PROJECT LEAD THE WAY

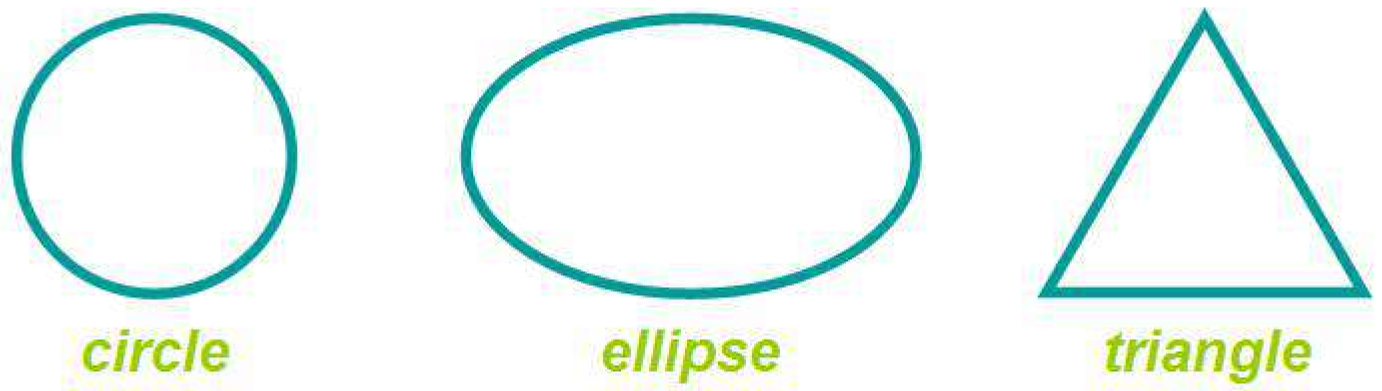
PLTW

Igniting imagination and innovation through learning.

