

ANGLES AND TRIANGLES

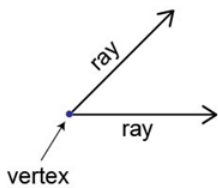
Take a look around you and examine some of the objects and structures we see most every day. Many of them are made up of **triangles**. A **triangle** is a two-dimensional shape with three straight sides. Triangles are frequently used in bridge and building design because they have a strong base, can hold their shape, and provide lots of structural support.



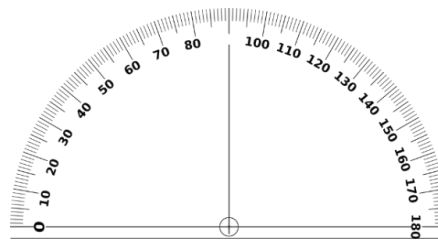
The branch of mathematics that studies shapes and figures is called **geometry**. **Plane geometry** is all about flat 2D, or two-dimensional, shapes that can be drawn on a piece of paper, like lines, circles, triangles, squares, and rectangles. These shapes have only two measurements, or **dimensions**, such as width and height. **Solid geometry** is about 3D or 3-dimensional shapes, like cones, cubes, and spheres. These objects have three measurements, such as width, height, and depth.

Trigonometry is a special branch of mathematics that deals with **angles**, **triangles**, and **trigonometric functions**. Functions have a single output, or answer, for each of their inputs. Trigonometric functions are widely used in sciences and professions that are related to geometry, such as astronomy, navigation, and many others.

To understand triangles, it is first necessary to learn a little about **angles**. When two straight lines meet, they form an **angle**. The space between the two lines, the angle, is usually measured in degrees. *The three angles of a triangle always add up to 180°.*



Vertex and rays



Protractor

The point where the lines meet is called the **vertex**. The lines are called **rays** or **arms**.

A **protractor** is a tool that is used to measure angles. It often has two sets of the same numbers, 0 - 180°, going in opposite directions. The protractor in the image above has only one set of numbers, 0 - 180°.



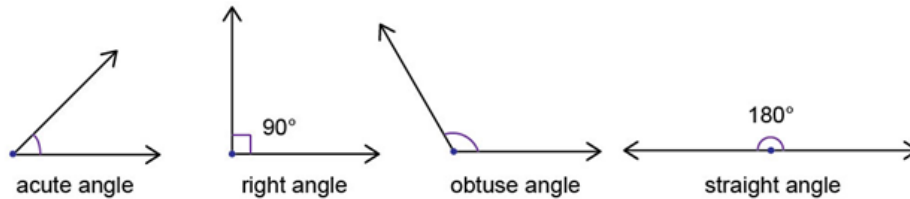
Four types of angles

Acute angle: An angle less than 90° but more than 0° .

Right angle: A right angle is equal to 90° .

Obtuse angle: An angle that is greater than 90° but less than 180° .

Straight angle (or straight line): An angle equal to 180° .

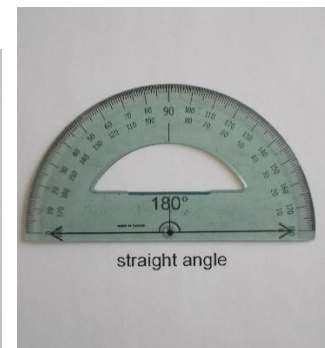
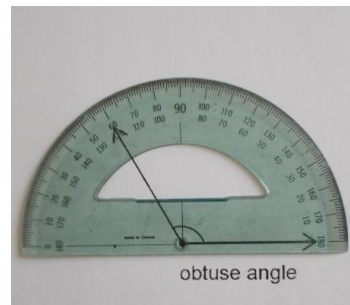
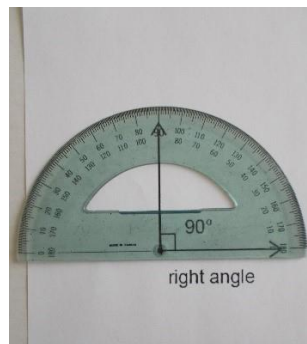
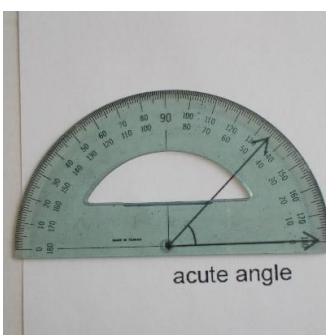


ACTIVITY: Measuring angles using a protractor

Materials:

- Pencil, marker, or pen and a ruler to draw different angles
- Paper
- Protractor

1. Draw several different angles on pieces of paper.
2. Line up the vertex of the angle with the mid-point on the protractor. The line that points to zero needs to line up with one of the rays of the angle.
3. Use the ruler on the outer curved edge of the protractor to count the degrees where the other ray intersects.
4. You may have to use a straight-edge ruler to make the second ray longer to get an accurate measurement.

