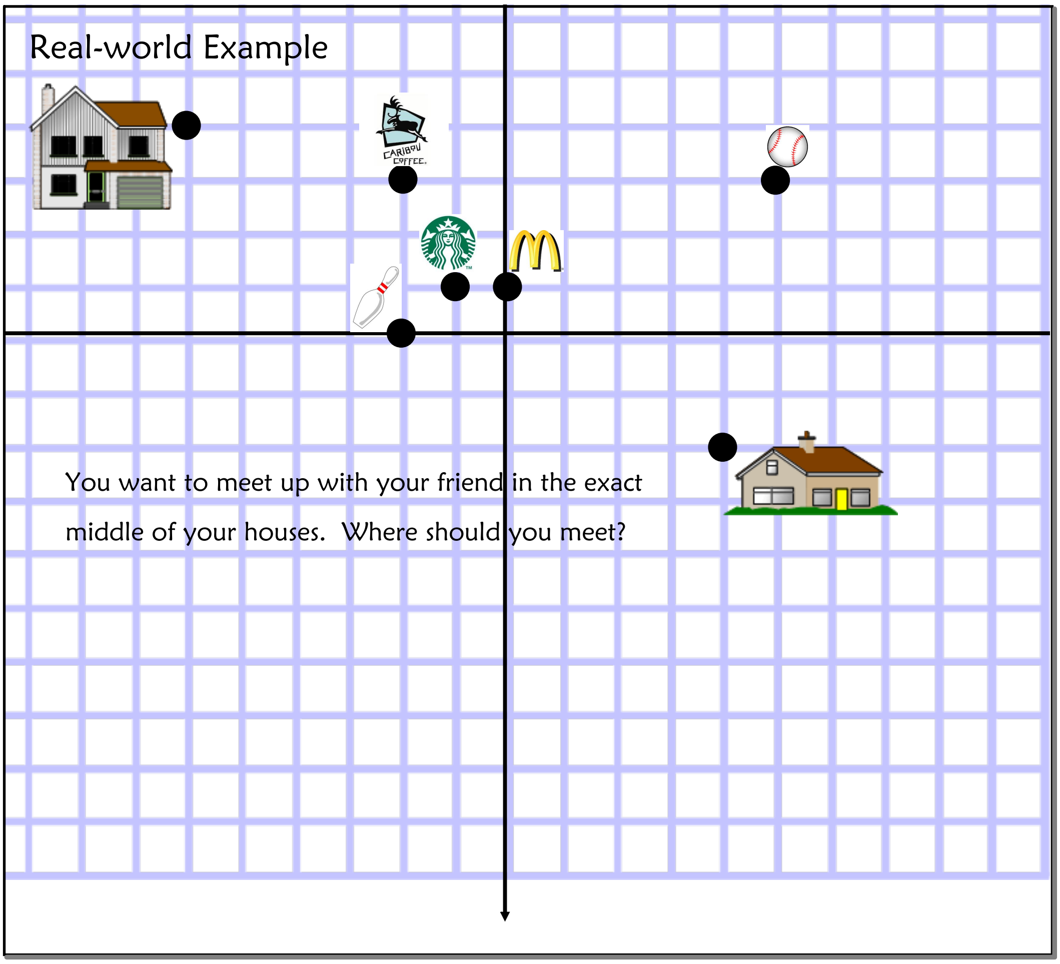
What is the midpoint of the pink and blue points?

What could the formula be?


Midpoint Formula
average of xs
average of ys
$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
(x_2, y_2)
(x_1, y_1)

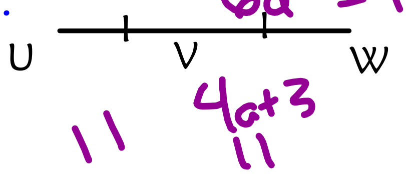

What is the other endpoint?
midpoint

Real-world Example



You want to meet up with your friend in the exact middle of your houses. Where should you meet?

Suppose V is the midpoint of $\overline{UW}$. $\overline{VW}$ = 4a + 3 and $\overline{UV}$ = 15 - 2a. Find the length of $\overline{UW}$.



$4a + 3 = 15 - 2a$

$6a = 12$

$a = 2$

Find the coordinate of R, the midpoint of $\overline{MT}$, given M (6, -3) and T (2, 4).

$(4, \frac{1}{2})$

$\frac{1}{2}$

Find the length of $\overline{XZ}$ given Y is the midpoint and $\overline{XY}$ = 2x - 6 and $\overline{YZ}$ = x + 7.

Circle- The set of all points in a plane at a given distant from a point.

Radius- A segment from a point on a circle or sphere to the center.
(OP is a radius-plural of radius is radii)

Center- Center of circle is usually O.

Chord: Line segment whose endpoints lie on a circle

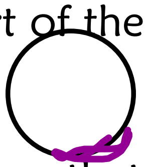
Diameter: Chord that passes through the center of the circle.

Secant: A line that contains a chord.

Tangent: A line that lies in the plane of a circle and that intersects the circle at exactly one point.

Point of tangency: Point that the tangent line intersects the circle.