Geometric Shapes and Area

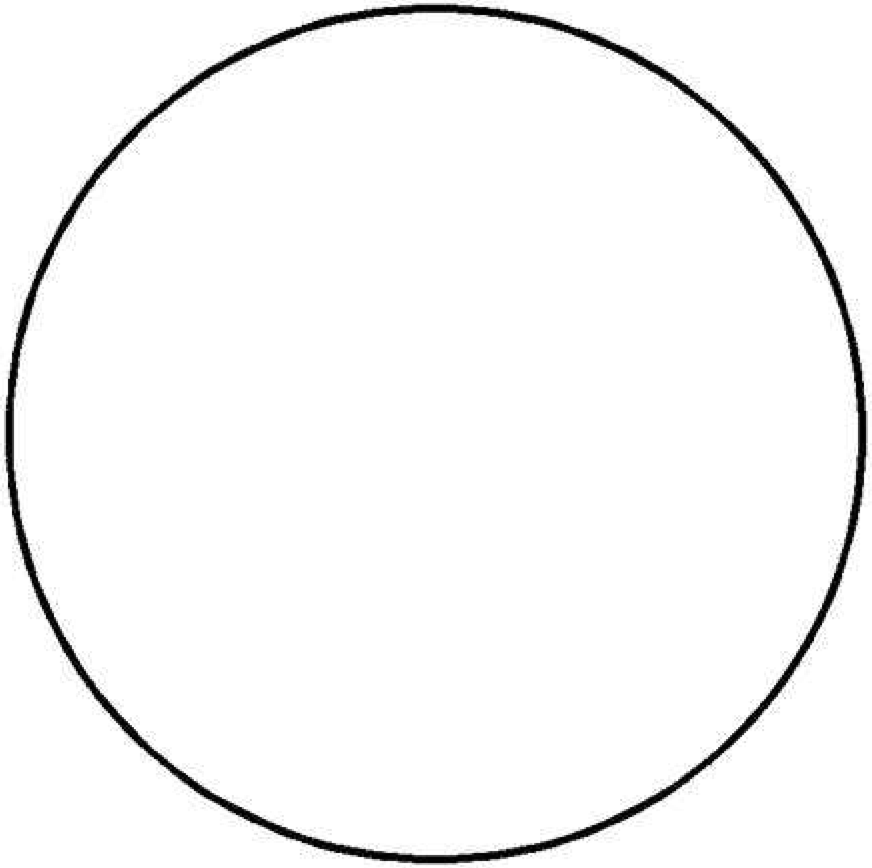
Shape

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



Circles

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



Circles

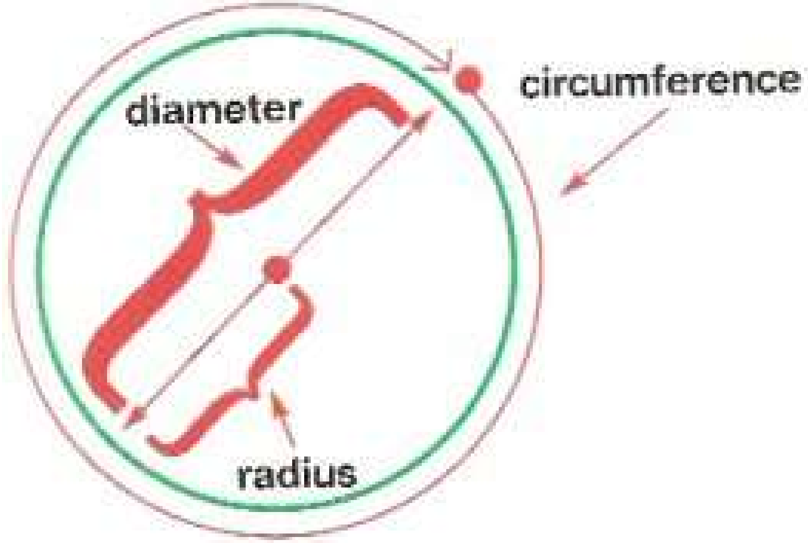
The *circle* is the simplest and strongest of all the shapes. *Circles* are found within the geometry of countless engineered products, such as buttons, tubes, wires, cups, and pins. A drilled hole is also based on the simple *circle*.

Area of a Circle

In order to calculate the area and circumference 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.

Circle Terms



- **Radius** – distance from the center of the circle to any point on it. **r = .5d**
- **Diameter** - the length of a straight line passing through the center of a circle and connecting two points on the circle **d = 2r**
- **Circumference** – distance around the circle. **c = 2πr** or **c =πd**

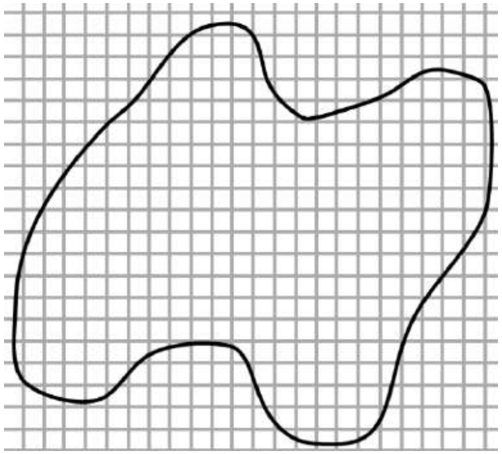
Question

1. Given the radius is 10 inches find the diameter and circumference

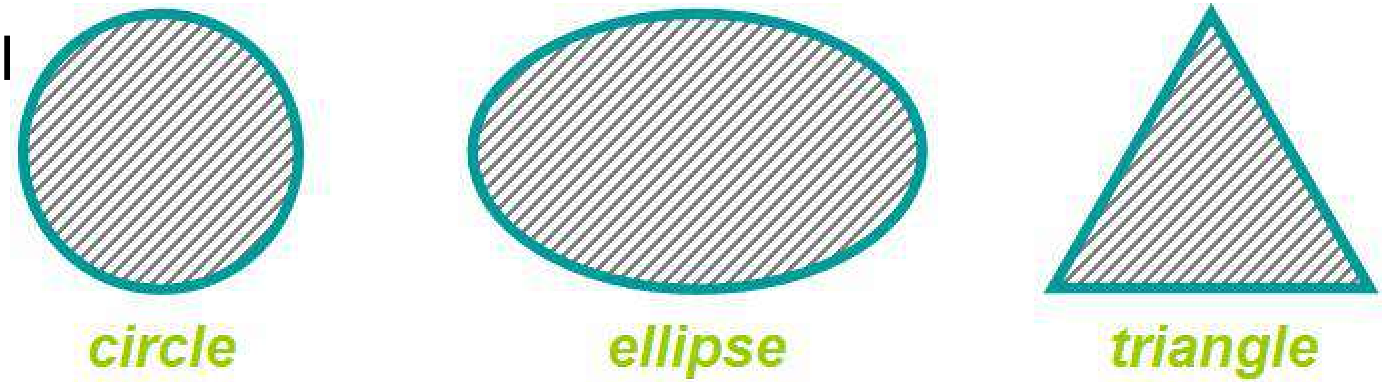
2. Given the diameter is 50 inches find the radius and circumference

3. Give the circumference is 200 inches find the radius and diameter.

Area



Area **is the measurement of a surface. All shapes represent enclosed two-dimensional spaces, and thus have *area*. It is in units squared. Units^2 (inches^2 , m**



