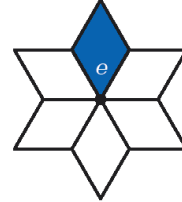
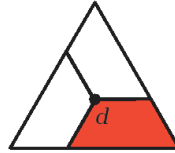
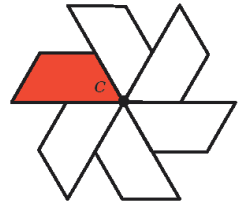
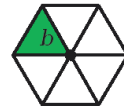
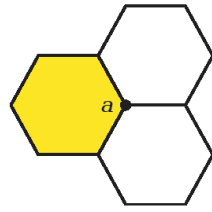




Angles and Angle Measurement

Student Workbook

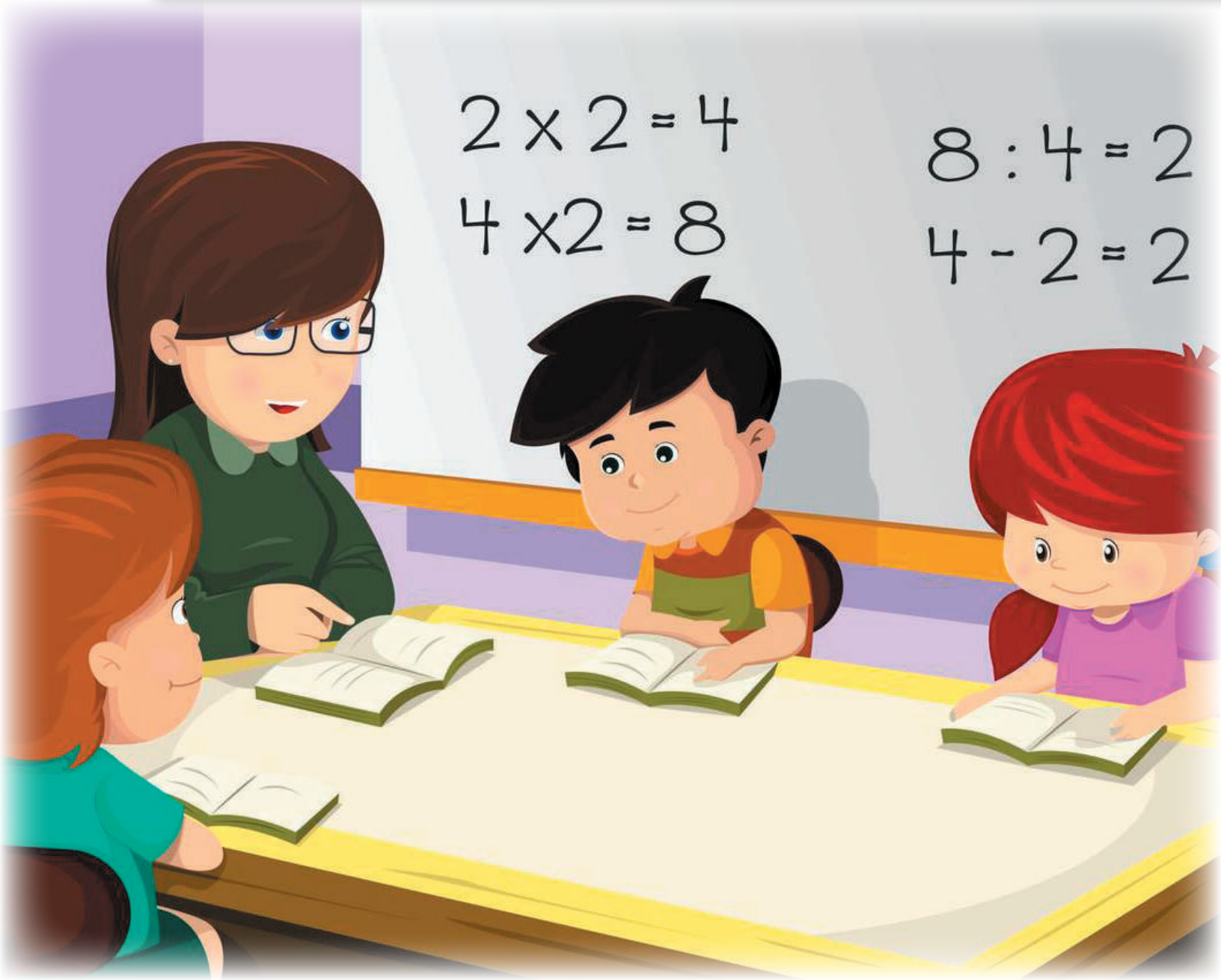


$$2 \times 2 = 4$$

$$4 \times 2 = 8$$

$$8 : 4 = 2$$

$$4 - 2 = 2$$



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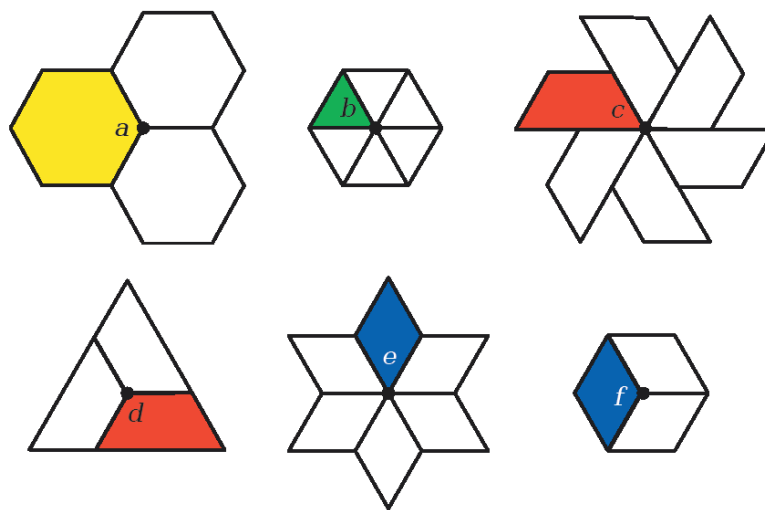
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Angles and Angle Measurement

Table of Contents

Lesson 1	How Would You Describe These Figures?	1
Lesson 2	Points, Lines, Rays, and Segments	4
Lesson 3	Two or More Lines	7
Lesson 4	Points and Lines All Around	11
Lesson 5	What is an Angle?	16
Lesson 6	Compare and Describe Angles	21
Lesson 7	The Size of Angles on a Clock	24
Lesson 8	The Size of Angles in Degrees	29
Lesson 9	Use a Protractor to Measure Angles	33
Lesson 10	Angles Measurement and Perpendicular Lines	38
Lesson 11	Use a Protractor to Draw Angles	41
Lesson 12	Types of Angles	45
Lesson 13	Find Angle Measurements	50
Lesson 14	Reasoning about Angles (Part 1)	53
Lesson 15	Reasoning about Angles (Part 2)	57
Lesson 16	Guess the Figure (optional)	61
Cumulative Practice Problems		
Section A:	Points, Lines, Segments, Rays, and Angles	64
Section B:	The Size of Angles	69
Section C:	Angle Analysis	75



Angles and Angle Measurement Student Workbook

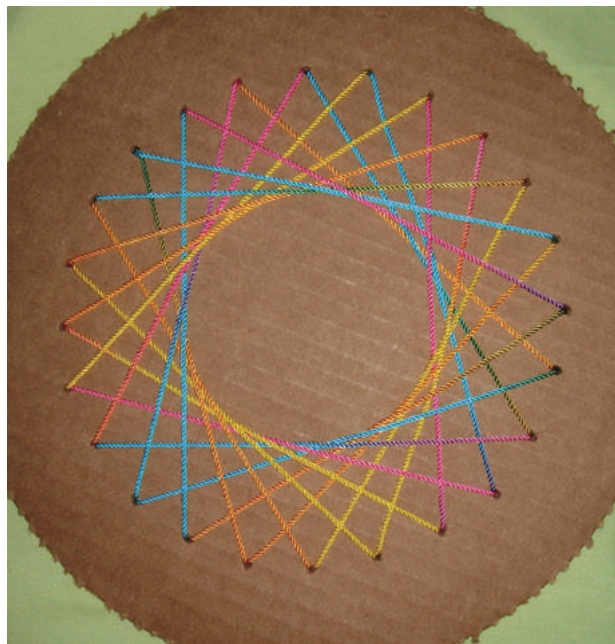
Core Knowledge Mathematics™

Lesson 1: How Would You Describe These Figures?

- Let's draw and describe geometric figures.

Warm-up: Notice and Wonder: String Art

What do you notice? What do you wonder?



1.1: Do You See What I See?

Work with a partner in this activity. Sit back to back or use a divider to block each other's view.

Partner A:

- Your teacher will give you a card. Don't show it to your partner.
- Describe the image on the card—as clearly and precisely as possible—so that your partner can draw it on a blank card.

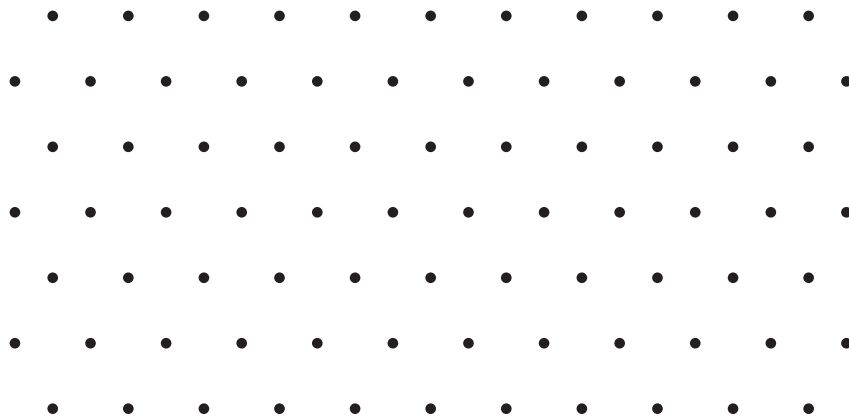
Partner B:

- Your teacher will give you a blank card.
- Your partner will describe an image. Listen carefully to the descriptions. On your card, create a drawing as described.

1. When done, compare the given image and the drawn image. Discuss:
 - Which parts were accurate? Which were off?
 - How could the descriptions be improved so the drawing could be more accurate?
 - Which words or descriptions are useful?
2. Try again with a second card from your teacher. When done, compare and discuss the images again.
3. Switch roles and repeat the exercise. Your teacher will give you 2 new cards (1 for each round).

1.2: Lines and Line Segments

Here is a field of dots.



1. Draw 5 lines, each one connecting at least 2 dots and extending as far as possible.
2. Did your lines make some familiar shapes or figures—perhaps a triangle, quadrilateral, a letter, or a number?

Identify at least one familiar shape or figure in your drawing. Trace the shape with a heavier mark or use a color pencil to make it obvious.

3. Share your drawing with your group members. Discuss:
 - How are the drawings alike? What do all the shapes have in common?
 - How are the drawings different?

Lesson 2: Points, Lines, Rays, and Segments

- Let's draw points, lines, line segments, and rays.

Warm-up: Number Talk: Finding Differences

Find the value of each expression mentally.

- $90 - 45$
- $270 - 45$
- $270 - 135$
- $360 - 135$

2.1: Card Sort: Who Am I?

Your teacher will give you a set of cards that describe or illustrate **points**, **lines**, **rays**, and **line segments**.

Sort the cards into 4 groups. Each group should represent the attributes or characteristics of one of the geometric figures.

