PROJECT LEAD THE WAY

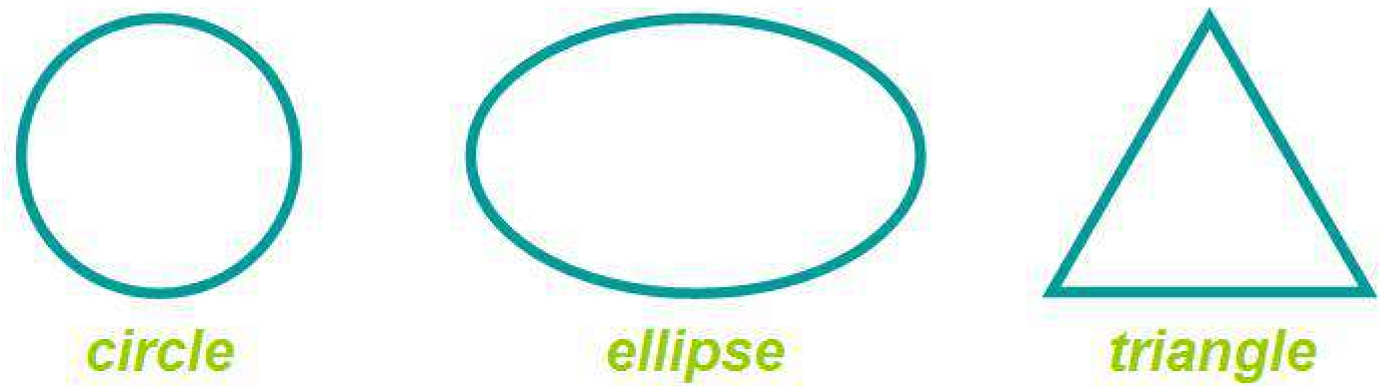
PLTW

Igniting imagination and innovation through learning.

Geometric Shapes and Area

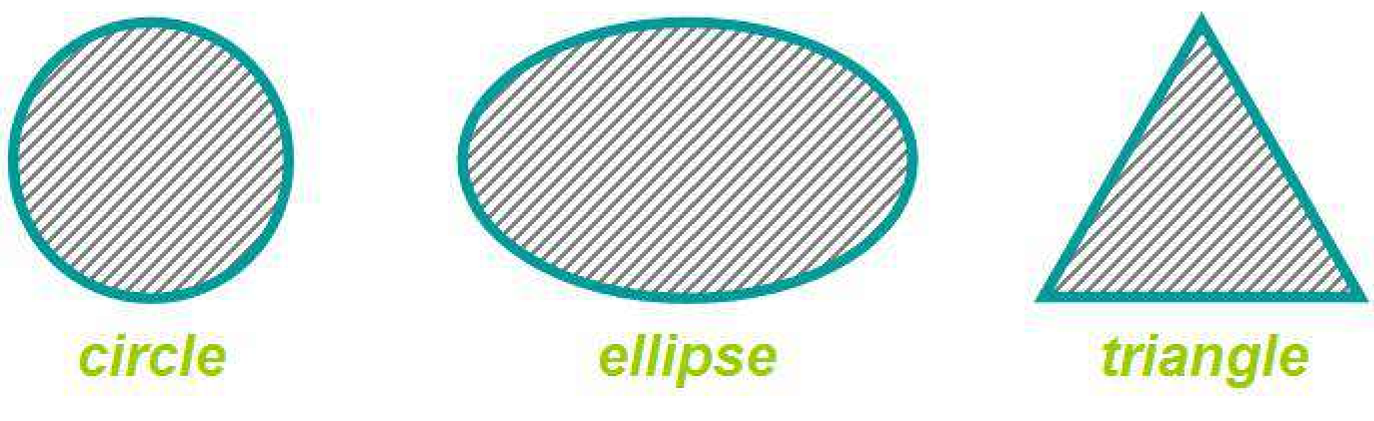
Shape

Shape **describes the two-dimensional contour that characterizes an object or area, in contrast to a three-dimensional solid. Examples include:**