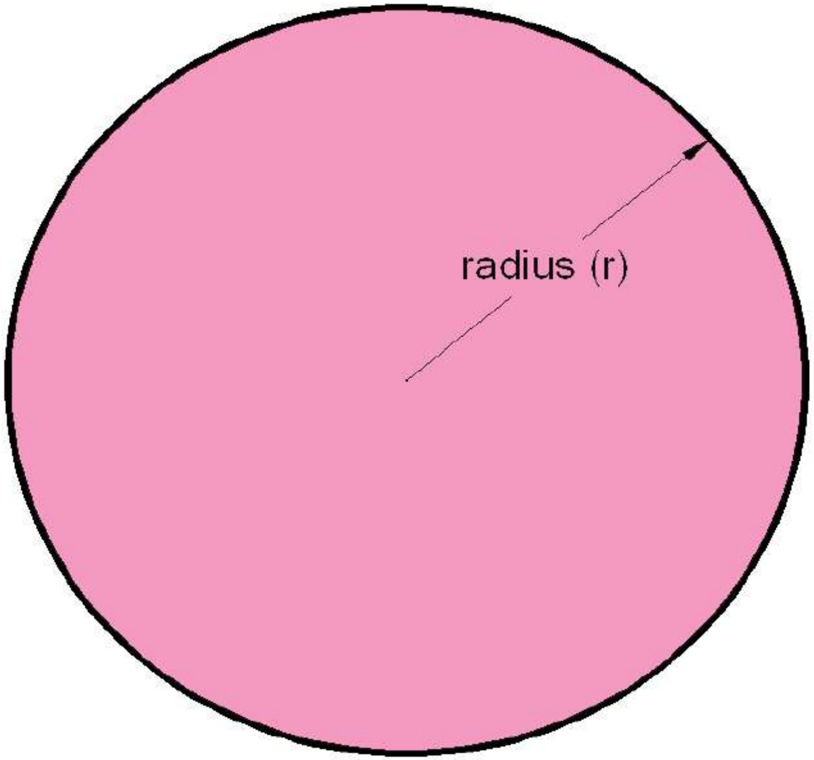
Area of a Circle

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

π = ***3.14***

r = ***radius***

A = ***area***



$A = \pi r^2$

Area

4. If the radius of a circle is 8 inches find area.

5. If the diameter of a circle is 4 inches find the area.

6. If the area of a circle is 25 find the radius and diameter.

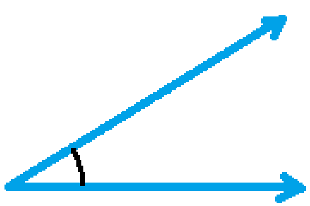
7. If the area of a circle is 25π *find the circumference*

Polygons

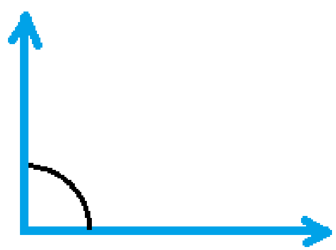
A *polygon* is any plane figure bounded by straight lines. Examples include the triangle, quadrilaterals, and pentagons.

Angles

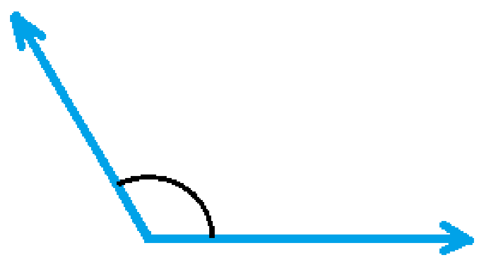
An *angle* is the figure formed by the intersection of two rays. *Angles* are differentiated by their measure.



Acute
Less than 90º



Right
Exactly 90º



Obtuse
Between 90º and 180º

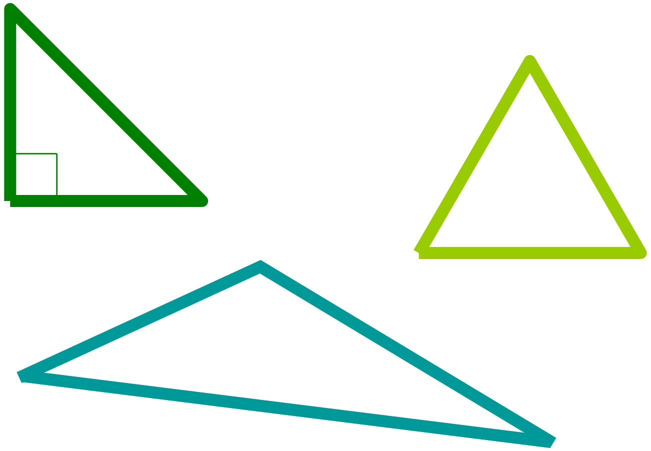
Straight
Exactly 180º

Triangles

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

There are three types of *triangles*:

- **Right triangle**
- **Acute triangle**
- **Obtuse triangle**



Triangles

Right – having a 90° angle

Obtuse – having an angle greater than 90°

Acute – All angles less than 90°

Equilateral – all sides equal and therefore all angles equal to 60°

Isosceles – two sides having the same length therefore two angles are the same

Scalene – All sides different lengths therefore all angles different

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.