Pause for directions from your teacher before completing the graphic organizer.

point	line
ray	line segment

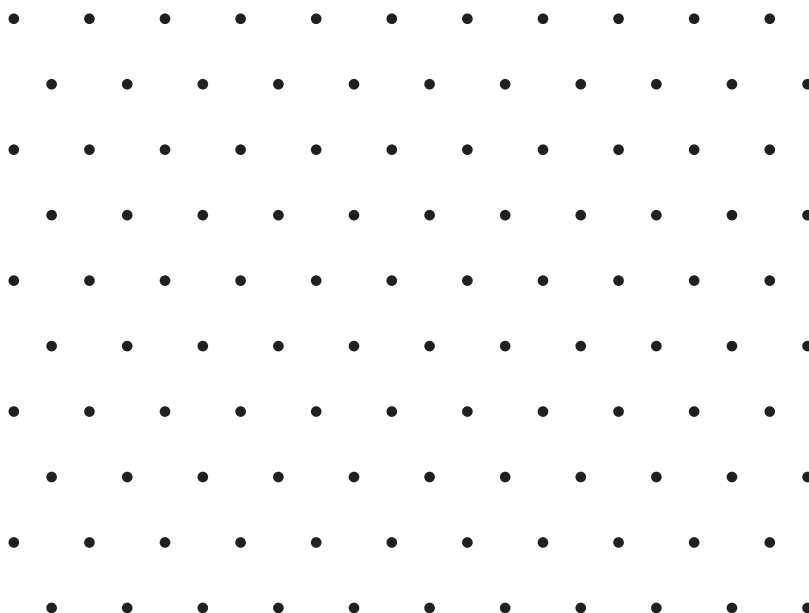
2.2: Make Some Shapes

1. Each dot on the grid represents a point. Draw line segments to create:

a triangle
a rhombus

a trapezoid
a hexagon

a pentagon
a rectangle

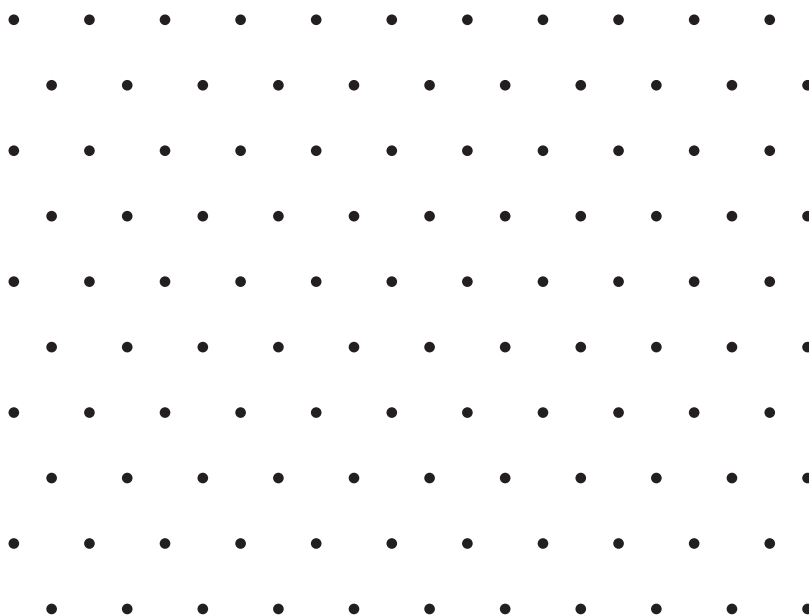


2. Draw a combination of rays and line segments to create:

an uppercase letter

a number

a lowercase letter

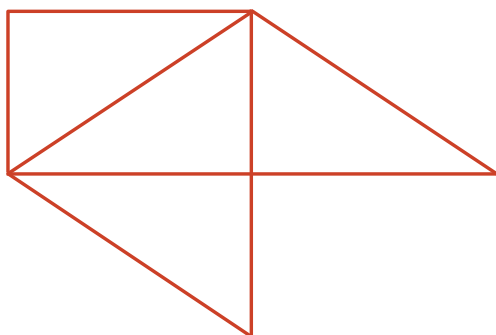


Lesson 3: Two or More Lines

- Let's look at lines that cross and lines that don't.

Warm-up: How Many Do You See: A Curious Figure

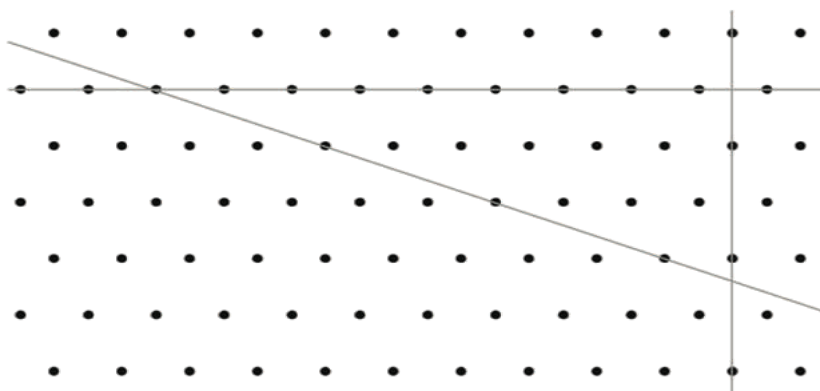
How many line segments do you see? How do you see them?



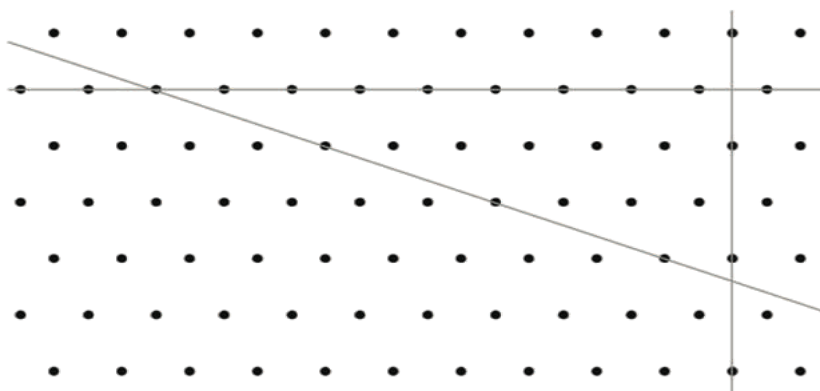
3.1: Four Lines

1. Three lines on a field of dots **intersect** (cross), forming a triangle. Can you draw a fourth line so that the four lines form a quadrilateral?

Use the drawing to show your reasoning, or explain why it cannot be done.



2. Here is a copy of the same drawing. Can you draw a fourth line to form a rectangle?

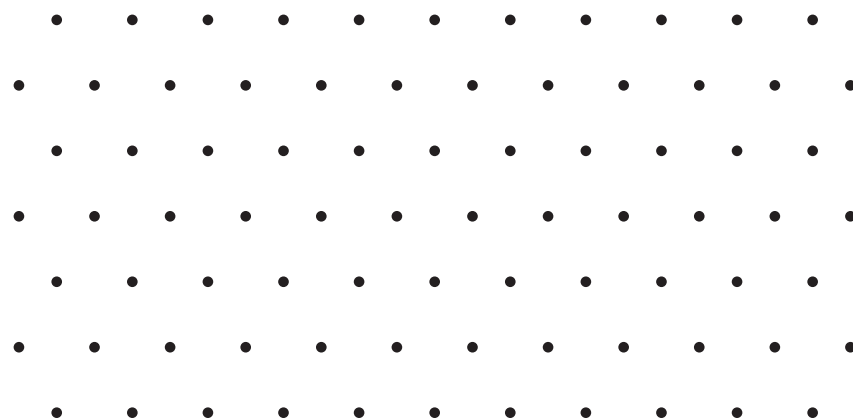


Use the drawing to show your reasoning, or explain why it cannot be done.

3. Discuss your drawings with your group. Check if they agree with your conclusions on both questions.

3.2: To Cross or Not to Cross

Here is another field of dots. Each dot represents a point.



1. Draw a line through at least 2 points. Label it line h .
2. Draw another line that goes through at least 2 points and intersects your first line. Label it line g .
3. Can you draw a new line that you think would never intersect:
 - a. line h ?
 - b. line g ?

If so, draw the line. Be prepared to explain or show how you know the lines would never cross. If not, explain or show why it can't be done.

4. Here is a trapezoid.

Do you think its top and bottom sides are parallel?
What about its left and right sides? Explain or show how you know.



If you have time: Can you draw a new line that you think would never intersect either line h or line g ? If so, draw the line and be prepared to explain or show how you know the lines would never cross. If not, explain why it can't be done.

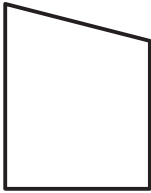
Lesson 4: Points and Lines All Around

- Let's find parallel and intersecting lines all around us.

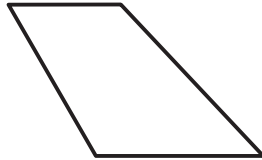
Warm-up: Which One Doesn't Belong: Four-sided Shapes

Which one doesn't belong?

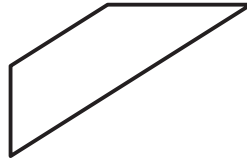
A



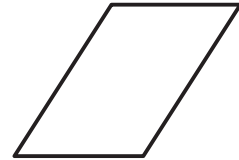
B



C



D



4.1: Spot Lines and Line Segments

1. Here is a map of a neighborhood in Staten Island, New York.



On the map, find and label the following items:

- 4 line segments of different lengths
- 3 pairs of parallel lines
- 2 pairs of lines that are not parallel

(Consider using different colors for the different types of lines.)

2. In the words WHALE and JOY,

W H A L E J O Y

which letter has:

a. No parallel segments? _____

b. Exactly one pair of parallel segments? _____

c. More than one pair of parallel segments? _____

d. Only one segment? _____

If you have time: Which does the uppercase alphabet use more: parallel segments or intersecting segments?

4.2: Draw and Design with Lines

1. Draw a sketch of a part of our classroom and be sure to include:

- a. at least 3 pairs of parallel line segments
- b. intersecting line segments that make square corners
- c. intersecting line segments that don't make square corners

Trade sketches with a partner and find the specified lines in each other's sketches.

2. Here are some symbols and logos that you may recognize. All of them have intersecting and parallel line segments.



Design a logo with at least 8 parallel segments and 8 intersecting line segments.

Use a ruler for any straight parts of your logo.

Lesson 5: What is an Angle?

- Let's look for angles and find out ways to describe them.

Warm-up: Notice and Wonder: A Wall of Clocks

What do you notice? What do you wonder?



5.1: Tricky Figures

Work with a partner in this activity. Choose a role: A or B. Sit back to back, or use a divider to keep one person from seeing the other person's work.

Partner A:

- Your teacher will give you a card. Don't show it to your partner.
- Describe both images on the card—as clearly and precisely as possible—so that your partner can draw the same images.

Partner B:

- Your partner will describe two images. Listen carefully to the descriptions.
- Create the drawings as described. Follow the instructions as closely as possible.

1. When done, compare the drawings to the original images. Discuss:

- Which parts were accurate? Which were off?
- How could the descriptions be improved so the drawing could be more accurate?

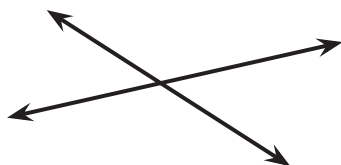
2. Switch roles and repeat the exercise. Compare the drawings to the original images afterwards.

If you have time: Request two new cards from your teacher (one card at a time). Take turns describing and drawing the geometric figure on each card.

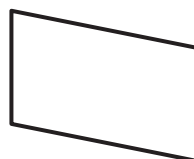
5.2: Angles or Not Angles?

1. Decide if each figure shows at least one angle. Explain or show your reasoning for each.

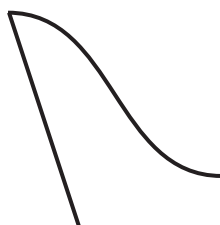
A



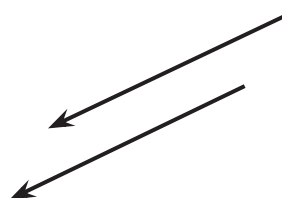
B



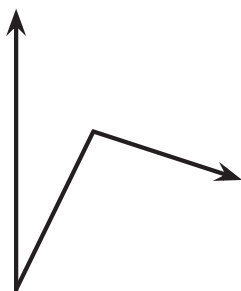
C



D



2. Clare and Kiran are looking at this diagram. Clare says there are no angles because the rays do not meet at a point. Kiran says he sees two angles.



