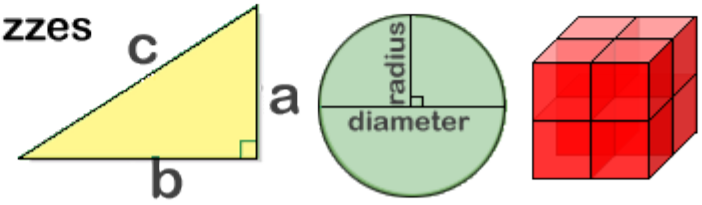
Ventura®
Educational Systems

Explore Math With Geometry Concepts

- Interactive Lessons
- Comprehension Quizzes
- Explorations
- Record Keeping
- Instructor's Guide



Instructor's Guide

Ventura Educational Systems

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Credits

App Design Ventura Educational Systems

Instructional Technology and Programming Fred Ventura, Ph.D.

Project Manager Marne Ventura

Fred Ventura, Ph.D. is an experienced classroom teacher and has taught elementary, secondary and college levels. He holds a doctorate in education from the University of California and presents workshops for educators on the instructional uses of technology.

Marne Ventura is an experienced classroom teacher and holds a masters degree in reading and language development of the University of California.

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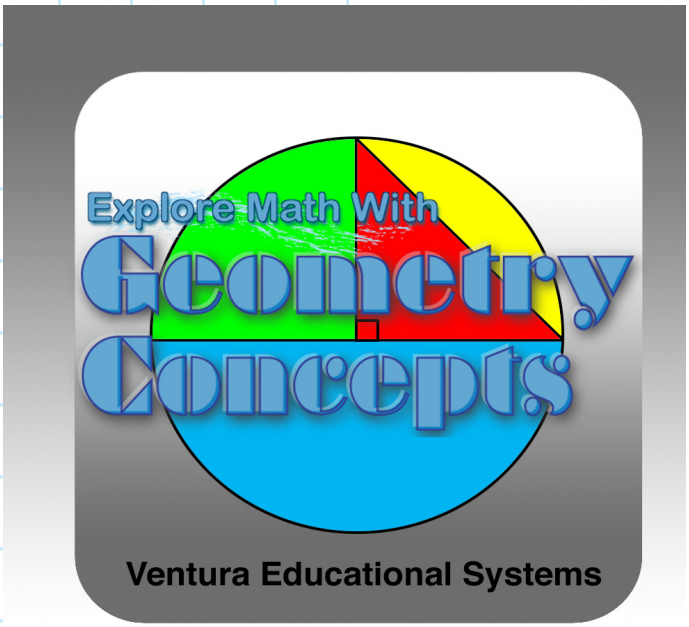

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The Importance of Learning Geometry

The mathematics curriculum traditionally has been designed to provide students with the opportunity to develop skills and acquire knowledge that would be important in adulthood and to prepare sutdents to enter careers that would not require a high level of mathematical ability.

Today the context of mathematics instruction needs to be much broader. The accelerated pace at which modern society produces technological change requires that high school graduates be prepared for careers in qhich mathematics will be very important. In order to be successful in many careers students will need to be confident in their mathematical abilities. They will need to be able to solve problems, to communicate mathematical ideas and to think logically.

Mathematics educators recognize that a sound curriculum needs to include the continued development of the language and symbolism used to communicate mathematical ideas. This is important at all levels. Students need to be encouraged to reflect upon and clarify their thinking about mathematical ideas and be able to express relationships. This is especially true in geometry.

A sound mathematics education enables student to formulate mathematical definitions and express generalizations that have been discovered through investigations. Students should be given the opportunity to express mathematical ideas both orally and in writing.

Effective teaching gives students the ability to read written presentations of mathematical material with comprehension and understanding. Engaged students will ask for clarification of ideas and also will seek additional information through questioning that extends the scope of the topics presented.

The student of geometry involves visualization. Students who study geometry using open-ended, discovery approaches learn to appreciate the economy, power and elegance of mathematical notation and become better able to conceptualize mathematical ideas and communicate those concepts through more abstract methods such as formulas.

Geometry Concepts is an app that is intended to help students develop their ability to understand geometry and to communicate geometric concepts. It is specifically designed to create a learning environment where basic ideas can be learned in an enjoyable way. We want students to use their iPads as a tool for exploring geometry. This app is most effective when students work in small groups so that the discussion of mathematical ideas is facilitated.

Introduction

The Geometry Concepts interactive learning system is designed to provide 7th grade enrichment through adult level instruction in mathematics. Several approaches to geometry instruction are combined in the design of this educational app. Geometry Concepts contains lessons, quizzes, interactive investigations and a variety of tools for illustrating fundamental ideas improrant in the student of geometry.

Exploratory modules encourage students to explore a variety of ideas including methods for classifying triangles, how to measure angles, shapes and properties, area and perimeter, central and inscribed angles, vertices and diagonals of regular polygons, pi, and the Pythagorean Theorem.

Geometry Concepts provides several methods for studying each topic, for example, reading a lesson and taking a quiz, exploring screens where diagrams to illustrate ideas by associating terms and key concepts, and open-ended explorations where students manipulated diagrams to better visualize a concept.

The main instructional goals of Geometry Concepts are given in these educational objectives:

1. To provide practice identifying and matching terminology related to introductory geometry. The app graphically represents geometric terms and key concepts and motivates student to learn by associating a geometric figure, diagram or symbolic notation.

2.To incrementally build an understanding of fundamental concepts by providing an easy-to-use format for exploring geometry.

3. To support the development of a student's sense of confidence in his or her mathematical ability by measuring and reporting the student's progress toward understanding the topics presented in each unit using quiz.

The app assists the learning process by providing a wealth of information and by providing a structure for experimentation.

Curriculum and Content

Geometry Concepts covers the content recommended by national and state instructional resources. It supports the curriculum frameworks adopted by many states and countries. The content specifically follows the recommended guidelines provided most departments of education for students in the middle and beginning high school grades. Because an active learning approach is used, Geometry Concepts also supports performance standards specific to the secondary math curriculum. The main topics covered by this learning system are:

Basic Concepts
Circles
Triangles and Angles
Lines and Planes
Area and Perimeter
2-D Figures
3-D Figures

Constructivist Experiences: Geometry Concepts is designed to provide a variety of learning experiences using different approaches and creative teaching methods. One key purpose of the compnents of the app is to provide students with constructivist experiences related to fundamental geometry concepts.

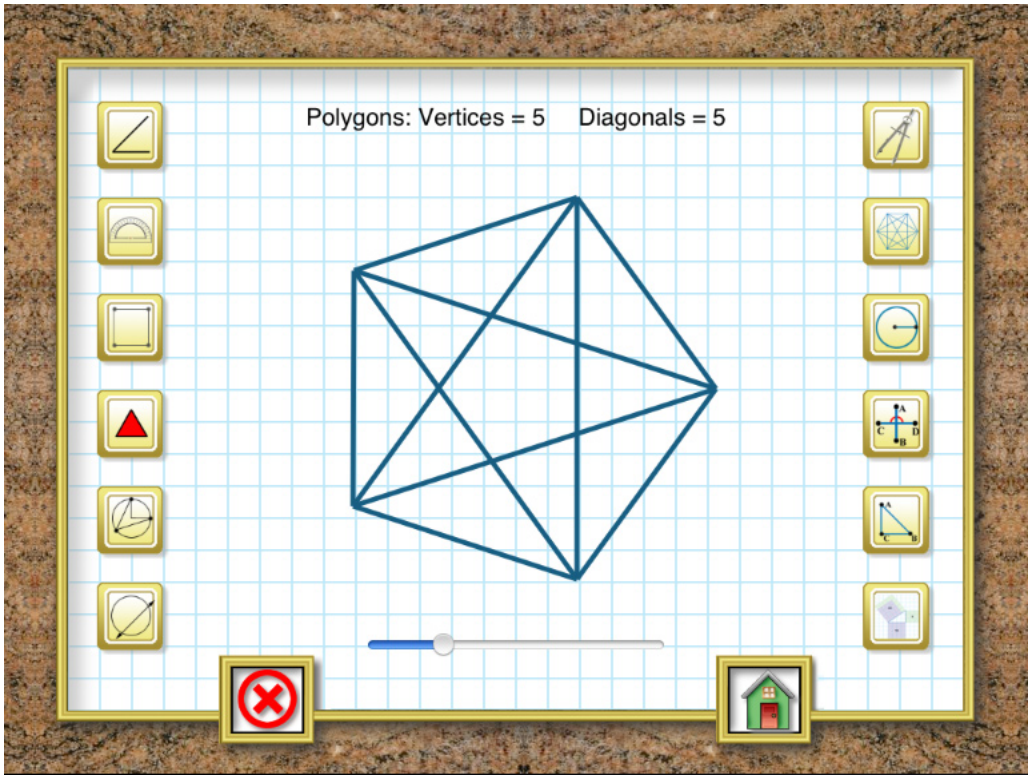
Cooperative Learning: The app is designed to facilitate learning experiences that are appropriate for individuals or small cooperative learning groups. Students can work together to share and compare their approach to finding the solution to a specific set of geometry problems that can be provided by the teacher are accessed using this instructional guide.

Learning Styles: Research in education has found that students have a variety of learning styles and modalities which mush be considered when designing instructional approaches. Geometry Concepts uses many techniques which are well-suited to visual learnings. For example, the tools for exploration included in the app are an effective way to make abstract geometric ideas understandable. In addition, because sound effects and speech are used in several of the learning modules, students who are auditory learners will be more engaged. For example, in the quizzes, praise for correct answers can be auditory. Kinesthetic learners are engaged through the use of iPad interface of swiping and tapping. Also, several activities suggested in the instructor's guide involve a confluence of visual, auditory and kinesthetic learning approaches.

Independent Investigations: The lesson ideas and instructional activities provided in the instructor's guide encourage students to do independent investigations of topics related to the application of the geometry concepts which are targeted by the scope of this application.

An Open-Ended Approach: Providing for open-ended questioning in math may seem like an oxymoron when we consider that most problems have a single answer. However, giving students an opportunity to think divergently in math class is important as a way to spark creativity and stimulate insight. Geometry Concepts attempts to provide open-ended experiences whenever possible. For example any of the activities using the Exploratory Tools provide for an open-ended experience using dynamically illustrated representations of key ideas.

For example, this screen shows an activity from the Exploratory Tools module where students explore regular polygons and the relationship between the number of vertices and the number of diagonals.

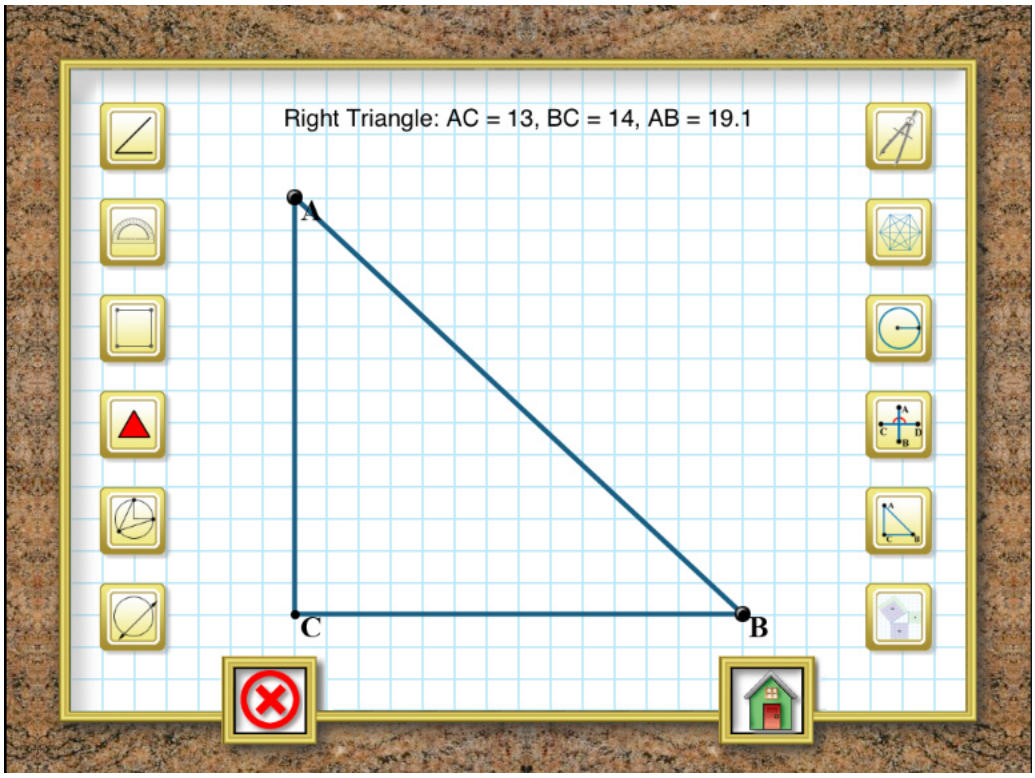


In this activity a slider is used to set the number of vertices. Diagonals are automatically drawn for each polygon. In the activity associate with the tool students are asked to develop a table showing the number of vertices and the number of diagonals and then try to develop a formula that will predict the number of diagonals for any polygon.

Critical Thinking:

Geometry Concepts engages the student in critical thinking and decision making through a series of projects and activities. A key feature in the design of the activities is to empower the student to make connections between representations of geometric models and related formulas and other abstract concepts.

By designing these explorations as investigations teachers can use them to foster critical thining in a mathematical context by posing open-ended questions and encouraging the students to use the interactive representations to justify their explanations. Here is one example:



For an open-ended math experience teachers might ask students to use this tool to find the hypotenuse of a right triangle with a base of 6 and an altitude of 8 units. Steps:

1. Drag point A so that it is a distance of 8 units from point A.
2. Move point B so that it is a distance of 6 units from point C.
3. What is the length of line segment AB (hypotenuse)?

This type of instructional approach will help students who are first learning to work with geometric figures to internalize about how these concepts apply to geometric problems that they will encounter later in their high school and college academic careers. Internalizing fundamental concepts will facilitate in students the ability to apply principals of geometry to new learning experiences.

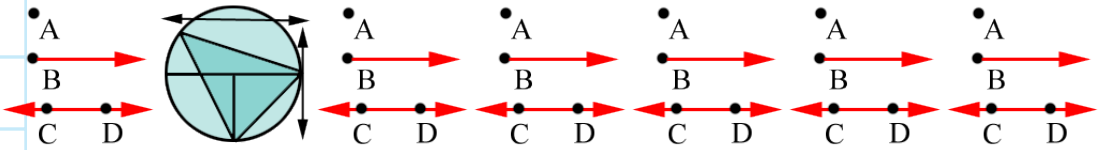
Educators will find that Geometry Concepts can be used in combination with other instructional programs and closely parallels the geometry curriculum taught in most secondary schools. The program provides students with an opportunity to review and explore the concepts learned in mathematics classes. The format of the system is designed to make learning fun. Each topic can be studied in a variety of ways. A quiz for each topic assesses the student's mastery of the material and helps to provide reinforcement.

With Geometry Concepts, students enjoy learning the ideas that are essential for success in higher level math courses. The program is an effective way to introduce students to geometry terms and concepts and can also be used as a tool to provide reinforcement of concepts previously studied.

Supplementary materials are provided in this manual and are designed to be used in conjunction with the iPad activities. The supplementary worksheets may be duplicated or projected for classroom use.

An Overview of the Geometry Concepts Learning System

Geometry Concepts combines traditional and innovative instructional techniques in an easy-to-use learning system. Each topic can be studied in a variety of ways. For example, first time users can opt to begin with a lesson and then follow-up the lesson with a quiz. After completing a lesson and quiz students can study terminology and key concepts in greater depth or use the interactive tools explore ideas by manipulating geometric figures.



Tap one of these seven icons to select a topic to study. The topics are: Basic Concepts, Circles, Angles and Triangles, Lines and Planes, Area and Perimeter, 2-Dimensional Figures, 3-Dimensional Figures.

Settings - Tap the Settings icon to select sound options. Sound Effects and Speech Enhancements are implemented at various places in the app and these features can be set 'on' or 'off'.

Notebook - Tapping the Notebook icon takes the student into the lessons.

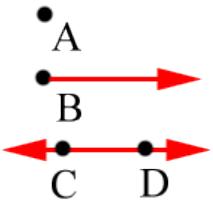
Probe - Tap the Probe icon to delve deeper into geometric terms, key concepts and detailed descriptions. Tap a diagram to reveal a term and concept. Tap 'more info' for a detailed description.

Quiz - Tap the Quiz icon to begin answering questions on the selected topic. Each multiple choice quiz question is illustrated with a diagram.

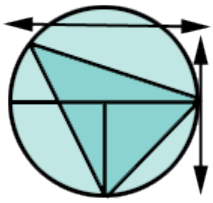
Tools - Tapping the Tools icon leads the student to 12 explorations. Each exploration examines a basic idea of geometry.

Info - The Info icon provides an overview of the features of the app and links to the associated website and also this instructor's guide.

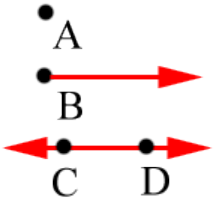
Topics



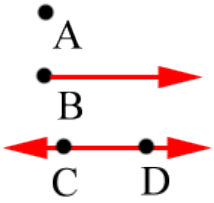
Basic Concepts
This lesson presents basic information about how points, lines, arcs, circles, squares and other polygons. The lesson demonstrates some of the fundamental concepts of geometry and ends by encouraging the student to explore other basic figures.



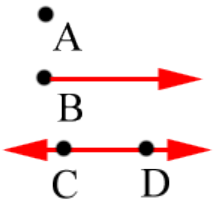
Circles
In this lesson the student learns about the parts of a circle, the effect of changes in the radius of a circle, the terminology related to lines and circles, and the relationship between inscribed and central angles.



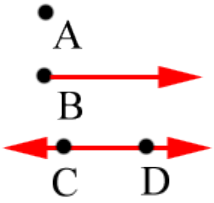
Angles and Triangles
In this Angles and Triangles lesson the student explores how angles and triangles are classified, the properties of angles created when lines intersect, supplementary and right angles, and the Pythagorean Theorem.



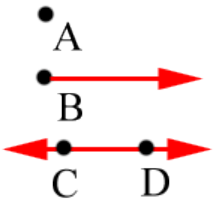
Lines and Planes
In the fourth lesson students explore the relationship between lines and planes. The terms parallel, perpendicular, and skew are introduced. In the latter part of the lesson the relationship of the angles that result when parallel lines are cut by a transversal is presented: corresponding, vertical, alternate interior, alternate exterior and supplementary angles.



Area and Perimeter
In the fifth lesson students explore area and perimeter of common geometric figures. A section of the lesson discusses the formula for finding the circumference of a circle. Related explorations provide students with additional information.



Planar Figures
Lesson 6 deals with the special parts of circles, triangles, and polygons. Concepts related to radius and diameter are presented and pi is explained as the ratio of the circumference and diameter. Calculations for finding the circumference of a circle are presented. The parts of a triangle, diagonals, and the applications for the Pythagorean Theorem are discussed.

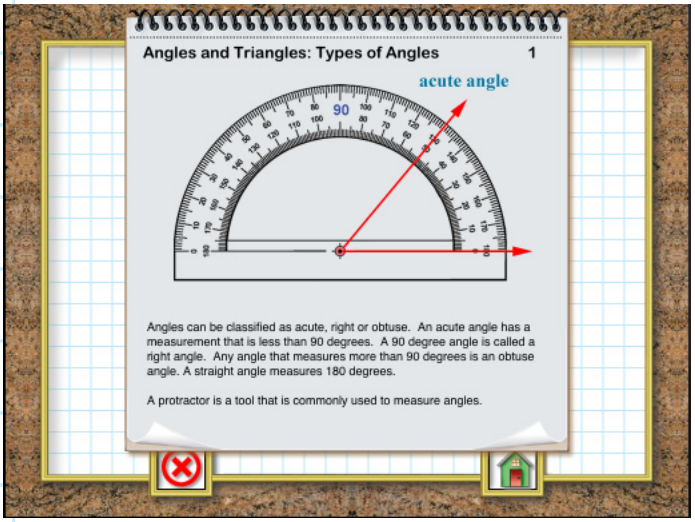


Settings

The settings screen provides two switches for controlling the sound features. Mild sound effects play when the user taps buttons or performs other actions while using the app. Speech Enhancements are positive reinforcement that occurs when quiz questions are answer correctly. These features can be set to either on or off.

Notebook

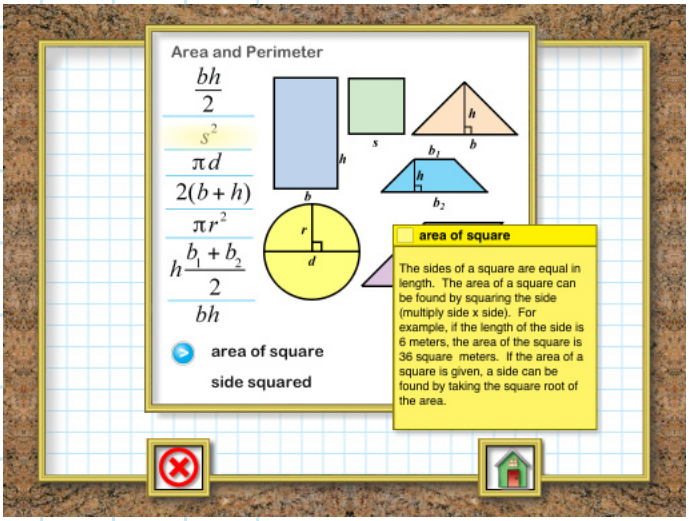
Below is a sample screen showing one of the pages from a lesson on Angles and Triangles. Swipe from right to left or tap the bottom right corner to move to the next page of the lesson. Swipe from left to right or tap the bottom left corner to move to the previous page of the lesson.



Many of the pages of the lesson feature animated illustrations. The animations are set to loop until the page is changed.

Probe

The Probe feature is an interactive screen where illustrations, formulas and other information related to the selected topic is presented. Tapping certain areas of the screen bring up terms and key concepts. A small blue 'more info' icon will also appear. Tapping this icon opens a note with more detailed information about the selected term and concept.

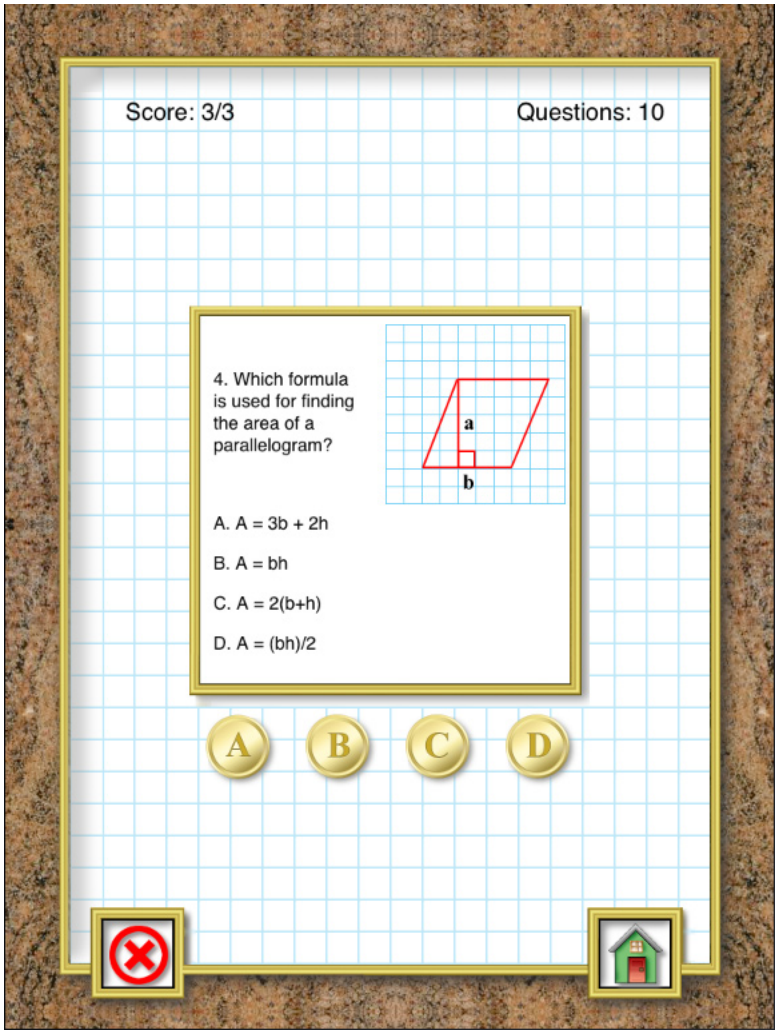


area of square

The sides of a square are equal in length. The area of a square can be found by squaring the side (multiply side x side). For example, if the length of the side is 6 meters, the area of the square is 36 square meters. If the area of a square is given, a side can be found by taking the square root of the area.

Comprehension Check Quiz

Students should be encouraged to carefully read each lesson and when finished take the quiz to assess comprehension. Once a satisfactory score is achieved for a particular lesson, the student should be encouraged to try some of the explorations or other activities. A helpful teaching practice is to require a specific level of performance on a quiz before allowing students to participate in a related math activity in order to insure that the students gets the maximum benefit from the activity.