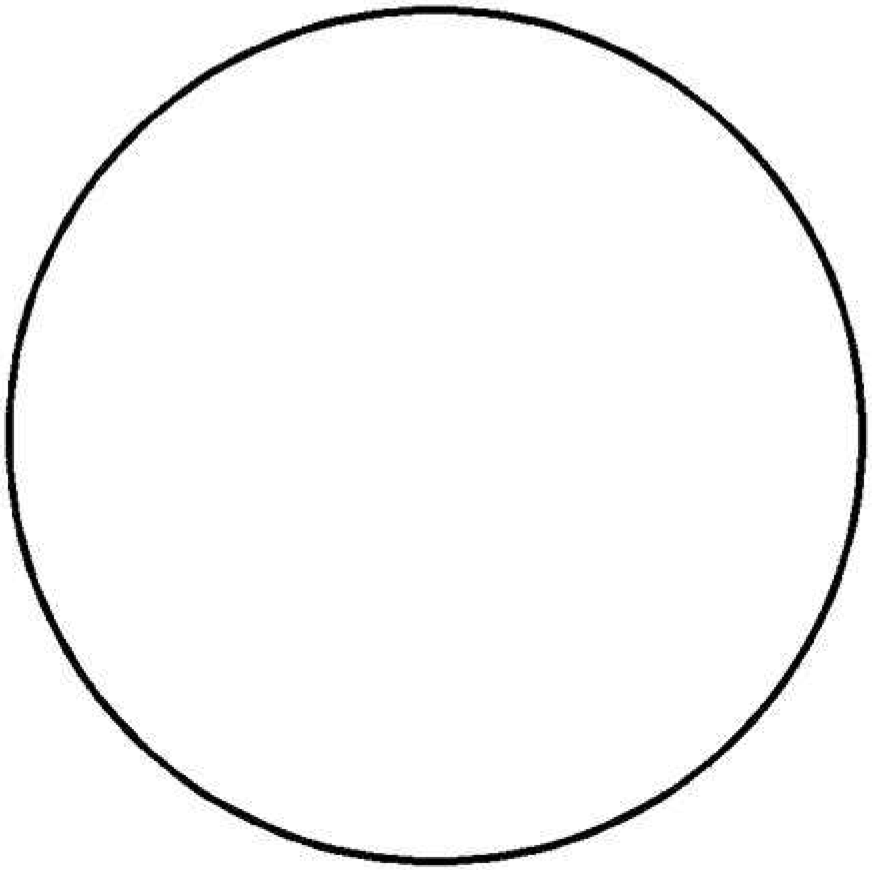
Area

Area **is the extent or measurement of a surface. All shapes represent enclosed two-dimensional spaces, and thus have *area*.**



Circles

A *circle* is a round plane figure whose boundary consists of points equidistant from the center.



Circles

The *circle* is the simplest and strongest of all the shapes. *Circles* are found within the geometry of countless engineered products, such as buttons, tubes, wires, cups, and pins. A drilled hole is also based on the simple *circle*.

Area of a Circle

In order to calculate the area of a ***circle***, the concept of π (pi) must be understood. π is a constant ratio that exists between the circumference of a ***circle*** and its diameter.

The ratio states that for every unit of diameter distance, the circumference (distance around the ***circle***) will be approximately 3.14 units.