Do you agree with either of them? How many angles do you see?

5.3: Discover Angles

Here are two figures.

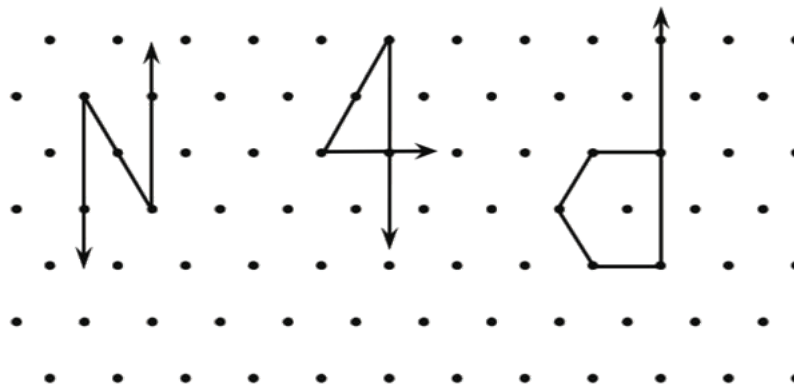


1. Find 2–3 angles in each figure. Draw pairs of rays to show the angles.
2. Sketch a part of your classroom that has 2–3 angles. Draw pairs of rays to show the angles.

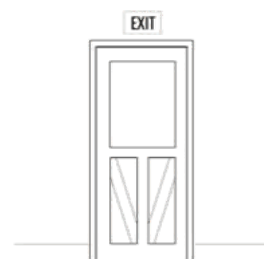
Section Summary

Section Summary

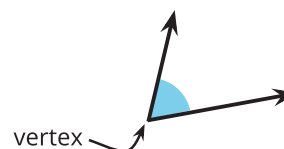
In this section, we learned the meanings of **points**, **lines**, **line segments**, and **rays**. We used these terms to describe figures and used these geometric parts to create drawings.



We learned about lines that cross—**intersecting lines**—and lines that never do—**parallel lines**, and we looked for examples of intersecting lines and parallel lines and segments in life.



Finally, we learned that an **angle** is a figure made up of two rays that share the same endpoint, and that the shared point is the **vertex** of the angle.



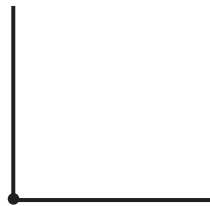
Lesson 6: Compare and Describe Angles

- Let's think about how to compare and describe angles.

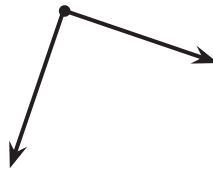
Warm-up: Which One Doesn't Belong: Angles

Which one doesn't belong?

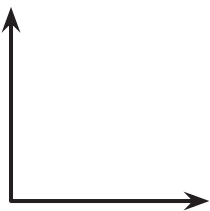
A



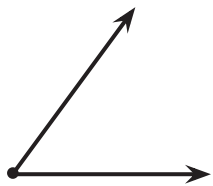
B



C



D



6.1: Card Sort: Angles

Your teacher will give you a set of cards with angles on them.

- Sort the angles into 3 or more categories and in a way that makes sense to you.
- Record your sorted angles here. Write words or phrases to describe each category. Be prepared to explain how you sorted the angles.

6.2: Order Angles

You will need cards A–P from an earlier activity.

Order the angles on the cards from smallest to largest.

Record your ordered angles. Explain or show how you decided which angle was the smallest and which was the largest.

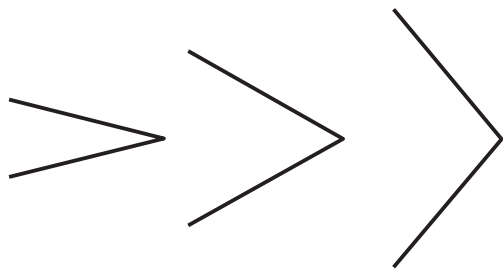
Lesson 7: The Size of Angles on a Clock

- Let's describe angles using the hands of a clock.

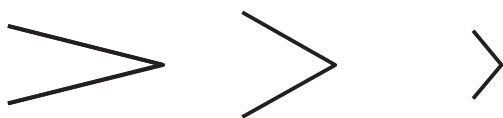
Warm-up: Notice and Wonder: Two Sets of Angles

What do you notice? What do you wonder?

Set 1



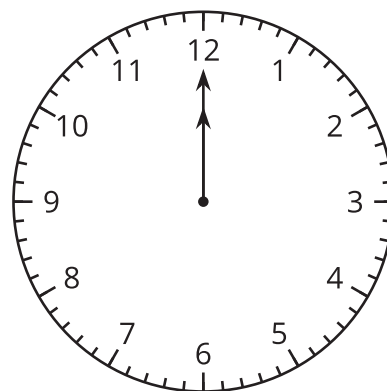
Set 2



7.1: Draw Angles Andre's Way

Andre used the hands of a clock to explain how to draw an angle to his partner.

"Imagine both hands are pointing at the 12. Turn the minute hand so it's pointing at the 3."

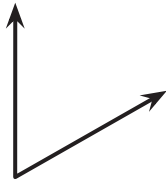


1. Draw Andre's angle.

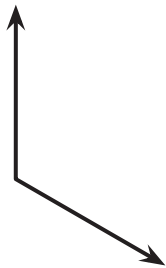
2. What is another way to describe how to draw the same angle using the clock?

3. Use Andre's way to explain how to draw these angles:

a.



b.



c.



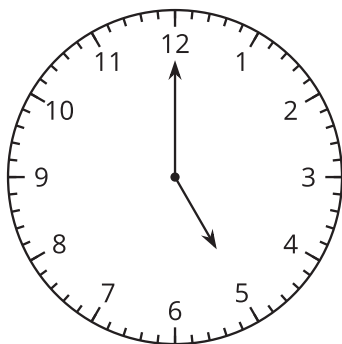
7.2: Compare Angles on the Clock

1. Here are some angles formed by the two hands of a clock.

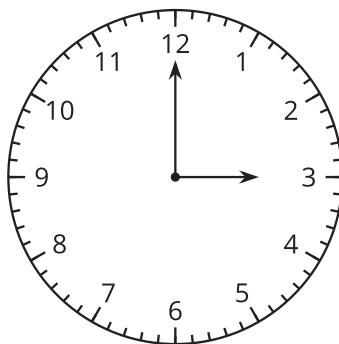
In each pair of angles, which angle is larger? Explain or show your reasoning.

a.

5:00

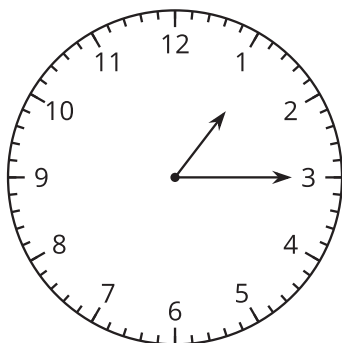


3:00

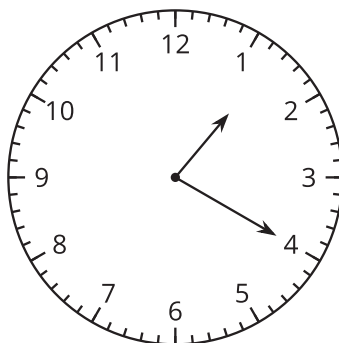


b.

1:15

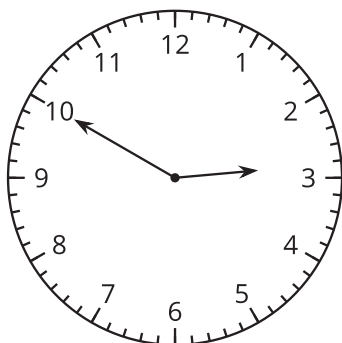


1:20

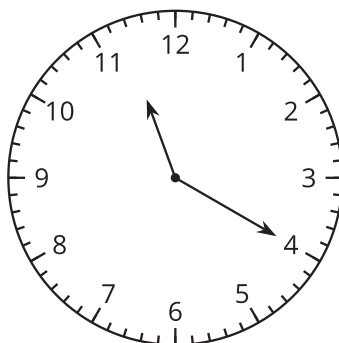


c.

2:50

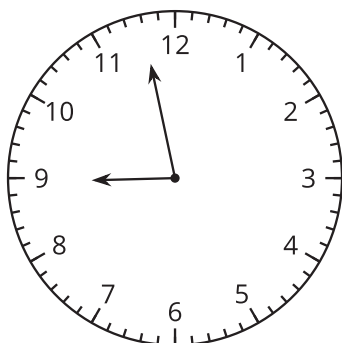


11:20

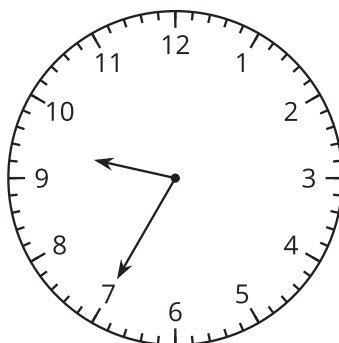


d.

8:58

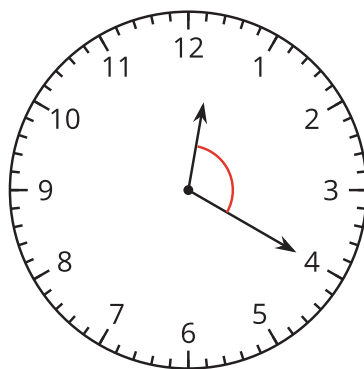


9:35



2. How large is this angle?

Describe its size in as many ways as you can.



Lesson 8: The Size of Angles in Degrees

- Let's describe the size of angles using degrees.

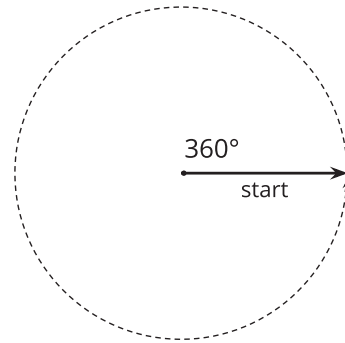
Warm-up: What Do You Know about 360?

What do you know about 360?

8.1: A Full Turn

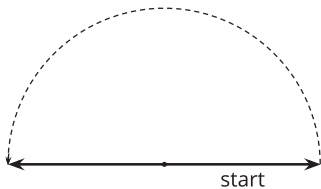
A ray that turns all the way around its endpoint and back to its starting place has made a full turn.

We say that the ray has turned 360 **degrees**.

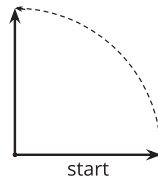


1. How many degrees has the ray turned from where it started?

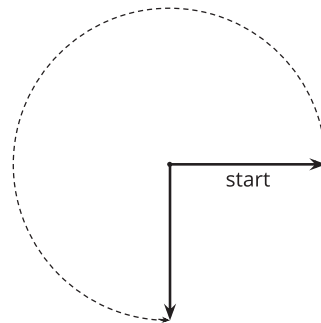
a



b



c



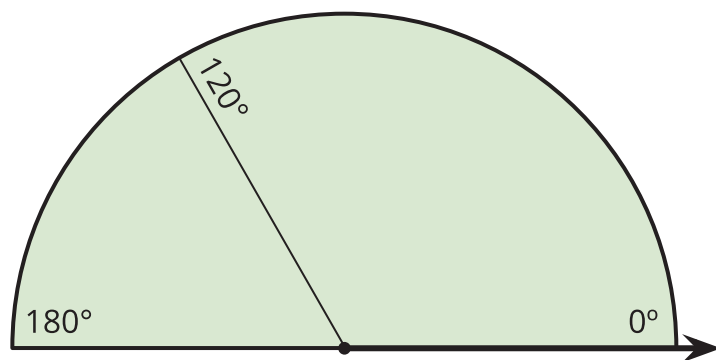
2. Sketch two angles:

a. an angle where a ray has turned 50°

b. an angle where a ray has turned 130°

8.2: Make a Measuring Tool

Your teacher will give you a sheet of paper in the shape of half a circle. It shows a 120° angle and a 180° angle from the ray on the bottom right.