Examples of Trusses

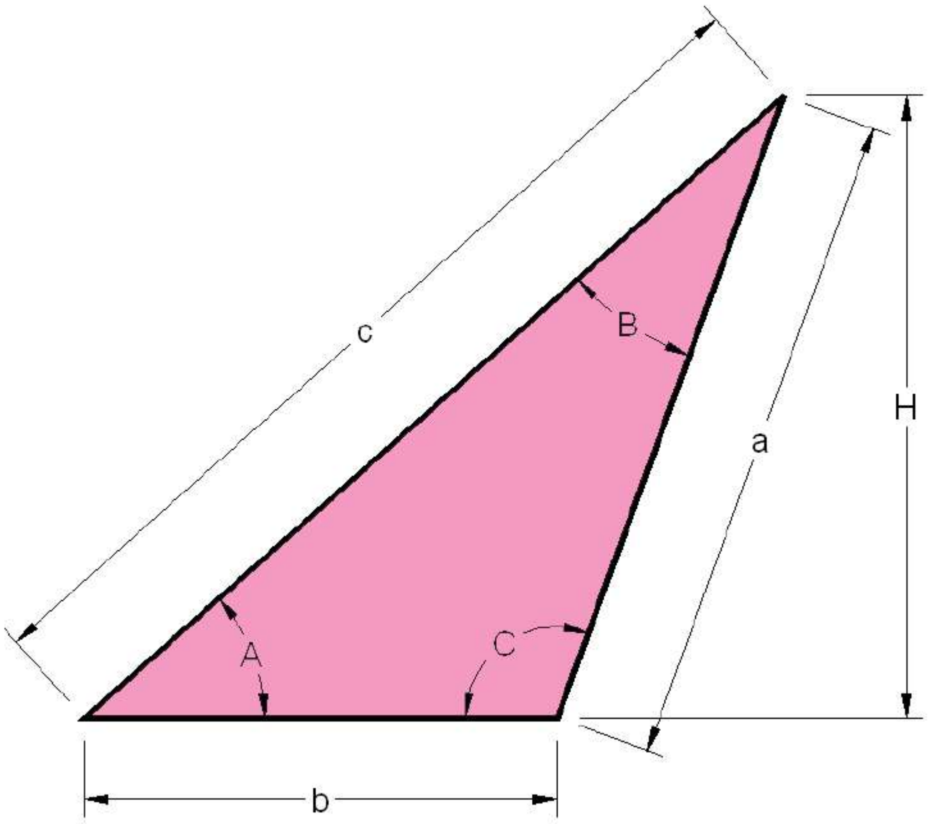
Area of a Triangle

To calculate the area of any *triangle*, the *base* and *height* must be known.