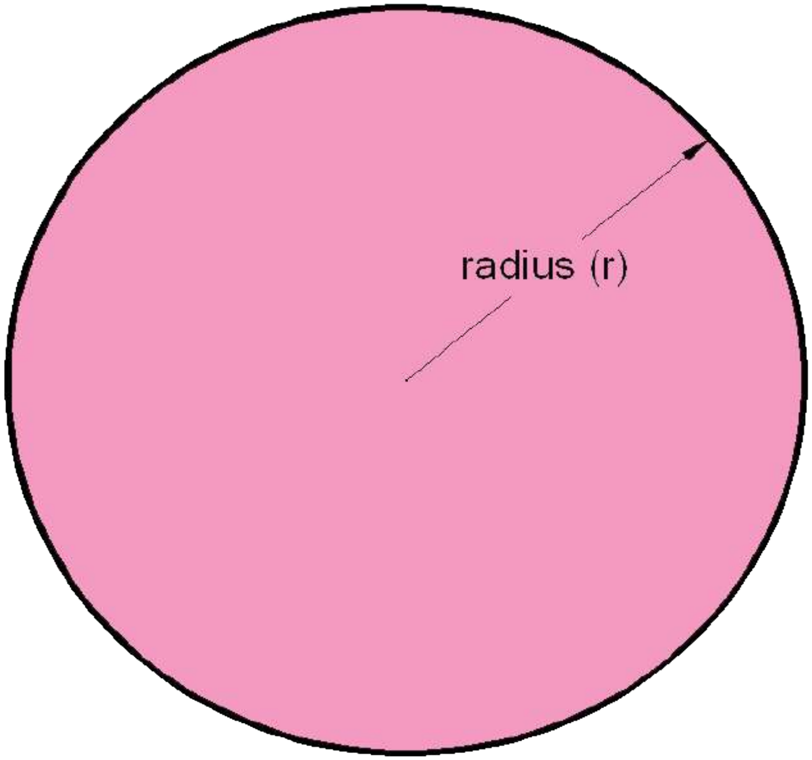
Area of a Circle

To calculate the area of a *circle*, the *radius* must be known.