On the half-a-circle paper:

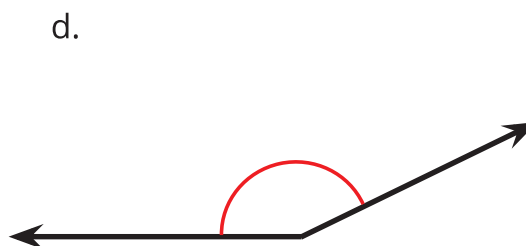
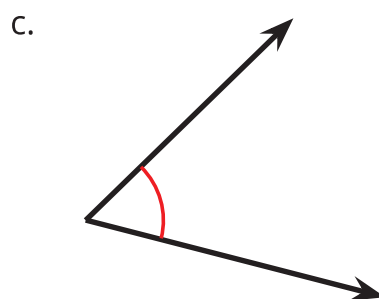
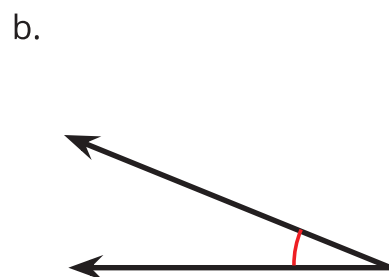
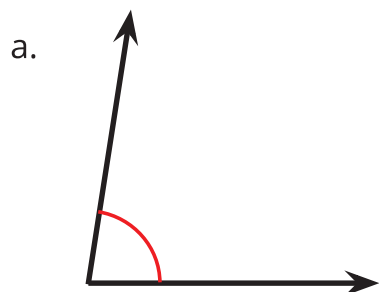
1. Draw a line segment to show a 90° angle from the same ray. Label it with the measurement. Be as precise as possible.
2. Draw lines to show the following angles (measured from the same ray). Label each line with the measurement.

60° 45° 30° 150° 135°

3. Can you find a 1° angle from that same ray? Explain or show how you might do it.

4. You just made a measuring tool!

How can it be used to estimate the size of an angle? Discuss your ideas with your group. Then, use your tool to estimate the sizes of at least two angles.



Lesson 9: Use a Protractor to Measure Angles

- Let's use some tools to measure angles.

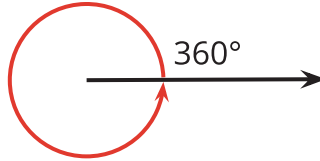
Warm-up: True or False: There's Something about 45

Decide if each statement is true or false. Be prepared to explain your reasoning.

- $2 \times 45 = 6 \times 15$
- $4 \times 45 = 2 \times 90$
- $3 \times 45 = 180 - 90$
- $6 \times 45 = 45 + 90 + 135$

9.1: How Large is a 1° Angle?

1. A ray that turns all the way around its endpoint and back to its starting place has made a full turn or has turned 360° .



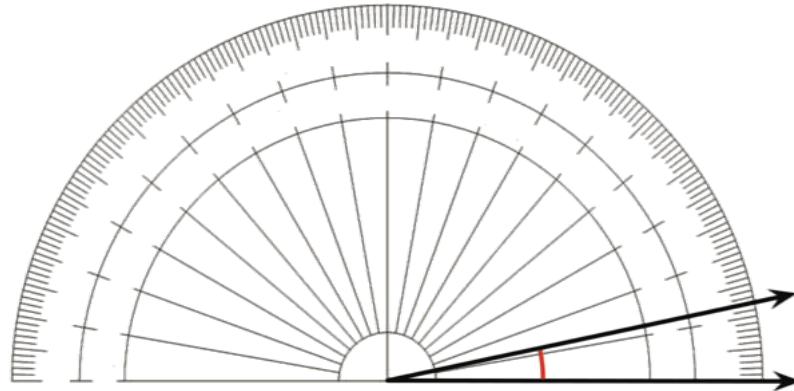
What fraction of a full turn is each of the following angle measurements?

- a. 120°
 - b. 60°
 - c. 45°
 - d. 30°
 - e. 10°
 - f. 1°
2. Your teacher will give you a **protractor**, a tool for measuring the number of degrees in an angle.
 - a. How is 1° shown on the protractor?
 - b. How many 1° measurements do you see?

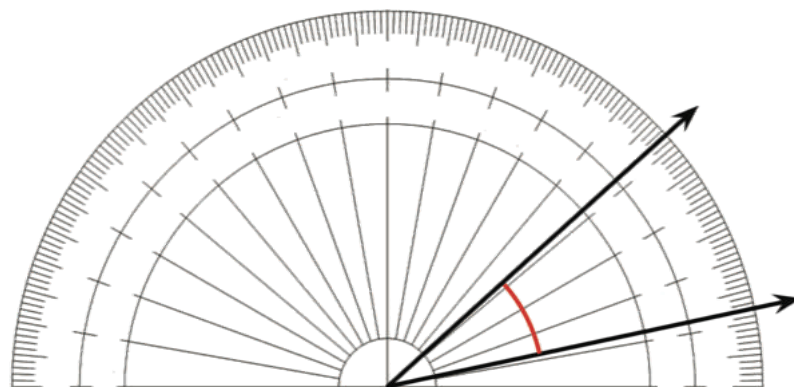
3. A protractor with no numbers has been placed over an angle.

- The center of the protractor is lined up with the vertex of the angle.
- The straight edge of the protractor is lined up with a ray of the angle.

How many degrees is this angle? Explain how you know.



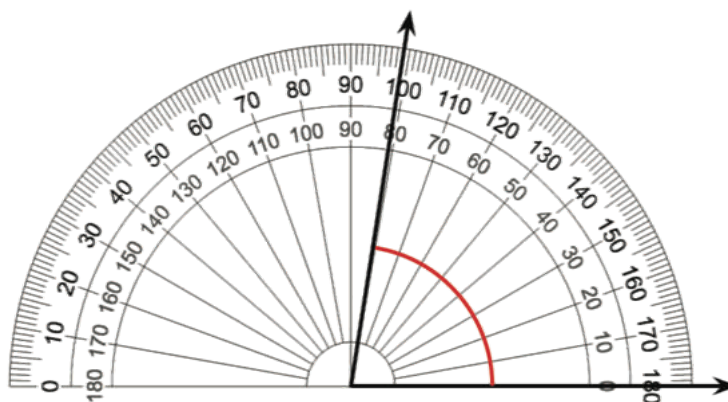
4. An angle contains thirty 1° angles, as shown. How many degrees is this angle?



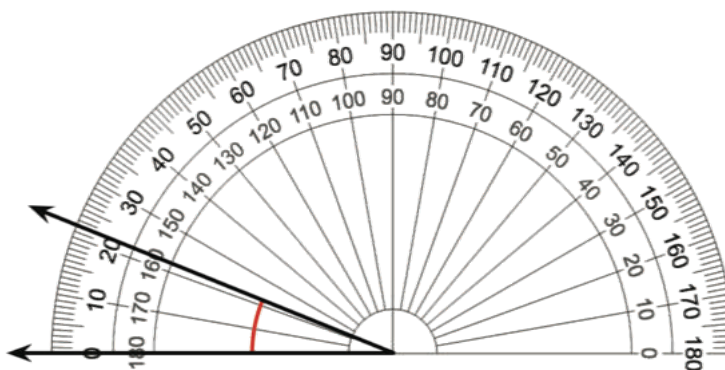
9.2: Use a Protractor

- Here are four angles whose sizes you may have estimated earlier. A protractor has been placed over each angle. Measure the size of each angle in degrees.

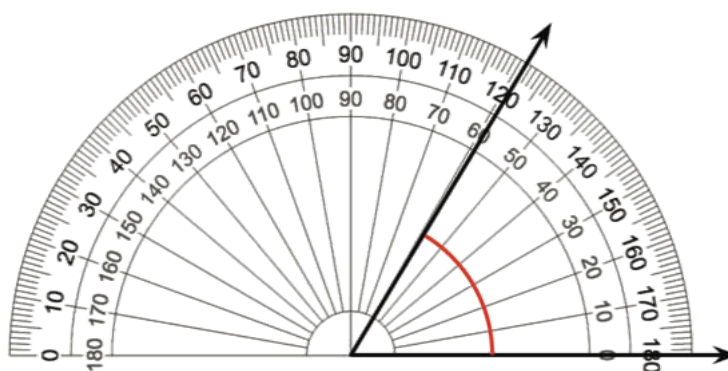
a.



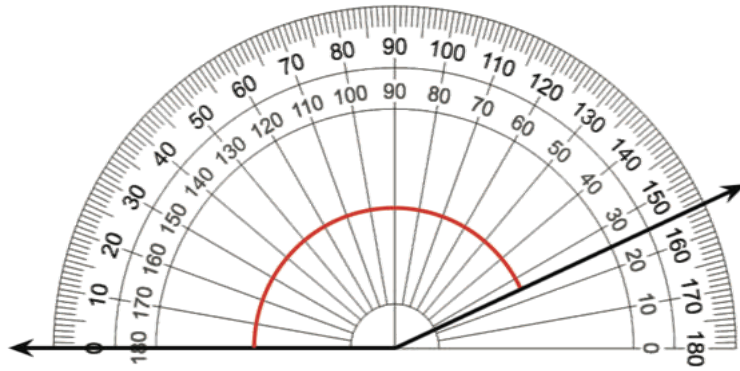
b.



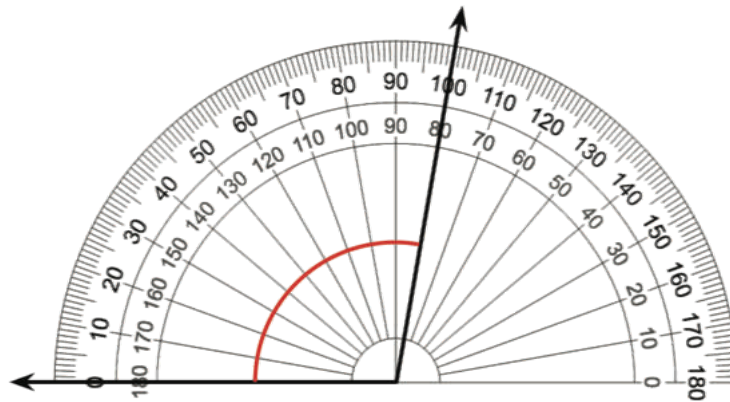
c.



d.



2. Elena and Kiran are measuring an angle with a protractor. Elena says the angle is 80° . Kiran says it shows 100° . Why might they end up with different measurements? Which one is correct? Explain your reasoning.



Lesson 10: Angle Measurement and Perpendicular Lines

- Let's measure all kinds of angles.

Warm-up: Number Talk: Quotients

Find the value of each expression mentally.

- $180 \div 2$

- $180 \div 4$

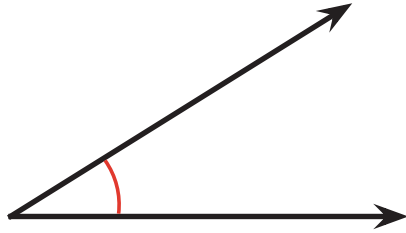
- $360 \div 8$

- $360 \div 16$

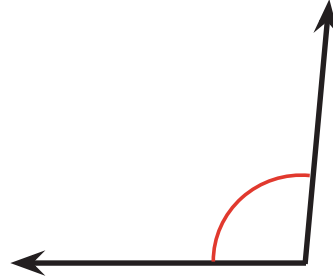
10.1: Angles Here, There, Everywhere

1. Use a protractor to find the value of each angle measurement in degrees.

a.