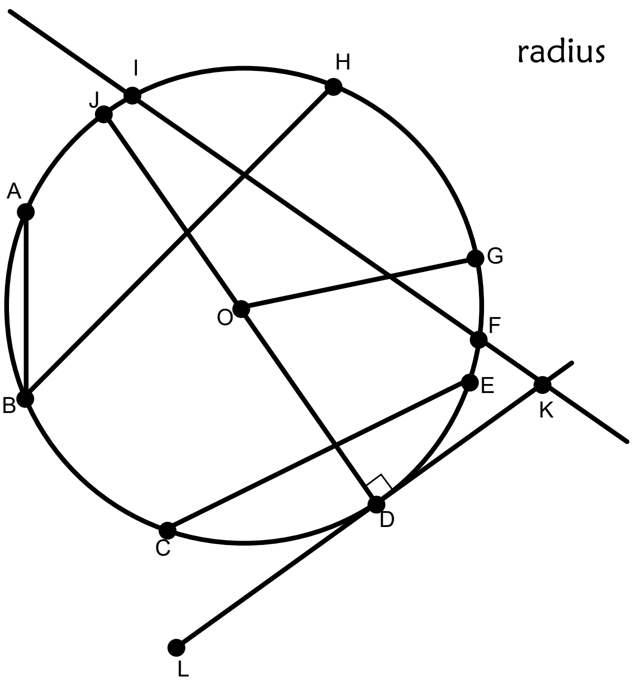
Arc of a circle: Two points on a circle and the continuous part of the circle between two points.



Semicircle: An arc that makes up half of the circle. (three letters)

Minor arc: An arc that is smaller than a semicircle. (two letters)

Major arc: An arc that is larger than a semicircle. (three letters)



radius chord diameter

secant tangent

point of tangency

major arc minor arc

semicircle center

radius $\overline{OG}$

diameter $\overline{JD}$

chord $\overline{CE}$

secant $\overleftrightarrow{IF}$

tangent $\overleftrightarrow{DK}$

point of tangency D

Major arc $\overset{\frown}{DEA}$

Minor arc $\overset{\frown}{DE}$

semicircle $\overset{\frown}{JHD}$

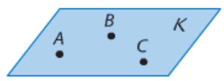
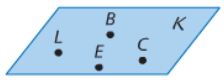
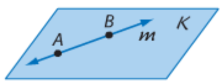
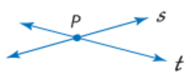
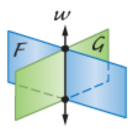
center O

Axiom (Postulate):

A statement that is accepted as true without proof.

Basic ideas about points, lines, and planes can be stated as postulates.

Postulates Points, Lines, and Planes

	Words	Example	
2.1	Through any two points, there is exactly one line.		Line *n* is the only line through points *P* and *R*.
2.2	Through any three noncollinear points, there is exactly one plane.		Plane *K* is the only plane through noncollinear points *A*, *B*, and *C*.
2.3	A line contains at least two points.		Line *n* contains points *P*, *Q*, and *R*.
2.4	A plane contains at least three noncollinear points.		Plane *K* contains noncollinear points *L*, *B*, *C*, and *E*.
2.5	If two points lie in a plane, then the entire line containing those points lies in that plane.		Points *A* and *B* lie in plane *K*, and line *m* contains points *A* and *B*, so line *m* is in plane *K*.
2.6	If two lines intersect, then their intersection is exactly one point.		Lines *s* and *t* intersect at point *P*.
2.7	If two planes intersect, then their intersection is a line.		Planes *F* and *G* intersect in line *w*.

Theorem: A result that has been proved to be true, using previous facts/theorems that were already known.

Do you know any theorems?

+ Once a statement has been proven, it can be used as a reason to justify other proofs.

So....Can you tell the difference between an Axiom (Postulate) and a Theorem?

Remember

Axioms	Theorems
Do not need proof	Use definitions, axioms, and other theorems to prove

Group problem solving:

Axiom	Theorem	Definition	
			Through any two points, there is exactly one line
			Lines, that form right angles are perpendicular
			Vertical angles are 2 nonadjacent angles formed by two intersecting lines
			Vertical angles are congruent
			If two lines intersect, then exactly one plane contains both lines
			A line segment has only one midpoint

Axiom	Theorem	Definition	
Through any two points, there is exactly one line			Through any two points, there is exactly one line
		Lines, that form right angles are perpendicular	Lines, that form right angles are perpendicular
		Vertical angles are 2 nonadjacent angles formed by two intersecting lines	Vertical angles are 2 nonadjacent angles formed by two intersecting lines
	Vertical angles are congruent		Vertical angles are congruent
	If two lines intersect, then exactly one plane contains both lines		If two lines intersect, then exactly one plane contains both lines
A line segment has only one midpoint			A line segment has only one midpoint

Constructions:

Sketch:

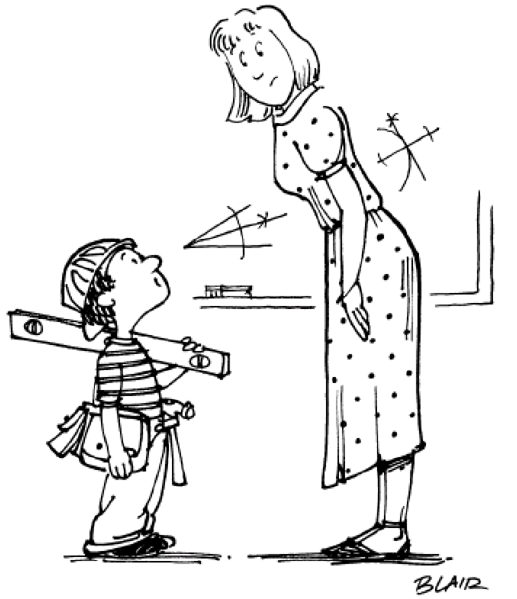
Freehand

Draw:

Ruler and Protractor

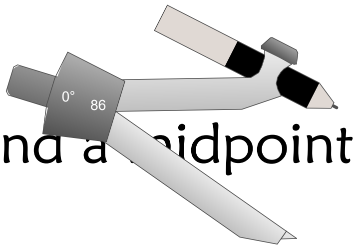
Construct:

Compass and Straightedge

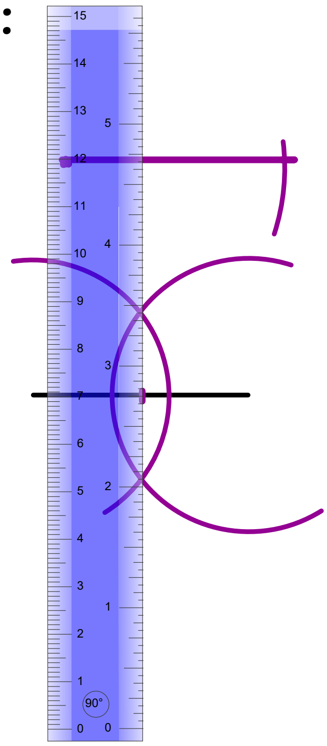


"BUT YOU SAID, 'COME READY TO DO CONSTRUCTIONS.'"

Duplicate a segment:

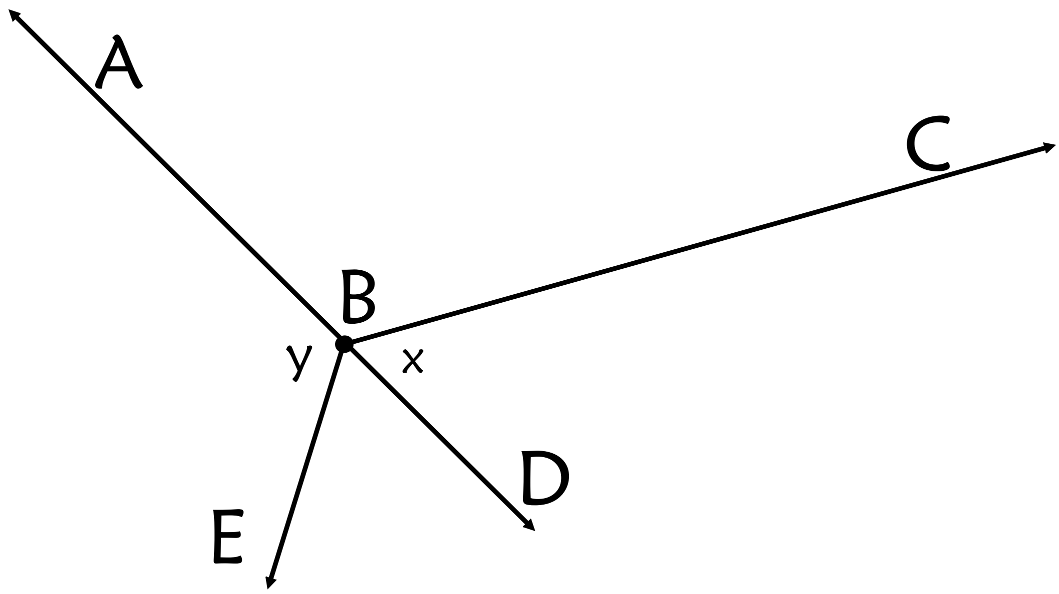


Find a midpoint:

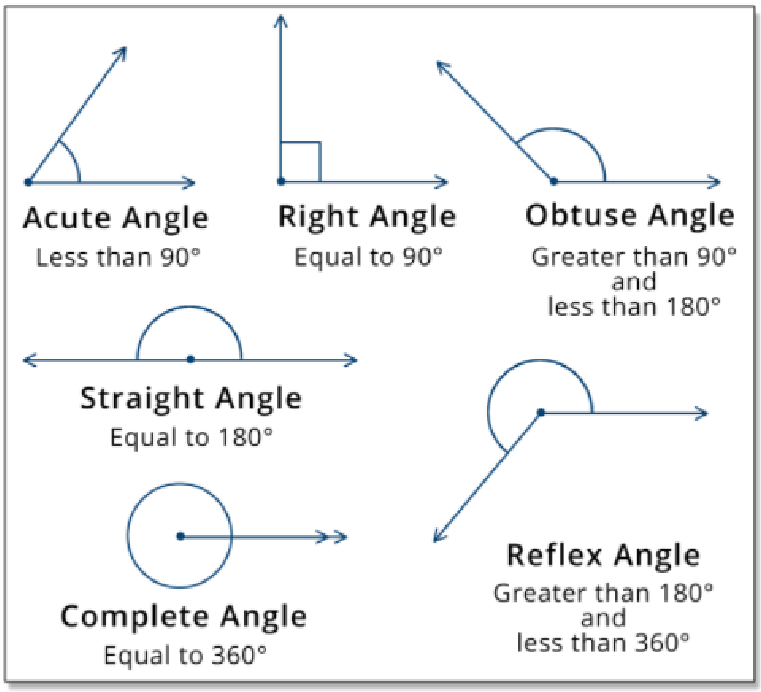


Add segments:

Name angles x and y.