$\pi \approx 3.14$

r = *radius*

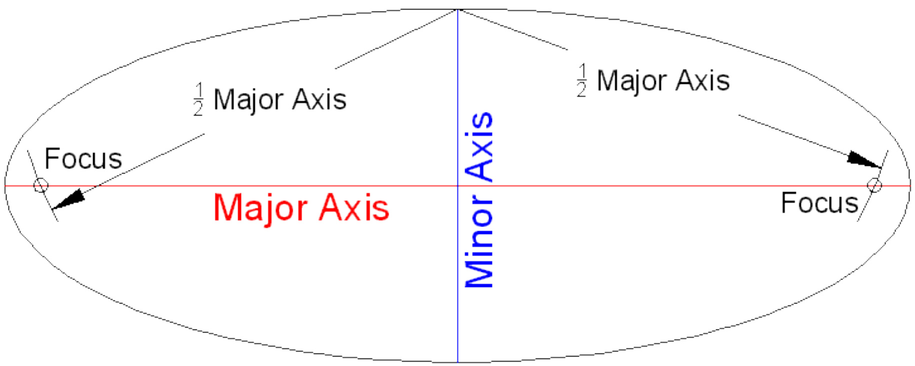
A = *area*

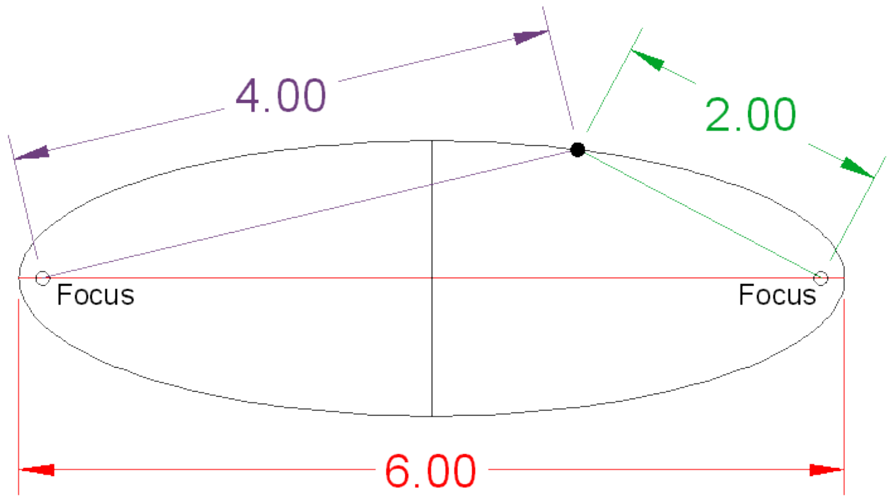


$$A = \pi r^2$$

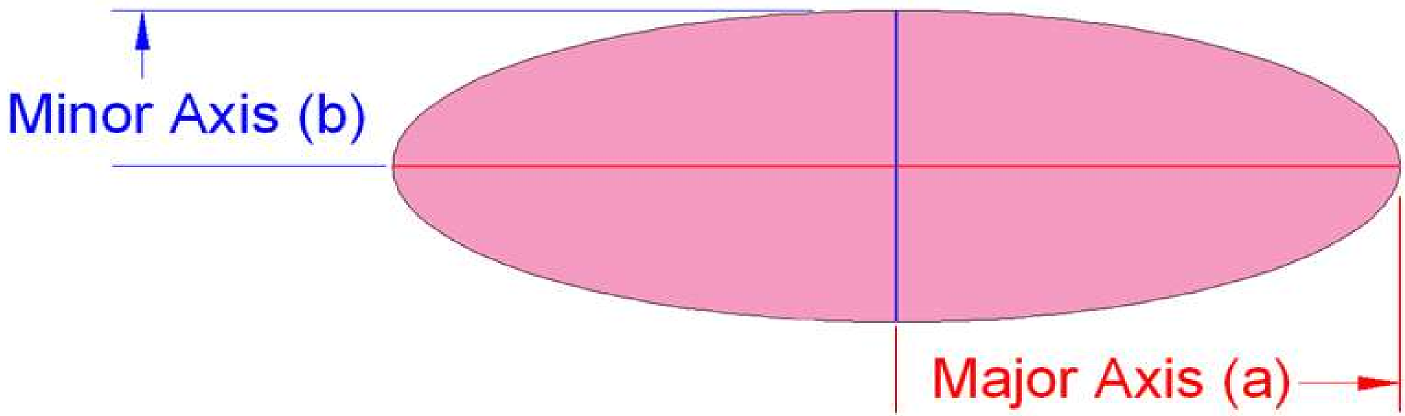
Ellipses

An ***ellipse*** **is generated by a point moving in a plane so that the sum of its distances from two other points (the foci) is constant and equal to the major axis.**





Ellipses



To calculate the area of an *ellipse*, the lengths of the *major* and *minor axis* must be known.

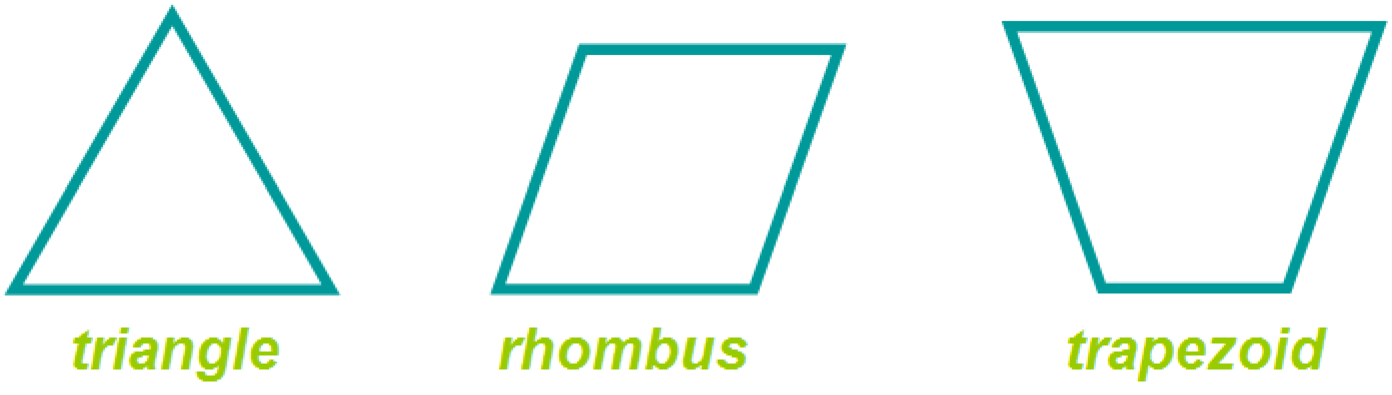
2a = major axis π = *3.14*

2b = minor axis ***A* = *area***

$$A = \pi ab$$

Polygons

A ***polygon*** **is any plane figure bounded by straight lines. Examples include the triangle, rhombus, and trapezoid.**