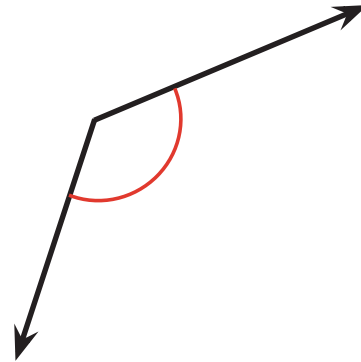
b.



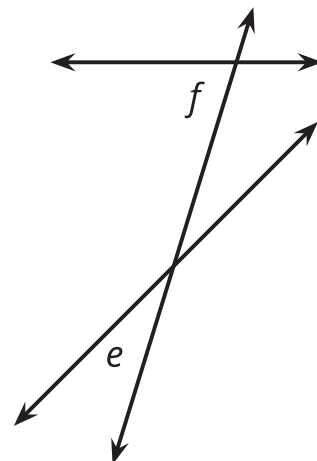
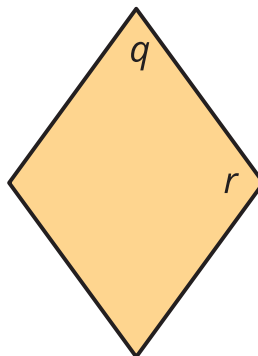
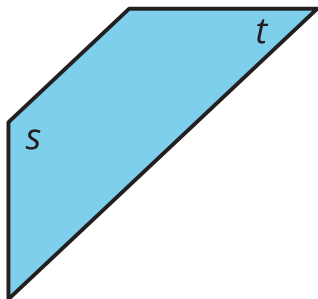
c.



d.



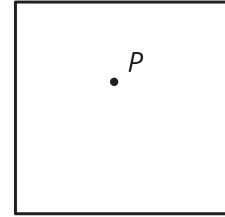
2. Use a protractor to measure the labeled angles in each figure.



10.2: A Folding Challenge

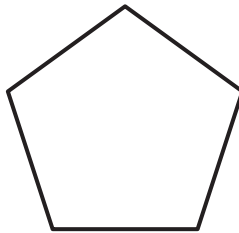
Tyler gave Lin a challenge: “Without using a protractor, draw four 90° angles. All angles have their vertex at point P .”

Lin folded the paper twice, making sure each fold goes through point P . Then, she traced the creases.



1. Your teacher will give you a sheet of paper. Draw a point on it. Then, show how Lin might have met the challenge.
2. When Lin folded the paper, the creases formed a pair of **perpendicular lines**. What do you think “perpendicular lines” mean?
3. Use Lin’s method to create a new pair of perpendicular lines through the same point. Trace the creases with a different color. Be prepared to explain how you know the lines you created are perpendicular.
4. Which shapes have sides that are perpendicular to one another?

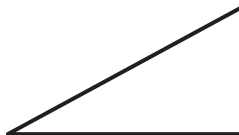
A



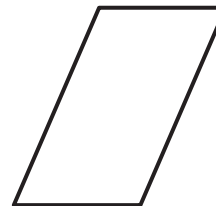
B



C



D



Mark the perpendicular sides. Be prepared to explain how you know the sides are perpendicular.

Lesson 11: Use a Protractor to Draw Angles

- Let’s draw some angles.

Warm-up: Estimation Exploration: Long Hand and Short Hand

How many degrees is the angle formed by the long hand and the short hand of the clock?



Make an estimate that is:

too low	about right	too high

11.1: Draw These Angles

1. Draw a line that is neither vertical nor horizontal. Put a point somewhere on that line. Use your protractor to draw a perpendicular line through that point. Be as precise as possible. (No folding this time!)

2. Here is a ray that starts at point M .



Use a protractor to draw:

- a. A ray starting at point M to create a 40° angle.
 - b. Another ray starting at point M to create a 20° angle.
 - c. One more ray starting at point M to create a 95° angle. Label each angle with its measurement.
3. In your drawing, there should be one angle that is not labeled with a measurement and is larger than 180° . Label the angle with an arc. How many degrees is this angle? Be prepared to explain how you know.

11.2: Angles Made to Order

Your teacher will give you some blank cards. Label them a–d.

1. On each card, draw an angle that meets one requirement. Use a ruler and a protractor.
 - a. an angle that is less than 35°
 - b. an angle that is between 35° and 80°
 - c. an angle that is greater than 80° but less than 120°
 - d. an angle that is greater than 120° but less than 180°
2. Trade cards with your partner.
 - a. Measure and record each angle your partner drew. Check to make sure each angle meets the requirement.
 - b. If a requirement is not met, return it to your partner so it can be corrected. Save the cards for the next lesson.

If you have time:

1. Create a drawing that shows several angles. Then, write some descriptions of your drawing. Be as specific as possible.
2. Ask a partner to recreate the drawing based on your descriptions. Does their drawing turn out as you had drawn? If not, adjust your descriptions and ask them to try again.

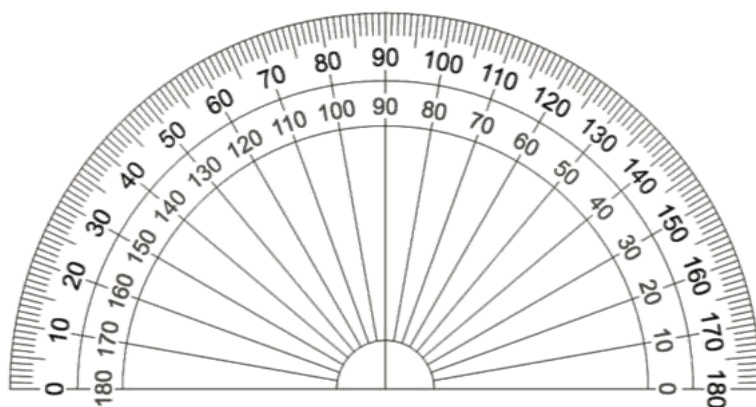
Section Summary

Section Summary

In this section, we learned about ways to describe and measure the size of angles.

We used clocks to describe angles as a turn of one away from the other. We learned that a degree is a measure of the turn around a circle and that 1 degree is $\frac{1}{360}$ of a full turn of a ray through a circle.

Finally, we learned that a **protractor** is a tool used to measure angles and can also be used to create angles of a certain measure.



A protractor has two sets of numbers and that either set of numbers could be used, but it is helpful to use the set that counts up from 0 rather than count down from 180. We used a protractor to measure and draw different angles.

Lesson 12: Types of Angles

- Let's look at different types of angles.

Warm-up: Number Talk: Fractions of 120 and 360

Find the value of each expression mentally.

- $12 \times \frac{1}{12}$

- $120 \times \frac{1}{12}$

- $360 \times \frac{1}{12}$

- $360 \times \frac{3}{12}$

12.1: Sorting Angles

In an earlier lesson, you and your partner drew some angles on cards.

Put the cards together and sort the angles into two groups. Be prepared to explain why you sort them the way you do.

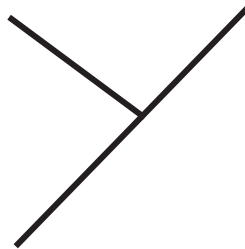
12.2: What is It, Really?

1. Mai and Jada are looking at this drawing. Jada says it is just a line. Mai says it is an angle.



With whom do you agree? Explain your reasoning.

2. Tyler and Andre were measuring an angle in a letter Y.



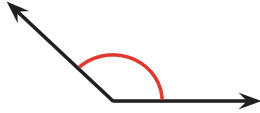
Andre said the angle he measured is obtuse. Tyler said the angle is acute.

Explain why they could both be right.

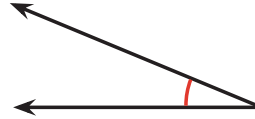
12.3: Small Angles, Large Angles

1. Identify each angle as acute, right, obtuse, or straight.

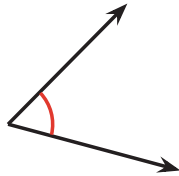
a.



b.



c.

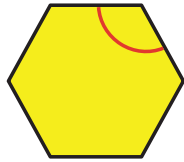


d. An angle formed by two 45° angles

e. A 91° angle

f. An angle that is in a rectangle

g.



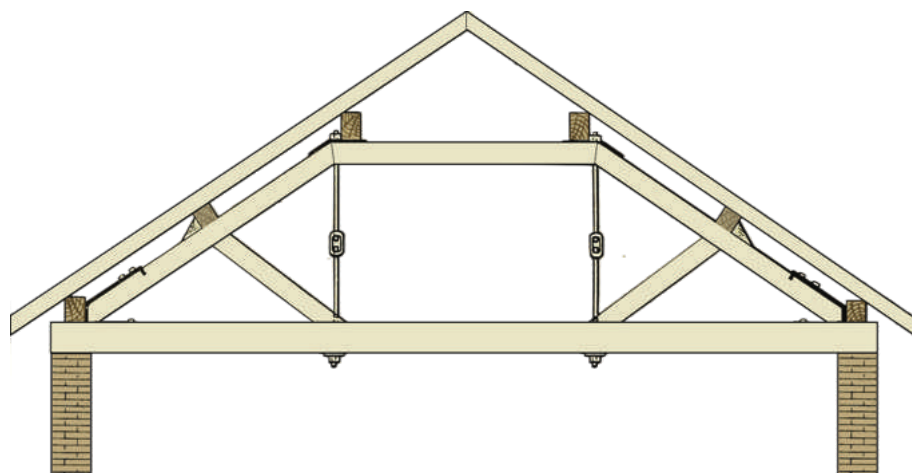
h.



i. An angle composed of two right angles

j. An angle composed of five 12° angles

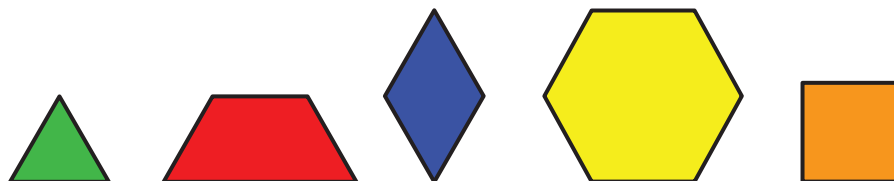
2. Here is a drawing of the structure of a roof.



Find as many acute and obtuse angles as you can in the drawing.

Use an "A" to label acute angles, a square (\square) for right angles, and an "O" for obtuse angles.

3.



a. Diego is holding a pattern block that has 2 acute angles and 2 obtuse angles. Which pattern block could it be?

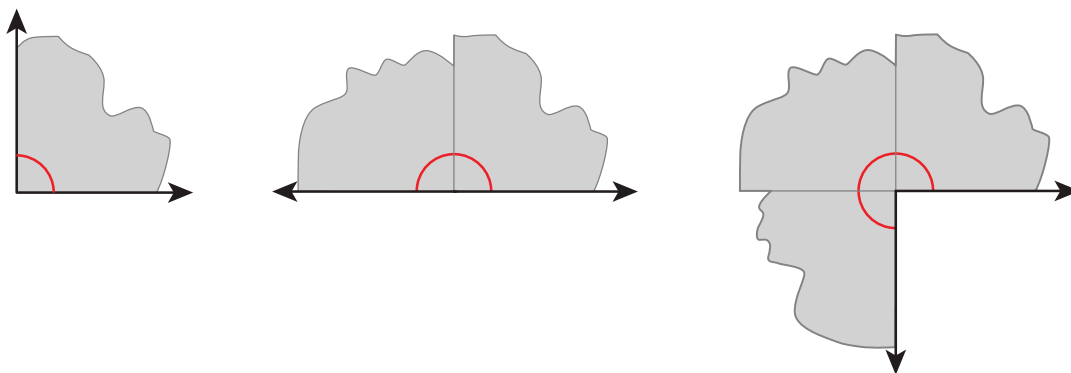
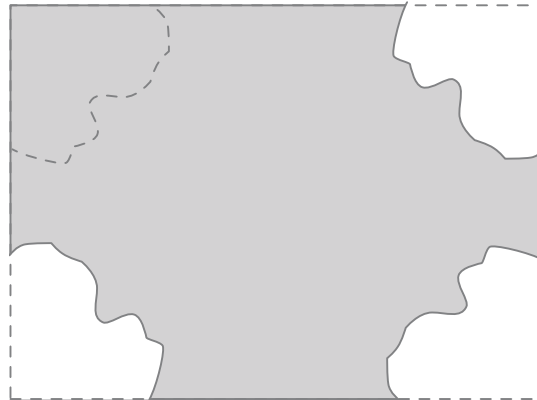
b. He then picks up a pattern block with no obtuse angles. Which pattern block could he be picking up? Explain your reasoning.