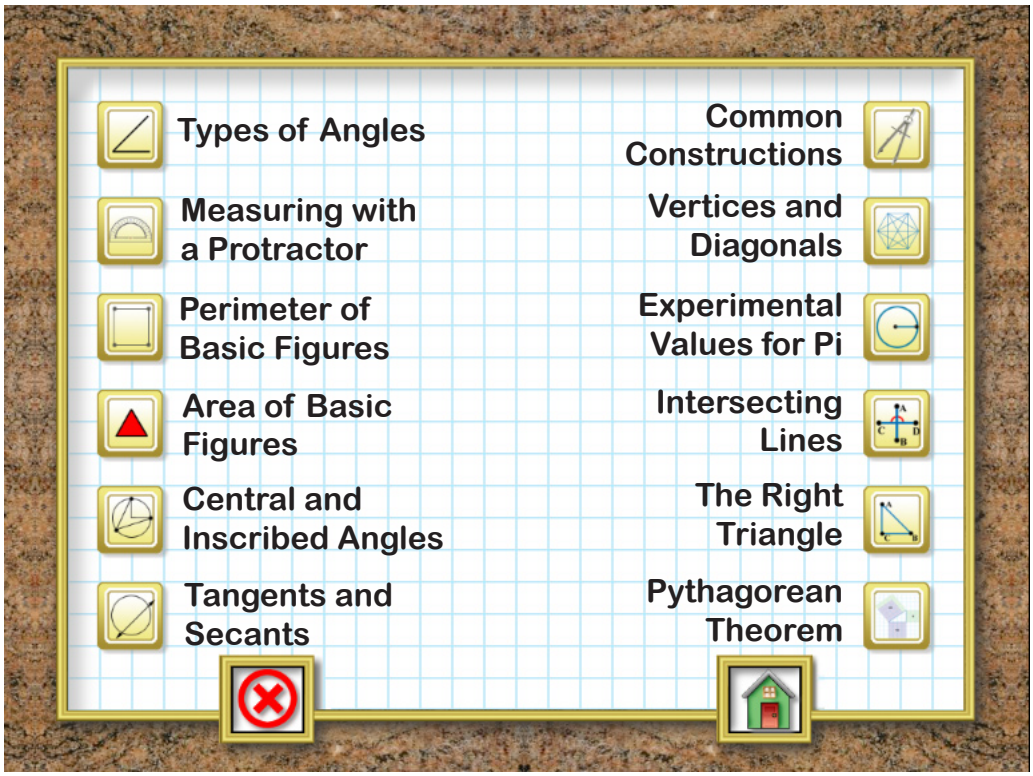


Tap A, B, C or D to choose the best answer to a quiz question. Tap anywhere on the screen to move to the next question in the quiz. Note that the number of questions answered correctly and number of questions attempted is reported at the top left of the screen and the number of questions in the quiz in shown at the top right.

Note: In the Settings the user can select to have Speech Enhancements 'on' or 'off'. If Speech Enhancements are activated, positive auditory rewards are spoken when correct answers are given.

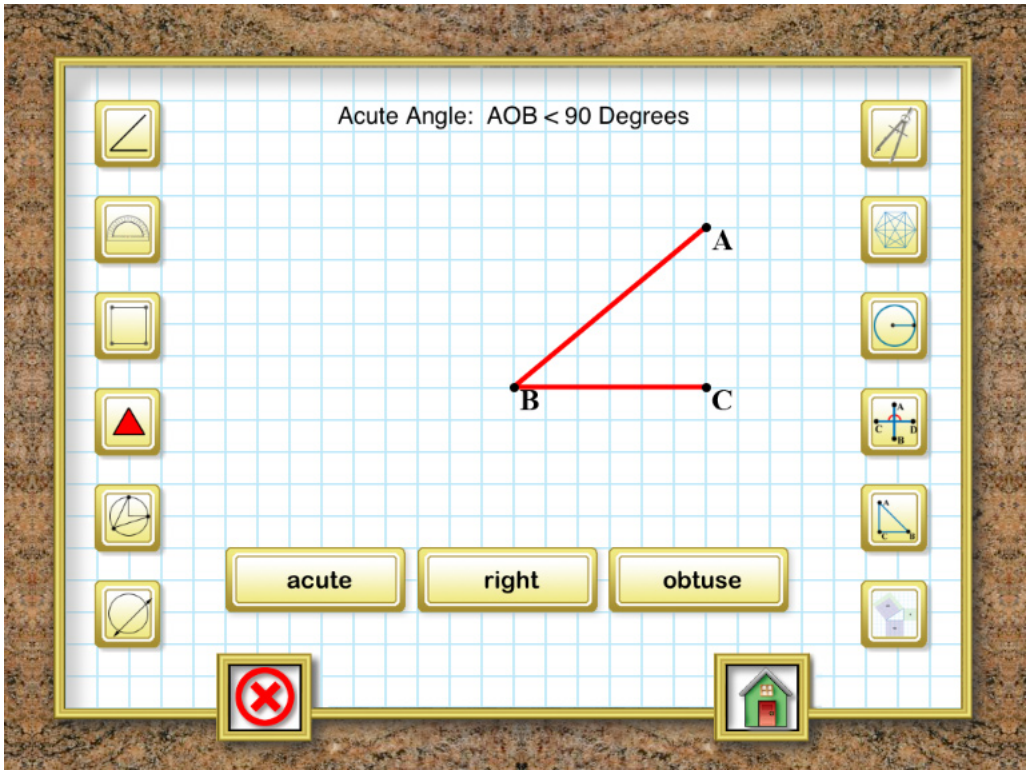
Tools for Exploration

In Geometry Concepts, a set of interactive tools provide students an opportunity to explore a variety of important ideas. After tapping the Tools icon a palette of icons appears. Each icon leads to an investigation.



Exploration #1: Types of Angles

Angles are classified by size. In this investigation students learn the meaning of the terms, obtuse, right and acute as applied to the measurement and description of angles. Tap one of the three buttons to see an example of each type of angle.



The Types of Angles Exploration Tool allows the user to choose which of three types of angle is displayed. By tapping buttons students see the three types of angles which are classified by size of angle. The terms acute, right, obtuse are introduced through this activity.

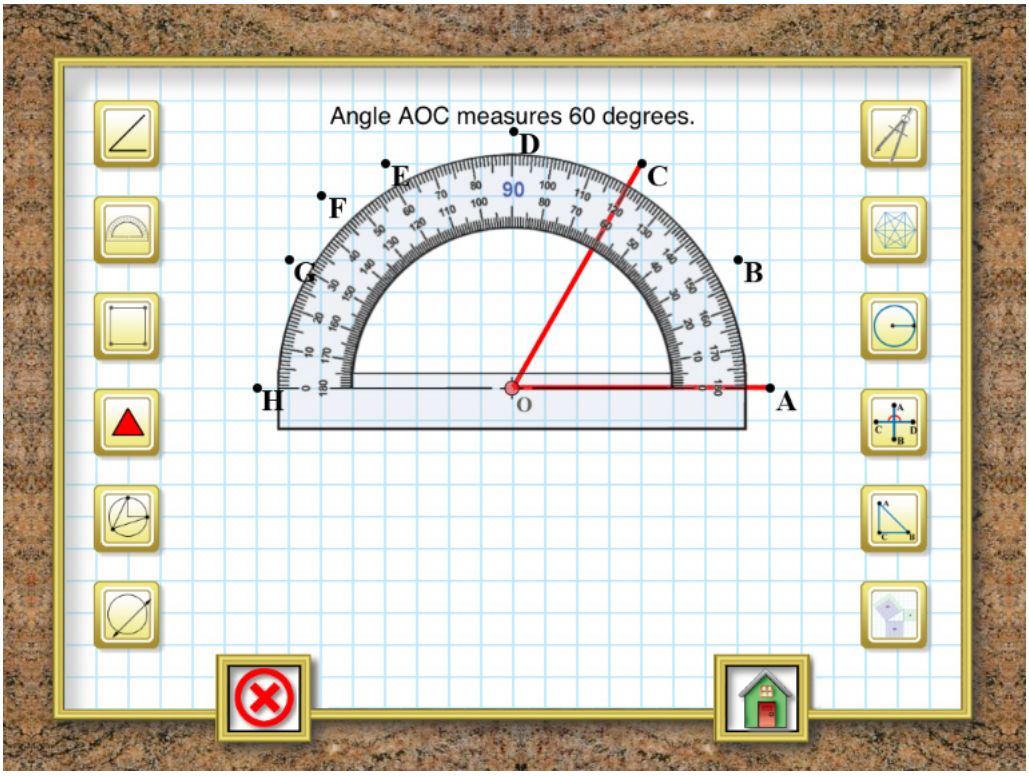
Acute - Angles that measure less than 90°.

Right - Angles that measure 90°.

Obtuse - Angles that measure more than 90°.

Exploration #2: Measuring with a Protractor

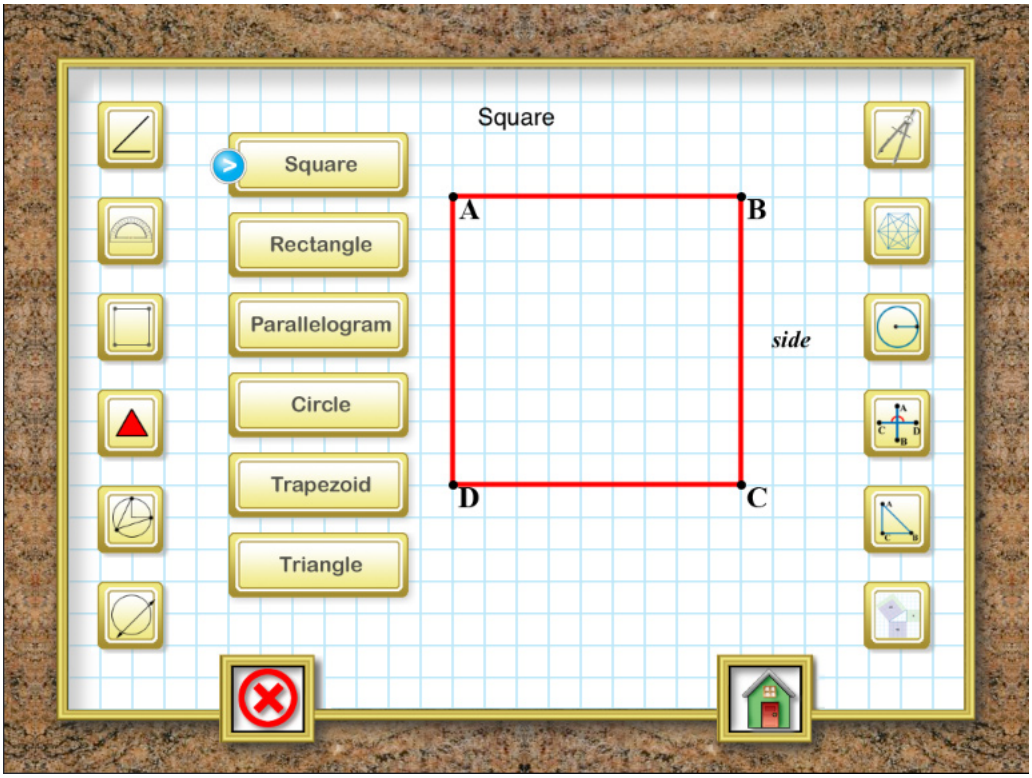
This exploration lets the students tap on points along the curved edge of a protractor to establish the measurement of an angle. Each angle is drawn and the measurement is reported to help the student better learn how to measure angles with a protractor and read the size of the angle from the scale of the protractor.



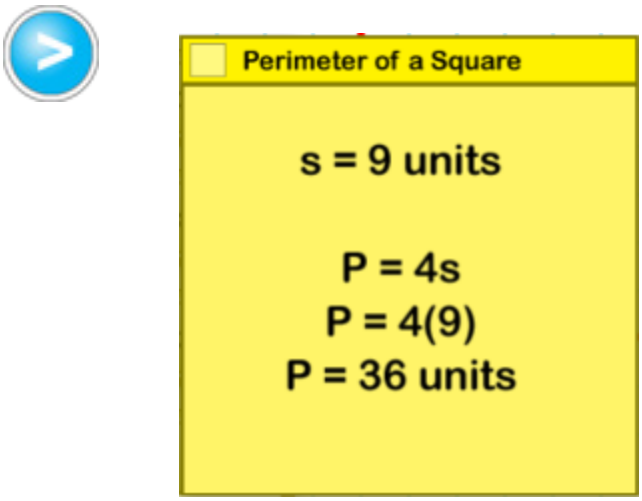
Tap one of the labeled points to move the angle and change the size. Review the terms obtuse, right and acute while using this tool.

Exploration #3: Perimeter of Basic Figures

Using the Perimeter of Basic Figures Exploration Tool lets students discover the formulas for finding the perimeter of squares, rectangles, parallelograms, circles (circumference), trapezoids and triangles.

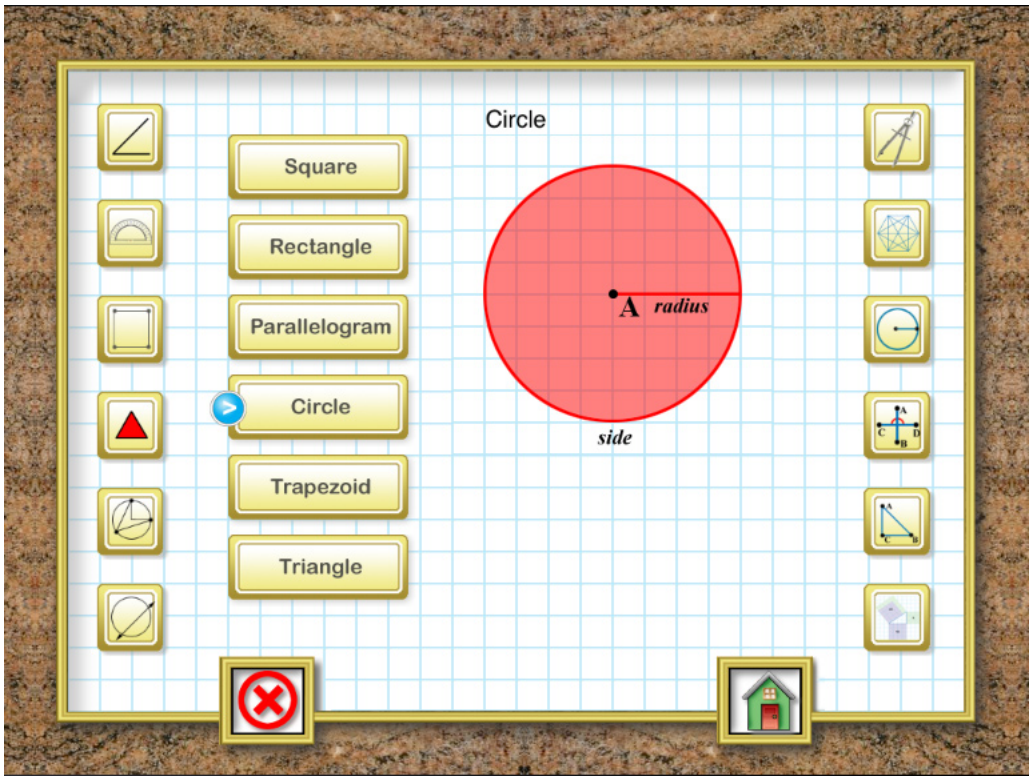


Tap one of the labeled buttons to reveal a figure. Once a figure has been selected and drawn a small blue 'more info' icon appears on the left side of the button. Tap this icon to bring a note showing the formula for calculating the perimeter and an example.

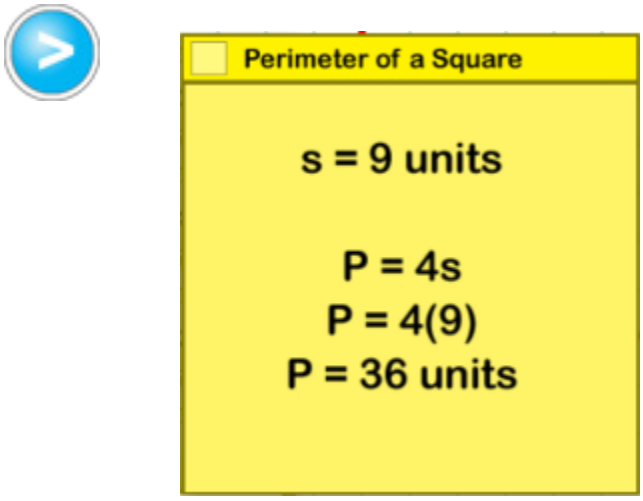


Exploration #4: Area of Basic Figures

Using the Area of Basic Figures Exploration Tool lets students discover the formulas for finding the area of squares, rectangles, parallelograms, circles, trapezoids and triangles.

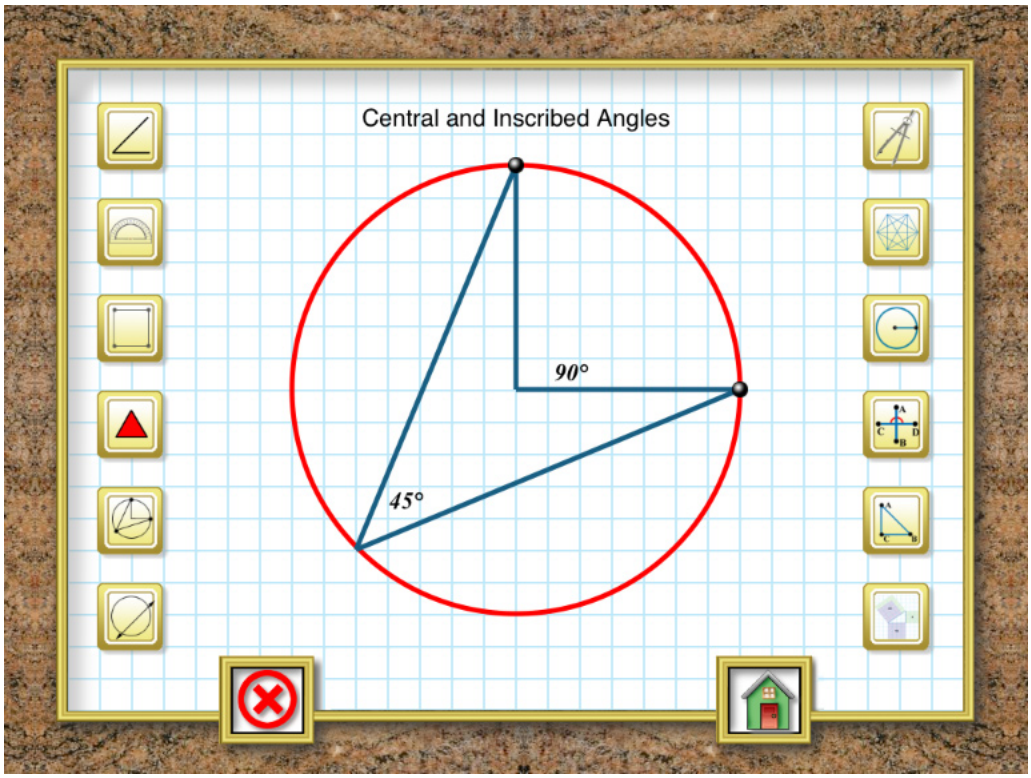


Tap one of the labeled buttons to reveal a figure. Once a figure has been selected and drawn a small blue 'more info' icon appears on the left side of the button. Tap this icon to bring a note showing the formula for calculating the area and an example.



Exploration #5: Central and Inscribed Angles

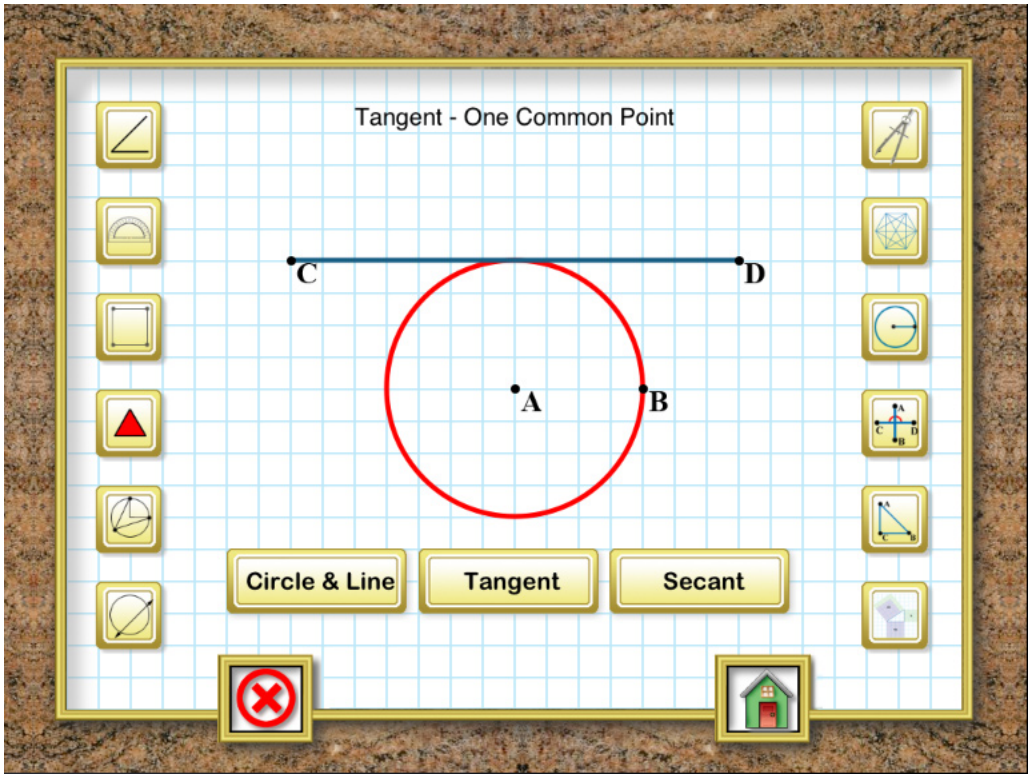
Central and inscribed angles are related. The inscribed angle is one-half the measurement of the related central angle. Using the Central and Inscribed Angle Tool students can discover this relationship.



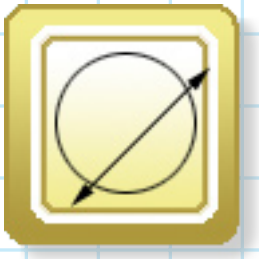
Drag either of the points that lie on the circumference of the circle. Observe the relationship between the central angle and the inscribed angle. The range for the central angle is from 0 to 180°. Point out to students that when the central angle is 180° a straight formed and the inscribed angle is 90°, a right angle.

Exploration #6: Circles and Lines

When a circle and a line lie in the same plane three conditions are possible. The Circles and Lines Exploration Tool illustrates the three possible conditions and presents the terminology related to each condition.



Three buttons allow the student to change which condition is illustrated.

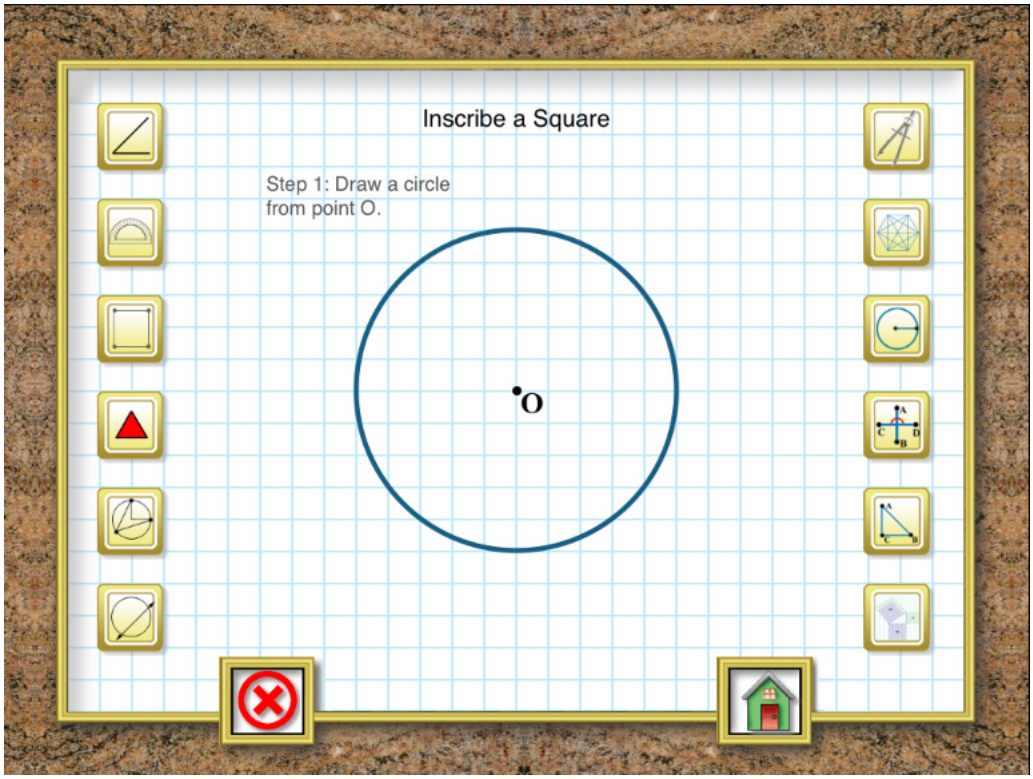


Exploration #7: Constructions

Constructions can be one of the more exciting and interesting parts of the geometry curriculum. While some approaches to teaching geometry have placed less emphasis on constructions than others, studying construction can be a rewarding experience for many students, especial when combined with opportunities for creative expression as in using construction techniques to create a colorful design.