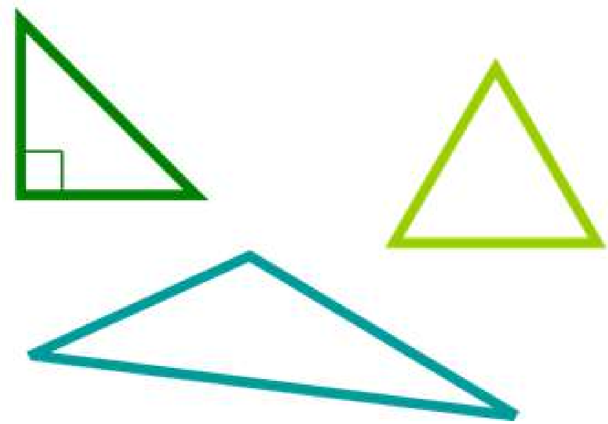


Triangles

A *triangle* is a three-sided polygon. The sum of the interior angles will always equal 180º.

All *triangles* can be classified as:

- Right Triangles
- Acute Triangles
- Obtuse Triangles



Triangles

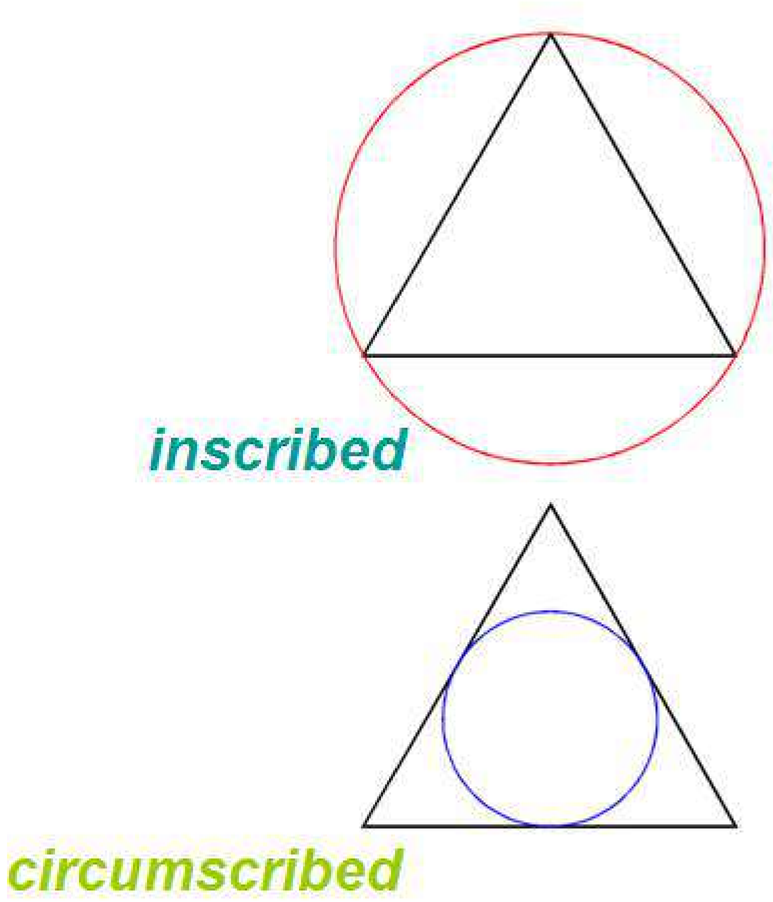
The triangle is the simplest, and most structurally stable of al polygons.

This is why triangles are found in all types o structural designs. Trusses are one such example.

Sign support truss based on a right triangle.