Lesson 13: Find Angle Measurements

- Let's compose and decompose angles to find their measurements.

Warm-up: Notice and Wonder: Corner Pieces

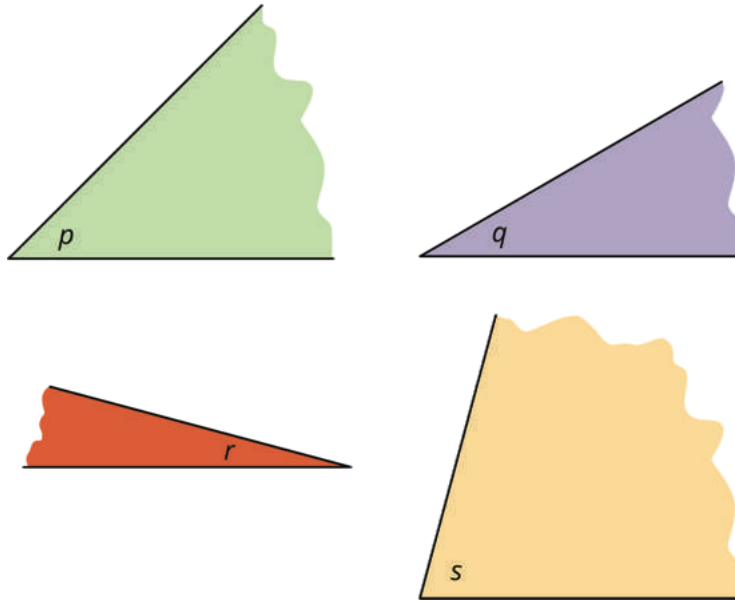
What do you notice? What do you wonder?



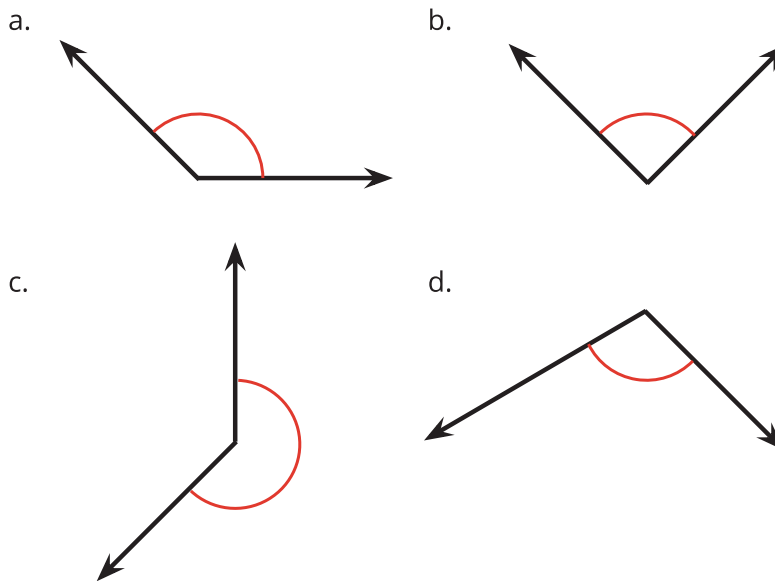
13.1: How Big Are These Angles?

Your teacher will give you materials that can help you find angle measurements.

1. Use the materials and what you know about a right angle to find the size of angles p , q , r , and s . Be prepared to explain or show your reasoning.

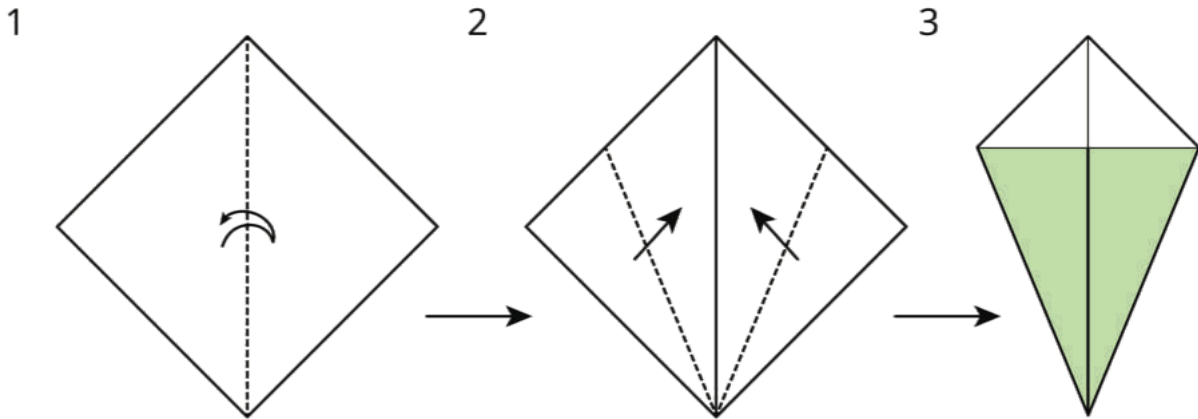


2. Next, use the measurements of angles p , q , r , and s to find the measurements of the following angles.

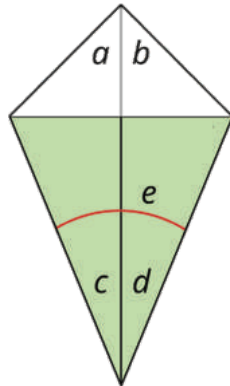


13.2: Angles in a Kite

Your teacher will give you a square sheet of paper. Follow the steps to fold the paper into a kite. Fold as precisely as possible.



Can you find the measurement of each labeled angle on the kite? If so, show your reasoning. If not, explain why not.



Lesson 14: Reasoning about Angles (Part 1)

- Let's find the size of angles on the clock.

Warm-up: Which One Doesn't Belong: Time After Time

Which one doesn't belong?

A



B



C

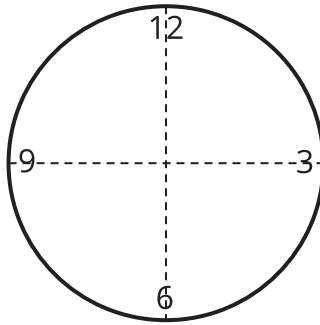


D



14.1: Draw a Clock

Kiran is drawing a clock. He draws a pair of perpendicular lines to find the placement of the numbers 3, 6, 9, and 12 around the circle.



1. How many degrees is each angle he has drawn so far? Explain how you know.

2. Help Kiran find the exact placement of the numbers "1" and "2" on the clock.

a. How many new lines does he need to draw?

b. What angles should be formed between the two lines he has already drawn and the new ones?

c. Draw the lines precisely and place the numbers "1" and "2" on the drawing.

3. Measure and draw as many lines as needed to complete the clock drawing so that all the numbers are precisely placed where they should be.

14.2: Tick Tock

1. What angles are formed by the hour and minute hands of the clock at these times?

a. 6 o'clock

b. 8 o'clock

c. 9 o'clock

d. 11 o'clock

e. 12 o'clock

2. How many degrees has the minute hand turned when it moves from 2:00 to 2:05?

What about from 2:05 to 2:30? Explain how you know.

3. The minute hand of the clock is vertical at 7 p.m. Sometime later, it makes an angle that is 120° from where it was at 7 p.m. What time could it be?

4. How many degrees does the minute hand turn in:

a. 10 minutes?

b. 1 minute?

c. 4 minutes?

Lesson 15: Reasoning About Angles (Part 2)

- Let's figure out missing angle measurements.

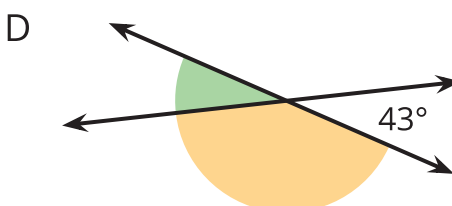
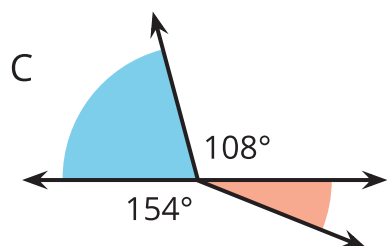
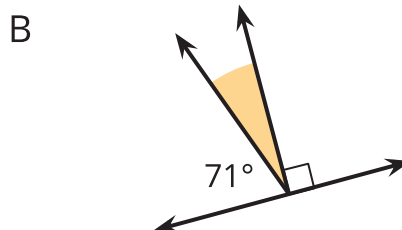
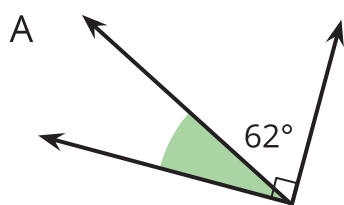
Warm-up: How Many Do You See: Obtuse Angles

How many angles do you see in the folded paper heart?



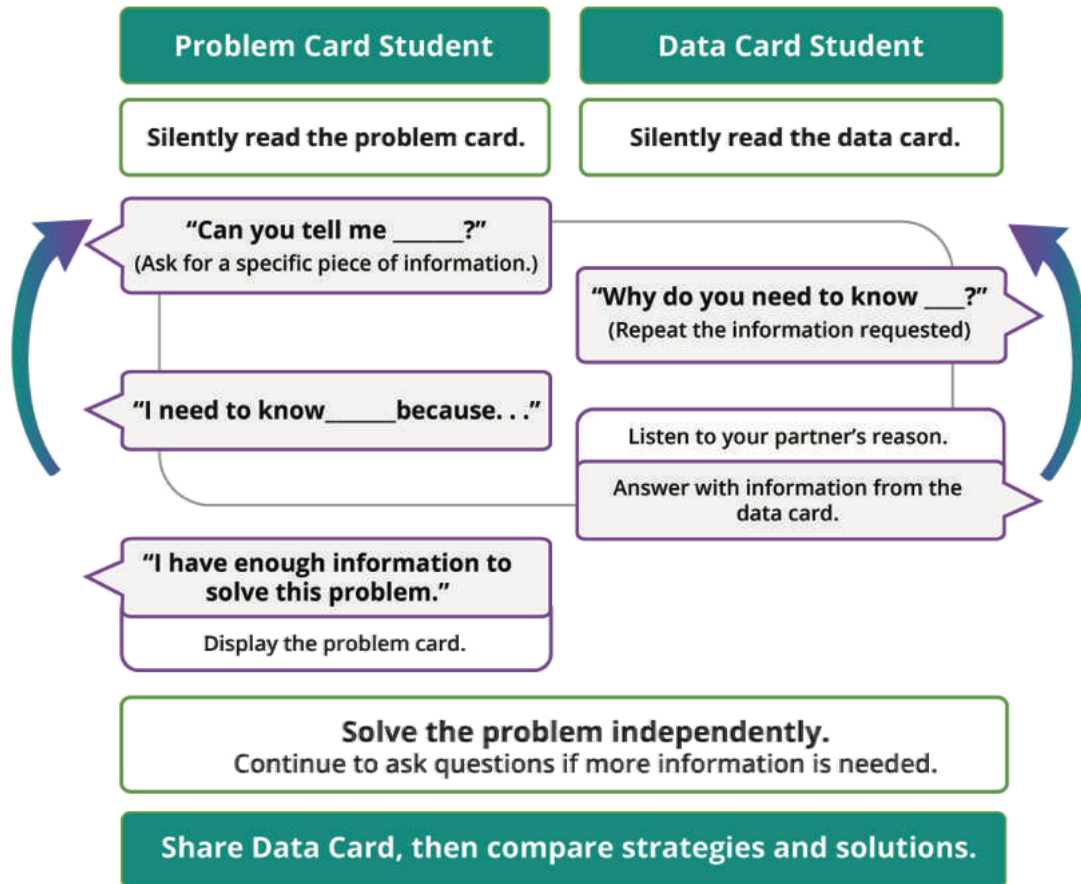
15.1: Shaded and Unshaded Angles

Find the measurement of each shaded angle. Show how you know.