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

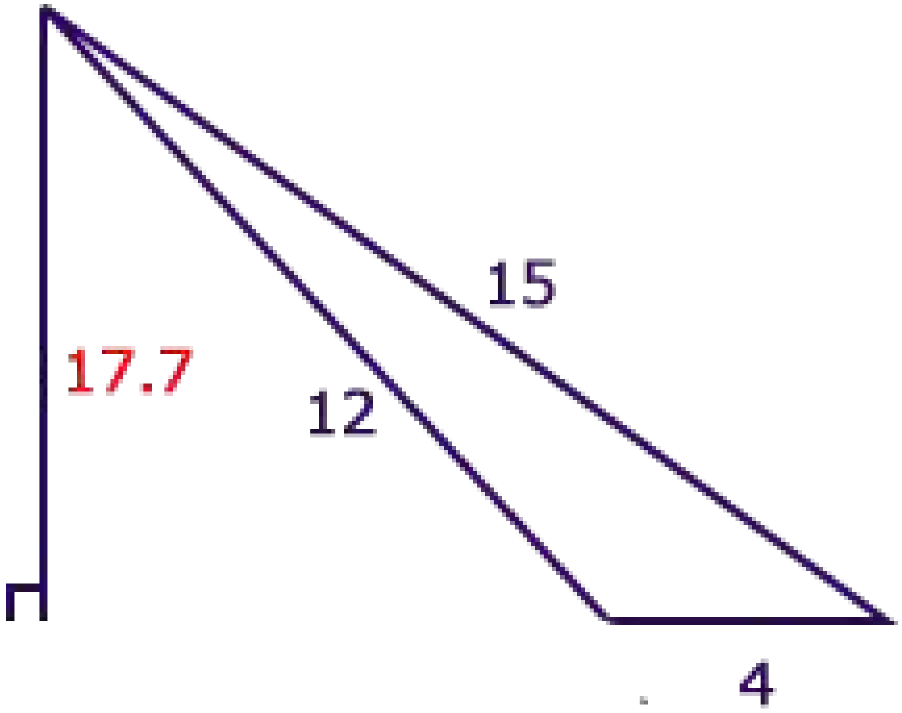
h **=** ***height***

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



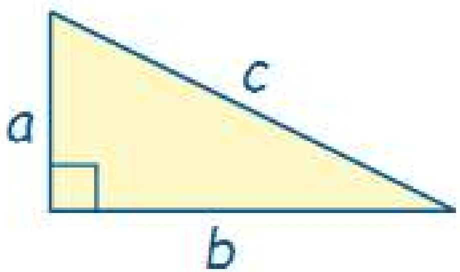
A **=** ***.5(bh)***

8. Find the area of the triangle



Pythagorean Theorem

Given a right triangle. a and b are the legs and c is the hypotenuse

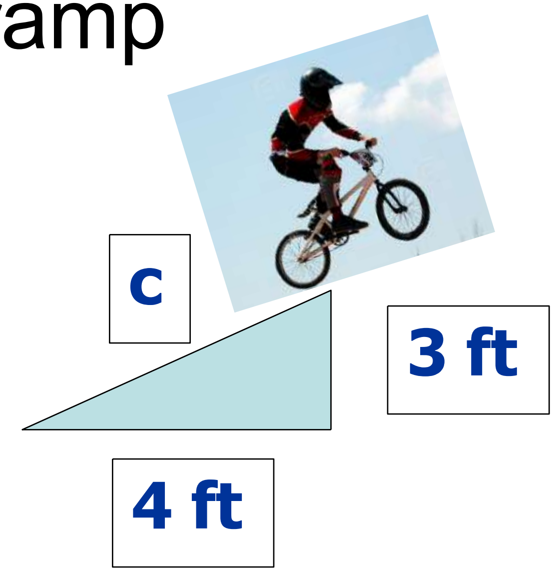


$a^2 + b^2 = c^2$

If a bicycle ramp has a height of 3ft and a base with a width of 4ft what is the length in feet of the incline of the ramp

9. Find the missing side length

If a bicycle ramp has a height of 3 ft and a base with a width of 4 ft what is the length in feet of the incline of the ramp



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

$$3^2 + 4^2 = c^2$$

$$9 + 16 = c^2$$

$$25 = c^2$$

$$25 = c^2$$

$$\sqrt{25} = \sqrt{c^2}$$

$$5 \;\; ft = c$$

10. Find the missing side length

A tree is leaning in the yard after a storm. The gardener gets a 10 foot rope and ties it to the trunk of the tree, 7 feet high. On the ground there is a stake which is attached to the other side of the rope. What is the distance between the base of tree and the stake?

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

$$7^2 + b^2 = 10^2$$

$$49 + b^2 = 100$$

$$-49 \qquad\qquad -49$$

$$b^2 = 51$$

$$\sqrt{b^2} = \sqrt{51}$$

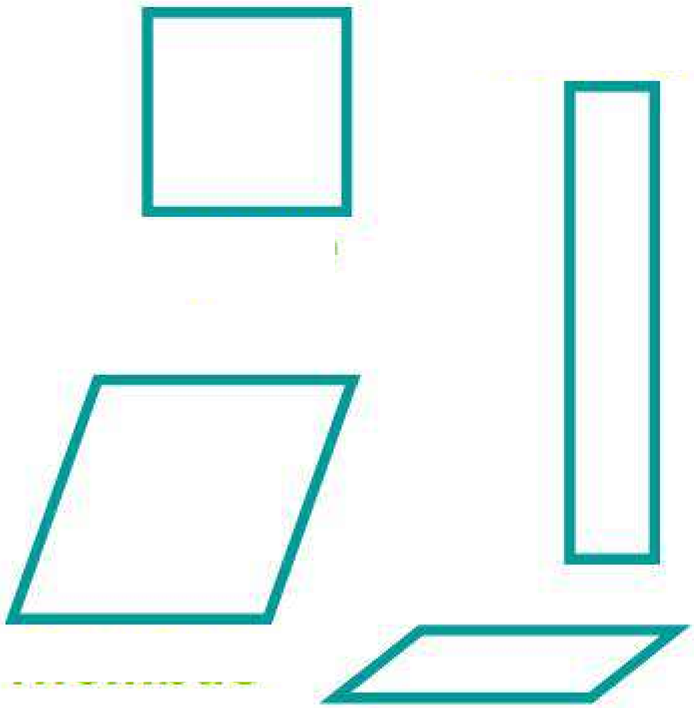
$$b = 7.14 \ \ ft$$

Quadrilaterals

A ***quadrilateral*** **is a four-sided polygon.**

Parallelograms

A *parallelogram* is a quadrilateral with opposite sides parallel. Examples include the square, rectangle, rhombus and rhomboid