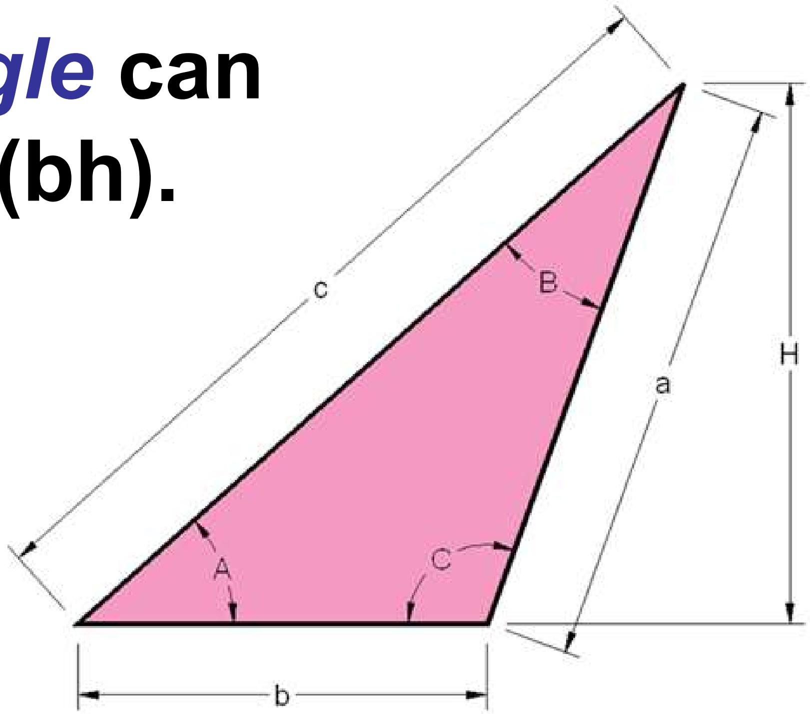
Triangles

Sometimes the terms *inscribed* and *circumscribed* are associated with the creation of *triangles* and other polygons, as well as area calculations.



Area of a Triangle

The area of a *triangle* can be calculated by .5(bh).