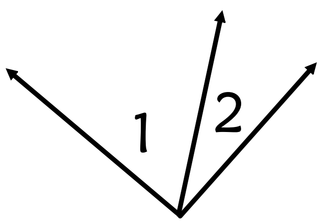


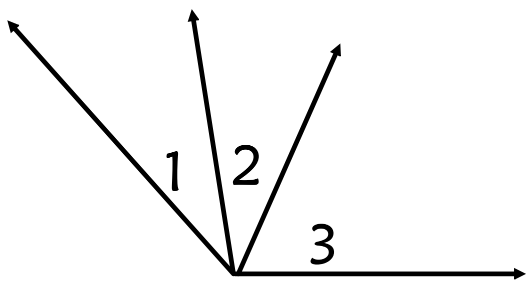
Angle- The intersection of two noncollinear rays at a common endpoint.



Adjacent angles : two angles that lie in the same plane and have a common vertex and a common side, but no common interior points

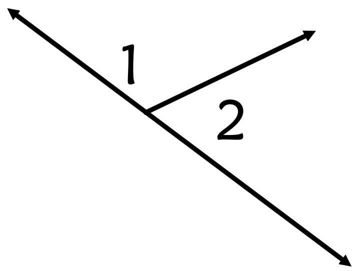
Ex.





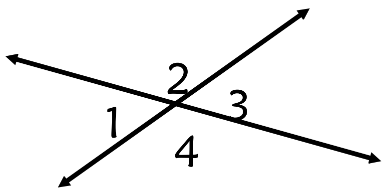
Linear Pair: a pair of adjacent angles with noncommon sides that are opposite rays

Ex.

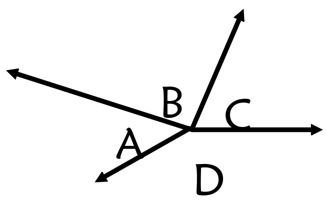


Vertical angles: two nonadjacent angles formed by two intersecting lines

Ex. ∠1 and ∠3?

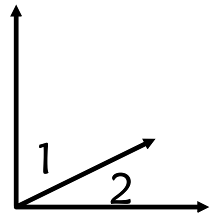


∠B and ∠D?

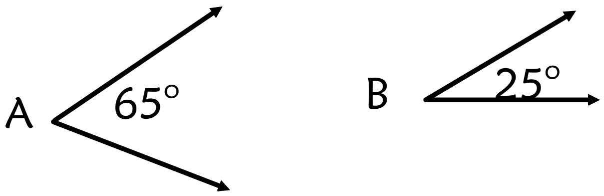


Complementary angles are two angles with measures that have a sum of 90°

Ex. ∠1 and ∠2 are complementary.

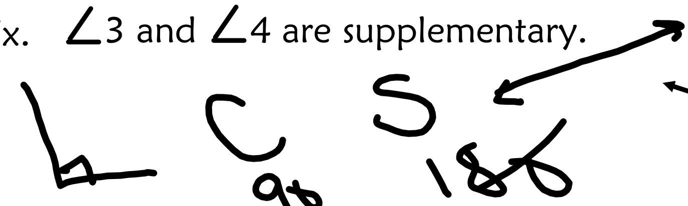


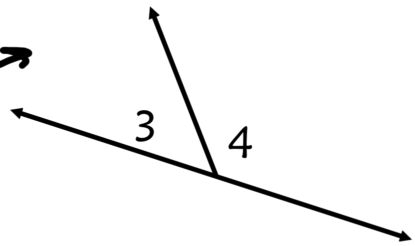
∠A is complementary to ∠B.



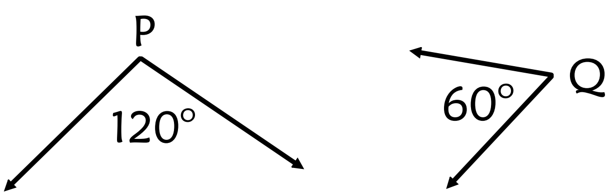
Supplementary angles are two angles with measures that have a sum of 180

Ex. ∠3 and ∠4 are supplementary.



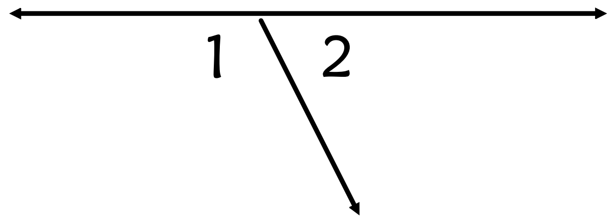


∠P and ∠Q are supplementary.



The angles in a linear pair are supplementary.

Ex. $m\angle 1 + m\angle 2 = 180$



Group Problems:

Find the measures of two supplementary angles if the measure of one angle is 6 less than 5 times the measure of the other angle.

$x = 5y\ 6$

$x + y = 180$

Find the measures of two ~~complementary~~ angles if one angle measures six degrees less than five times the measure of the other.

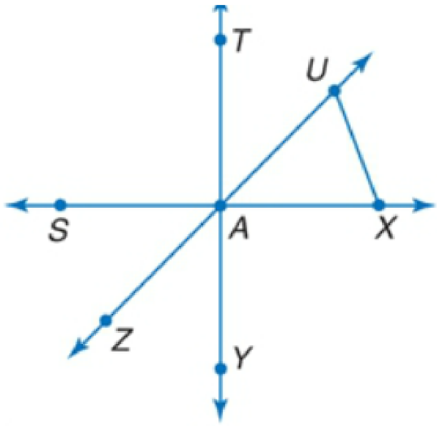
~~A. 1, 1~~

~~B. 21, 111~~

C. 16, 74

D. 14, 76

Determine whether the statement " ∠TAU is complementary to ∠ UAY" can be assumed from the figure.