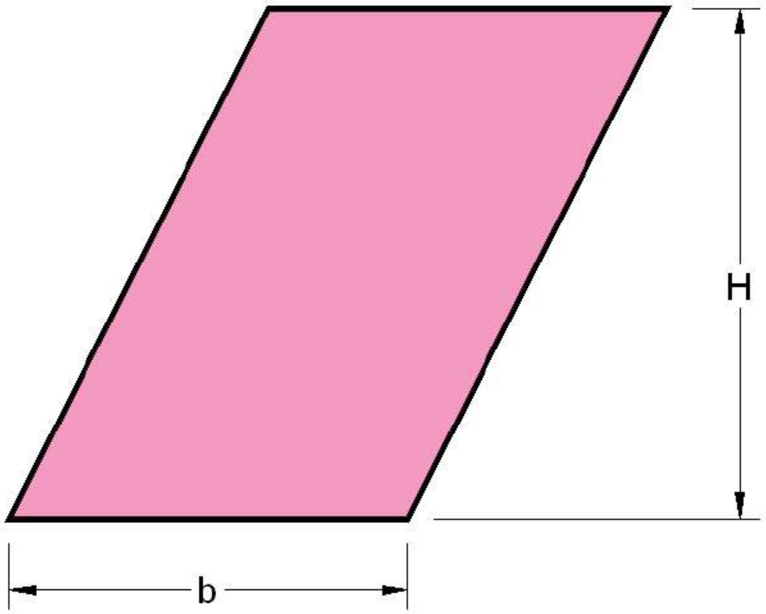
Parallelogra

To calculate the area of a *parallelogram*, the *base* and *height* must be known.

b* = *base

h* = *height

A* = *area



$$A = bh$$

Parallelograms

11. What is the area of a parallelogram with height 5 and base 10?

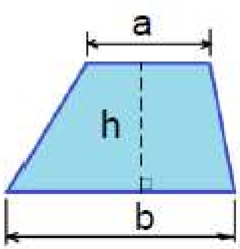
12. What is the height of rectangle with base 20 and area of 1000 in^2?

13. A square with an area of 648 mm^2. What is the length of its sides?

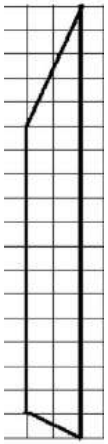
Trapezoid

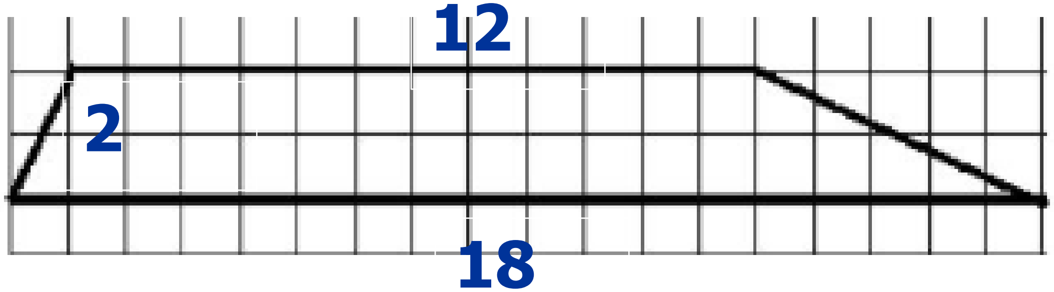
Trapezoid

Area = ½(a + b)h (3.16)



14. Find the area of the trapezoid

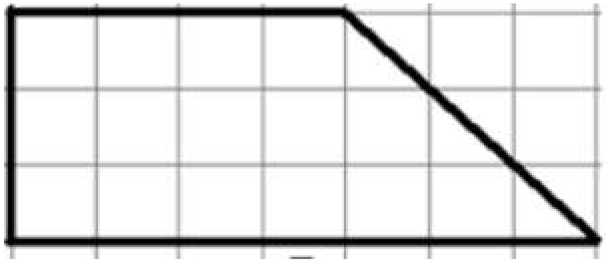




A = .5(12 + 18)·2

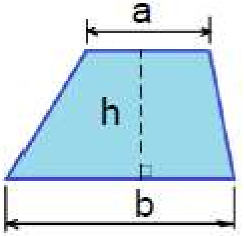
A = 30 units^2

15. Area of trapezoid



Trapezoid

Area = ½(a + b)h (3.16)