b **=** ***base***

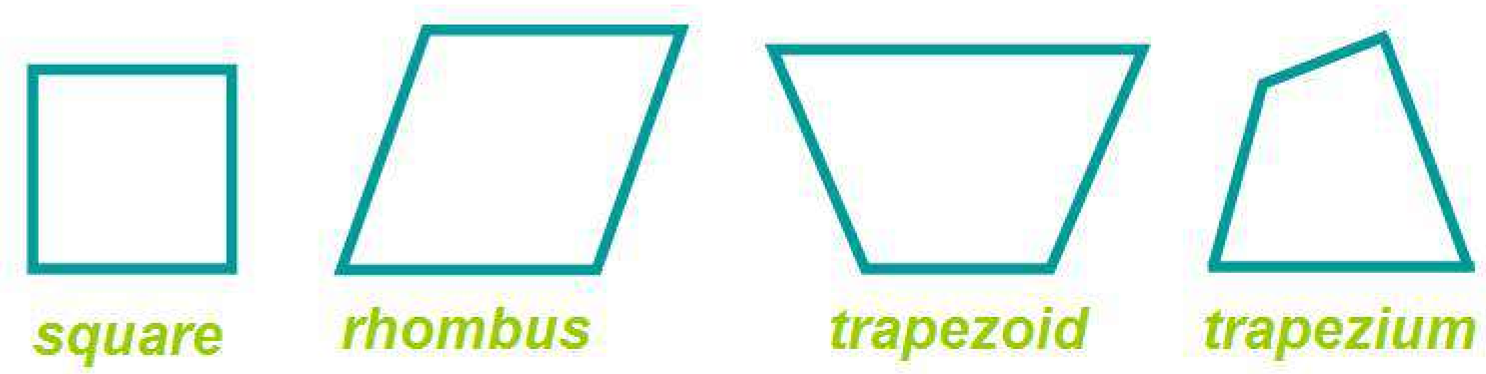
h **=** ***height***

A **=** ***area***

A **=** ***.5(bh)***

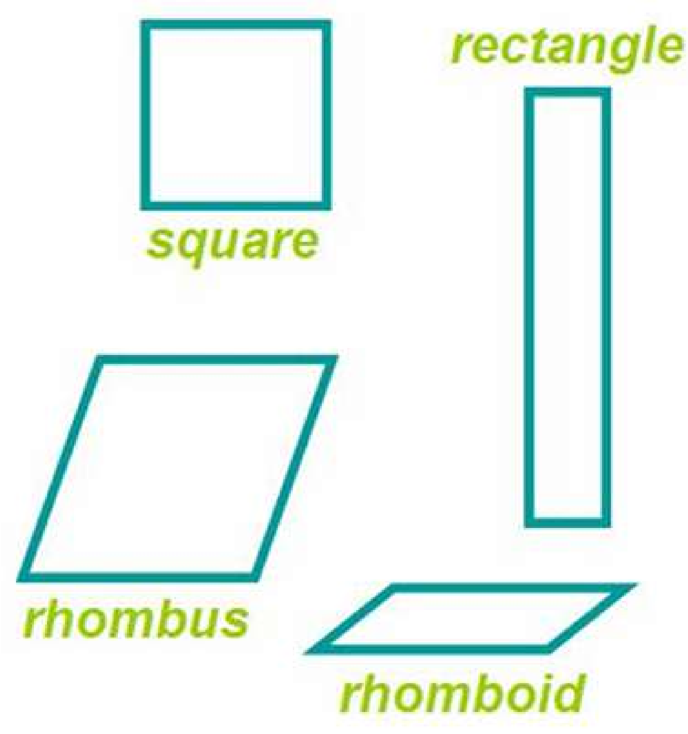
Quadrilaterals

A ***quadrilateral*** **is a four-sided polygon. Examples include the square, rhombus, trapezoid, and trapezium:**



Parallelograms

A *parallelogram* is a four-sided polygon with both pairs of opposite sides parallel. Examples include the square, rectangle, rhombus and rhomboid.



Parallelograms

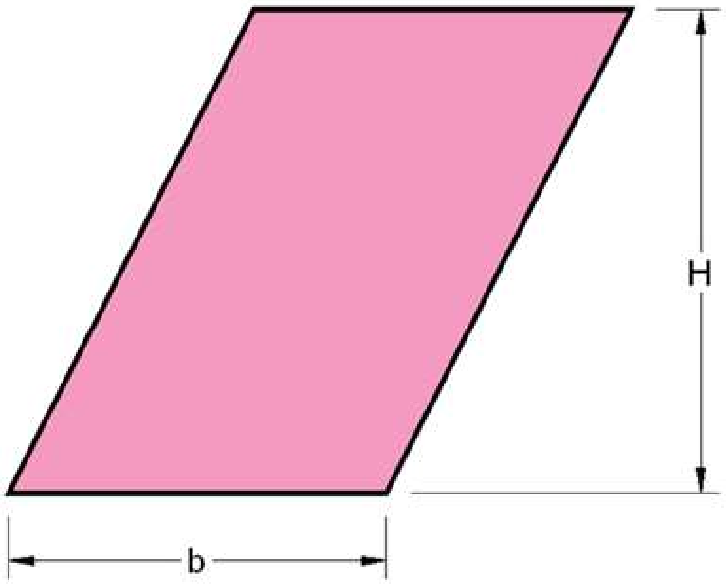
The area of a *parallelogram* can be calculated by A = bh

