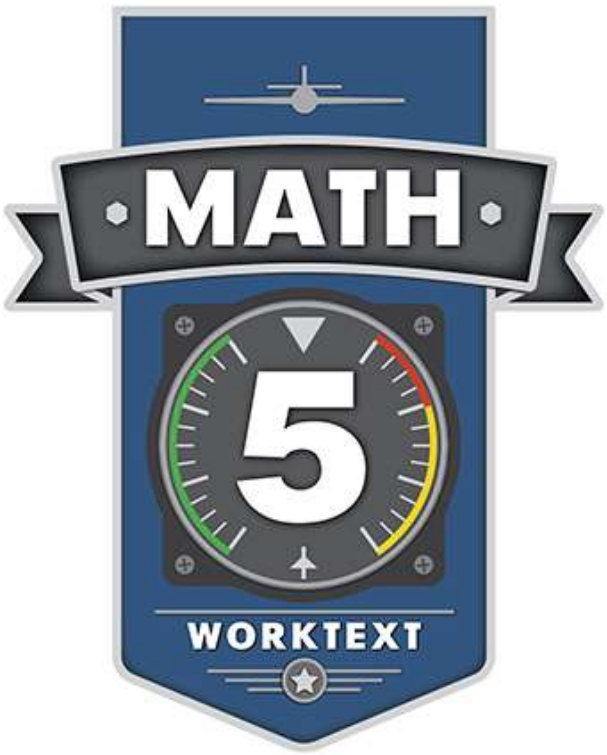


Fourth Edition

bju press
Greenville, South Carolina

Geometry: Lines & Angles

Chapter 4

The Wright Brothers

Wilbur and Orville Wright were interested in mechanical things even as children. They built their own toys and fixed their friends' bicycles. They loved to experiment with new inventions. Wilbur thought up the ideas, and Orville figured out how to design and make them.

Both boys were extremely interested in the idea of flight. They studied the subject in great detail, reading the writings of George Cayley and Samuel Langley. In 1899 they began designing their own model gliders, and by 1903 they had come up with a design they believed would actually be able to fly.

The Wrights' airplane, named the *Flyer*, had two 40-foot wings and was powered by a 12-horse-power engine. It had two propellers driven by bicycle chains, and it had a rudder to control the direction of its flight.

The Wrights traveled to Kitty Hawk, North Carolina, to test the *Flyer*. Sunday, December 13, was a beautiful day for flying, but the brothers refused to test their machine on the Lord's Day. Instead they spent the day reading and resting.

The next day, the brothers laid a wooden rail track on the side of a hill. Wilbur climbed aboard the plane and it shot off down the track. Before reaching the bottom of the hill, it lifted into the air. But Wilbur turned the nose of the aircraft up suddenly. The *Flyer* slowed and then fell to the ground.

Controlling the angle at which an airplane's wings meet the air (the angle of attack) is critical to maintaining lift. God established the principles that determine this angle. Exceeding it stalled the plane and brought failure.

The Wrights did not give up, however. Three days later, on December 17, 1903, Orville attempted to fly the plane. The wind was stronger this time, so they laid the track on level ground. They started the engine, and the *Flyer* moved down the track. Just as it lifted into the air, a friend snapped the famous picture shown above. Orville carefully controlled the angle of attack so that the plane stayed level. It flew 120 feet in 12 seconds. Mankind's attempt to conquer flight had taken a giant step forward.

Design the Best Paper Airplane

On a pleasant February day in 2012, a paper airplane named *Suzanne* floated through an airplane hangar near Sacramento, California, and broke the world record for the farthest flight by a paper aircraft. The plane's creator, John Collins, known today as "the Paper Airplane Guy," earned a place in the Guinness World Records. Lucky accident? Hardly. As a child Collins was fascinated by paper airplane folding and continued to practice it as he grew into adulthood. And he studied. His study of aerodynamics and origami provided valuable ideas for designing an award-winning paper glider.

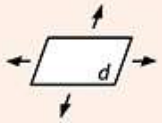
John Collins has folded, refolded, and flown thousands, maybe millions, of paper airplanes in his life, varying the angles, adjusting the weight, and exchanging one type of paper for another. But there are some factors he can't change and must constantly explore and adapt to. Like the principles of flight. Who determined that lift must exceed weight or that thrust must overcome drag for Collins's creations to float on the breeze? The same Person who designed the eagle, which stirs up its nest, hovers over its young, and spreading out its wings, takes them and transports them on its wings (Deuteronomy 32:11). God established the principles of flight, which apply equally to eagles and paper airplanes.