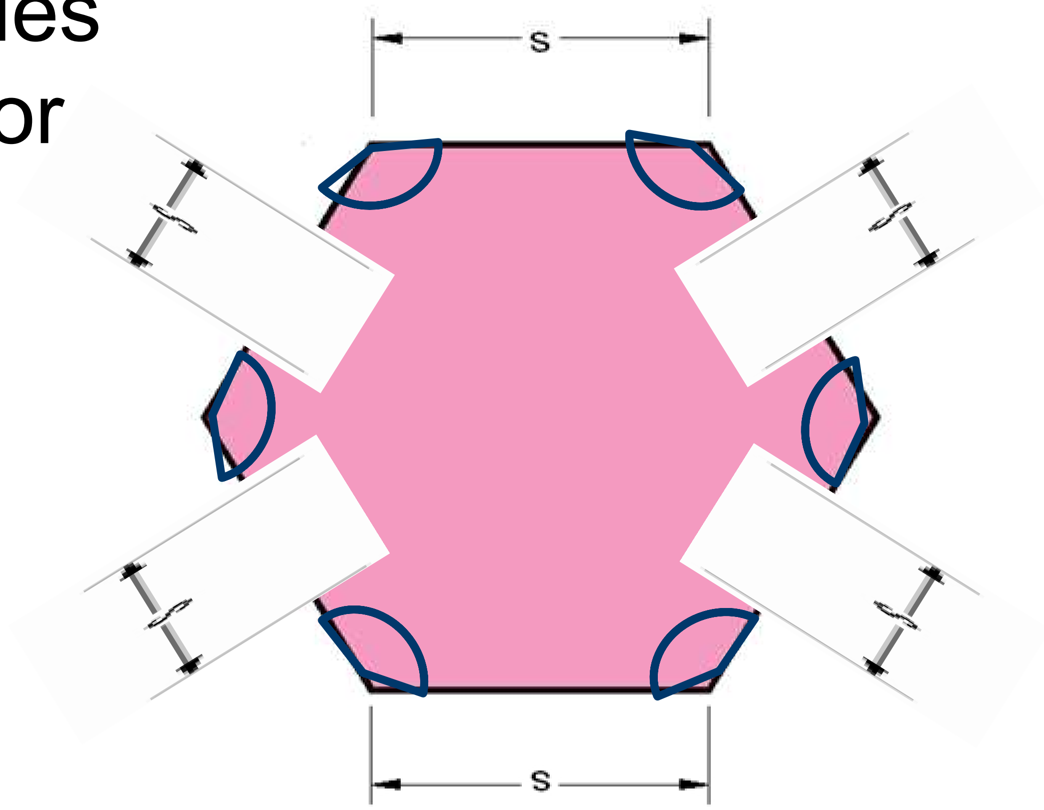


A = .5(4 + 7)·3

A = 16.5 unit^2

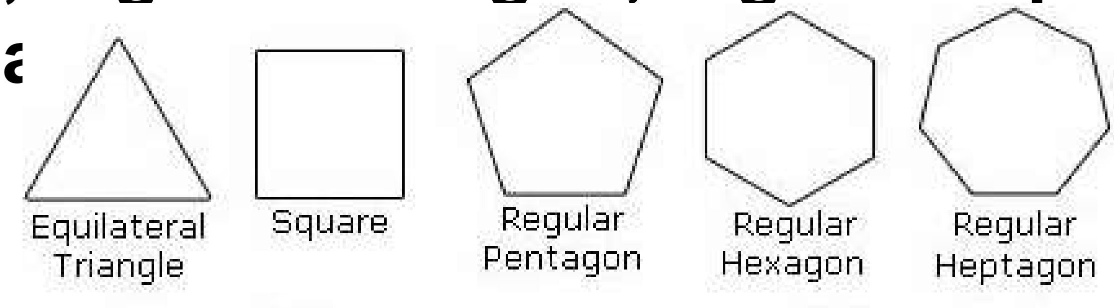
Regular Polygons

A *regular polygon* is a polygon with all sides equal and all interior angles equal.

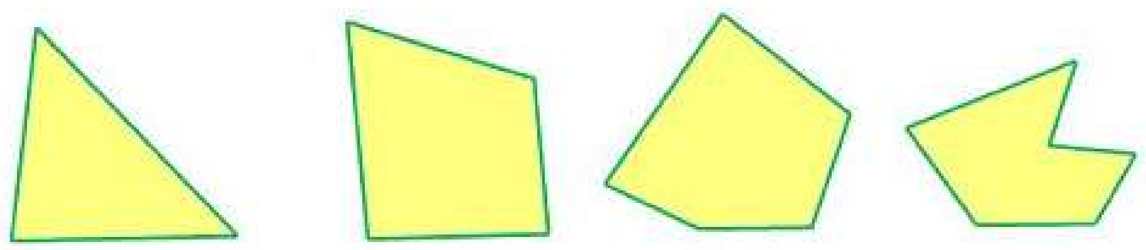


Regular Multisided Polygons

A *regular polygons* include the regular pentagon, regular hexagon, regular heptagon, and regul