A. Yes

B. No

Given $\angle S = (9x - 9)^\circ$:

Determine the value of x that would make ∠ S a Right Angle.

Determine two values of x that would make ∠ S an Acute Angle.

In the figure, $\overrightarrow{KJ}$ and $\overrightarrow{KM}$ are opposite rays. $\overrightarrow{KN}$ bisects ∠JKL.

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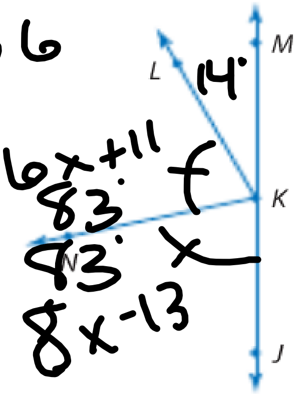


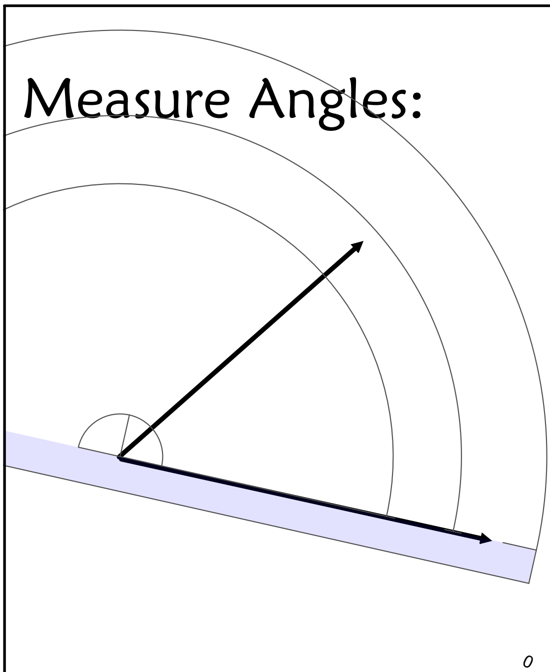
If m ∠JKN = 8x - 13 and m ∠NKL = 6x + 11, find m ∠JKN.

$8x - 13 = 6x + 11$

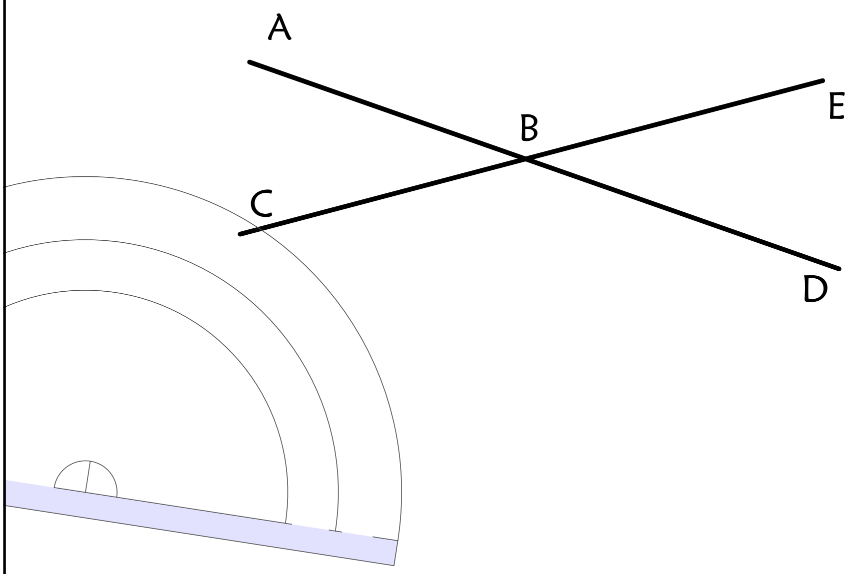
$2x = 24$

$x = 12$

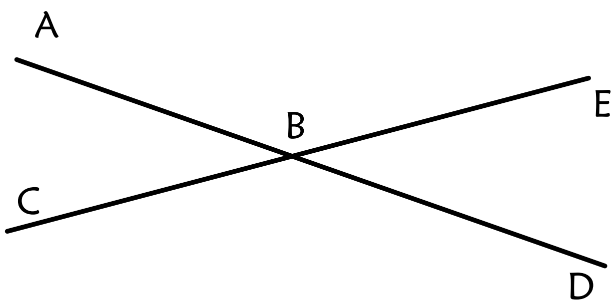
Measure Angles:



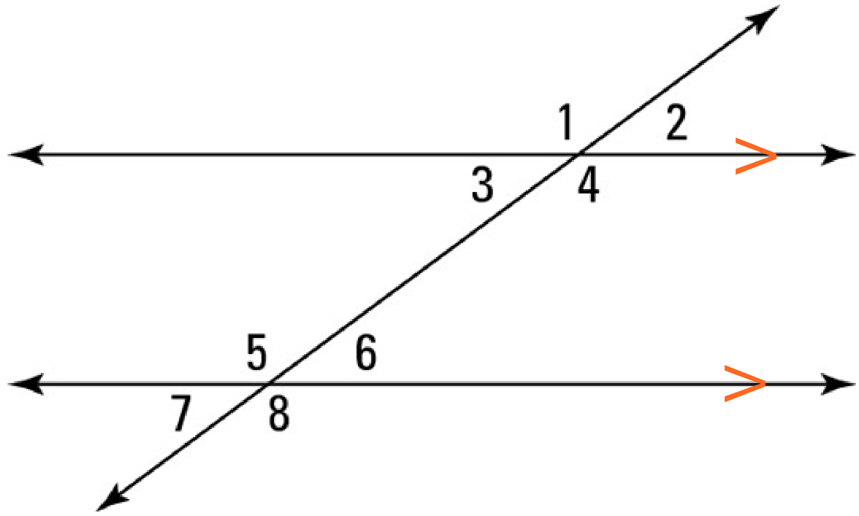
Find the measure of each angle in these intersecting segments.



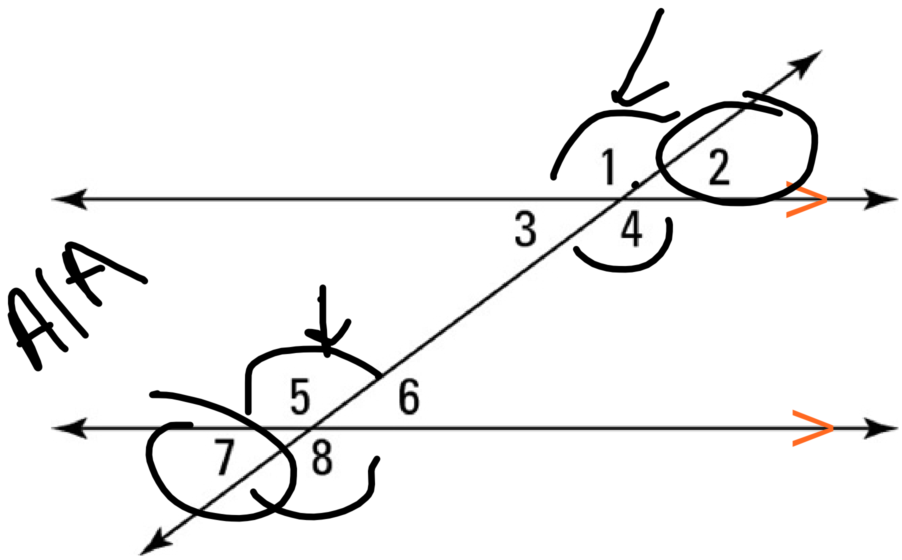
Find the measure of each angle in these intersecting segments.



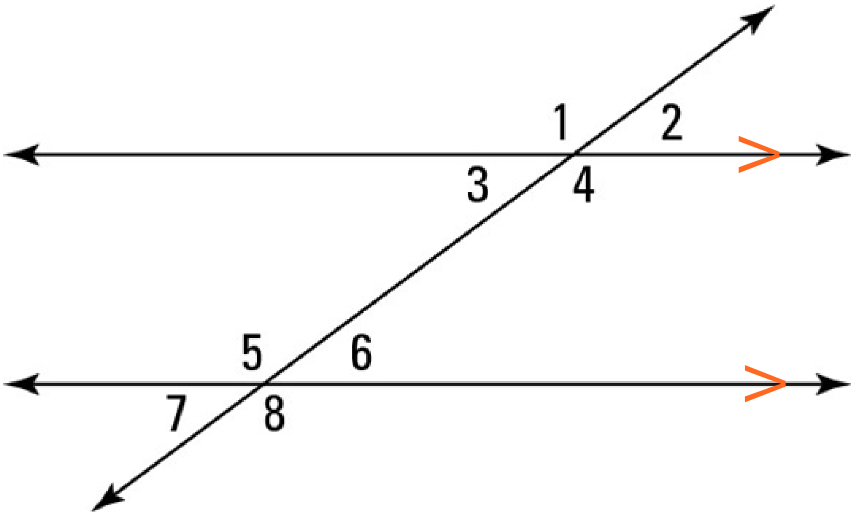
Find the measure of each angle. What do the orange arrows mean?