15.2: Info Gap: A Whole Bunch of Angles

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.



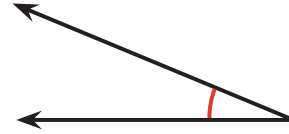
Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.

Section Summary

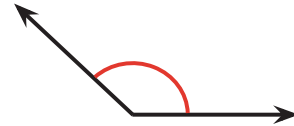
Section Summary

Earlier in the unit, we learned that a right angle measures exactly 90° . In this section, we learned other ways to name angles based on their measurements.

- **Acute angles** are less than 90° .



- **Obtuse angles** are greater than 90° but less than 180° .

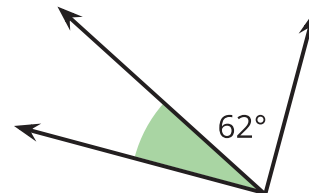


- **Straight angles** are exactly 180° .



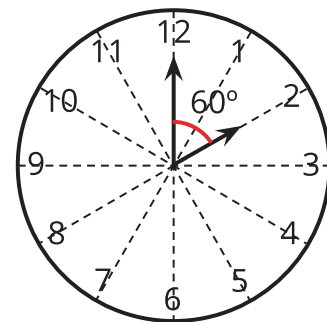
We also solved problems about angles. For example, if two angles make a right angle or a straight angle, we can use the size of one angle to find the other.

The shaded angle here must be 28° because it makes a right angle when combined with the 62° angle.



Another example: Knowing that a full turn measures 360° , we reasoned that the long hand of a clock makes:

- a 360° angle every hour
- a 180° angle every one-half hour
- a 90° angle every 15 minutes
- a 60° angle every 10 minutes

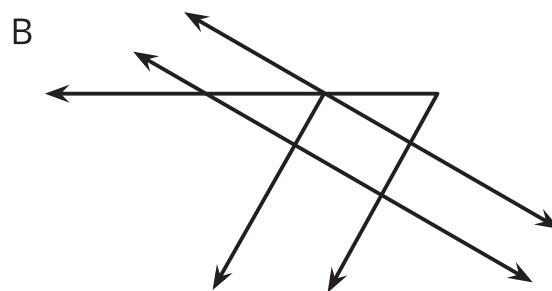
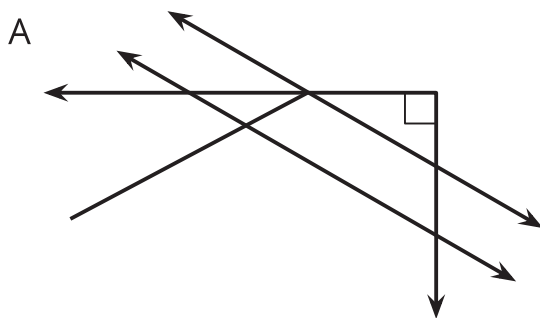


Lesson 16: Guess the Figure

- Let's draw and identify all kinds of two-dimensional figures.

Warm-up: Notice and Wonder: Two Figures

What do you notice? What do you wonder?



16.1: Make a Change

Your teacher will give you a set of cards. Each partner picks one of the cards.

1. Draw the figure you selected, but make at least one change.

2. Look at your partner's card and drawing. What change did your partner make?

If you have time, repeat with another card.

16.2: Guess My Figure

1. Create a two-dimensional shape that has at least 3 of the following:
 - a. ray
 - b. line segment
 - c. right angle
 - d. acute angle
 - e. obtuse angle
 - f. perpendicular lines
 - g. parallel lines

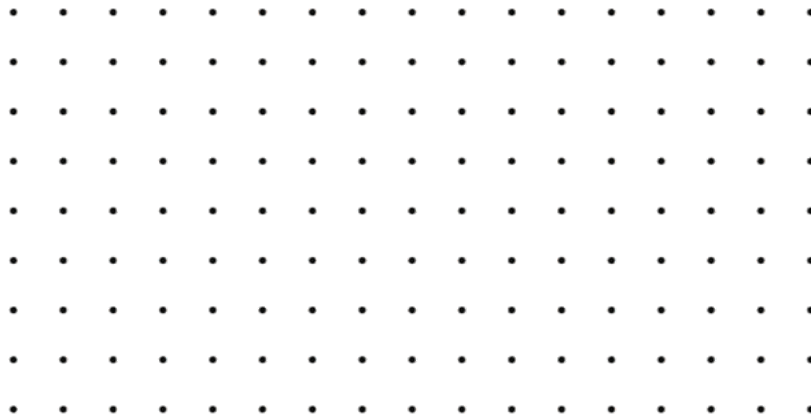
2. Without showing your partner, describe the figure so that your partner is able to draw it as best as possible.

3. Switch roles, and draw your partner's shape based on their description.

Section A: Practice Problems

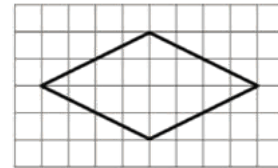
1. Pre-unit

Draw a rectangle on the grid and label it A. Draw a triangle and label it B. Draw a hexagon and label it C.



2. Pre-unit

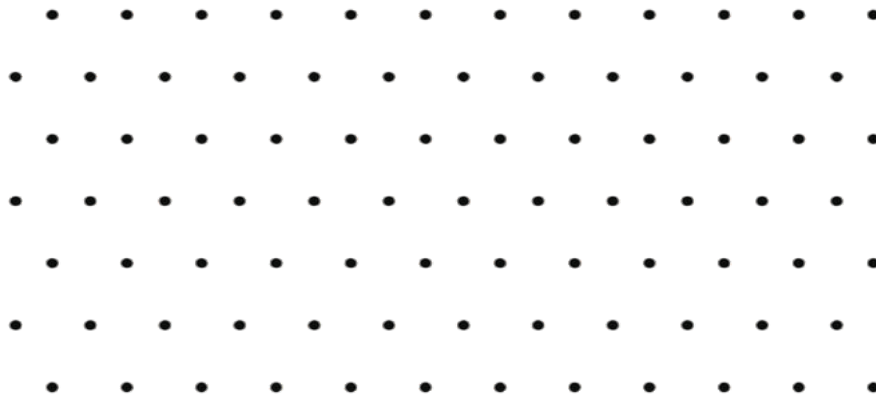
a. Is the shape a rhombus? Explain your reasoning.



b. Is the shape a rectangle? Explain your reasoning.

c. Is the shape a square? Explain your reasoning.

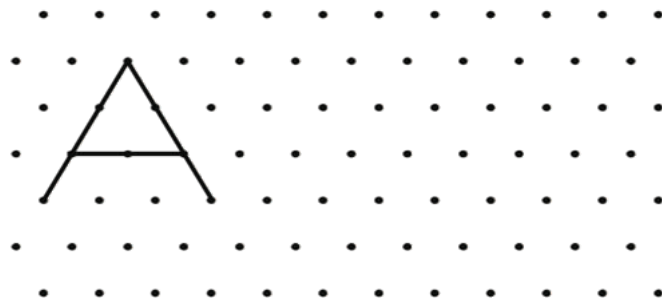
3. a. Draw 4 different lines through points on the grid. At least two of the lines should cross another line.



- b. Mark at least 3 different segments in your drawing.

(From Unit 7, Lesson 1.)

4. a. Circle the line segments that make up the letter A.

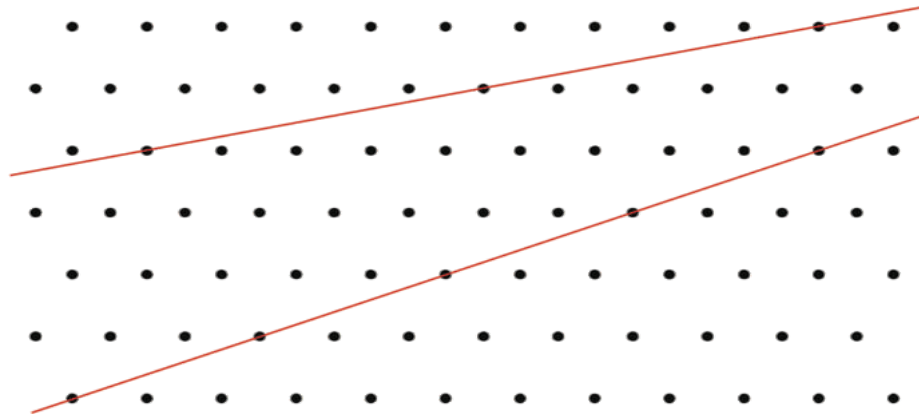


- b. Draw 4 rays that surround a rectangle.

- c. Can you find 4 different rays that surround the same rectangle?

(From Unit 7, Lesson 2.)

5. Andre says that these two lines are parallel because they do not intersect.



a. Explain why Andre is not correct.

b. Draw a line that is parallel to one of the lines in the image.

(From Unit 7, Lesson 3.)

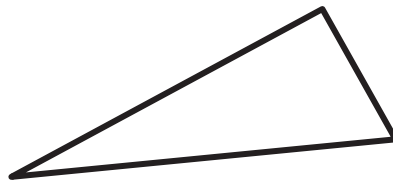
6. a. Which segments of the letter Z are a pair of parallel lines? Draw the lines.

b. Sketch a line that is parallel to the third segment in the Z.



(From Unit 7, Lesson 4.)

7.



- a. Find one angle in the figure. Draw a pair of rays to show the angle and extend them as far as you can.
- b. Find another angle in the figure. Draw a pair of rays to show it. Extend the rays as far as you can. (If you'd like, you can use a different colored pencil for this pair of rays.)
- c. Now that you have drawn some rays, do you see other angles that you didn't see before? If you see one or more, label each one with a letter.

(From Unit 7, Lesson 5.)

8. Exploration

Here is a riddle. Can you solve it?

"I am a capital letter made of more than 1 segment with no curved parts. I have no perpendicular segments or parallel segments. What letter could I be?"

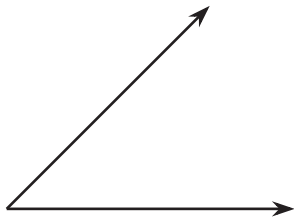
9. Exploration



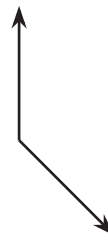
- Name or describe any shapes that you recognize in the painting.
- Do you see any parallel lines? If so, trace or circle them. (If you'd like, you can use a different colored pencil for each set of parallel lines.)
- Are there any angles in the painting? If so, mark them or describe where they are.

Section B: Practice Problems

1. A



B



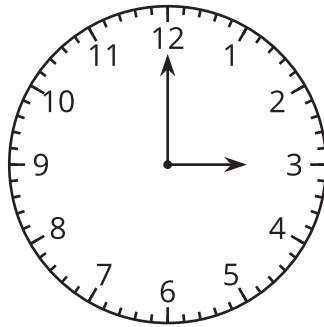
- a. Write two statements that compare the size of angles A and B.

- b. Draw an angle C that is bigger than both angle A and angle B.

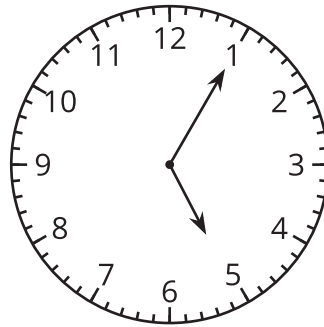
(From Unit 7, Lesson 6.)

2.

A



B

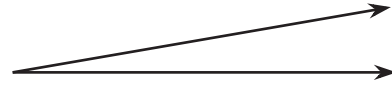


a. Which set of clock hands make a greater angle? Explain how you know.

b. Choose one of the clocks and describe how to use the clock to draw the angle represented by the hands on the clock.