b = *base*

h = *height*

A = *area*

A = *bh*



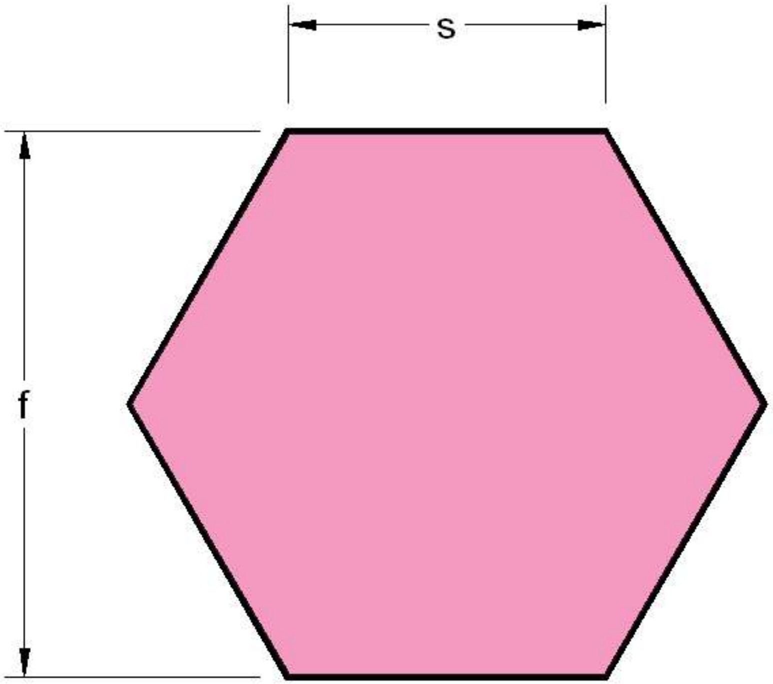
Regular Multisided Polygons

A ***regular multisided polygon*** **has equal angles, equal sides, and can be inscribed in or circumscribed around a circle.**

Examples of *regular multisided polygons* include the pentagon, hexagon, heptagon, and octagon.

Multisided Polygons

To calculate the area of a *multisided polygon*, a side length, distance between flats (or diameter of inscribed circle), and the number of sides must be known.



Multisided Polygons

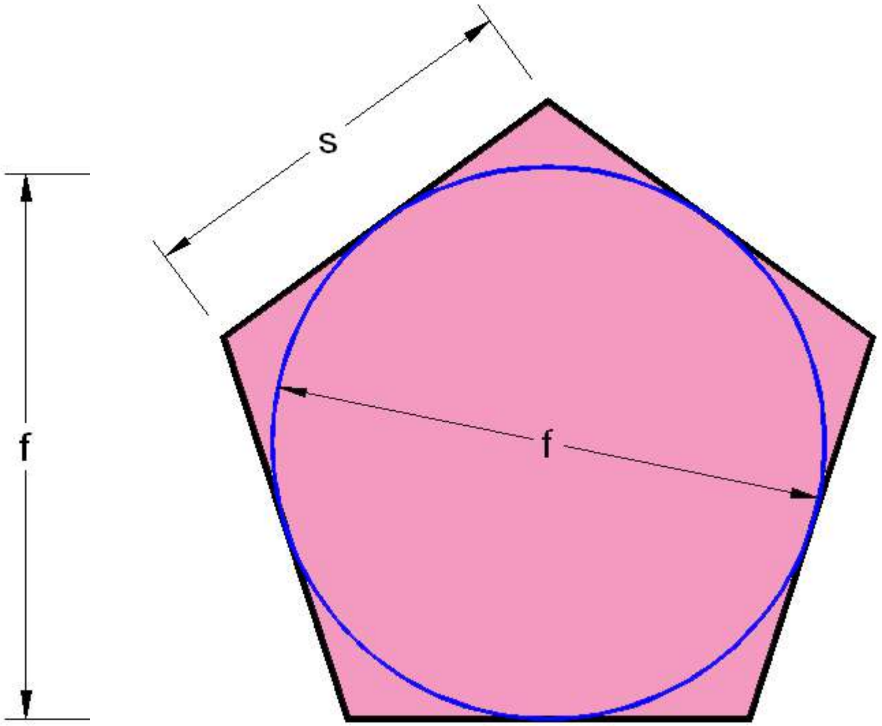
Area calculation of a *multisided polygon*:

s = *side length*

f = *distance between flats or diameter of inscribed circle*

n = *number of sides*

A = *area*



$$A = n\frac{s(.5f)}{2}$$