Using simple construction tools, a straight edge and an compass for drawing arcs, a great deal of geometry can be learned. The Constructions Tool shows a step-by-step processes to illustrate five basic constructions:

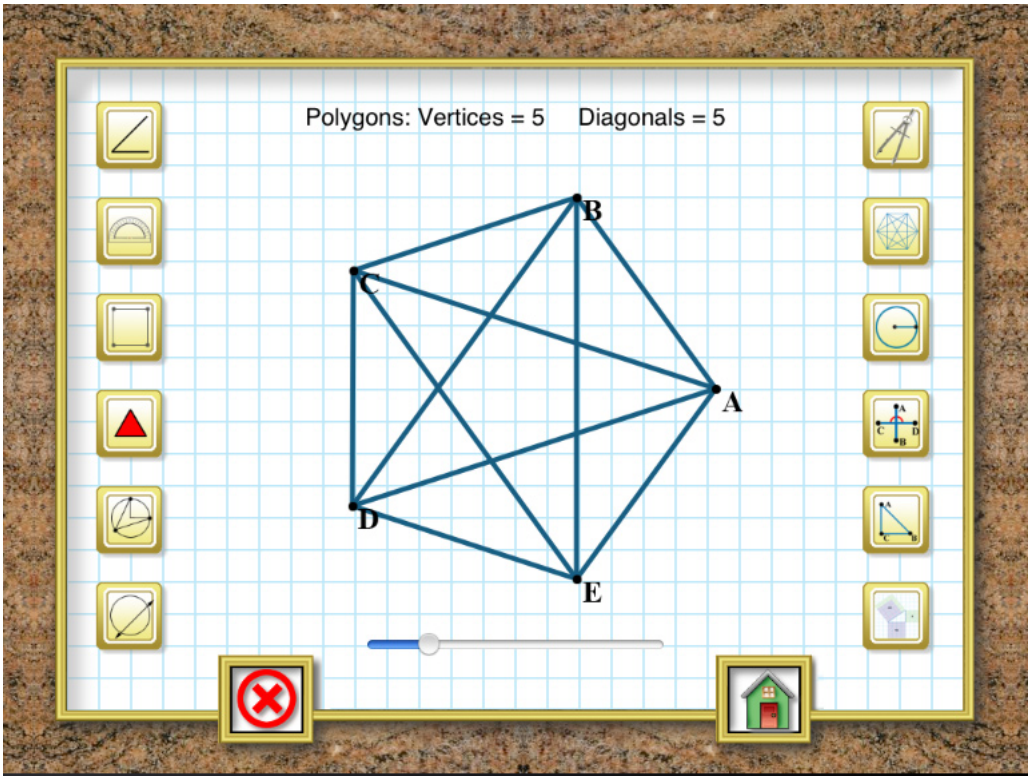
1. Bisect a Line Segment
2. Bisect an Angle
3. Perpendicular Line from a Point not on the Line
4. Perpendicular Line from a Point on the Line
5. Inscribe a Square



Exploration #8: Diagonals

In a polygon a line from one vertex to another non-adjacent vertex is called a diagonal. Tapping Diagonals icon from the Exploration Tools palette provides an opportunity to discover the relationship between the number vertices that a polygon has and the number of diagonals.

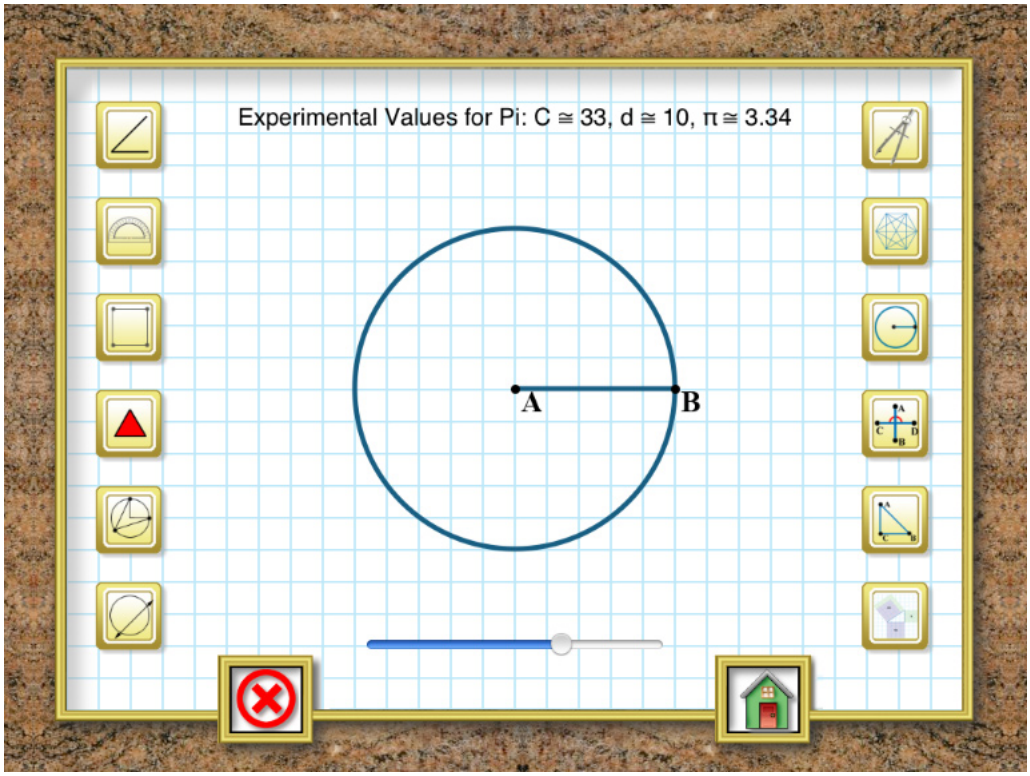
A slider is used to set the number of vertices for a regular polygon. The diagonals for the polygon are automatically draw as soon as the number of vertices is set. The number of vertices and diagonals are reported.



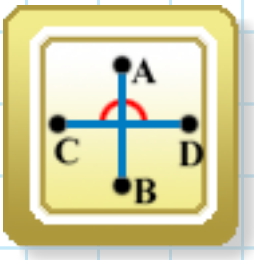
Exploration #9: Experimental Values for Pi

Find any round object in the classroom and measure the circumference and diameter of the object. A table top, trash can or clock face might be appropriate things to measure. Find the ratio of the circumference to the diameter and you have calculated an experimental value for pi.

Any measure involves a certain amount of inaccuracy. The Experimental Values for Pi Exploration Tool incorporates random amounts of inaccuracy. This exploration simulates the process of finding round objects and measuring the circumference and diameter.

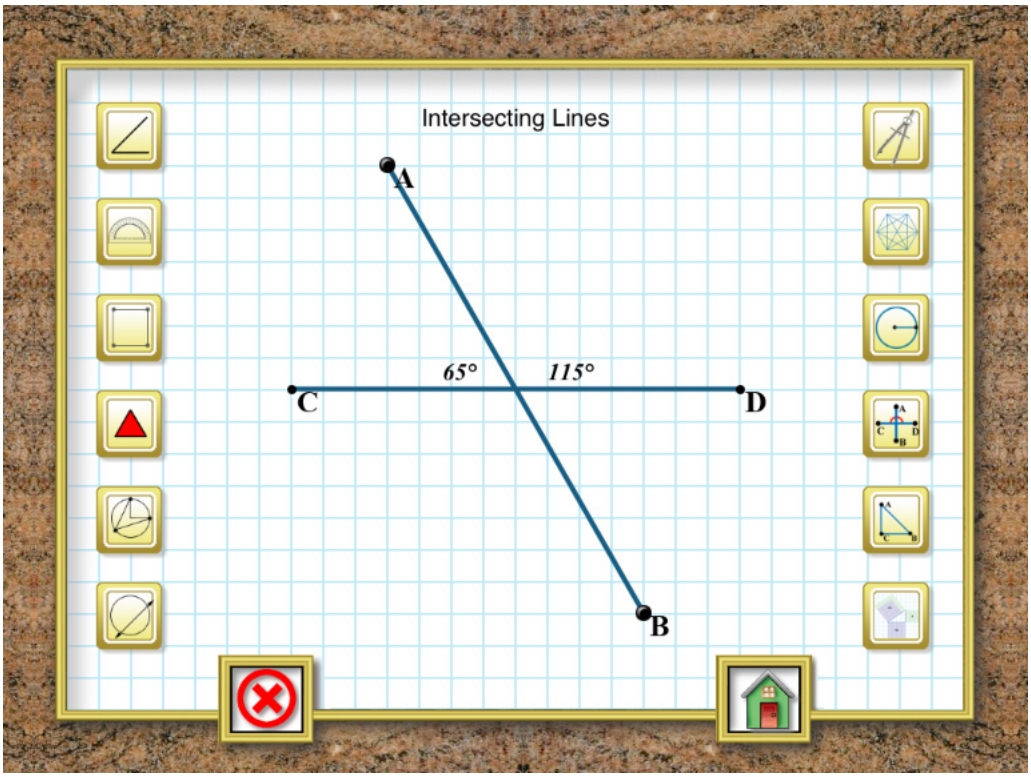


In the activities section of this manual a lesson is provided where students use this tool to generate 10 experimental values for pi and then find the average to get an approximation of pi.

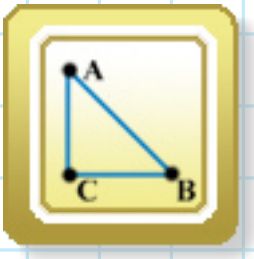


Exploration #10: Intersecting Lines

Intersecting lines form four angles. Pairs of vertical and adjacent angles have special properties. The relationship of the angles formed when two lines intersect can be studied using the Intersecting Lines Exploration Tool.

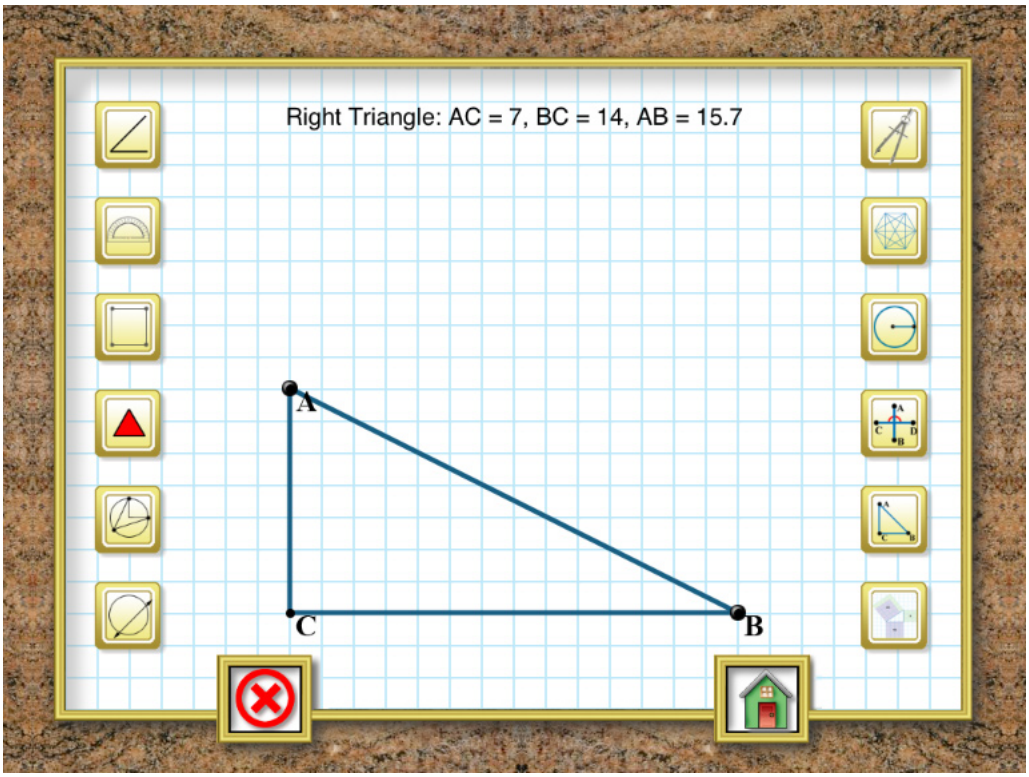


By dragging the points labeled A or B the student can change the orientation of the line and thereby change the angles. As the point is moved the line changes and the angle measurements are reported.



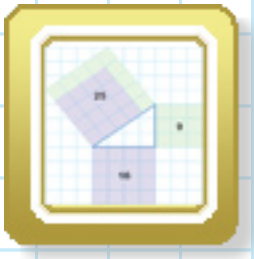
Exploration #11: Right Triangles

The right triangle is the cornerstone of Euclidean geometry. Using this exploration students study the special properties of the right triangle.



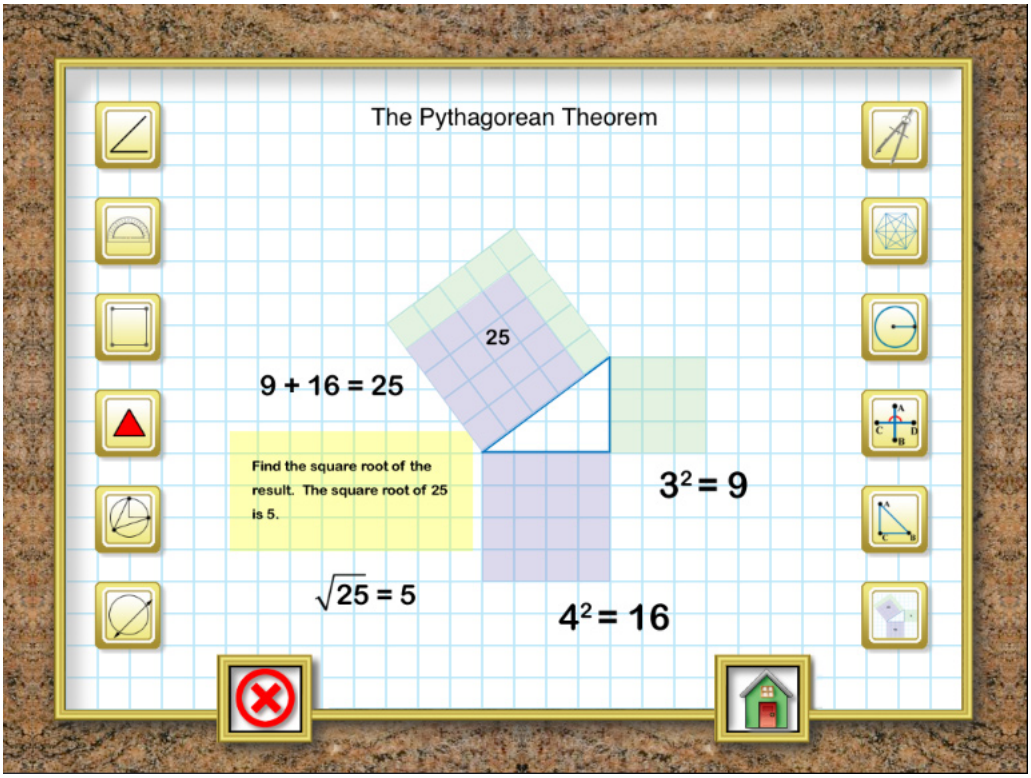
After tapping the Right Triangle icon, a triangle is displayed on the screen with three points labeled A, B and C. Points A and B are able to be manipulated. Point C remains fixed. Point A can be slid up or down to increase or decrease the altitude of the right triangle (AC). Point B can be slid right or left to increase or decrease the base of the right triangle (BC).

As the triangle's dimension are manipulated the altitude, base and hypotenuse is reported. In the activities section of this manual students will use this tool to check calculations that involve the application of the Pythagorean Theorem.



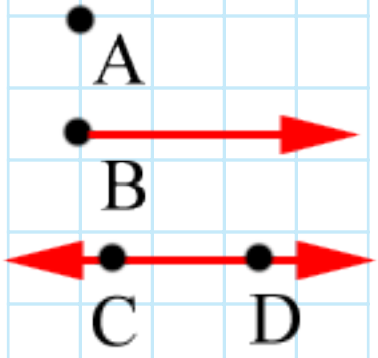
Exploration #12: The Pythagorean Theorem

This Exploration Tool demonstrates a calculation that involves an application of the Pythagorean Theorem. Swipe the screen from right to left to advance through the demonstration.



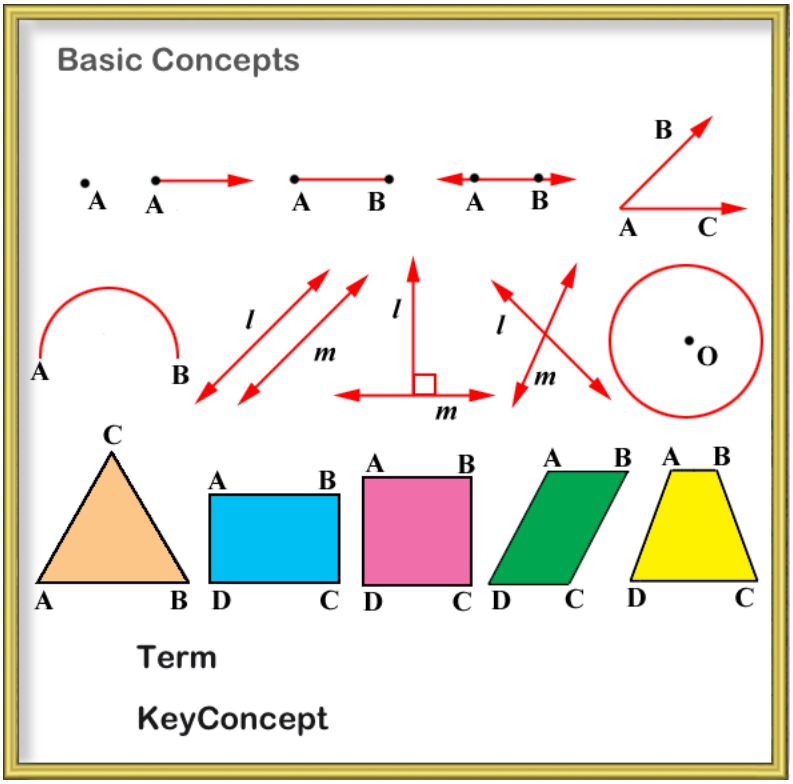
Activities

Terms Review
Basic Concepts 28



Terms Review: Basic Concepts

Select Basic Concepts by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



1. _____
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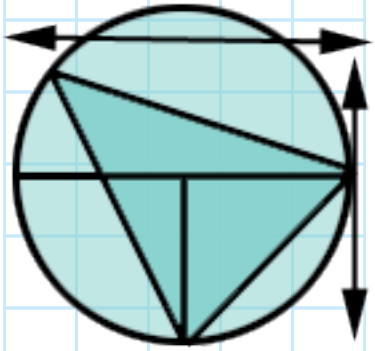
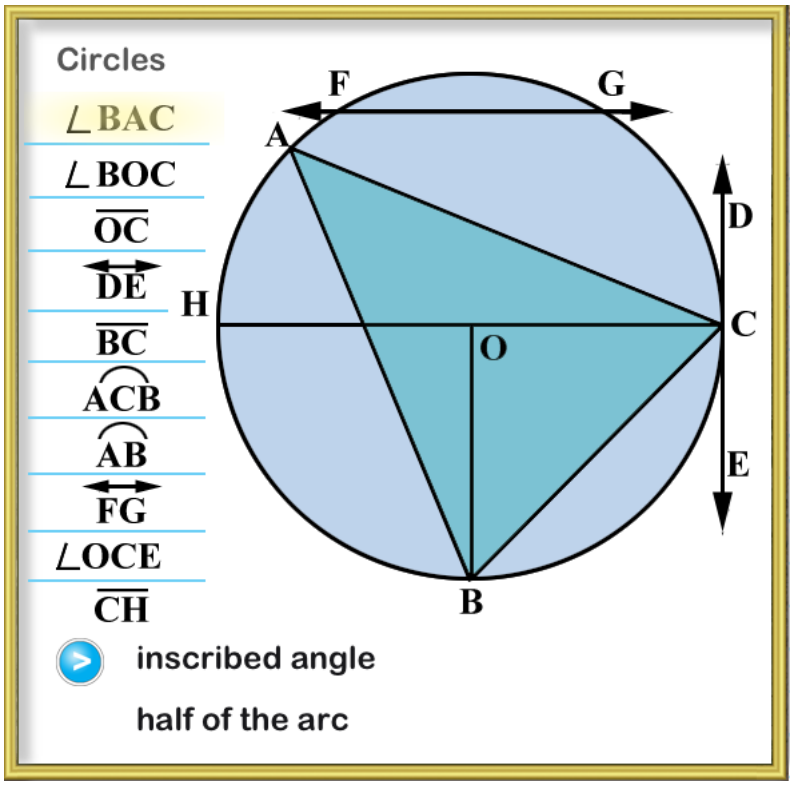
11. _____
12. _____
13. _____
14. _____



Terms Review: Circles

Select Circles by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



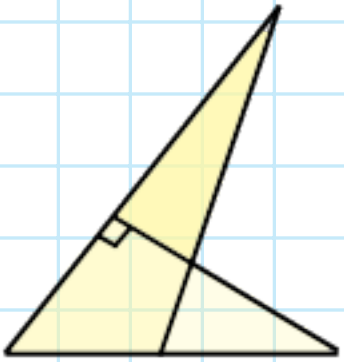
1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

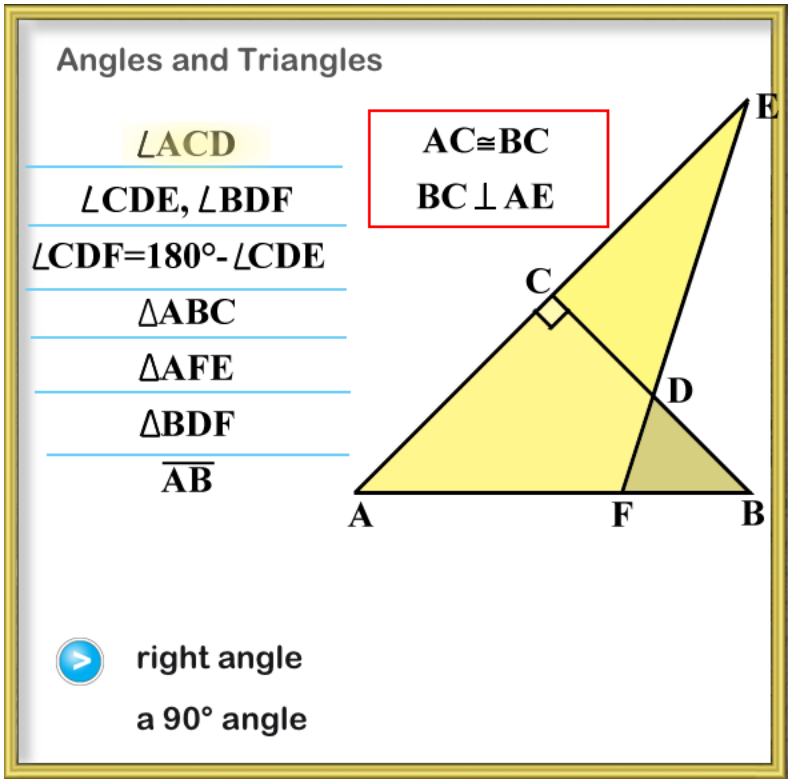
4. _____ 9. _____

5. _____ 10. _____



Terms Review: Angles and Triangles

Select Angles and Triangles by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



1. _____
2. _____
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4. _____
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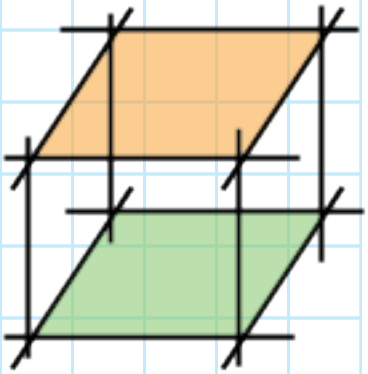
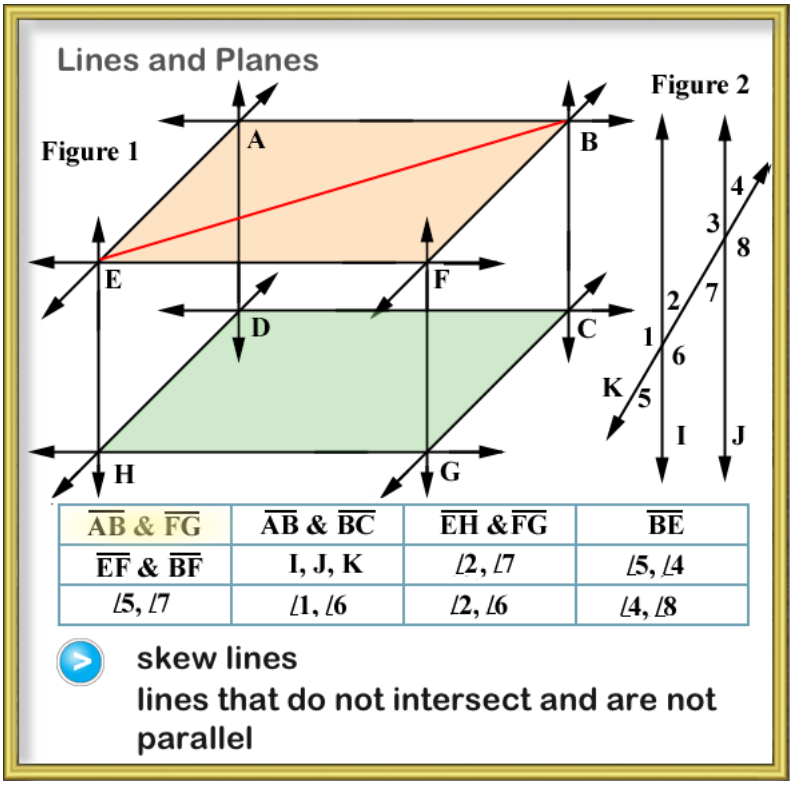
6. _____
7. _____



Terms Review: Lines and Planes

Select Lines and Planes by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



1. _____
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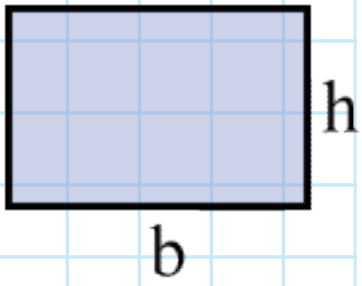
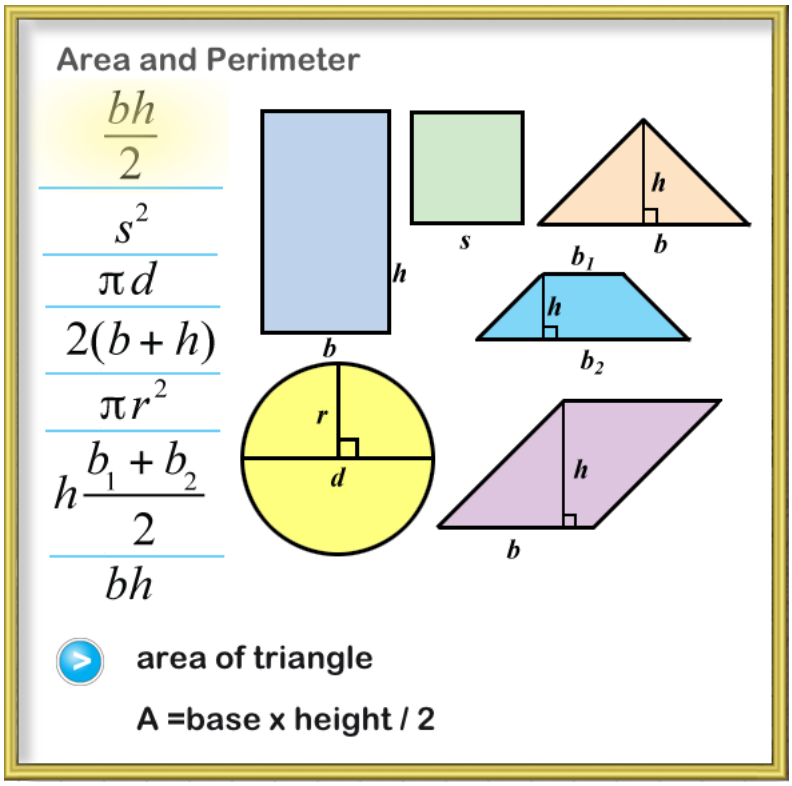
10. _____
11. _____
12. _____

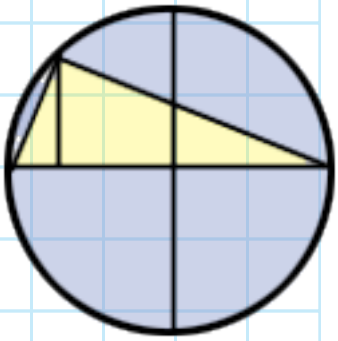


Terms Review: Area and Perimeter

Select Lines and Planes by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.