(From Unit 7, Lesson 7.)

3. This angle has a measure of 10° .



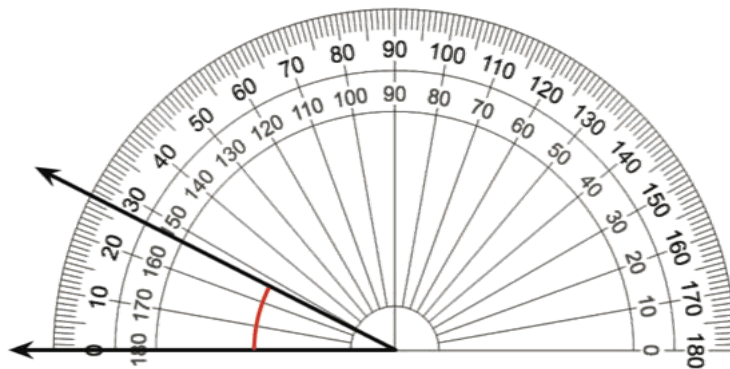
a. How many of these angles can you put together, without overlaps, to make a complete circle? Explain or show how you know.

b. Explain how you can use the given angle to sketch a 5° angle.

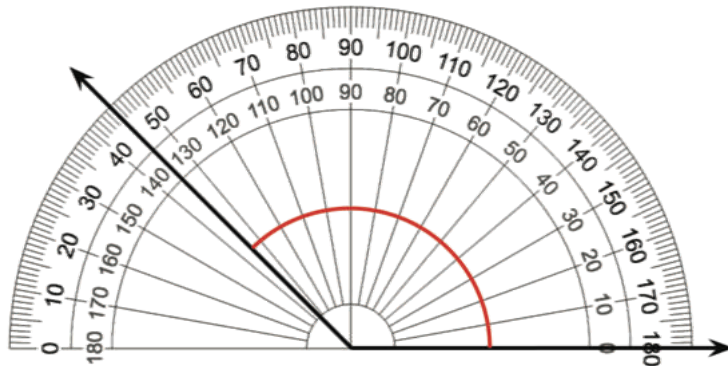
(From Unit 7, Lesson 8.)

4. Use the given protractor to find the measurement of each angle.

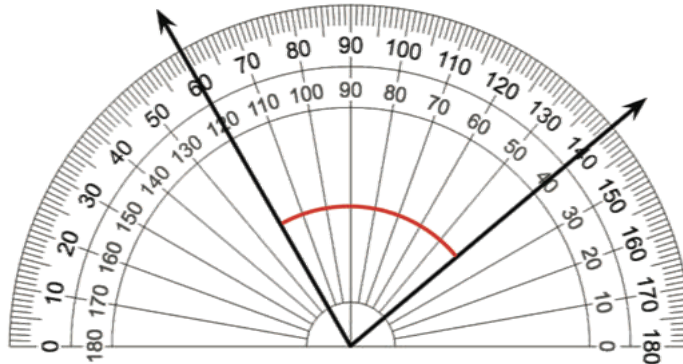
a.



b.



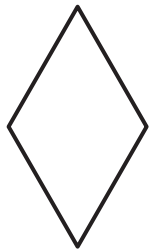
c.



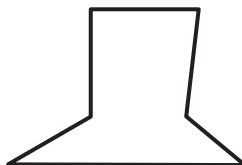
(From Unit 7, Lesson 9.)

5. Which of these shapes have segments that are perpendicular to one another?
Trace or circle the perpendicular segments.

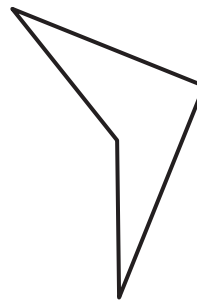
A



B



C



(From Unit 7, Lesson 10.)

6. Draw a ray. How many different 35° angles can you make using your ray and another ray? Explain your reasoning and make the angles.

(From Unit 7, Lesson 11.)

7. **Exploration**

What is the smallest angle you can draw?

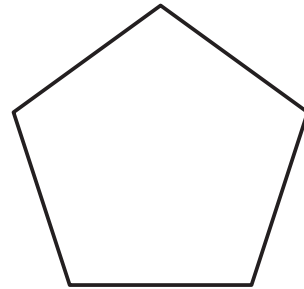
- a. Can you draw a 10° angle?

- b. What about a 5° angle or a 1° angle?

- c. What is difficult about drawing a small angle?

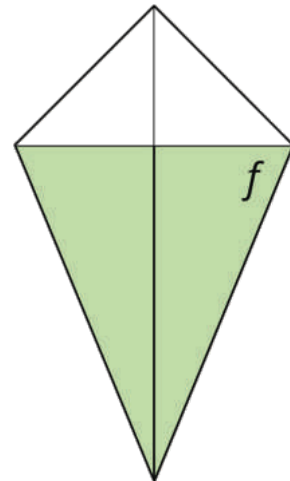
8. Exploration

- What are the measurements of the angles on the pentagon?
- Connect every pair of vertices of the pentagon with a line segment. What do you notice? What do you wonder?



9. Exploration

Can you estimate or find the measurement of the angle labeled f ? If so, explain or show how you know.



Section C: Practice Problems

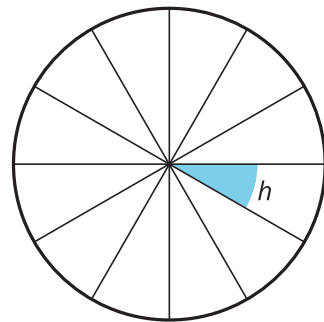
1. a. Draw an acute angle. Explain how you know the angle is acute.

- b. Extend one of the rays of your angle in the opposite direction. Explain why you've now created a new angle that is obtuse.

(From Unit 7, Lesson 12.)

2. a. The circle is divided into 12 equal parts. What is the measure of angle h ?

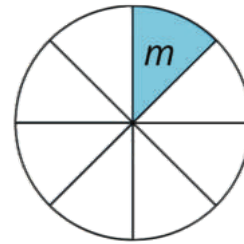
Explain or show how you know.



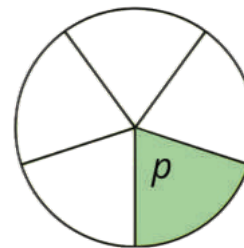
- b. Can you put together 20° angles to make a circle? How many of them will it take?

(From Unit 7, Lesson 13.)

3. a. A circle has been cut into eighths. How many degrees is the angle labeled m ? Explain or show your reasoning.

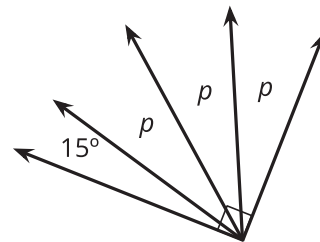


- b. Another circle has been cut into fifths. How many degrees is the angle labeled p ? Explain or show your reasoning.



(From Unit 7, Lesson 13.)

4. a. What is the measure of each angle p ? Explain or show how you know.



- b. How many 25° angles can you fit together at one vertex without gaps or overlaps?

(From Unit 7, Lesson 13.)

5. a. What angles are made by the hour and minute hands on a clock at these times? Explain or show your reasoning.

■ 3:00

■ 5:00

■ 6:00

- b. How many degrees has the hour hand moved between 3:00 and 7:00?
Explain or show how you know.

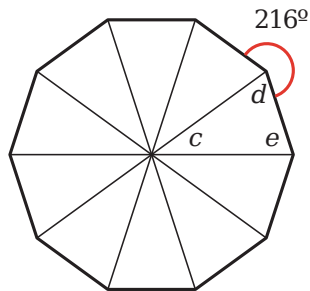
(From Unit 7, Lesson 14.)

6. When Jada looked up at the clock, the long hand pointed at 12. Less than an hour later, she looked up again, and the long hand of the clock had turned 210 degrees. How many minutes had passed? Explain or show your reasoning.

(From Unit 7, Lesson 14.)

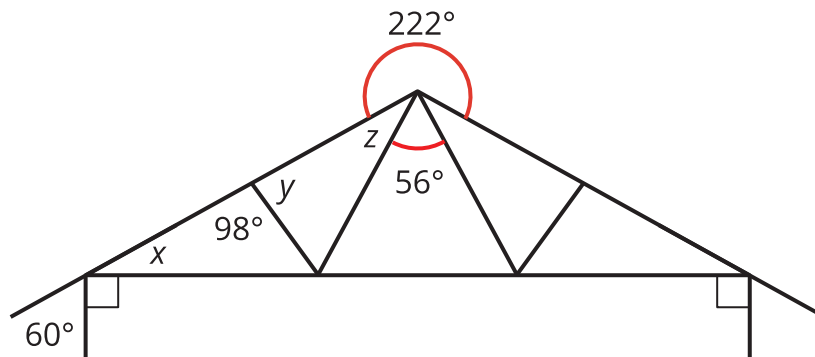
7. Find the measure of each labeled angle in the drawing. Assume that:

- The angles of the triangles meeting at the point in the middle of the figure are all the same.
- The other angles of the triangles all have the same measure.



(From Unit 7, Lesson 15.)

8. In this diagram each angle on the left hand side is the same as the corresponding angle on the right hand side. Find the measure of angles x , y , and z . Explain or show your reasoning.



(From Unit 7, Lesson 15.)

9. Exploration

Tyler wonders if the hour hand and minute hand ever point in the same direction at the same time. Can you find some times when the hour hand and minute hand point in the same direction? Explain or show your reasoning.

10. Exploration

a. Draw a rhombus with a 50° angle. Explain how you know your shape is a rhombus.

b. Draw another rhombus with a 50° angle. How are your rhombuses the same? How are they different?

11. Exploration

How many degrees does the minute hand turn in each of the following times?
Show how you know.

a. 30 seconds

b. 10 seconds

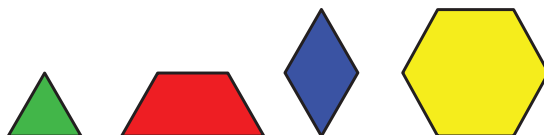
c. 80 minutes

d. 2.5 hours

12. Exploration

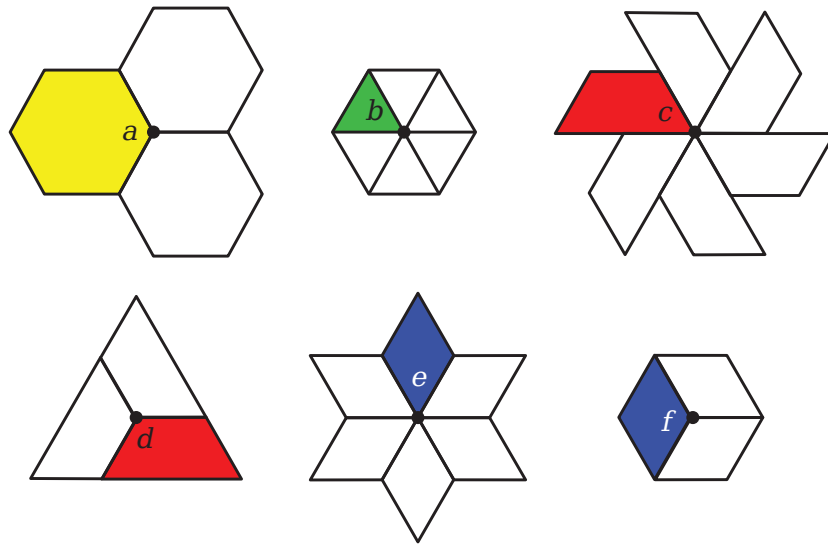
Here are diagrams of some pattern blocks. Each shape has some angles.

a. How many angles do you see inside each shape?



- a triangle
- a trapezoid
- a rhombus
- a hexagon

b. Here are diagrams of each type of blocks arranged around a shared point.



Use what you know about angle measurement to find the sizes of angles a – f . Show your reasoning.

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