Irregular *polygons*



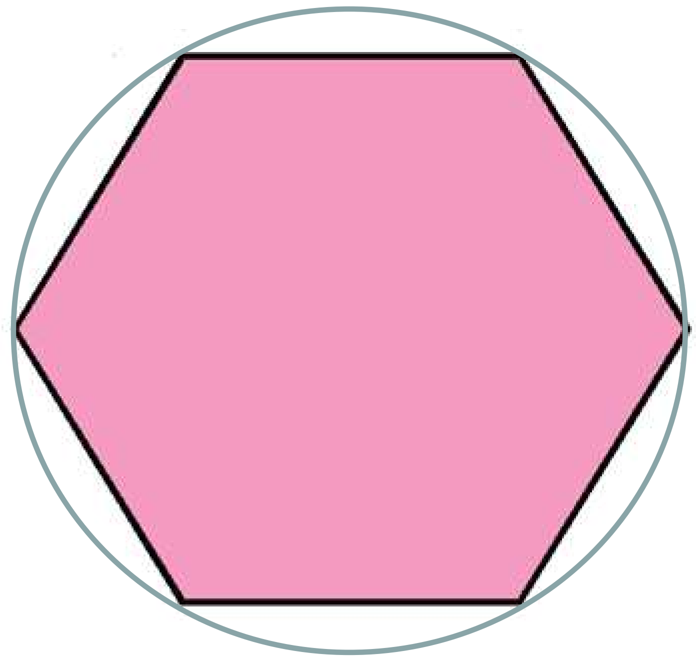
Triangle Quadrilateral Pentagon Hexagon

Multisided Regular Polygons

A *regular polygon* can be inscribed in a circle

•An inscribed polygon is a polygon placed inside a circle so that all the vertices of the polygon lie on the circumference of the circle

•Or you can say the circle circumscribes the polygon

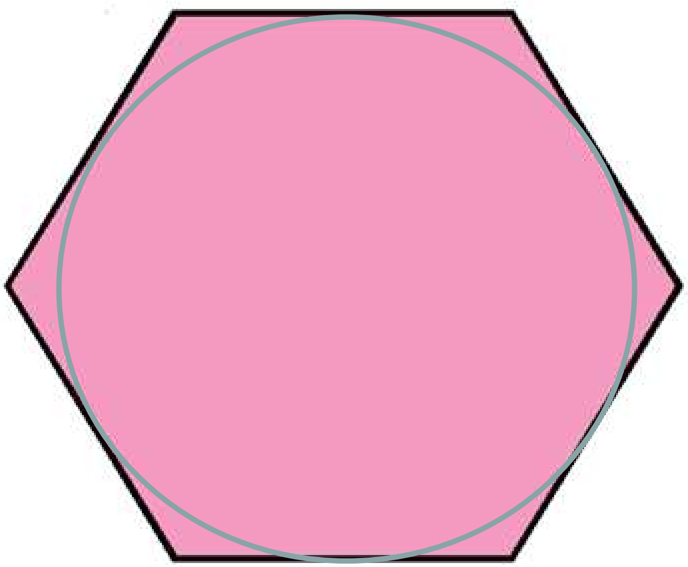


Multisided Regular Polygons

A *regular polygon* can also circumscribe around a circle.

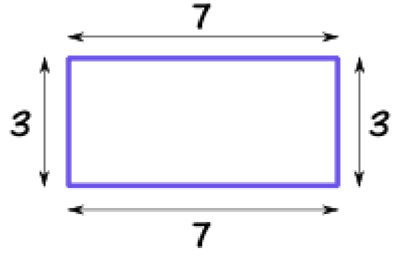
- A circumscribed polygon is a polygon placed outside a circle so that all of sides of the polygon are tangent to the circle

- Or you can say the circle inscribes the polygon



Perimeter

Perimeter - the distance around a two dimensional shape.



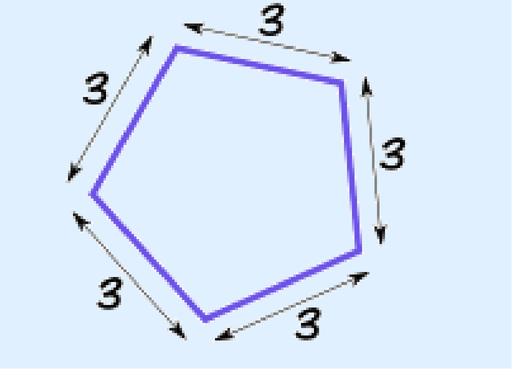
16.

P = 7 + 3 + 7 +3

P = 20 inches

Find the perimeter

17. A regular pentagon has side lengths of 3 cm. What is the perimeter of the pentagon?



p = 3 · 5

p = 15 in