Mark any congruent angles



Mark any congruent angles



Types of angles and parallel lines

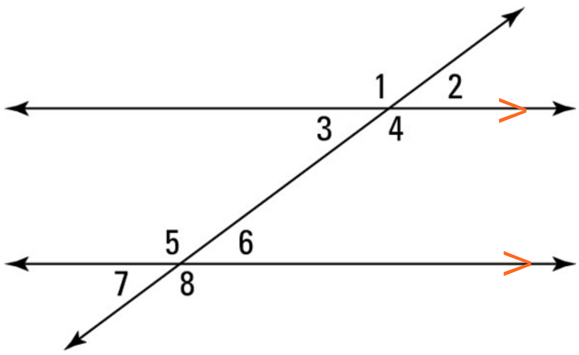
Corresponding Angles, Vertical Angles,

Alternate Interior Angles, and

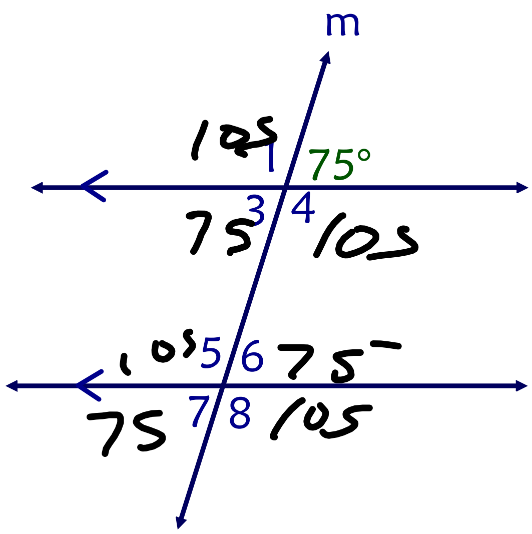
Alternate Exterior Angles are

Congruent when a transversal cuts

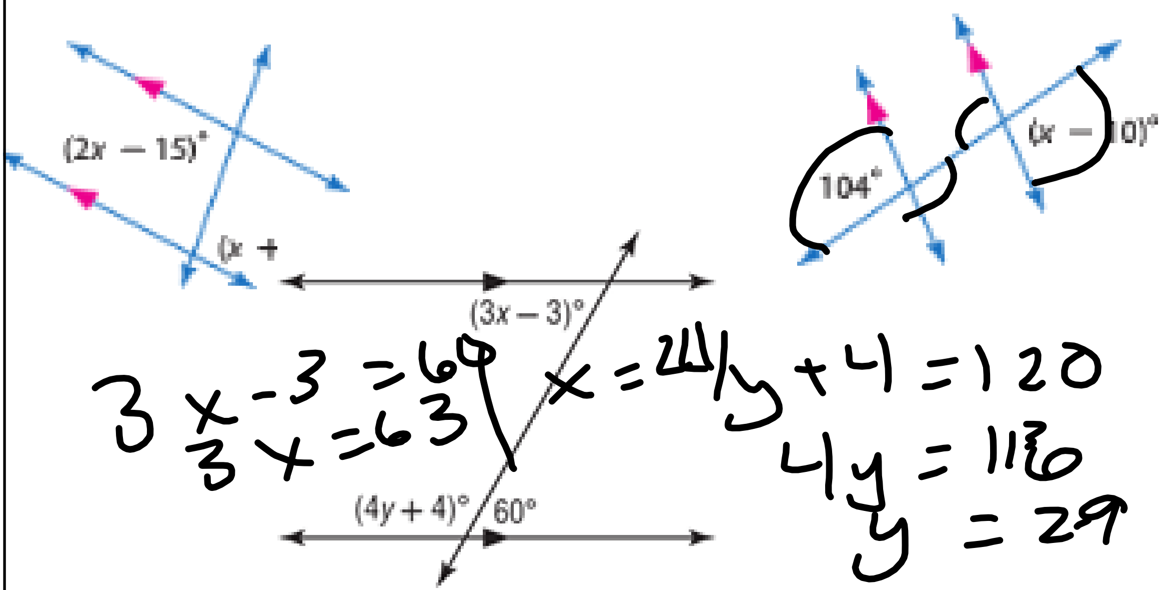
parallel lines.