Are you ready to transform a lowly piece of paper into a flying marvel? What if your plane sinks like a weight? If it does, you might take some advice from the Paper Airplane Guy: "I think in terms of outcome; not success or failure. Like any science experiment, there's no wrong outcome. It's just data; information from which you can move forward."[1] Enjoy the process and learn from the experience. Be the world's next great innovator!

[1] https://makezine.com/2018/05/24/john-collins-paper-airplanes-interview/

Points, Lines & Planes

Name _____

			
Read: point *A*	**Read:** line *BC* or line *CB*	**Read:** line segment *DE* or line segment *ED*	**Read:** plane *d*
	Symbol: $\overleftrightarrow{BC}$ or $\overleftrightarrow{CB}$	**Symbol:** $\overline{DE}$ or $\overline{ED}$	
A **point** is a location in space.	A **line** is a straight path of points that goes on endlessly in both directions.	A **line segment** is a part of a line. It has 2 endpoints.	A **plane** is a flat surface that goes on endlessly in all directions.

Use a ruler to draw the figure. Use the symbol to name the figure.

1. **Line**

_____ or _____

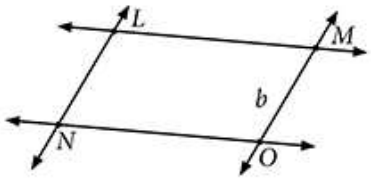
2. **Line segment**

_____ or _____

3. **Line**

_____ or _____

Use plane *b* to find the answer. Write the answer using symbols.



4. Name the 4 line segments.

_____

5. Name the 4 points on this plane.

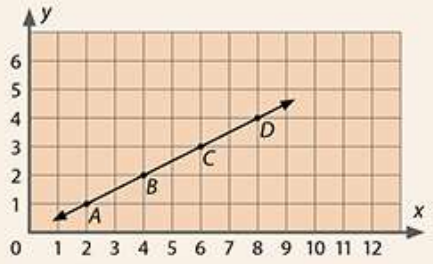
_____

6. Name the 4 lines.

_____

Complete the sentence.

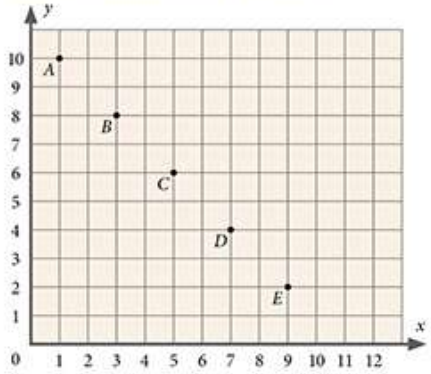
7. A line segment has two _____.
8. A plane goes on endlessly in _____ directions.
9. A line goes on _____ in both directions.
10. A piece of string is an example of a _____.
11. The head of a pin is an example of a _____.



An ordered pair is two numbers that locate a point on a coordinate graph. The first number is the *x*-coordinate. It is located on the horizontal axis. The second number is the *y*-coordinate. It is located on the vertical axis. (*x*, *y*)

A (2, 1) *B* (4, 2) *C* (6, 3) *D* (8, 4)

Write the ordered pair for the point.



12. *A* _____ 13. *B* _____

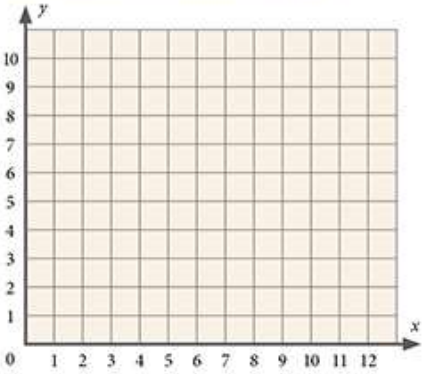
14. *C* _____ 15. *D* _____

16. *E* _____

17. Draw a line through points *A*, *B*, *C*, *D*, and *E*. Name the line that is formed.

_____

Plot and label the points on the graph.



18. *F* (4, 1) *G* (5, 2) *H* (6, 3)
I (7, 4) *J* (8, 5)

19. If points *F*, *G*, *H*, *I*, and *J* are connected, will they form a straight line?

_____

Write the ordered pair for the point.