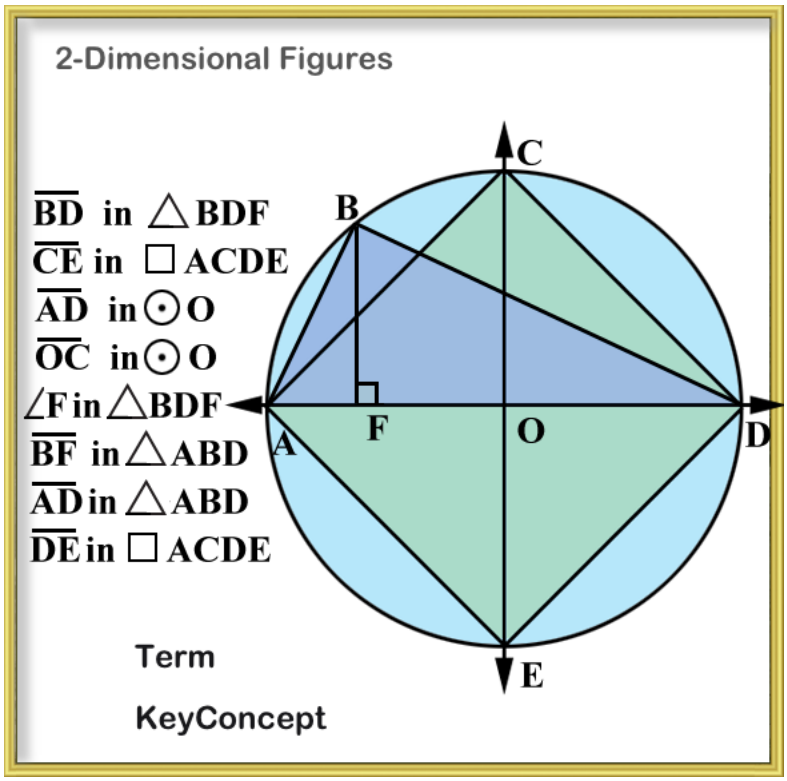


1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____



Terms Review: 2-Dimensional Figures

Select Lines and Planes by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



1. _____
2. _____
3. _____
4. _____
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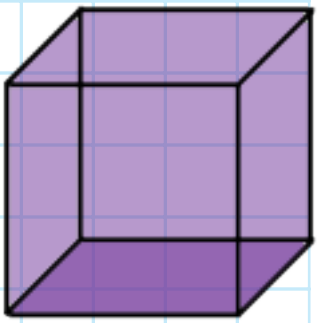
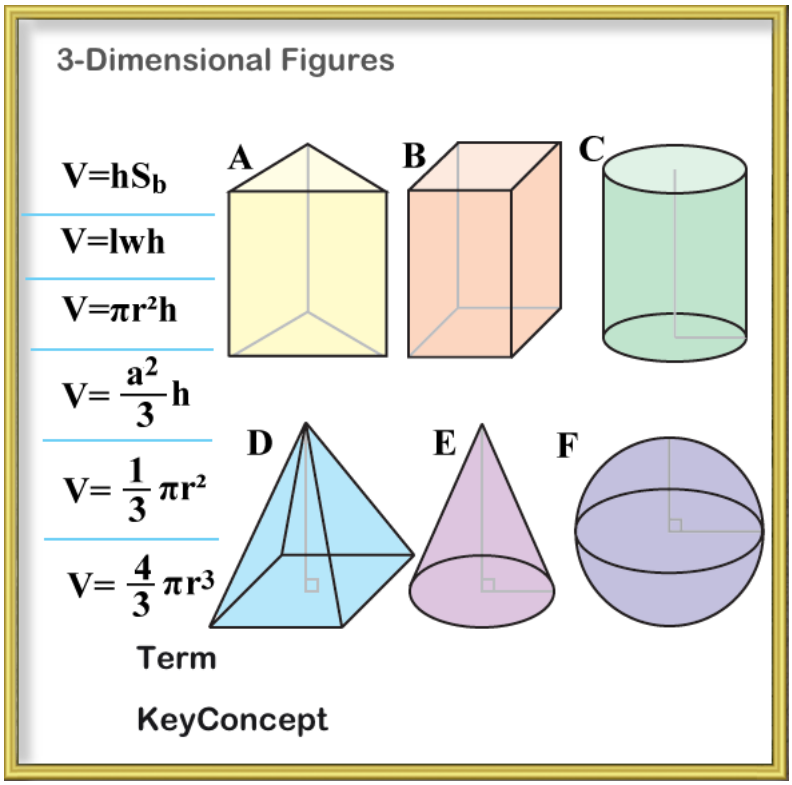
6. _____
7. _____
8. _____



Terms Review: 3-Dimensional Figures

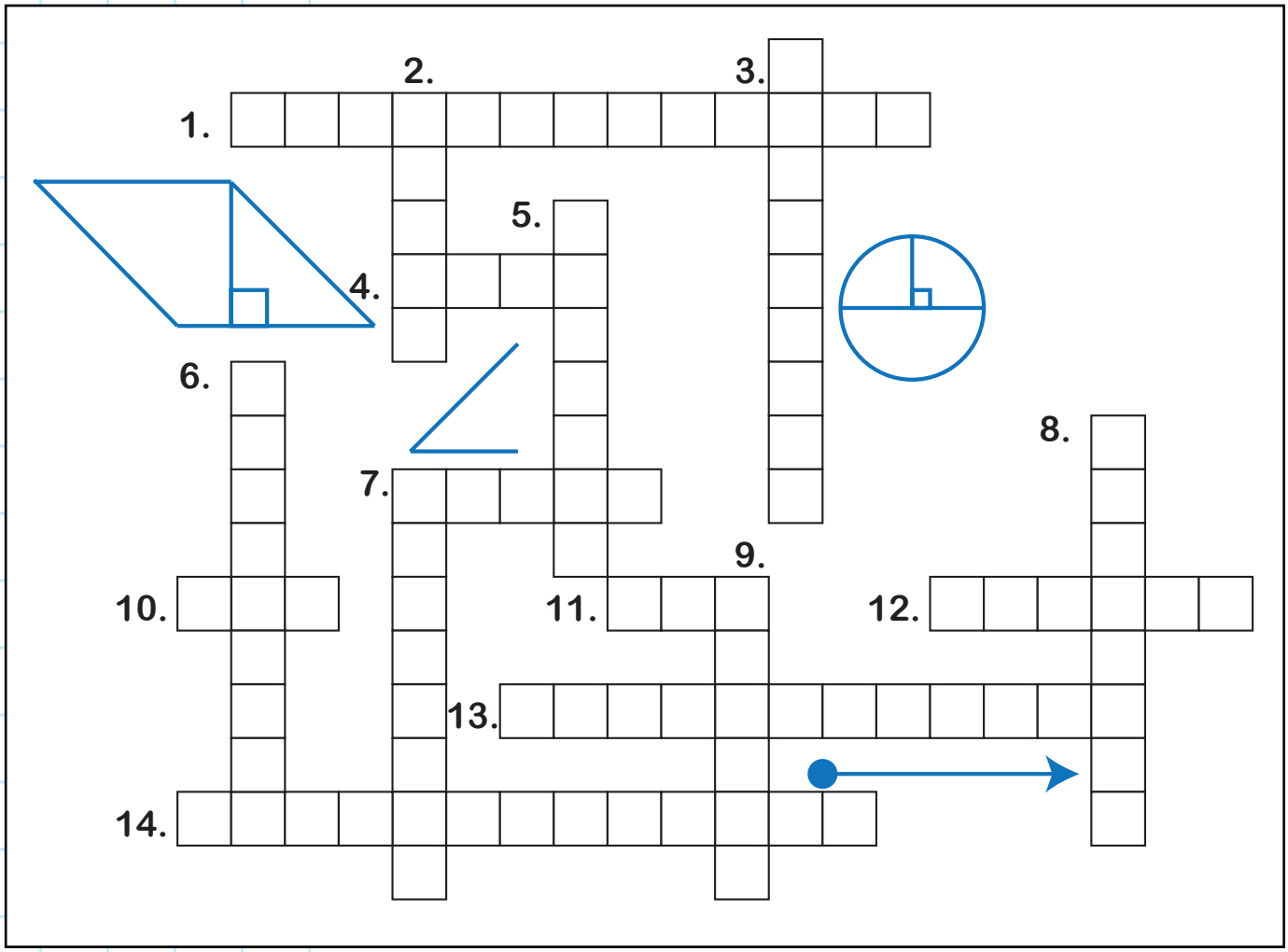
Select Lines and Planes by tapping the icon from the Topic Menu. Tap the Probe button to open the activity. Use this activity to find out about each of the geometry terms for this topic. Write each term on one of the lines below. Put a number on the graphic to show the location of the figure that corresponds with the term.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Crossword Puzzle

Select Basic Topics by tapping the Basic Topics icon. Use the Probe to study the terms presented. Print this page and complete this crossword puzzle to review the terms.



Across

1. A geometric figure with two pairs of parallel sides.
4. The name for a set of points that extend infinitely in opposite directions.
7. A position.
10. A set of points extending infinitely in one direction.
11. A part of a circle.
12. A figure with four congruent sides and four right angles.
13. Lines that cross at a single point.
14. Lines that form a right angle.

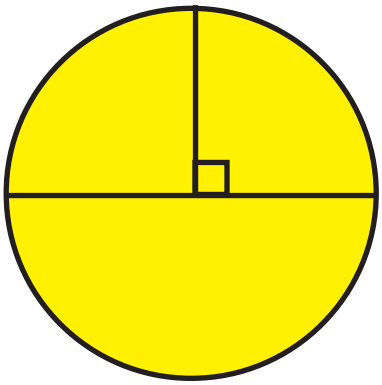
Down

2. Two rays extending from the same point.
3. A figure with two parallel sides and two sides that are not parallel.
5. A part of a line.
6. A parallelogram with four right angles.
7. Lines in which all corresponding points are the same distance apart.
8. A three-sided figure.
9. All the points that are a given distance from a point and in a plane.

Practice with Angles and Arcs

Answer these questions after you have completed the unit on circles. Remember that the length of the radius is one-half the length of the diameter and that a circle is 360°.

In this figure: AC = 100 cm



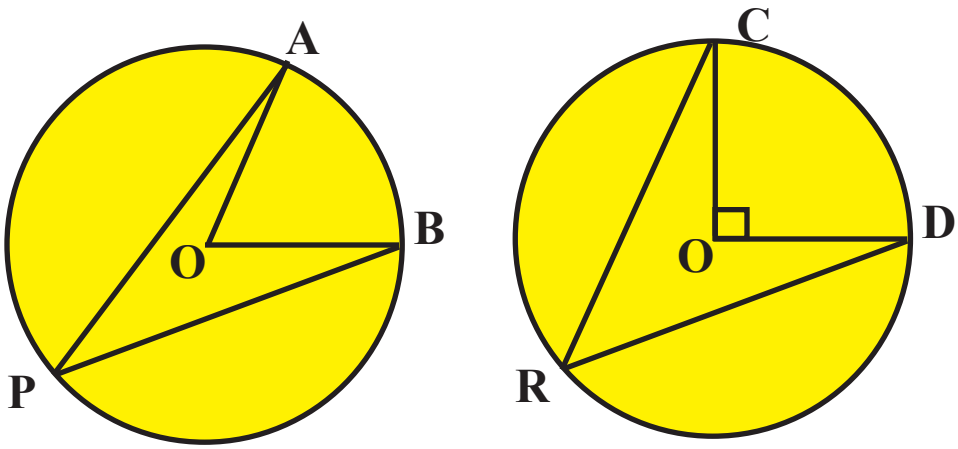
Complete this table by finding the lengths of these line segments or the measurements of these arcs.

Figure	Dimensions
Line Segment OB	1.
Line Segement OC	2.
Arc BC	3.
Arc AC	4.

An arc created by a central angle is equal to the measure of the arc. The measurement of an inscribed angle is one-half the measurement of the arc.

In these figures:

O is the center of the circle
Angle AOB equals 50°
Line OC is perpendicular to OD

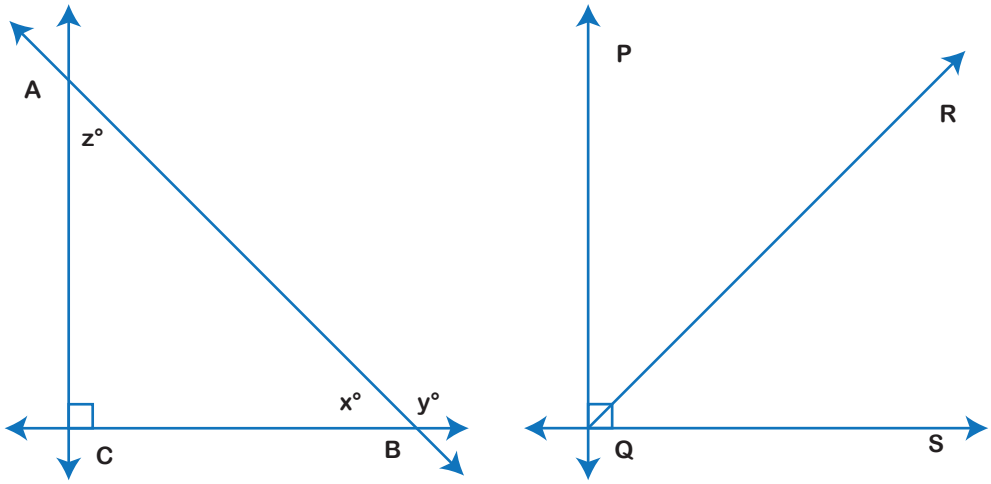


Complete this table by finding the lengths of these angles and arcs.

Figure	Dimensions
Arc AB	5.
Angle APB	6.
Arc APB	7.
Angle CRD	8.

Angles with Special Relationships

Answer these questions after you have completed the unit on Triangles and Angles.



1. If $x = 55°$, then what is y?

2. If $y = 32°$, then what is x?

3. If $x = 60°$ and the sume of all angles in a triangle is $180°$, then what is the measure of angle z?

4. What is the measure of angle y if $x = 57°$?

5. What is the sum of x and y?

6. If x increases by $10°$ what happens to the measurement of angle y?

7. If y and x are equal then what is the value of each?

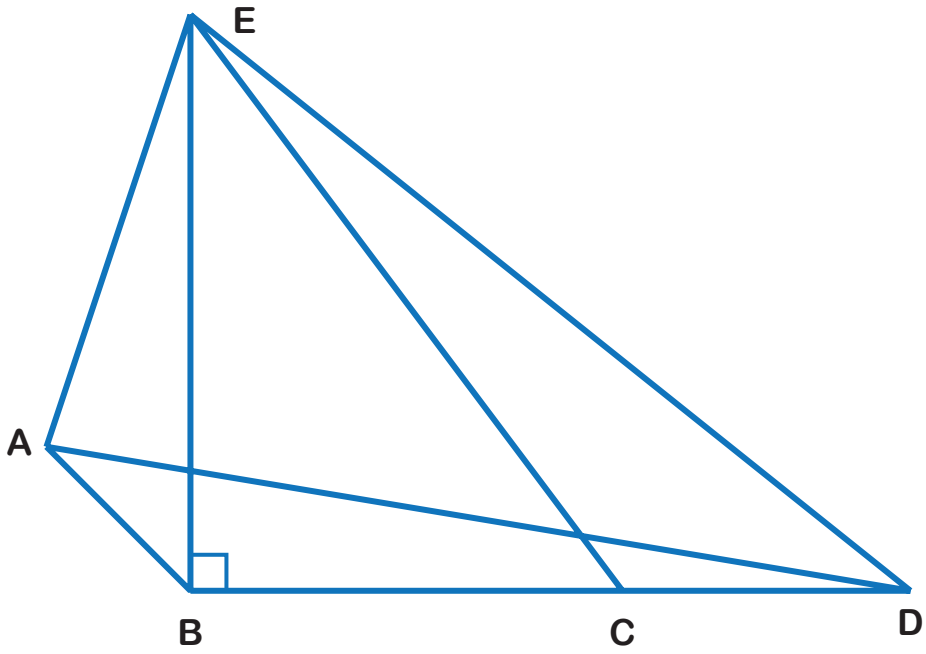
8. What is the sume of angle PQR and RQS?

9. If angle PQR measures $40°$, then what is the measurement of angle PQS?

10. If the measurement of angle PQR equals the measurement of angle PQS then what is the value of each?

Classifying Triangles

Use this figure to identify the triangle given in each exercise. In the space next to the notation for each triangle, write the words: right triangle, acute triangle or obtuse triangle.



Triangle	Classification
ΔABE	1.
ΔEBC	2.
ΔECD	3.
ΔABD	4.

Make a sketch of each type of triangle on the grids shown below. Mark an "A" on all the angles that are acute angles, mark "R" on all the right angles, and mark "O" on the obtuse angles.

Acute Triangle

Right Triangle

Obtuse Triangle

Lines and Planes

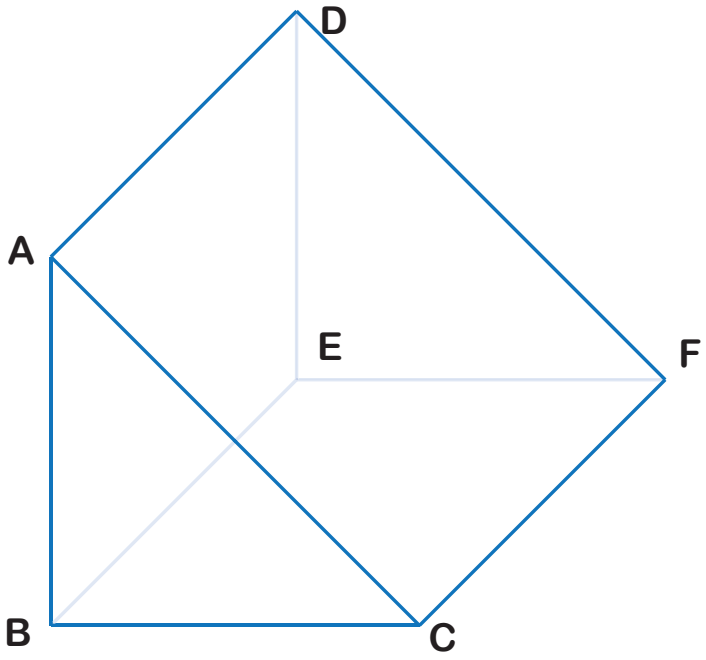
The figure shown below is a triangular prism. It is a three dimensional object with three rectangular sides and two triangular bases. Describe the relationship between each pair of lines given in the chart. Use the words: perpendicular, parallel or skew.

Lines	Relationship
AB & DE	1.
AC & DE	2.
DE & EF	3.
AC & DF	4.
EF & AB	5.

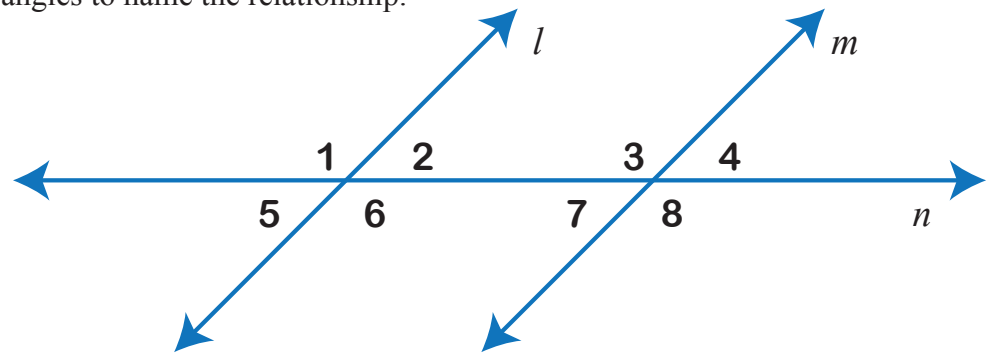
skew

perpendicular

parallel



When a pair of parallel lines are intersected by a transversal eight angles are formed. The angles have special relationships. Draw a line from each pair of angles to name the relationship.



6. ∠1 & ∠2
7. ∠1 & ∠2
8. ∠1 & ∠2
9. ∠1 & ∠2
10. ∠1 & ∠2

corresponding

alternate exterior

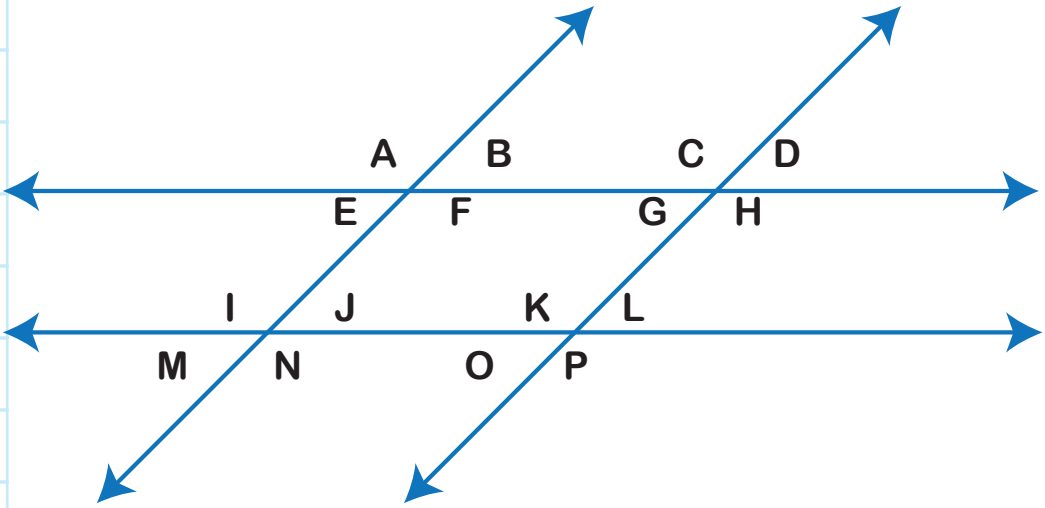
supplementary

vertical

alternate interior

Parallel Lines

This figure shows two pairs of parallel lines that intersect. Determine the measurement of the angles based on the information given. Write the reason in the column on the right.



If $m\angle A = 135°$, then	Reasons
1. $m\angle B =$	
2. $m\angle C =$	
3. $m\angle H =$	

4. If $m\angle J = 60°$, then	Reasons
5. $m\angle O =$	
6. $m\angle I =$	
7. $m\angle L =$	

Answer these questions and explain your reasoning.