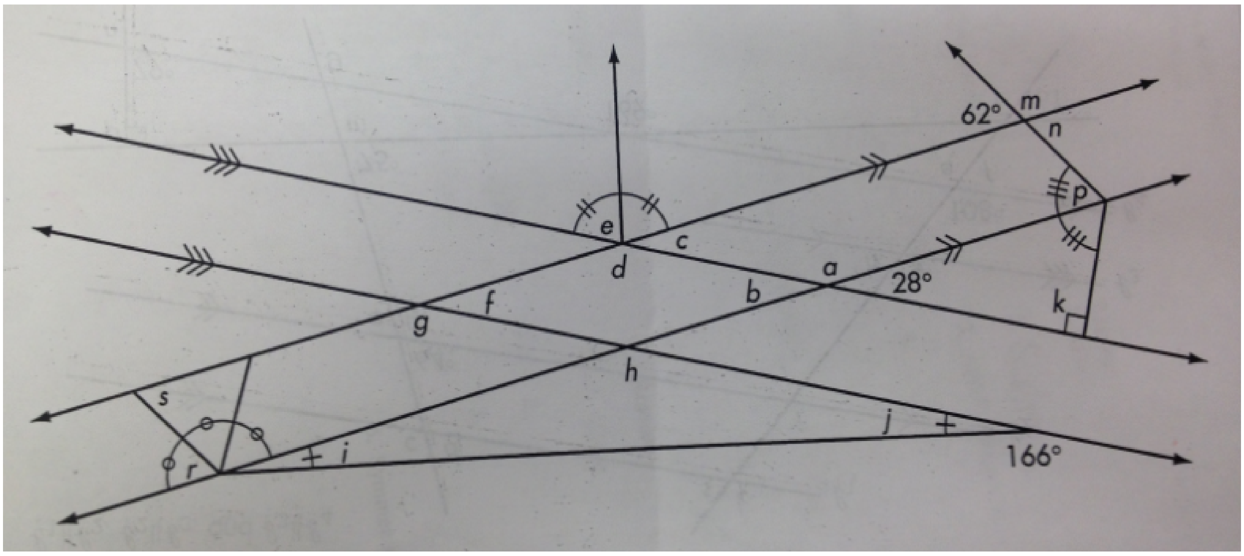


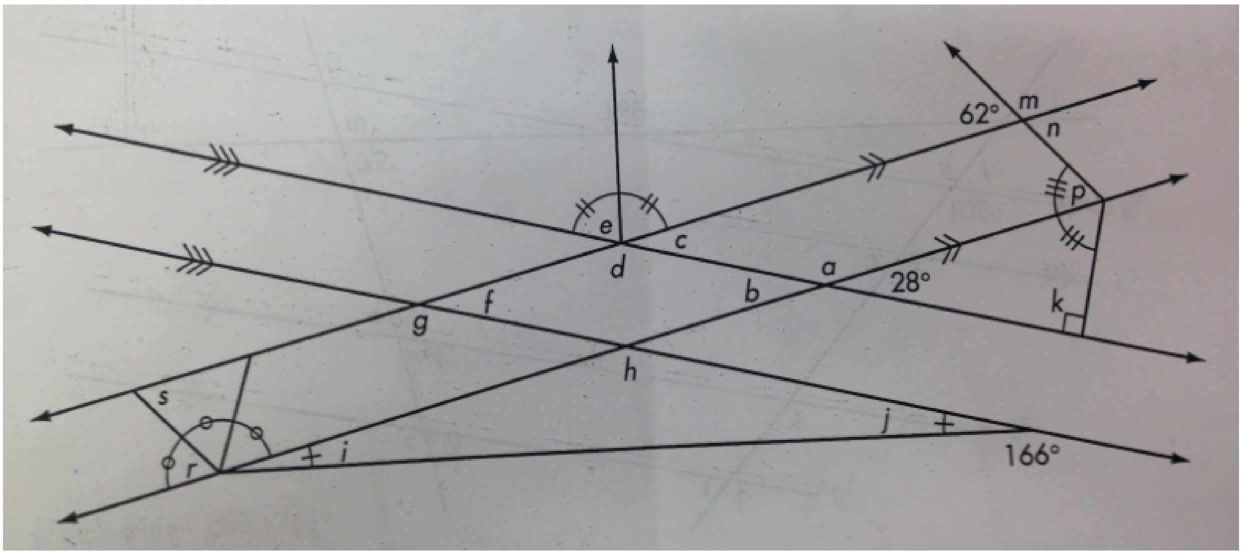
If m∠2 = 75°, find the degree measures of the rest of the angles.



Solve for x.




62°
m
n
p
e
c
d
a
28°
b
f
g
k
h
s
j
i
r
166°


62°
m
n
p
e
c
d
a
28°
b
f
g
k
h
s
j
i
r
166°

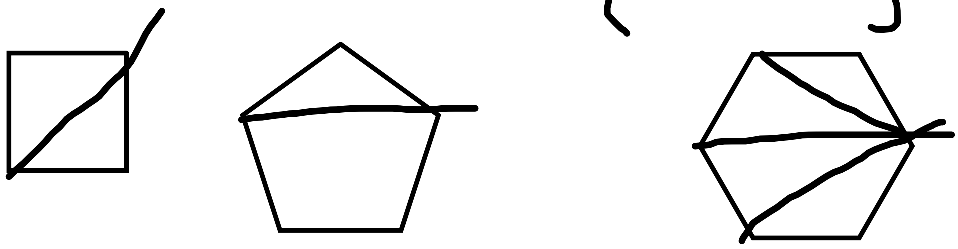
Measure the angles in a triangle. 180°

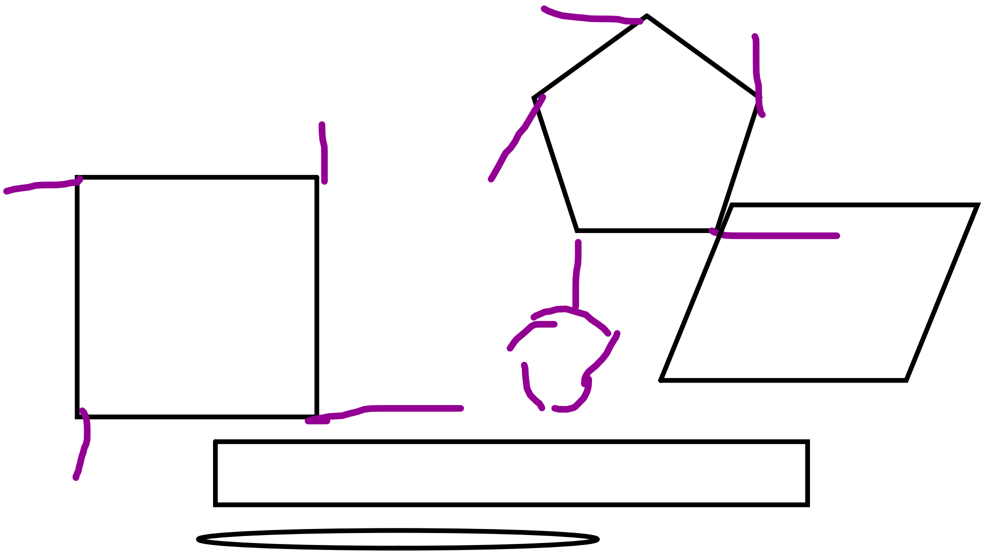
Now a square, pentagon and hexagon.

360 540 720

$(n-2)180$

What do you notice?





A conditional is a compound statement formed by combining two statements, a hypothesis and a conclusion, by using the words, " if... then..."

The converse is formed by switching the hypothesis and conclusion in the original statement. If... then... to not move.

Statement:
If an object is a rose, then it is a flower.

Converse:

Statement:
If the triangle is isosceles, then the triangle's base angles are congruent.

Converse:

Proof by example does NOT work, however proof by contradiction DOES work!