20. *A* _____ 21. *B* _____

22. *C* _____ 23. *D* _____

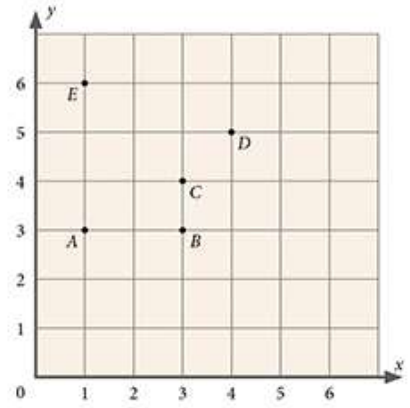
24. *E* _____

25. If points *A*, *B*, *C*, *D*, and *E* are connected, will they form a straight line? _____

26. Which coordinate do points *B* and *C* share?

○ the *x*-coordinate 3

○ the *y*-coordinate 3



Rays & Angles

Name _____

Read: ray *AB*

Symbol: $\overrightarrow{AB}$

A **ray** is a part of a line that goes on endlessly in one direction.

Use a ruler to draw the figure. Use the symbol to name the figure.

1. **Ray *CD***

2. **Ray *FE***

3. **Ray *NM***

4. **Ray *QR***

5. **Ray *ST***

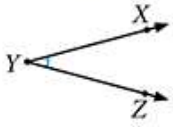
An **angle** is formed when 2 rays share the same endpoint. The shared endpoint is called the **vertex**.

Point *B* is the vertex.
Ray *BA* and ray *BC* form this angle.

To name an angle, the vertex can be used alone or as the middle of 3 points.

Read:	**Symbol:**
angle *B*	∠*B*
angle *ABC*	∠*ABC*
or angle *CBA*	or ∠*CBA*

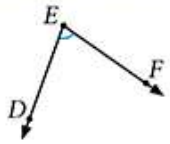
Use the symbol to name the figure.



6. Name the 2 rays that form this angle. _____ and _____
7. Circle the vertex on the diagram. Name the vertex. _____
8. Write 2 other names for ∠*Y*. _____

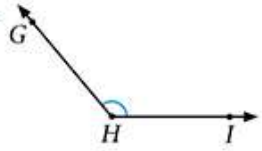
Use the three points to name the angle.

9.



_____

10.



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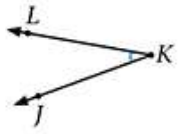
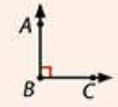
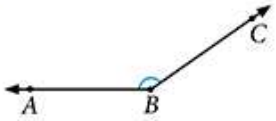
11.

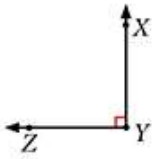


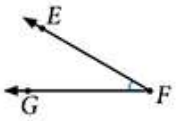
_____

A **right angle** measures 90°.	An **acute angle** measures less than 90°.	An **obtuse angle** measures greater than 90°.	A **straight angle** measures 180°.
			
$\angle ABC$ is a right angle.	$\angle DEF$ is an acute angle.	$\angle GHI$ is an obtuse angle.	$\angle JKL$ is a straight angle.

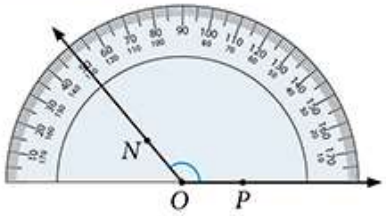
Classify the angle as acute, obtuse, or right. Explain your answer.

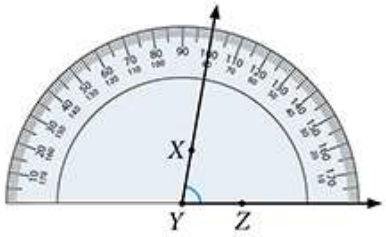
12. 

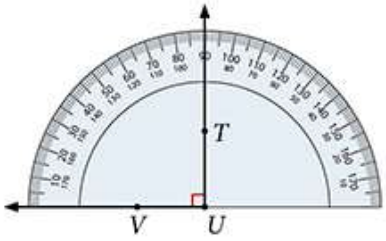
13. 

14. 

Use the symbol and three points to name the angle. Classify the angle as acute, obtuse, right, or straight. Write the measure of the angle.

15. 

16. 

17. 

18. 

STEM ACTIVITY

Name _____

1. What problem do you want to solve?

_____

_____

2. How could you solve this problem? Use your own paper for recording ideas or drawings if needed.

_____

_____

3. Which design and material will you use? Use your own paper for recording ideas or drawings if needed.

_____

_____

4. Why did you choose this design and material?

_____

_____

5. Construct your airplane, then sketch a picture of it. Measure the plane's dimensions and at least 4 of its angles and label them on your sketch.

6. What changes did you make to improve your airplane?

_____

_____

7. How far do you predict your airplane will fly? _____

8. Record the distances your airplane flies and mark its longest flight. _____

9. How could you improve your design? Draw a picture and explain.

10. Did you modify your plane? _____ If so, did it fly better after being modified? _____

11. What did you learn about paper airplane design from this lesson?

_____

_____

_____

12. **Reflection:** What would you tell someone who says that the order and consistency we observe in the principles of flight can be explained by chance?