8. Name any eight pairs of supplementary angles in the diagram shown above.

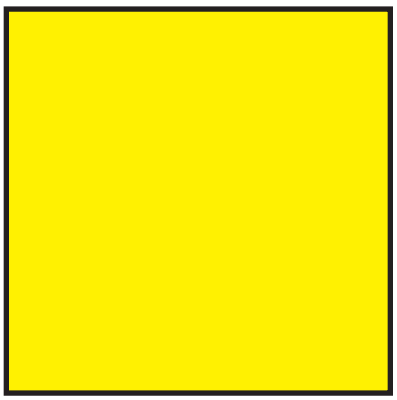
9. Name any four pairs of vertical angles.

10. Name any four pairs of corresponding angles.

Area and Perimeter Problems

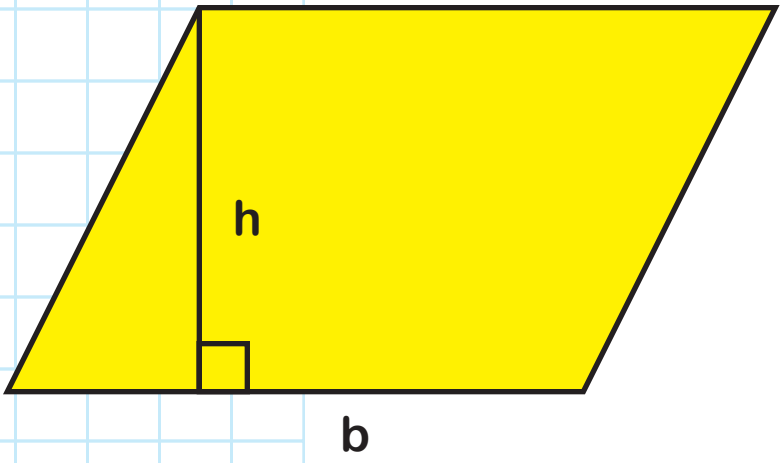
Practice using the formula for finding the area and perimeter of a square by completing this chart.

$$A = s2$$
$$P = 4s$$



area	perimeter	side
1.		8 cm
2.		13 cm
3. 36 cm^2		
4.	100 cm	
5. 81 cm^2		
6.		15 cm

Practice finding the area of a parallelogram by completing this table.



$$A = bh$$

area	base	height
7.	4 cm	12 cm
8.	12 cm	8 cm
9. 40 cm^2		10 cm
10. 50 cm^2	5 cm	
11. 60 cm^2	15 cm	
12.	20 cm	30 cm

13. How many 12 inch square tiles are needed to cover a courtyard that is 5 yards on each side.

14. What is the area of a parallelogram that has a base of 9 cm and a height of 10 meters? _____

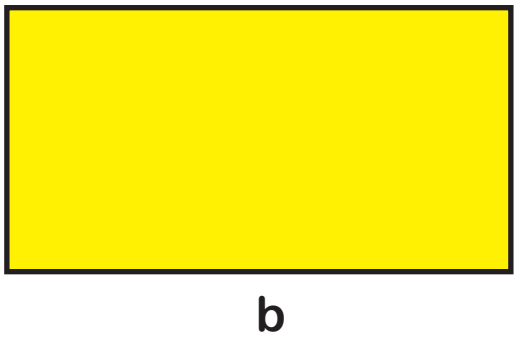
15. Find the area of a parallelogram with a base of 12 cm and a height of 5 cm. _____ What is the area of a triangle with the same dimensions? _____

Area and Perimeter Problems

Complete this chart using the formula for finding the area of a rectangle.

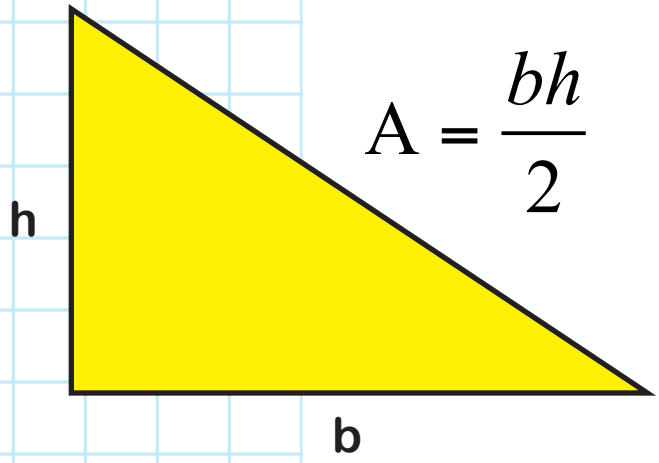
$$A = bh$$

$$P = 2(b+h)$$



Area	Perimeter	Base	Height
1.		5 cm	9 cm
2.		8 cm	7 cm
3. 60 cm^2		10 cm	
4.	100 cm		30 cm
5. 130 cm^2		10 cm	
6. 40 cm^2		10 cm	

Practice finding the area of a triangle by completing this table.



$$A = \frac{bh}{2}$$

Area	Base	Height
7.	8 cm	4 cm
8.	12 cm	3 cm
9. 30 cm^2	10 cm	
10. 50 cm^2		5 cm
11. 60 cm^2	10 cm	
12.	15 cm	30 cm

13. What is the area of a rectangle with a base of 3 meters and a height of 1.5 meters? _____ What is the perimeter? _____

14. The area of a triangle is 30 m^2 and the base is 9 m. What is the height?

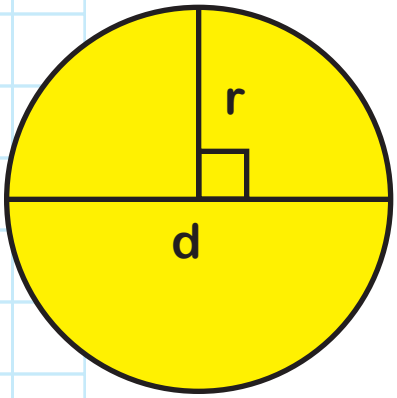
15. Find the area of a rectangle with a base of 12 cm and a height of 6 cm. _____ What is the area of a triangle with the same dimensions.

Area and Circumference Problems

Practice working with the formulas for the area of a circle by completing this chart. Use 3.14 or 22/7 as a value for pi. Round your answer to the nearest tenth.

$$C = \pi d$$

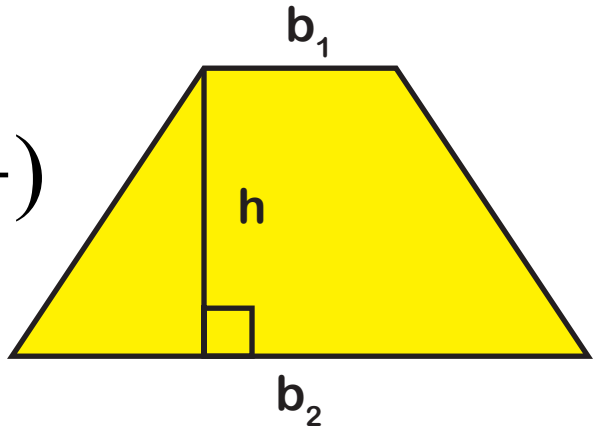
$$A = \pi r^2$$



Area	Circumference	Radius	Diameter
1.		4 cm	
2.		5 cm	
3.			7 cm
4.		7 cm	
5.			9 cm
6.		10 cm	

A trapezoid is a four-sided figure with two parallel sides and two non-parallel sides. The height is the distance between the parallel sides. Find the area of the trapezoids given in the table.

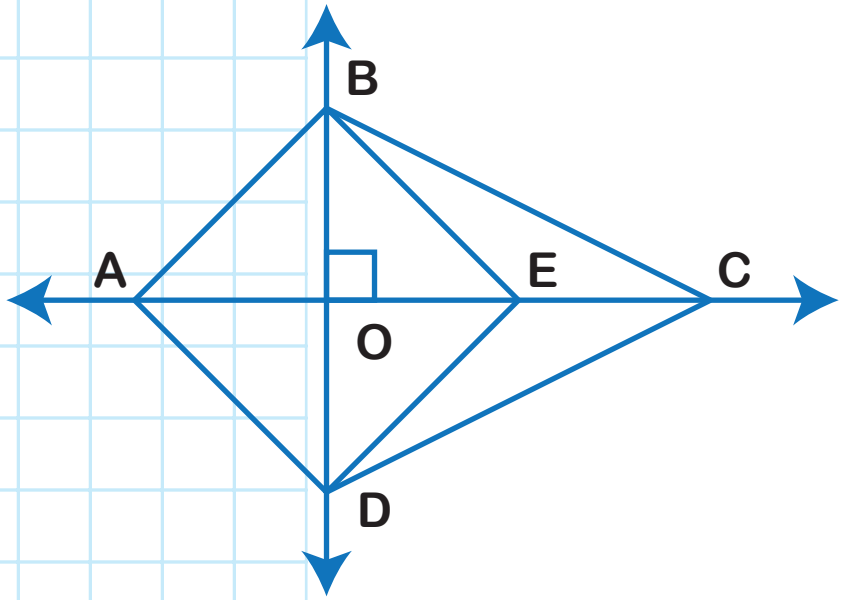
$$A = h\left(\frac{b_1 + b_2}{2}\right)$$



Area	Base 1	Base 2	Height
7.	3 cm	8 cm	4 cm
8.	10 cm	12 cm	3 cm
9.	10 cm	15 cm	10 cm
10.	6 cm	8 cm	5 cm
11.	10 cm	12 cm	6 cm
12.	15 cm	18 cm	30 cm
13.	15 cm	30 cm	30 cm

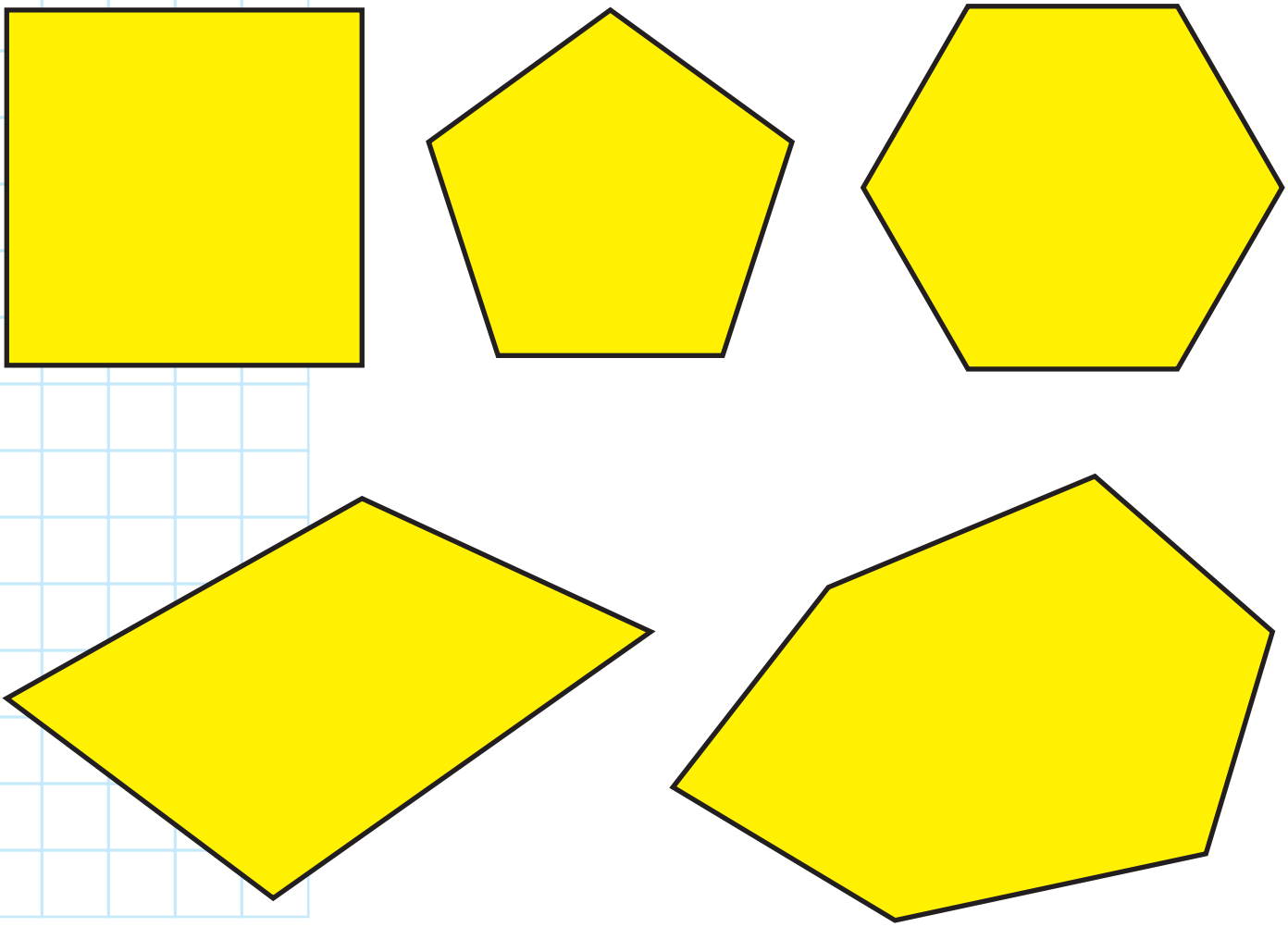
Hypotenuses and Diagonals

Complete the table by naming the hypotenuse for each triangle given.



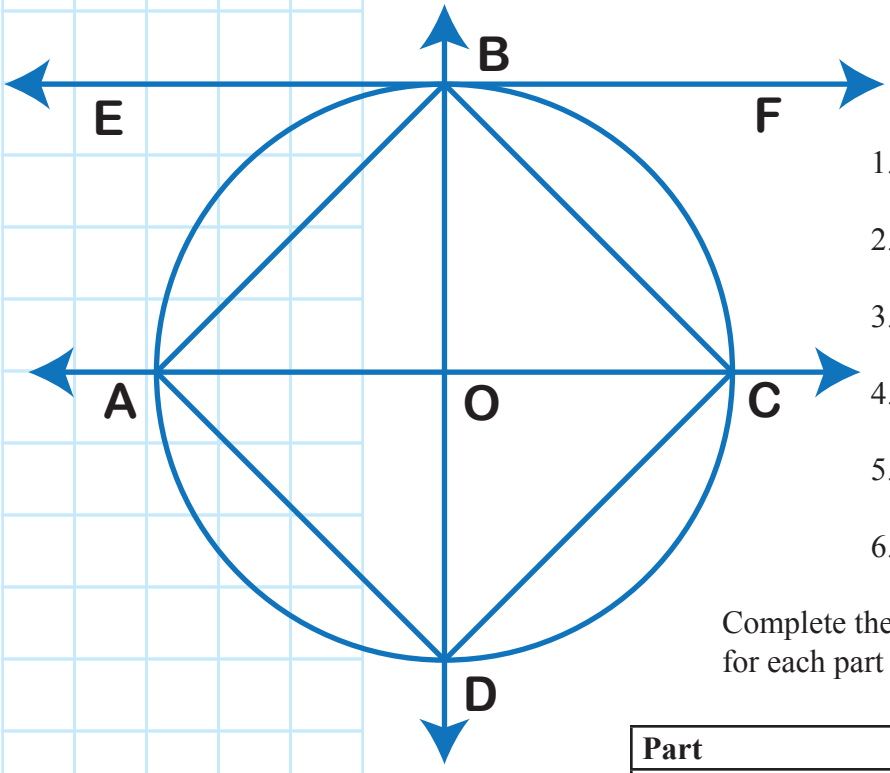
Triangle	Hypotenuse
1. ΔAOB	
2. ΔBOE	
3. ΔBOC	
4. ΔDOE	
5. ΔDOC	
6. ΔDOA	

Copy these shapes on a piece of paper. Use a ruler to draw all the possible diagonals for each of these figures.



Review of Terms

Study the figure. Draw lines to connect a line or line segment given on the left to a phrase on the right.



1. CD	tangent to circle O
2. BC	diameter in circle O
3. OC	hypotenuse in ΔBOC
4. EF	chord in circle O
5. AC	base in ΔBCD
6. BD	radius in circle O

Complete the table by writing the name of the term for each part of the figure.

Part	Name
7. OB in ΔBOC	
8. OC in ΔBOC	
9. BD in □ABCD	
10. OC in circle O	
11. AC in circle O	
12. CD in circle O	

Use the figure and the information given to find the answers. Round your answer to the nearest tenth.

OC = 3.5 cm

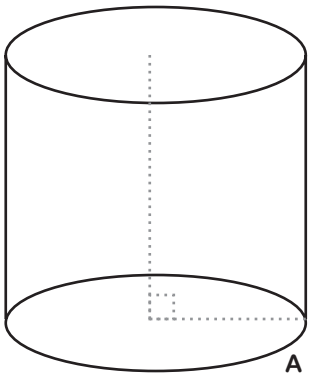
BC = 5 cm

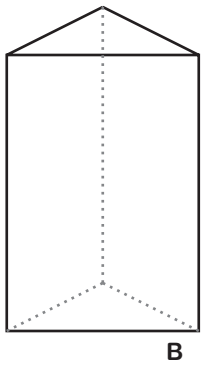
EF || AC

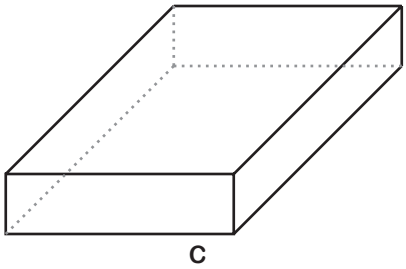
Find	
13. Length of AC	
14. Area of rectangle ABCD	
15. Area of circle O	
16. Measurement of ∠ OBF	

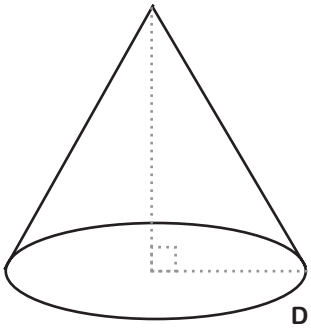
Solid Figures

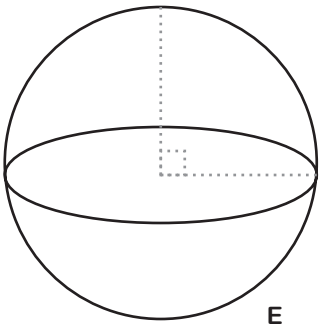
Complete the table by writing the letter of the correct figure in the space next to its name.











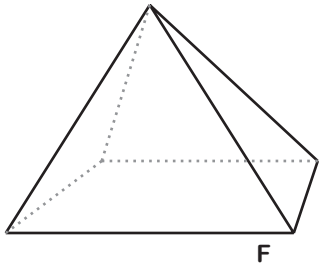
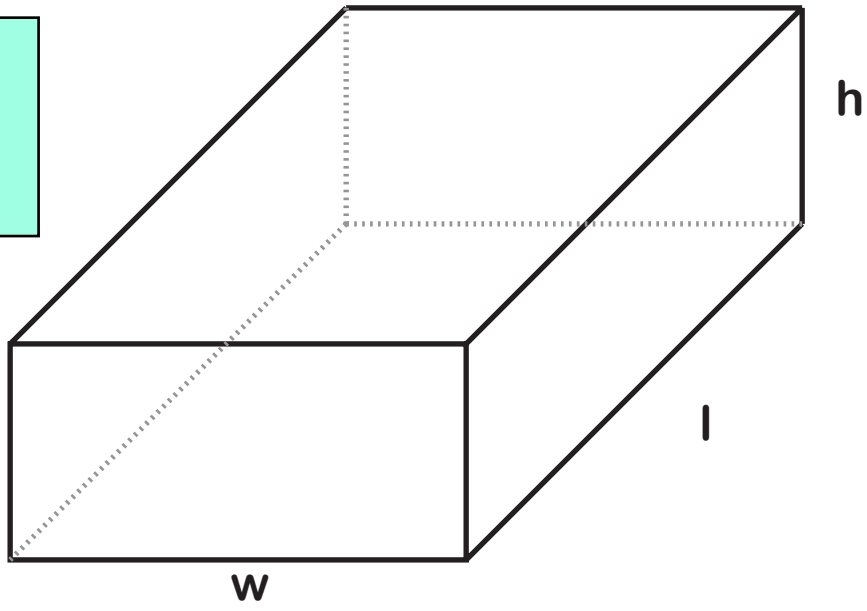


Figure	Letter
circular cylinder	
rectangular cylinder	
regular prism	
sphere	
pyramid	
circular cone	

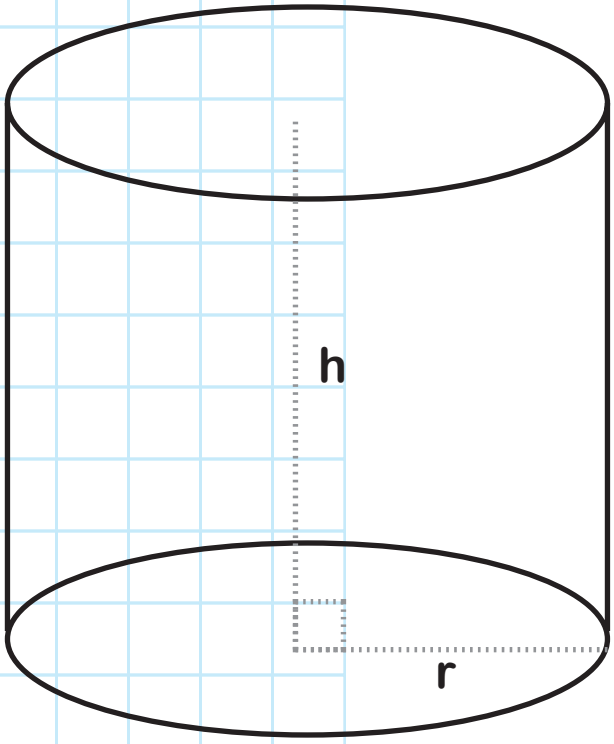
Volume Calculations

Write the formula for finding the volume of each solid in the space provided. Complete the table by finding the volume of each rectangular prism and cylinder.

Formula
1.



	Length	Width	Height	Volume
2.	5 cm	10 cm	3 cm	
3.	4 cm	16 cm	10 cm	
4.	13 cm	8 cm	10 cm	
5.	5 cm	5 cm	5 cm	



Formula
6.

	Radius	Height	Volume
7.	5 cm	10 cm	
8.	4 cm	16 cm	
9.	13 cm	8 cm	
10.	7 cm	5 cm	

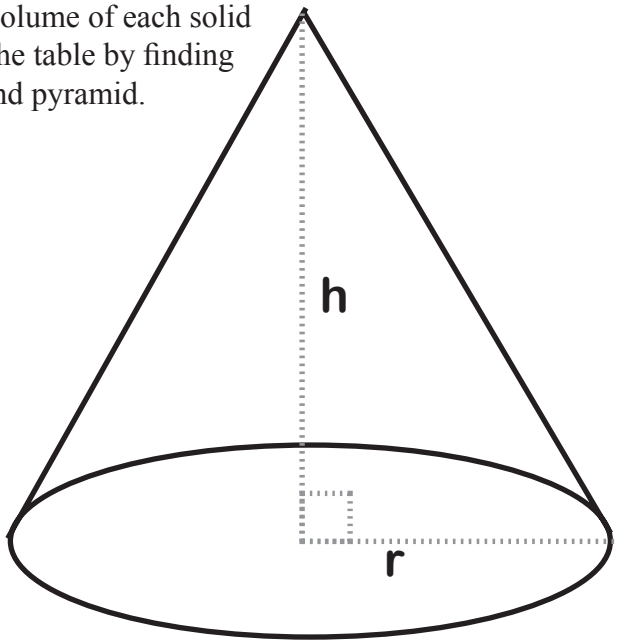
11. A large rectangular storage tank is 20 meters long, 10 meters wide and 10 meters deep. What is the capacity of the tank? _____

12. Calculate the volume of a pyramid that is 2.5 meters high with a square base that is 3 meters on each side. _____

Volume Calculations

Write the formula for finding the volume of each solid in the space provided. Complete the table by finding the volume of each cone, sphere and pyramid.

Formula
1.

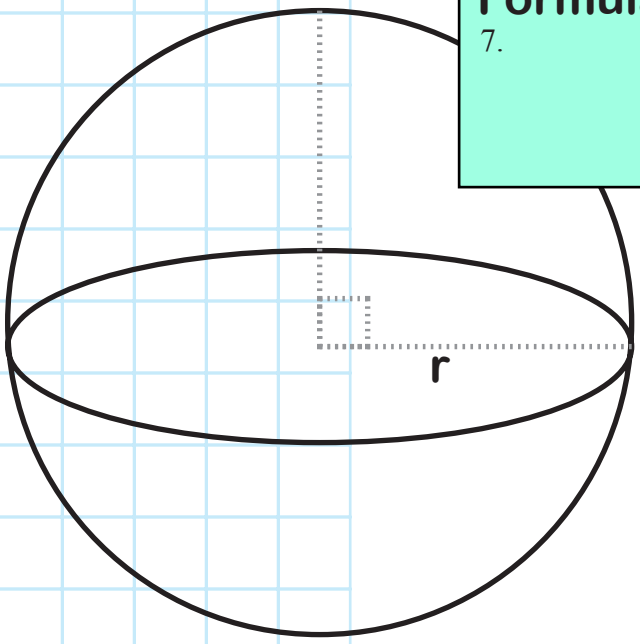


Radius	Height	Volume
2. 15 cm	10 cm	
3. 30 cm	16 cm	
4. 13 cm	12 cm	
5. 5 cm	5 cm	

6. A cylindrical can is 10 cm tall. The diameter is 8 cm. What is the volume?

_____

Formula
7.