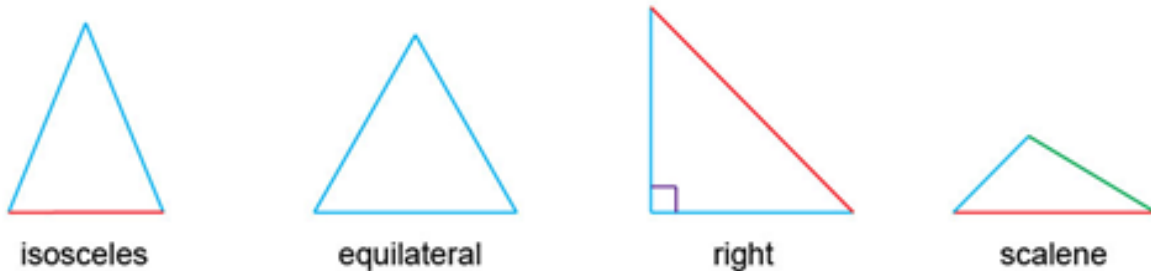


Triangle tidbits

- ◇ A triangle is a polygon with three sides, three angles, and three vertices.
- ◇ The three inside angles of a triangle always add up to 180° .



- ◇ Triangles can be classified by their angles and their sides.
- ◇ **Isosceles triangle:** Two sides of equal length and two equal angles. **Isosceles** is from the Greek word meaning “equal legs”. This triangle has two equal sides or “legs” joined by an odd side.
- ◇ **Equilateral triangle:** Three sides of equal length and three equal angles. The three angles are always 60° . The name **equilateral** comes from the words equal and lateral (lateral means side).
- ◇ **Right triangle:** This triangle has one angle that is 90° . The longest side of a right triangle is called the **hypotenuse**. It is always opposite the right angle.
- ◇ **Scalene triangle:** No sides of equal length and no equal angles. **Scalene** comes from the Greek word meaning uneven.



Triangles can also be named by what kind of angle is inside. For example, an **acute** triangle has angles that are all less than 90° . A **right** triangle has a right angle (90°). An **obtuse** triangle is the opposite of an acute triangle. It has one angle more than 90° .

ACTIVITY: Make the four types of triangles using craft sticks

Materials:

- Craft sticks
- Glue (optional)

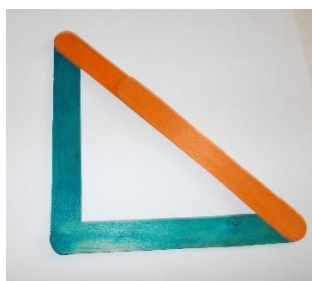
1. Use the craft sticks to create each of the triangles: isosceles, equilateral, right, and scalene. You will need to use two sticks to increase the length of a side(s) for some of the triangles.
2. Practice measuring the angles of your craft stick triangles using your protractor



Isosceles



Equilateral



Right (orange = hypotenuse)



Scalene



More facts about triangles:

- Ancient astronomers used a method called **triangulation** to measure the distance between stars by calculating the length of one side of a triangle, measuring the angles formed and shaping a network of connected triangles and their measurements.
- The ancient Egyptian Pyramids, which were created in about 2900 BC, have perfect triangular faces.
- Trusses used in building roofs and bridges are triangular in shape. Triangles are often used in construction because they are very strong.
- Triangular concepts are used to calculate the height of tall objects such as mountains and buildings.
- GPS (global positioning system) uses triangulation algorithms to determine the location or placement of an object using its latitude and longitude.

ADDITIONAL RESOURCES

Books available from the Washoe County Library System:

[*Dear Dragon's Fun with Shapes*](#) by Margaret Hillert

[*Figuring Out Geometry*](#) by Rebecca Wingard-Nelson, Rebecca

[*The Greedy Triangle*](#) by Marilyn Burns

[*I Spy Shapes in Art*](#) by Lucy Micklethwait

[*A Math Journey Through Space*](#) by Anne Rooney

[*The Shape of Things*](#) by Janine Scott

[*Shapes in Math, Science, and Nature: Squares, Triangles, and Circles*](#) by Catherine Ross

[*Triangle*](#) by Mac Barnett and Jon Klassen

[*Triangles*](#) by David Adler

[*Triangles*](#) by Sarah L. Schuette

[*What is a Triangle?*](#) By Rebecca Kai Dotlich

[*What's Your Angle Pythagoras?: A Math Adventure*](#) by Julie Ellis

Videos:

Clarendon Learning, "Angles for Kids - An intro into the world of Angles" <https://youtu.be/sajxuoq7QyQ>

Magic Pathshala, "Types of angles" <https://youtu.be/UgfSwlqi4Qg>

Sesame Street, "Grover and Rosita and Triangles" <https://youtu.be/ZDqChRDPnZc>



Sesame Street, "The Triangle is Right!" https://youtu.be/O_S3qopVb5g

Smile and Learn, "Triangles for Kids – Equilateral, Isosceles, Scalene, Acute Triangle, Right Triangle, and Obtuse" <https://youtu.be/oQeK4LyKLHw>

Websites:

DK findout! <https://www.dkfindout.com/us/math/geometry/triangles/>

Khan Academy, Basic Geometry <https://www.khanacademy.org/math/basic-geo>

PBS Learning Media, K-8 Mathematics, Geometry <https://knpb.pbslearningmedia.org/subjects/mathematics/k-8-mathematics/geometry/>

Stanford University, Development and Research in Early Math Education (DREME) Network, What Children Know and Need to Learn about Shape and Space <https://prek-math-te.stanford.edu/spatial-relations/what-children-know-and-need-learn-about-shape-and-space>