_____

_____

_____

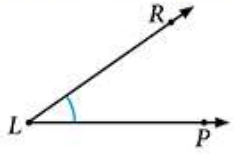
_____

_____

Chapter 4 REVIEW

Name _____

Use the symbol to name the figure.

1. 

_____

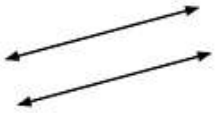
2. 

_____

3. 

_____

Classify the lines as intersecting, parallel, or perpendicular.

4. 
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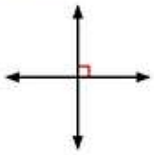
5. 
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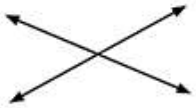
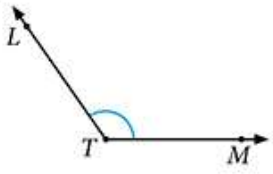
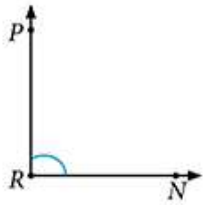
6. 
_____

Classify the angle as acute, obtuse, right, or straight. Use a protractor to find the measure of the angle.

7. 

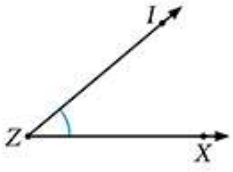
_____

$\angle LTM$ measures _____.

8. 

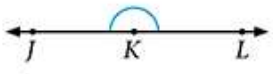
_____

$\angle PRN$ measures _____.

9. 

_____

$\angle IZX$ measures _____.

10. 

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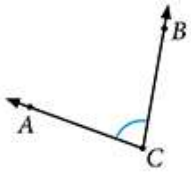
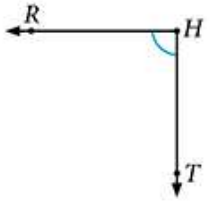
$\angle JKL$ measures _____.

11. 

_____

$\angle ACB$ measures _____.

12. 

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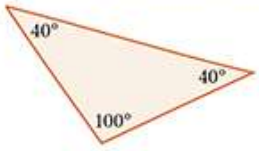
$\angle RHT$ measures _____.

Classify the triangle as acute, obtuse, or right.

13. 

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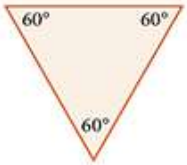
14. 

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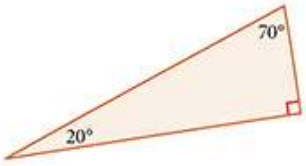
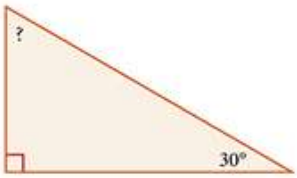
15. 

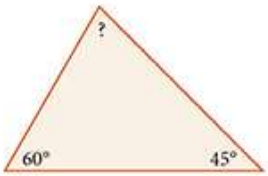
_____

Complete the equation to find the measure of the unknown angle.

16. 

180° − (_____ + _____) = ____?____

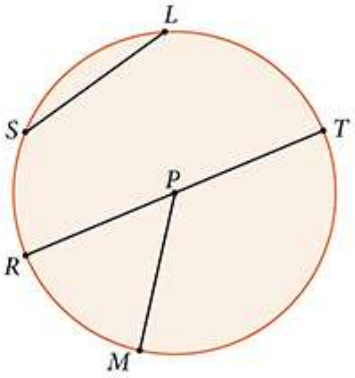
180° − _____ = _____

17. 

180° − (_____ + _____) = ____?____

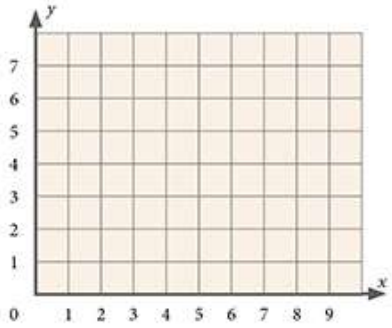
180° − _____ = _____

Follow the directions.



18. Trace the diameter in green.
19. Trace a radius in red.
20. Trace a chord in blue.
21. Name the circle. _____

Plot and label the points on the graph. Answer the question.



22. *A* (3, 1) *B* (5, 3)
C (7, 5) *D* (9, 7)

23. Connect the points. Do they form a straight line?

_____