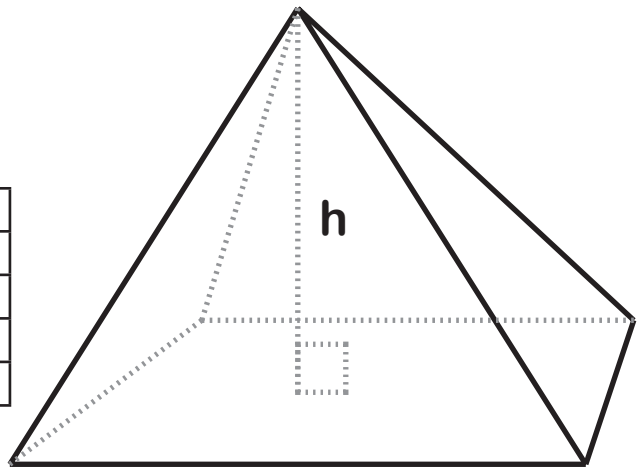


Complete this table by finding the volume of these spheres.

Radius	Volume
8. 12 cm	
9. 21 cm	
10. 9 cm	
11. 3 cm	

Note: *For these problems, all of the pyramids have a base that is a square.*

Formula
12.



Side	Height	Volume
13. 18 cm	10 cm	
14. 6 cm	8 cm	
15. 3 cm	9 cm	
16. 5 cm	5 cm	

Volume Applications

Find the answer to each problem.

1. Billy filled his party hat with jelly beans. The hat is 12 inches high with a diameter of 16 inches. Find the approximate volume of the candy.

2. This giant beach ball has a diameter of 24 inches. What is the volume of the air inside?

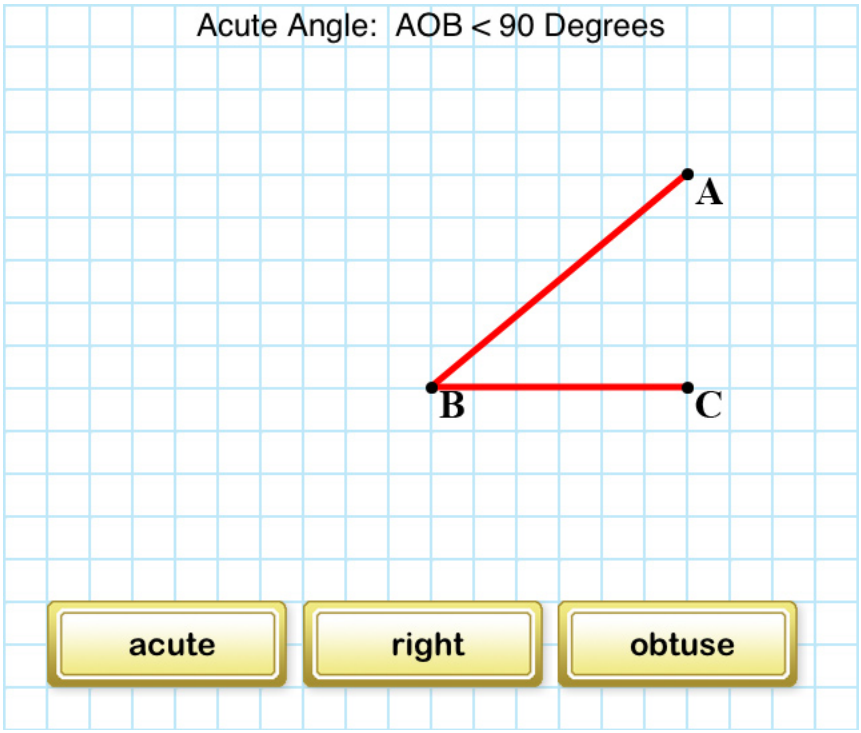
3. An oatmeal box is filled with cereal. The box is 7 inches high with a diameter of 5 inches. What is the volume of cereal?

4. An archeologist discovered an ancient pyramid. It is 100 feet high with a square base of 100 feet on each side. What is the volume?

5. Mary's tent is 5 feet high with a square base of 7 feet on each side. What is the volume of the interior?

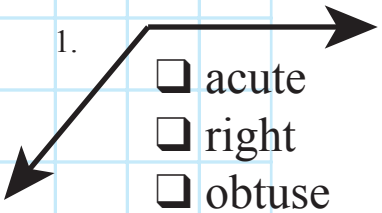
Classifying Angles

Choose the Angles Exploration Tool. Tap the buttons to see an example of an acute, right or obtuse angle.



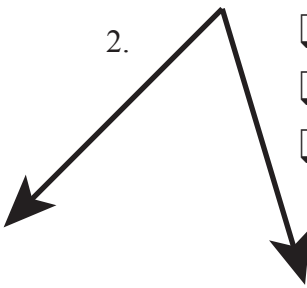
Estimate the size of each angle. Check a box to classify the angle.

1.



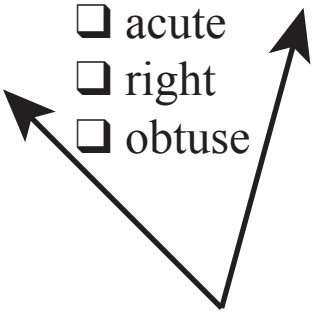
❑ acute
❑ right
❑ obtuse

2.



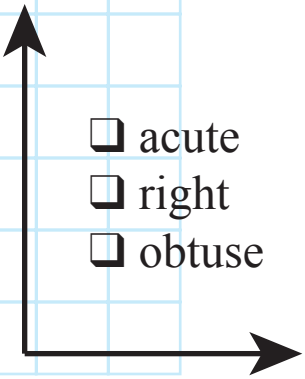
❑ acute
❑ right
❑ obtuse

3.



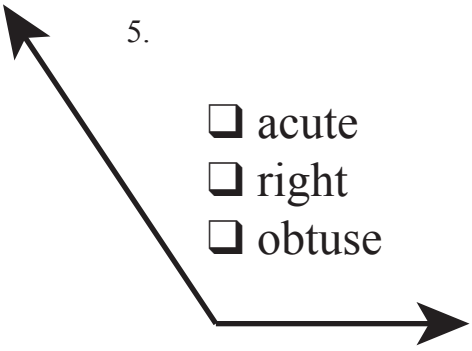
❑ acute
❑ right
❑ obtuse

4.



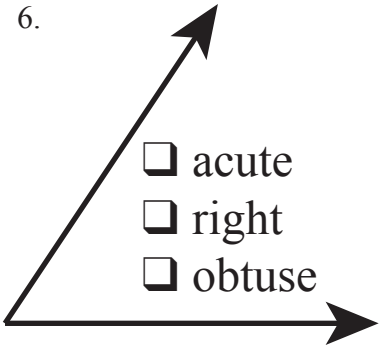
❑ acute
❑ right
❑ obtuse

5.



❑ acute
❑ right
❑ obtuse

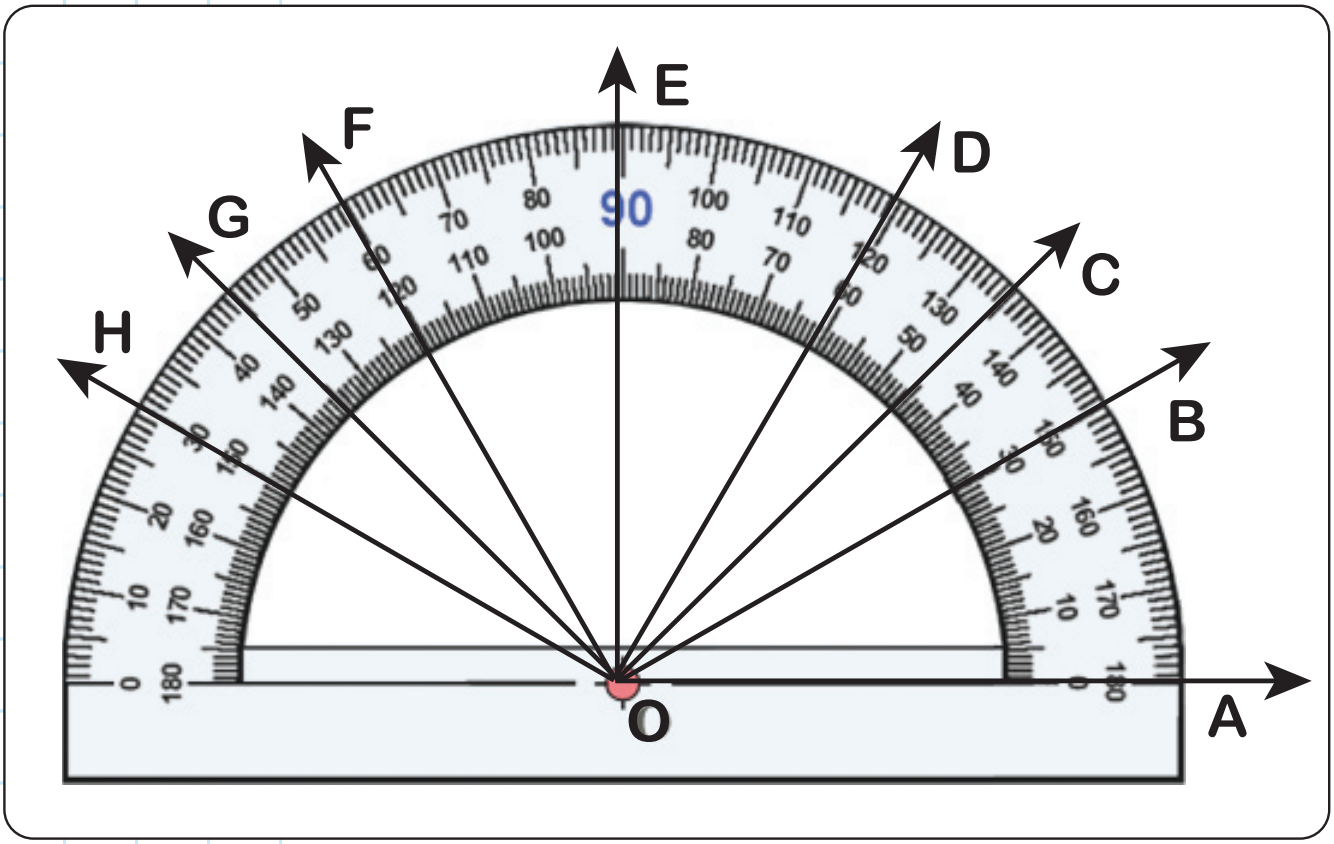
6.



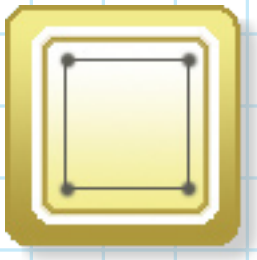
❑ acute
❑ right
❑ obtuse

Classifying Angles

Choose the Measuring Angles Exploration Tool. Tap points A-H to change the angle. Practice reading the measure of an angle using the protractor. Write the measurement of each angle given below.



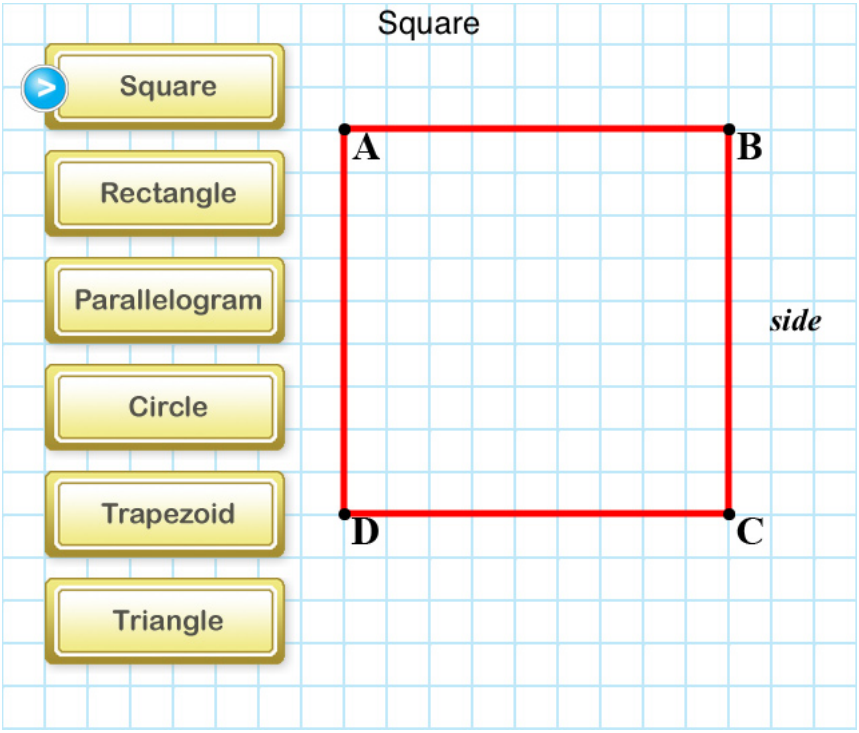
1. $m\angle GOA =$ _____
2. $m\angle EOA =$ _____
3. $m\angle DOA =$ _____
4. $m\angle COA =$ _____
5. $m\angle BOA =$ _____
6. $m\angle FOA =$ _____



more info

Perimeter Exploration

Choose the Perimeter Exploration Tool. Tap the buttons to see an example of each figure. Tap the "more info" button to find the formula for calculating the perimeter of each figure.

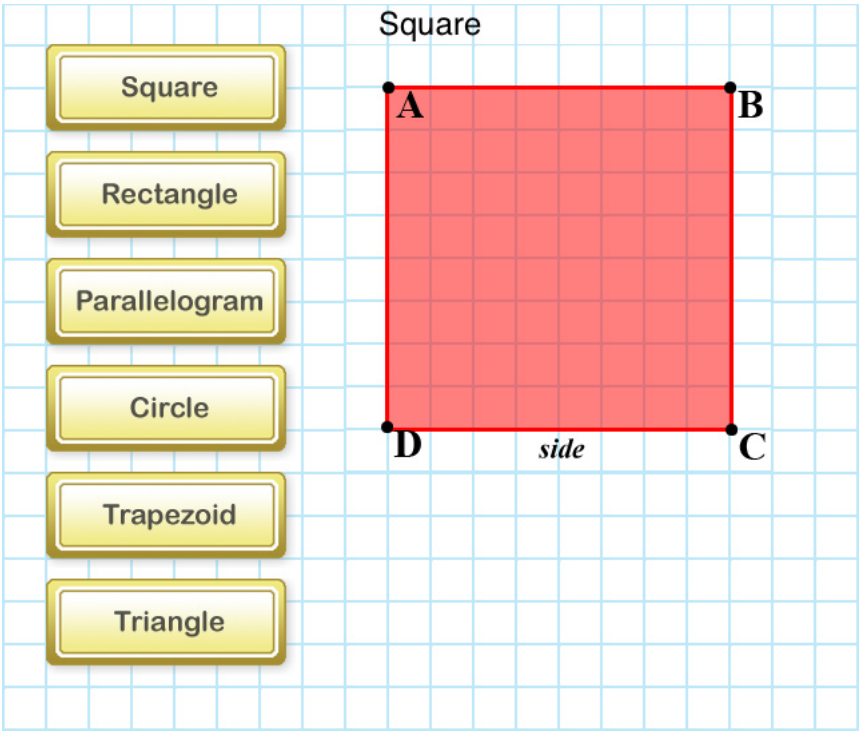


Use the Perimeter Exploration Tool to help you complete this table. Remember, the distance around a circle is called the circumference.

	Shape	Name	Formula
1.			
2.			
3.			
4.			

Perimeter Exploration

Choose the Area Exploration Tool. Tap the buttons to see an example of each figure. Tap the "more info" button to find the formula for calculating the perimeter of each figure.



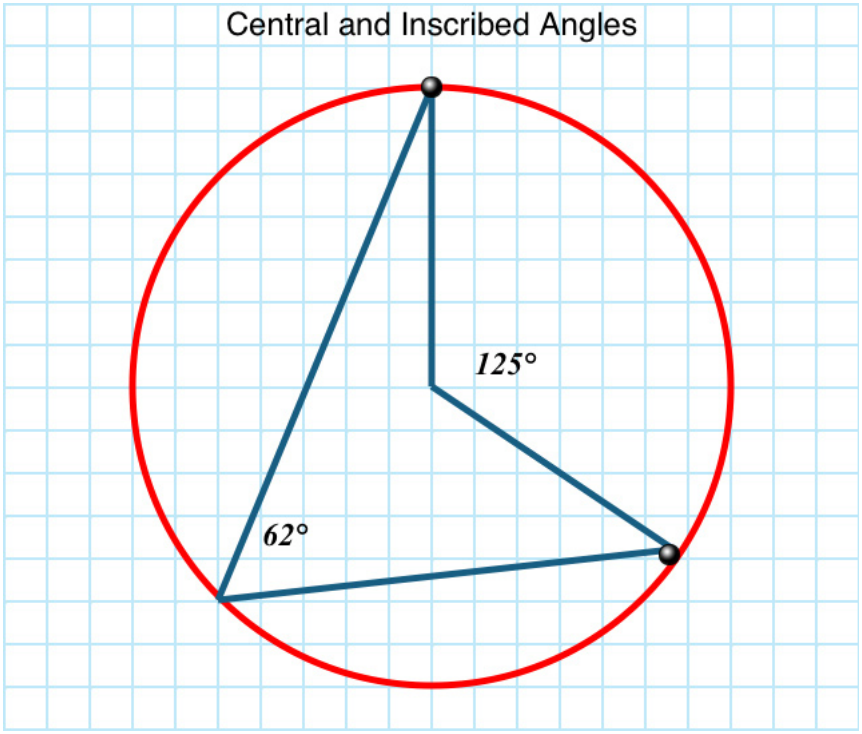
Use the Area Exploration Tool to help you complete this table. Remember, for calculations the value of 3.14 is often used for pi.

	Shape	Name	Formula
1.			
2.			
3.			
4.			

Central and Inscribed Angles

Choose Central and Inscribed Angles from the Exploration Tools menu. Drag one of the points to increase or decrease the size of the arc. Notice that as the arc changes, the measurements of the central and inscribed angles also change.

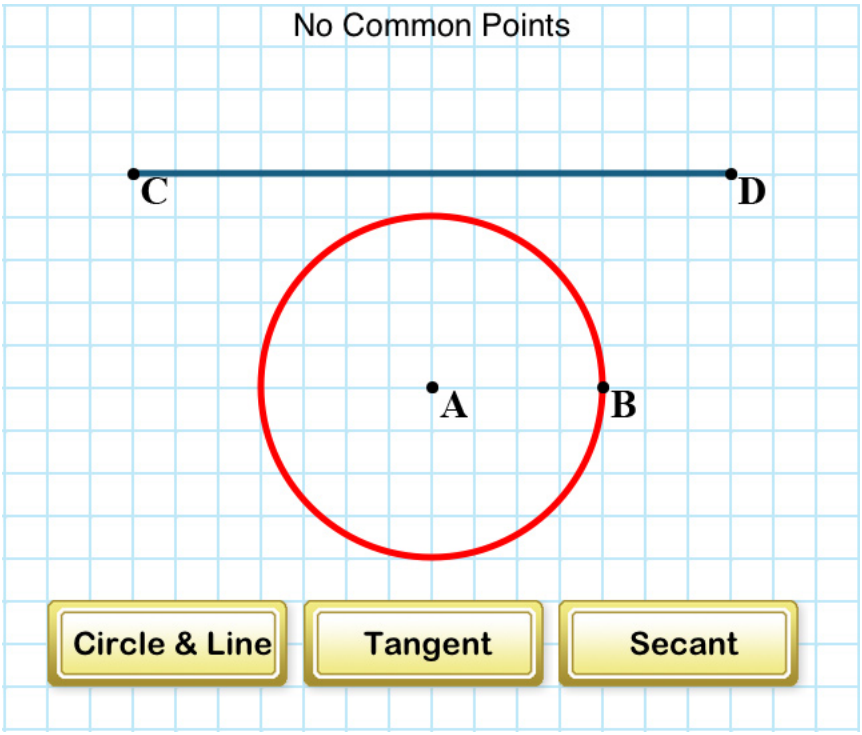
Use this exploration to complete the table.



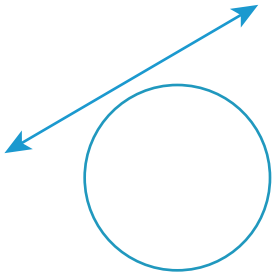
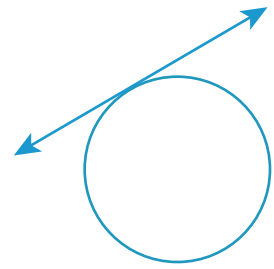
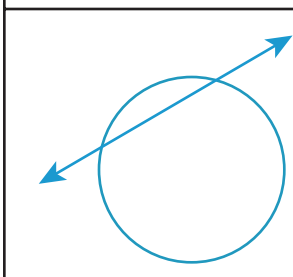
	Central Angle	Inscribed Angle
1.	50°	
2.		30°
3.	120°	
4.	100°	
5.		55°
6.	46°	
7.		15°

Circles and Lines

Choose Circles and Lines from the Exploration Tools menu. Tap the buttons to see examples of each possible condition for a circle and a line.

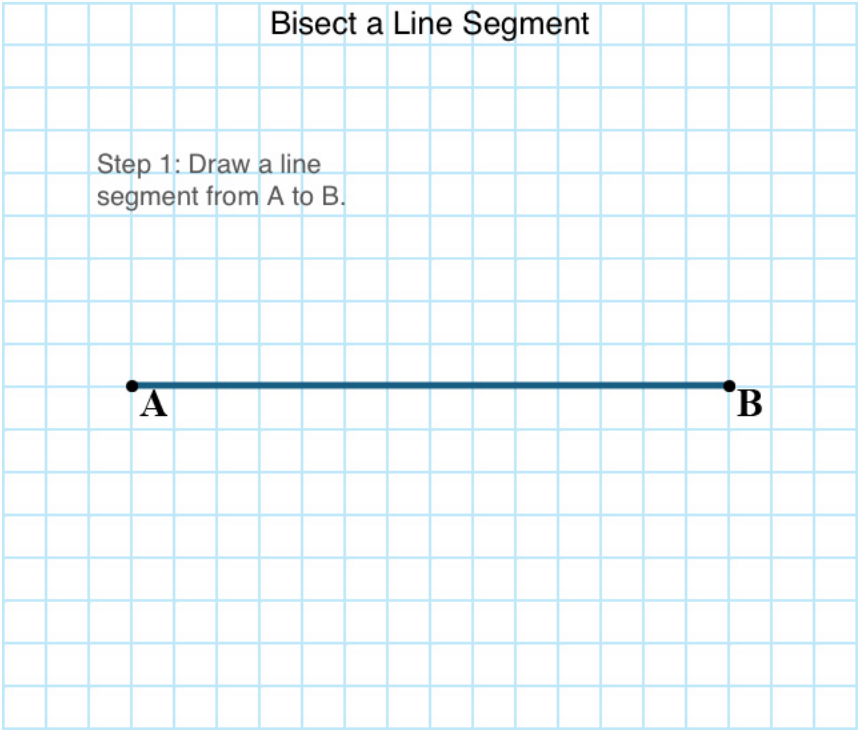


Write a term or phrase to complete the table.

Constructions

Choose Constructions from the Exploration Tools menu. Follow the step-by-step instructions for each construction. Swipe from right to left to step through the construction.



In this project you will use a ruler and a compass to perform five geometric constructions.

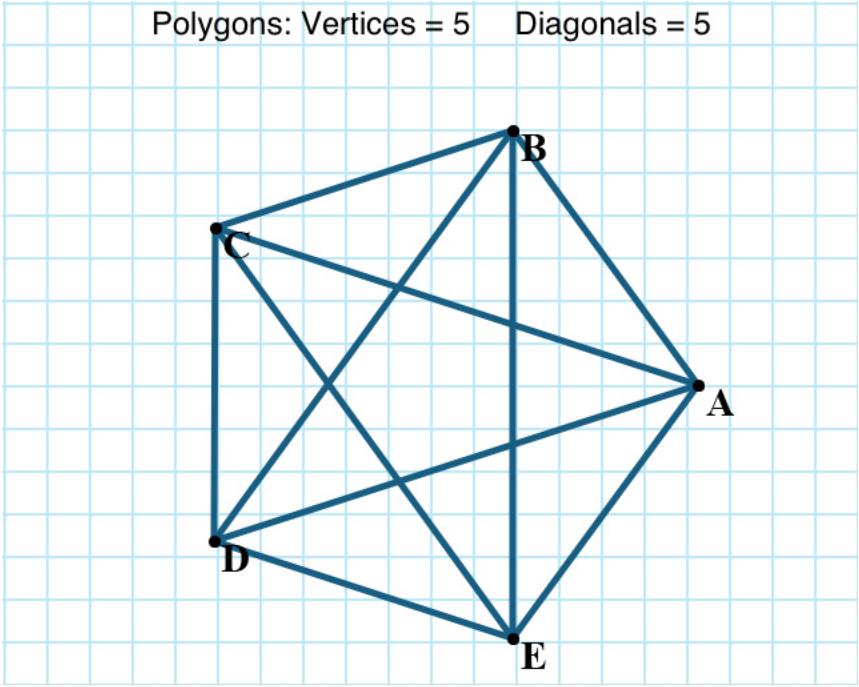
Use the Constructions Exploration Tool as your guide. Follow the instructions on the screen.

Carefully perform each step and remember that neatness and accuracy are important.

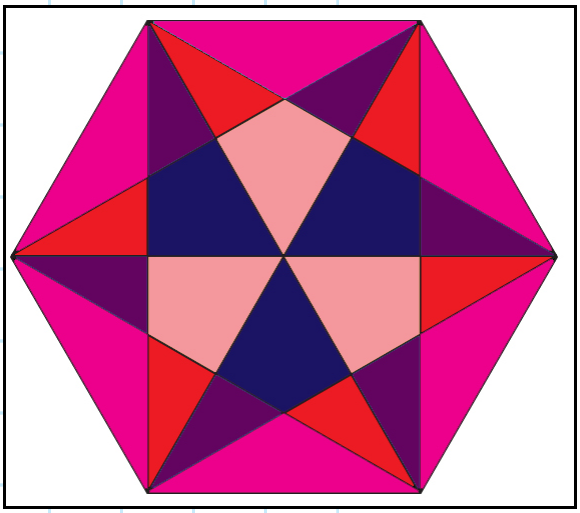
Take your time and enjoy the beauty and art of each geometric construction.

Polygons, Vertices and Diagonals

Choose Polygons, Vertices and Diagonals from the Exploration Tools menu. Complete the table to show the number of vertices and diagonals for each polygon. Use the slider control to increase or decrease the number of vertices.



Polygon Sides	Vertices	Diagonals
4	4	2
5	5	
6	6	
7	7	
8	8	
9	9	
10	10	
11	11	
12	12	

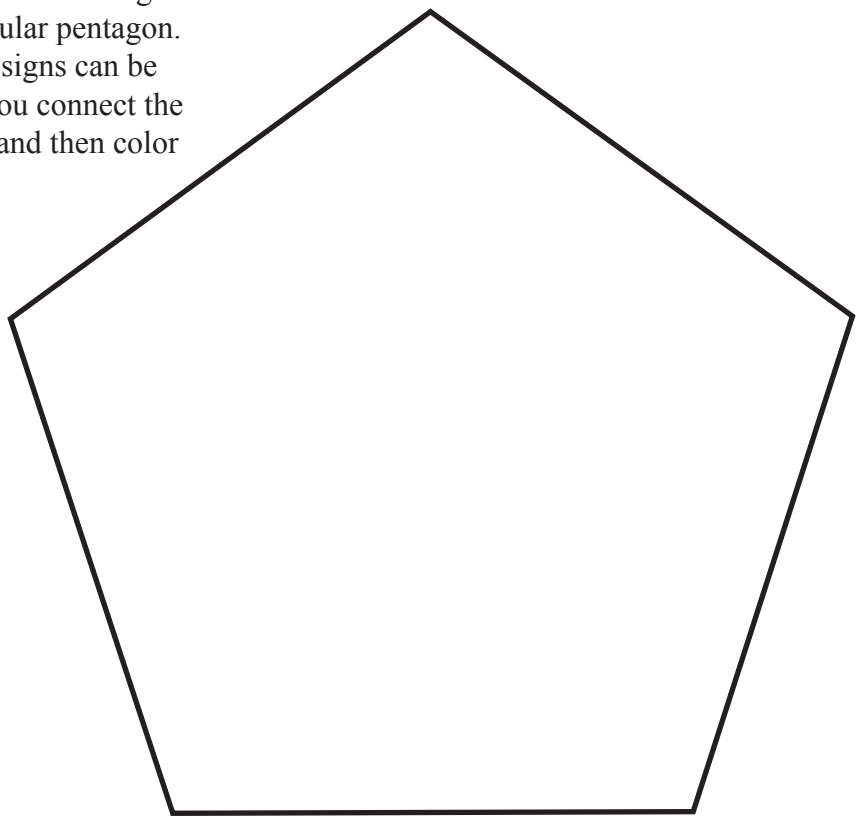


Designs with Diagonals

Use a ruler to make designs using the polygons on the next 4 pages. Interesting designs can be produced if you connect the intersections and then color the design.

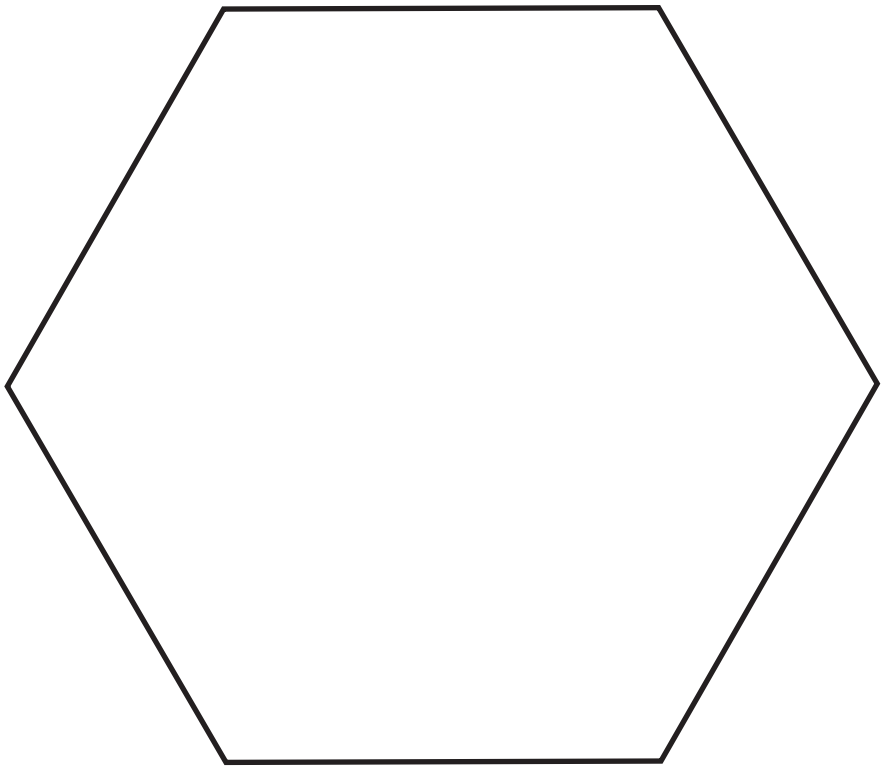
Pentagon

Use a ruler to make designs using this regular pentagon. Interesting designs can be produced if you connect the intersections and then color the design.



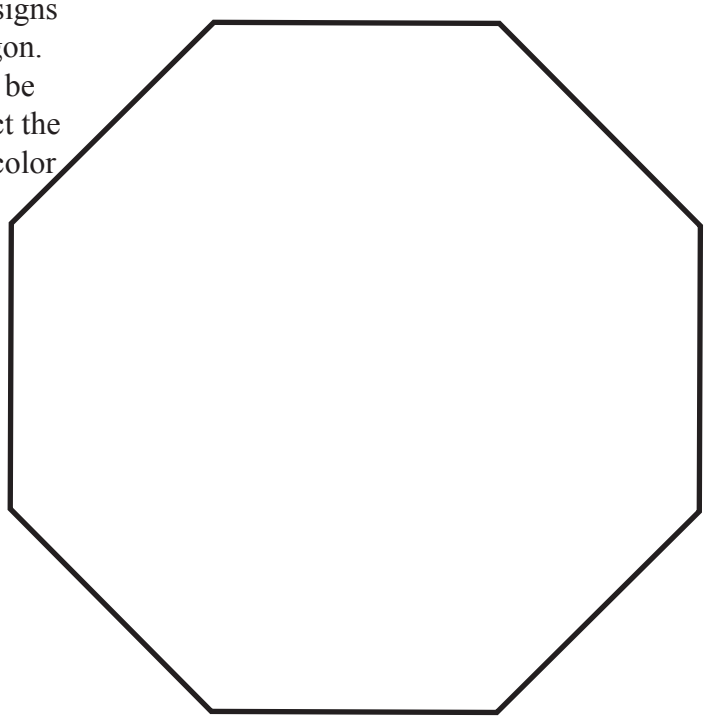
Hexagon

Use a ruler to make designs using this regular hexagon. Interesting designs can be produced if you connect the intersections and then color the design.



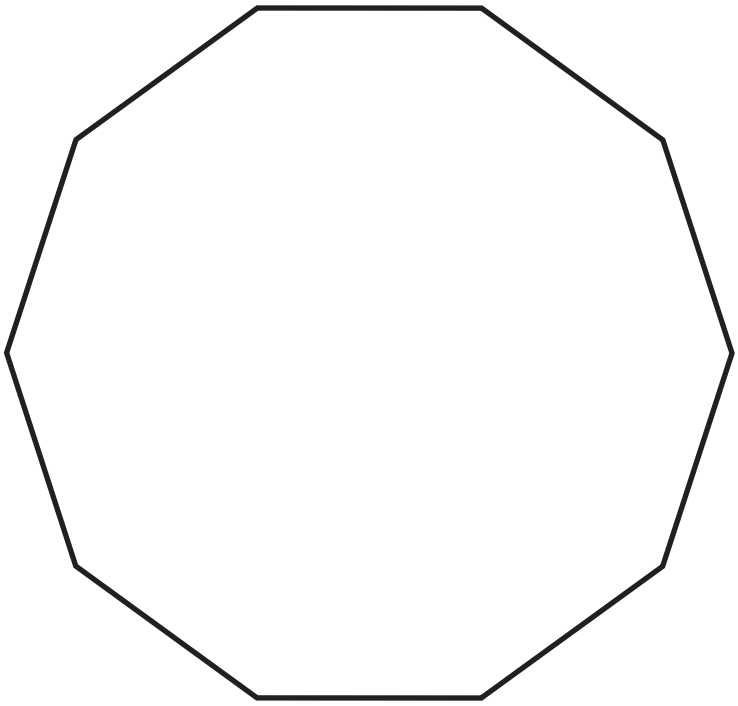
Octagon

Use a ruler to make designs using this regular octagon. Interesting designs can be produced if you connect the intersections and then color the design.



Decagon

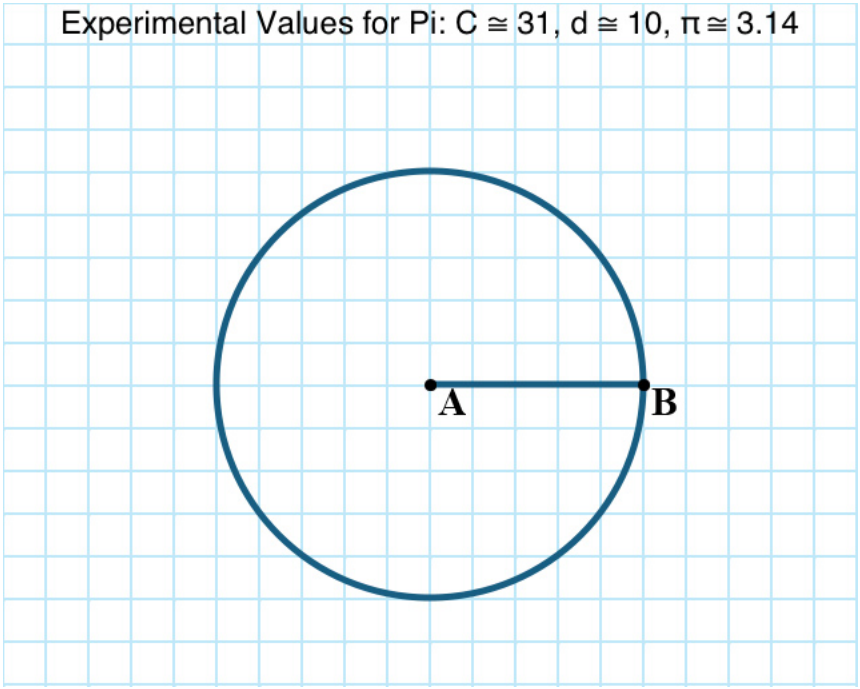
Use a ruler to make designs using this regular decagon. Interesting designs can be produced if you connect the intersections and then color the design.



3.14159265
3589793238
4626433832
7950288419
7169399375
1058209749
4459230781
6406286208
9986280348
2534211706
79...

An Experimental Value for Pi

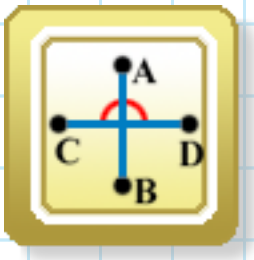
Choose the Experimental Value for Pi from the Exploration Tools menu. Pi is the ratio of the circumference of a circle to the diameter. This activity simulates measuring the circumference and diameter of a circular object. All measurements are an approximation. Based on a measurement an experimental value for pi is calculated.



Use the slider to increase or decrease the radius. Perform the experiment 10 times and record the data in a table.

Trial	Circumference	Diameter	Value for Pi
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total			

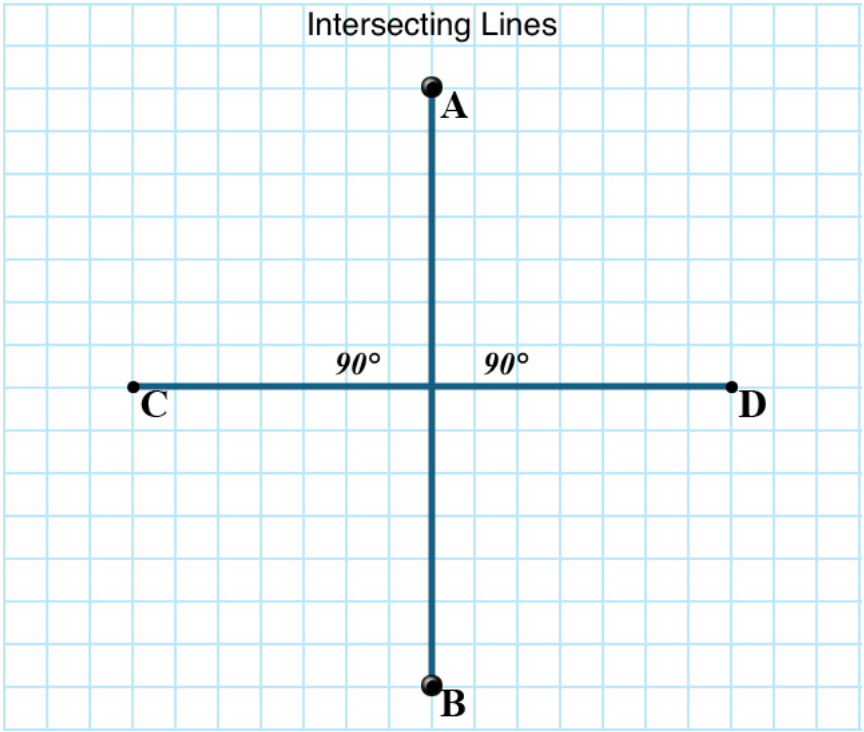
Add the values for pi and record the average. _____. Shown in the column on the left are the first 100 digits of pi. How close is your experimental value for pi to this number? _____



Intersecting Lines

When two lines intersect pairs of vertical and supplementary angles are formed. In this example these pairs of vertical angles are congruent. The center of the circle is point O.

∠AOD ∠BOD ∠COB ∠AOC



Experiment with the intersecting lines exploration and then complete these charts by filling in the missing measurements.

1.

Angle	Measurement
∠AOD	109°
∠BOD	
∠COB	
∠AOC	

2.

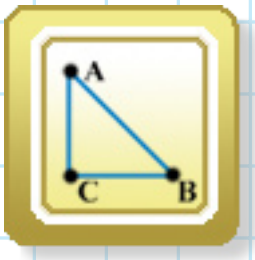
Angle	Measurement
∠AOD	
∠BOD	
∠COB	
∠AOC	52°

3.

Angle	Measurement
∠AOD	
∠BOD	
∠COB	64°
∠AOC	

4.

Angle	Measurement
∠AOD	
∠BOD	135°
∠COB	
∠AOC	

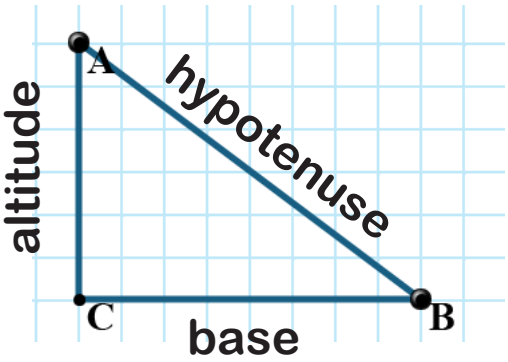


Applying the Pythagorean Theorem

The Pythagorean Theorem can be used to find a missing side of a right triangle. It is used in architecture, navigation and engineering.

Use the Right Triangle Exploration Tool to study this special relationship. This formula is used to express the relationship between the sides of a right triangle. Use the formula to calculate the hypotenuse of a right triangle. Check your work using the Right Triangle Exploration Tool.

AC is the altitude and represented by *a* in the formula. CB is the base and represent by *b* in the formula. The hyptenuse (AB) is represented by *c* in the formula.



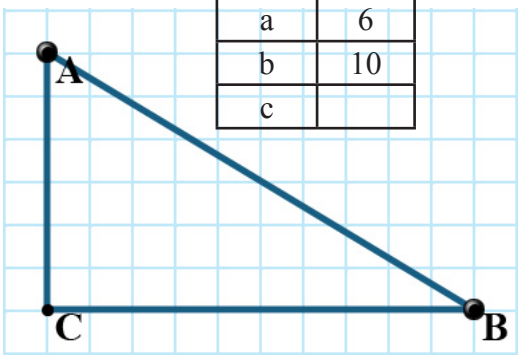
$$c^2 = a^2 + b^2$$

$$c = \sqrt{a^2 + b^2}$$

Complete each table by finding the missing value.

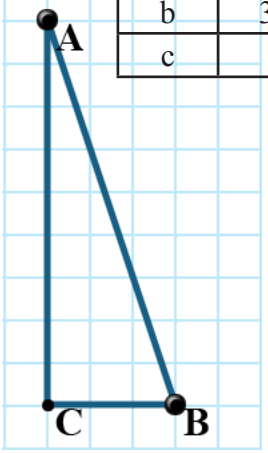
1.

side	value
a	6
b	10
c	



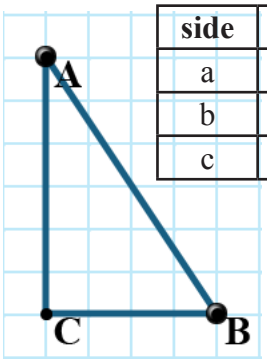
2.

side	value
a	9
b	3
c	



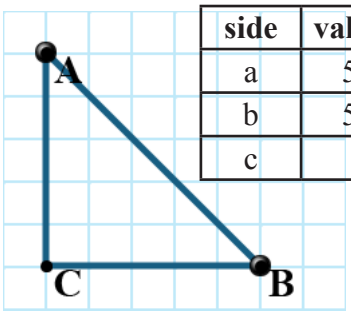
3.

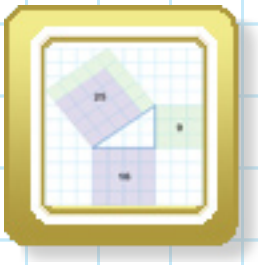
side	value
a	6
b	4
c	



4.

side	value
a	5
b	5
c	

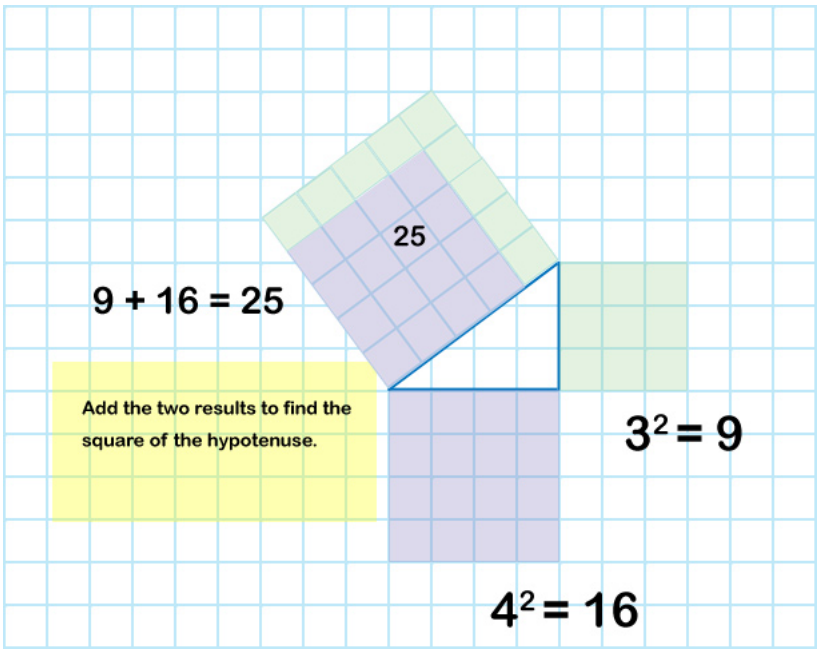




Exploring the Pythagorean Theorem

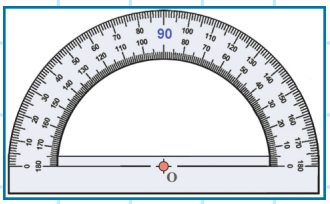
There are many proofs of the Pythagorean Theorem. Choose the Pythagorean Theorem from the Exploration Tools menu. Step through the lesson to see a demonstration of how the square of side *a* plus the square of side *b* is equal to the square of side *c*.

$$c^2 = a^2 + b^2$$



A value for *c* can be found by taking the square root of boths sides of the equation.

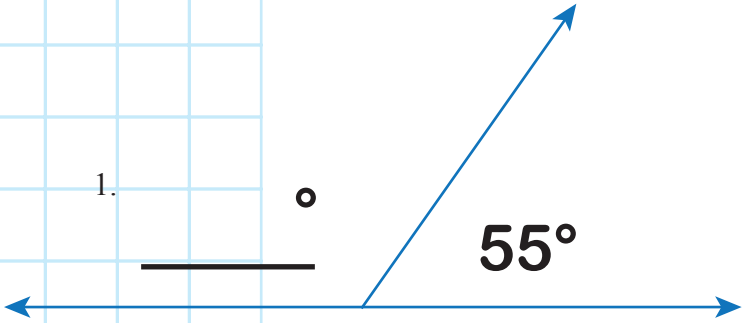
$$c = \sqrt{a^2 + b^2}$$



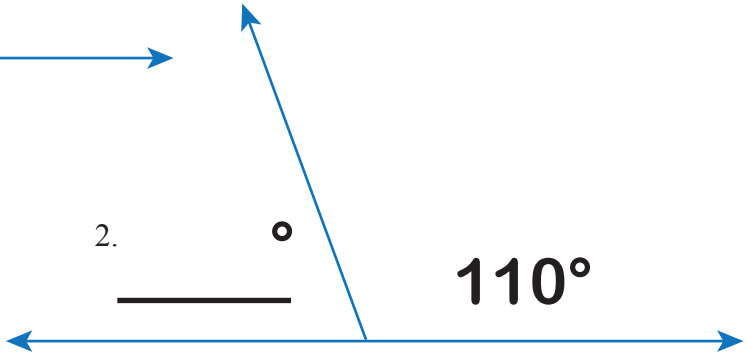
Supplementary Angles

The sum of two supplementary angles is 180°. Each figure shows a pair of supplementary angles. The measurement of one angle is given. Find the missing measurement.

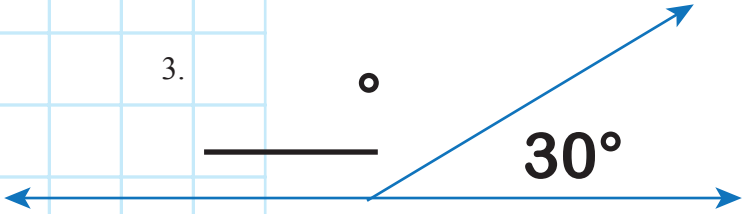
1. ____°



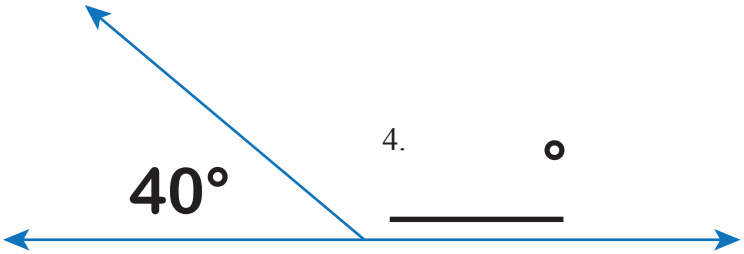
2. ____°



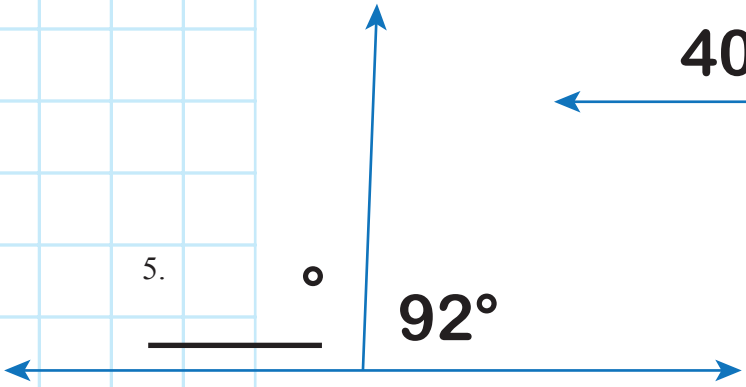
3. ____°



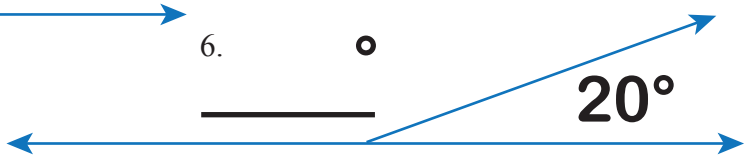
4. ____°

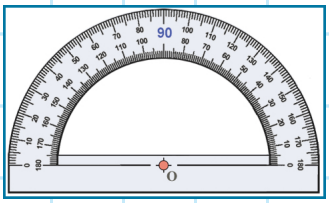


5. ____°



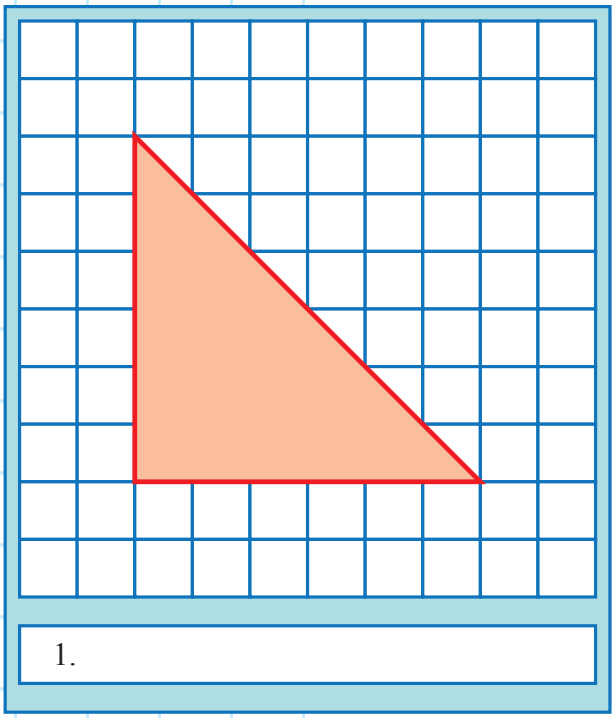
6. ____°



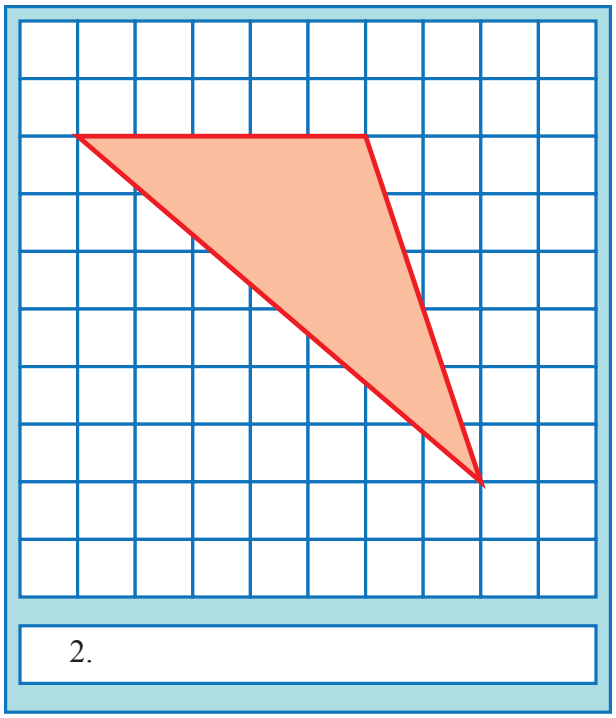


Classifying Triangles by Angles

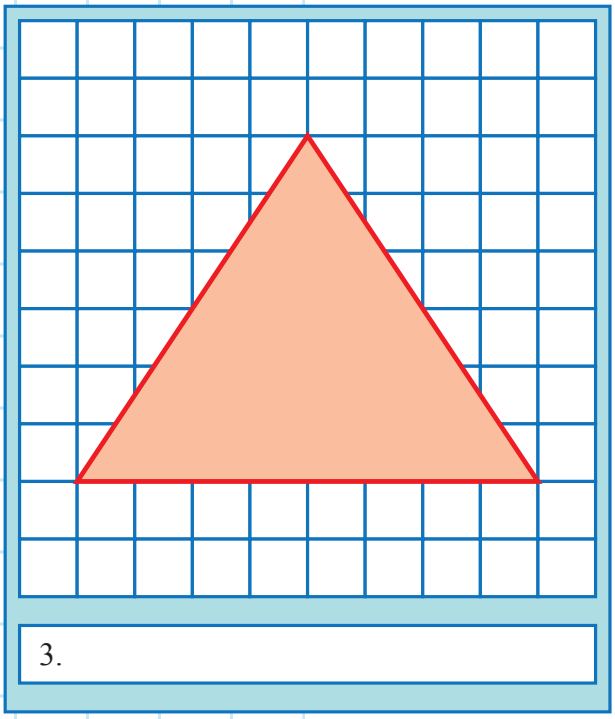
When all three angles in a triangle are less than 90°, the triangle is an acute triangle. If one angle is a right angle, the triangle is a right triangle. If one angle is greater than 90°, the triangle is obtuse triangle. Write acute, right or obtuse to describe these triangles.



1.



2.



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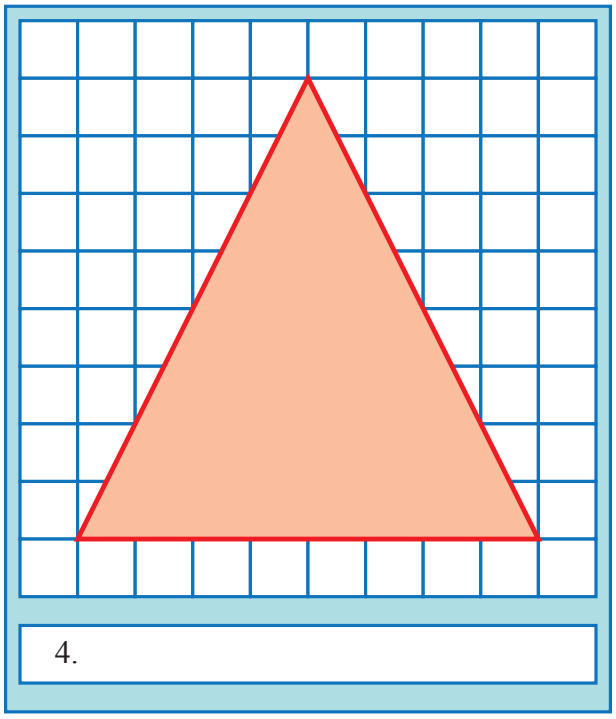

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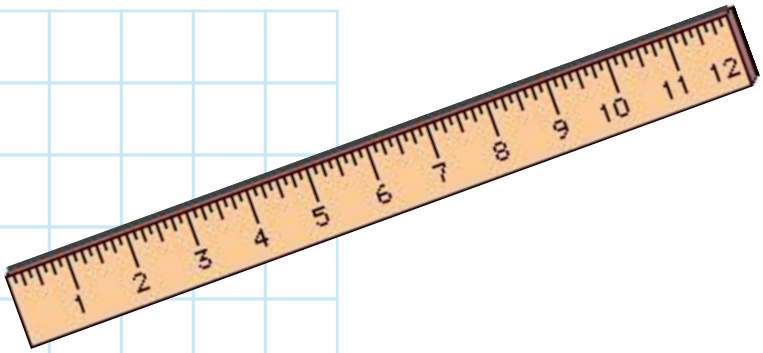
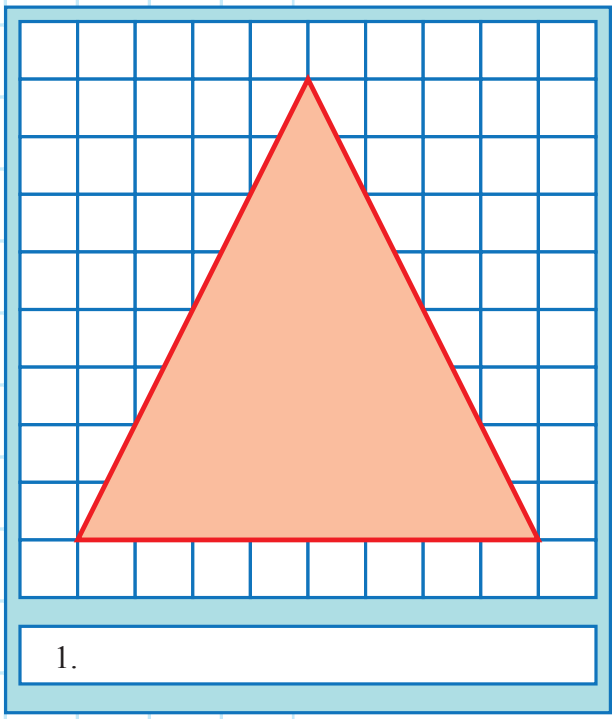
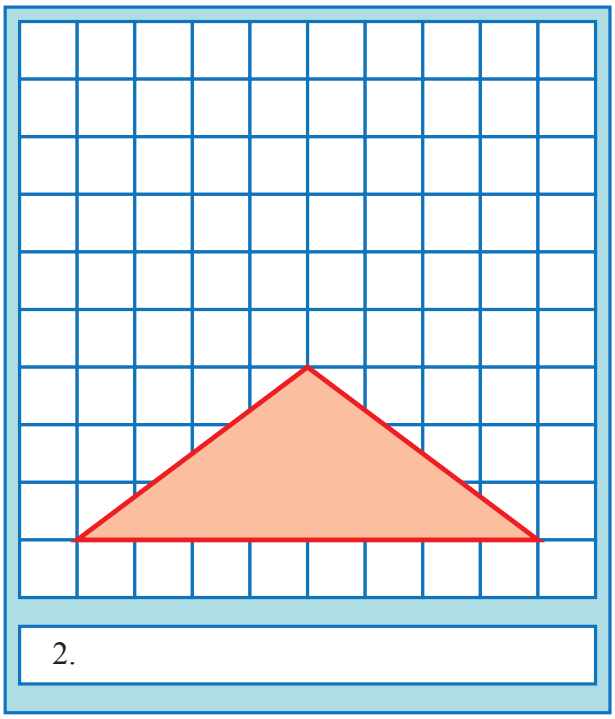


Classifying Triangles by Sides

When all three sides in a triangle are equal, the triangle is an equilateral triangle. If two sides of the triangle are the same, then the triangle is an isosceles triangle. If all three sides are different lengths, then the triangle is a scalene triangle. Write equilateral, isosceles or scalene to describe these triangles.



1.



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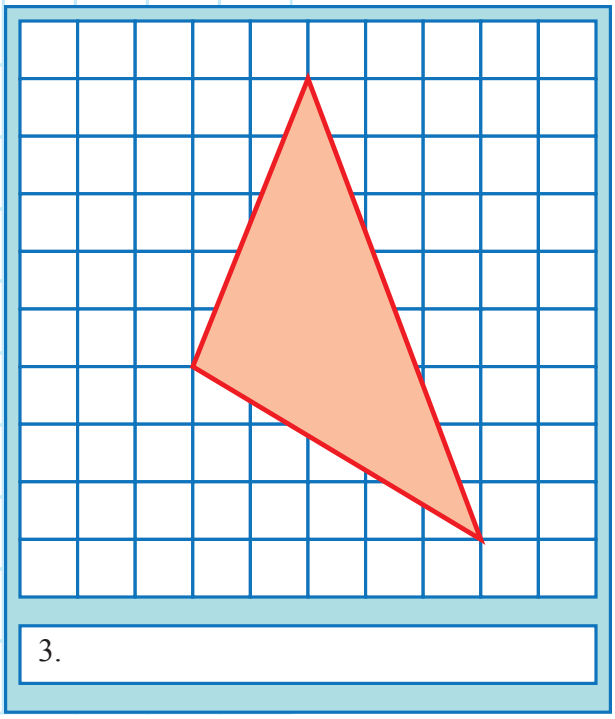

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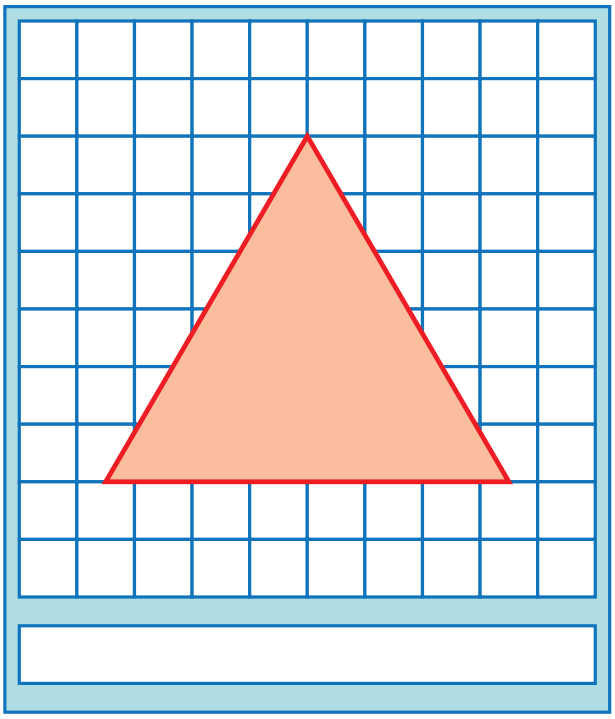
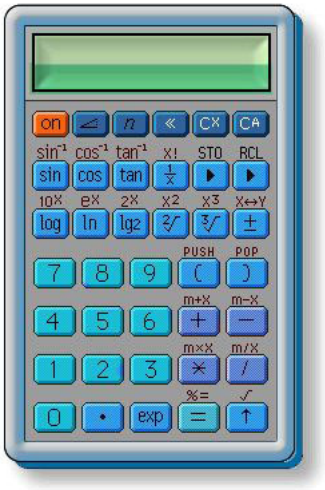


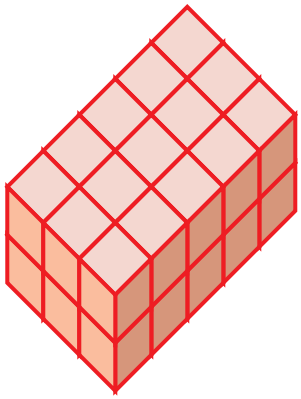


Understanding Volume

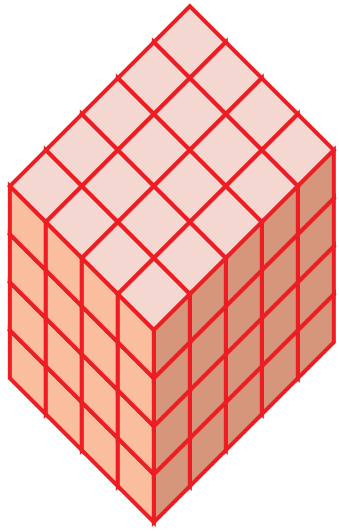
Volume can be defined as the amount of space that an object occupies. The volume of a rectangular prism can be found by multiplies the length times the width times the height.

$$V = lwh$$

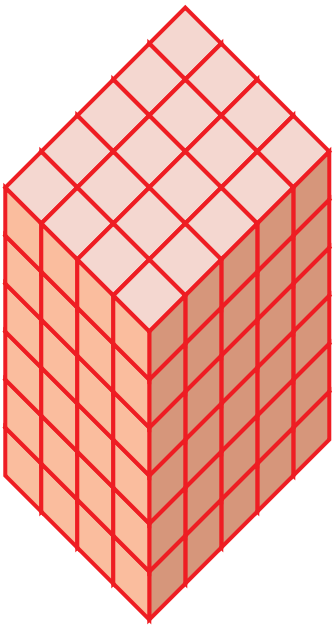
Find the volume of each figure.



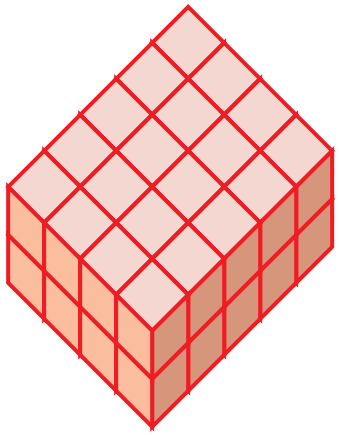
1. _____



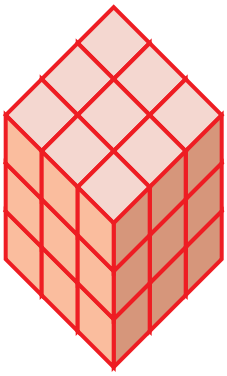
2. _____



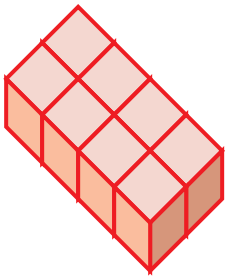
3. _____



4. _____



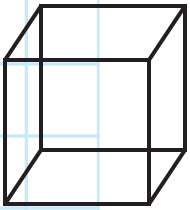
5. _____

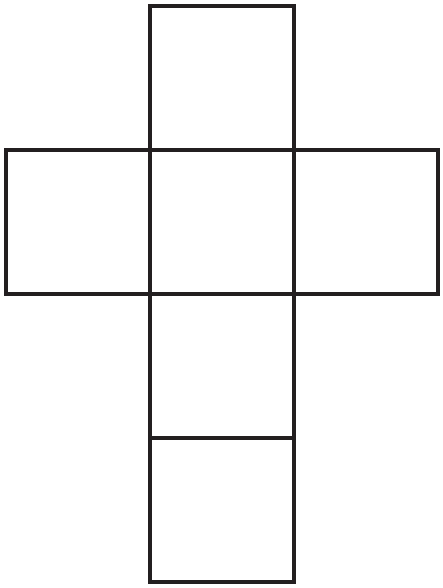


6. _____

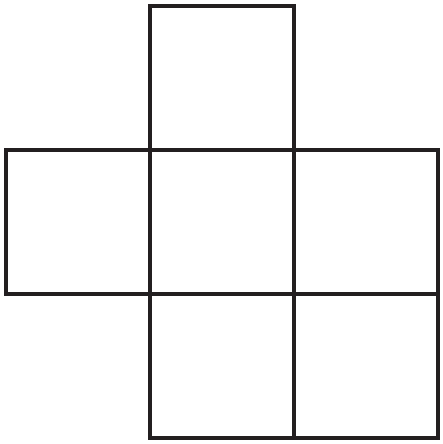
Nets

Identify which nets will make the 3-D shapes and which will not. Choose yes or no for each example.

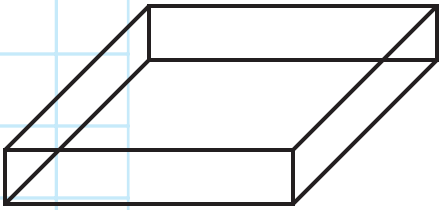


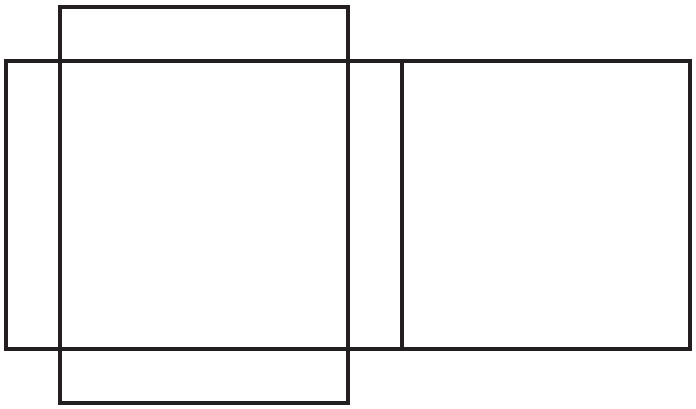


1. ❑ Yes ❑ No

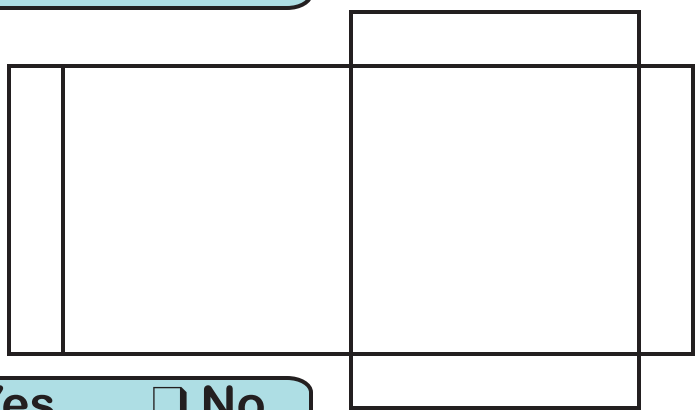


2. ❑ Yes ❑ No





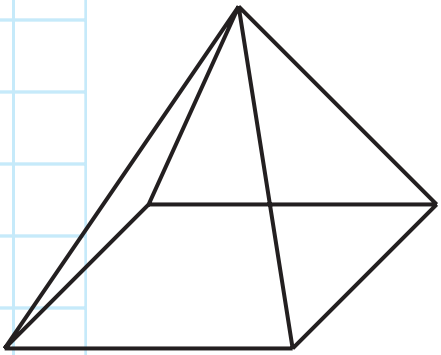
3. ❑ Yes ❑ No

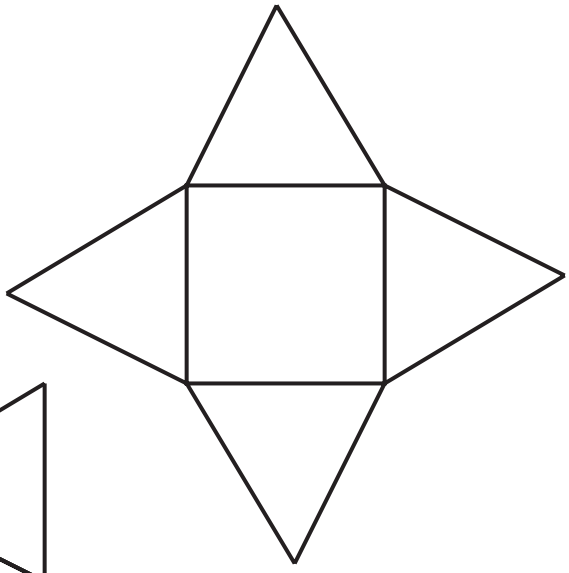


4. ❑ Yes ❑ No

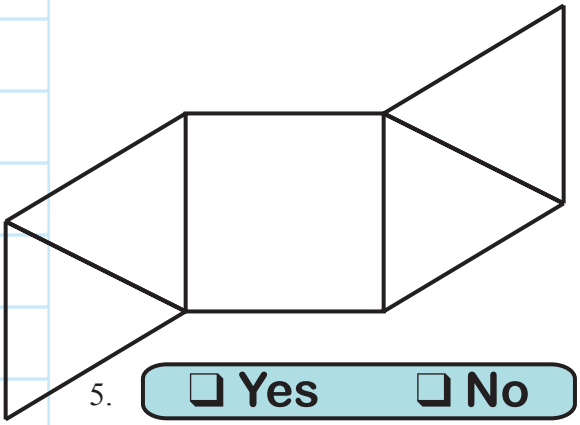
Nets

Identify which nets will make the 3-D shapes and which will not. Choose yes or no for each example.

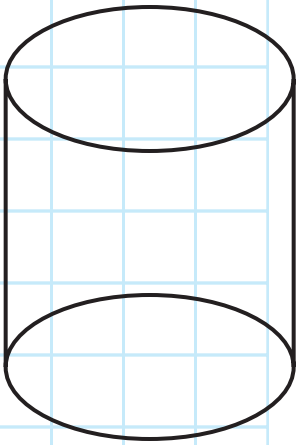


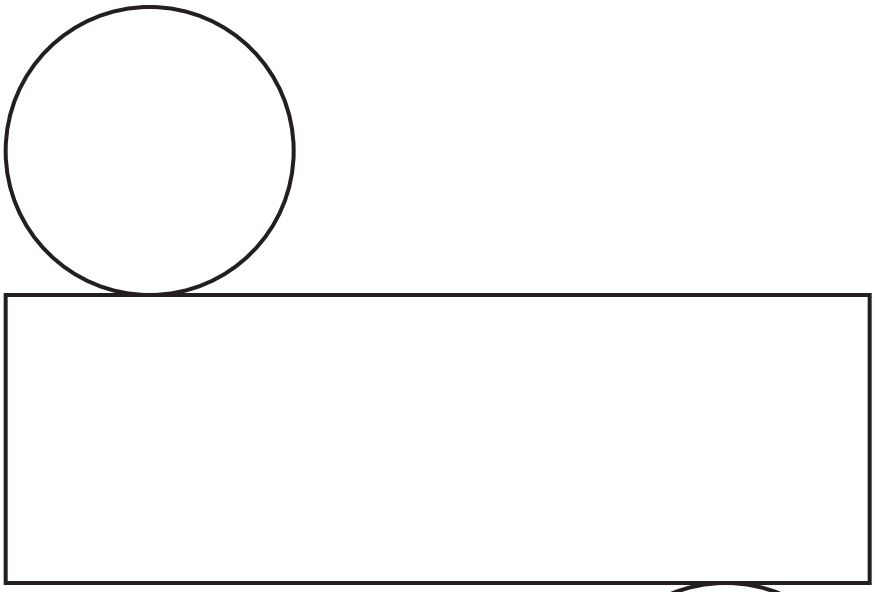


6. ❑ Yes ❑ No



5. ❑ Yes ❑ No





7. ❑ Yes ❑ No