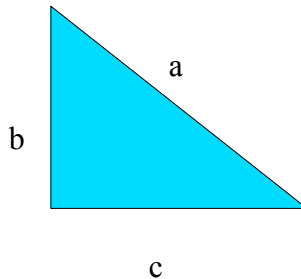


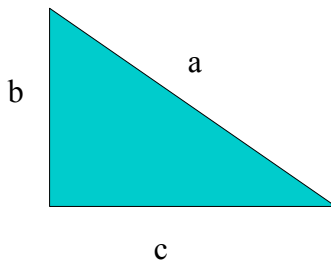
UNIT 10: 2-D SHAPES. AREAS.**Pythagoras' Theorem:**

In the right-angled triangle:



The side a is the hypotenuse and the sides b and c are the legs (also called catetum)

Pythagoras' Theorem: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the legs.



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

Pythagoras' Theorem enables us to calculate one side of a right-angle triangle when the other two sides are known.

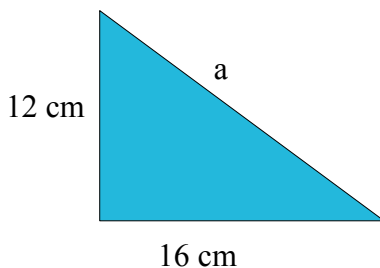
If the legs are known, the hypotenuse can be calculated $a^2 = b^2 + c^2 \Rightarrow a = \sqrt{b^2 + c^2}$

If the hypotenuse and one other side are known, the remaining side can be calculated:

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

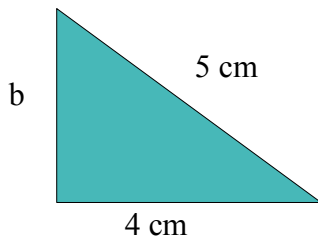
Examples:

a) Calculate the hypotenuse of a right angle triangle whose other side measure 12 cm and 16 cm.



$a^2 = b^2 + c^2 \Rightarrow a^2 = 12^2 + 16^2 \Rightarrow a^2 = 144 + 256 \Rightarrow a^2 = 400 \Rightarrow a = \sqrt{400} = 20$
The hypotenuse measures 20 cm.

b) The hypotenuse of a right-angled triangle measures 5 cm and one of the legs measures 4 cm. Calculate the length of the unknown leg.



$$b^2 = a^2 - c^2 \Rightarrow b^2 = 5^2 - 4^2 \Rightarrow b^2 = 25 - 16 \Rightarrow b^2 = 9 \Rightarrow b = \sqrt{9} = 3$$

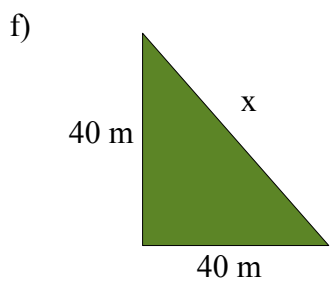
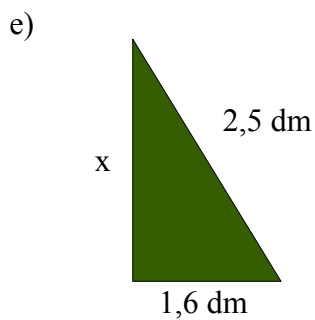
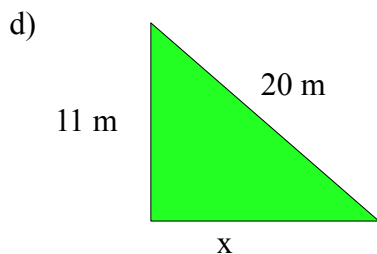
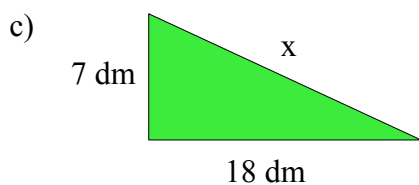
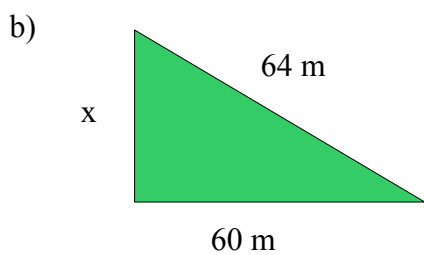
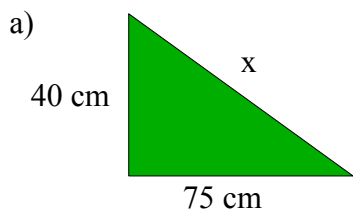
The unknown leg measures 3 cm

Activities.



1. Calculate the hypotenuse of a right-angled triangle whose other sides measure 30 cm and 16 cm.
2. The legs of a right-angled triangle measure 15 cm and 20 cm. Find the length of the hypotenuse.
3. The hypotenuse of a right-angled triangle measures 34 dm and one its leg measures 30 dm. How long is the other leg?
4. The hypotenuse of a right-angled triangle measures 39 m and one of the legs measures 15 m. Calculate the length of the unknown leg.

5. Find the length of the unknown side for each of the following right-angled triangles. If the result is not exact, express it as a decimal number:



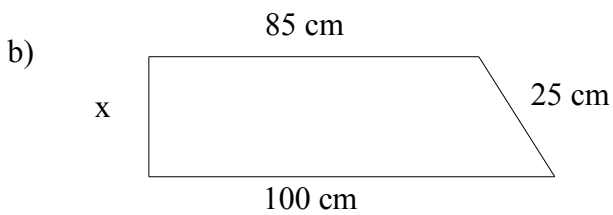
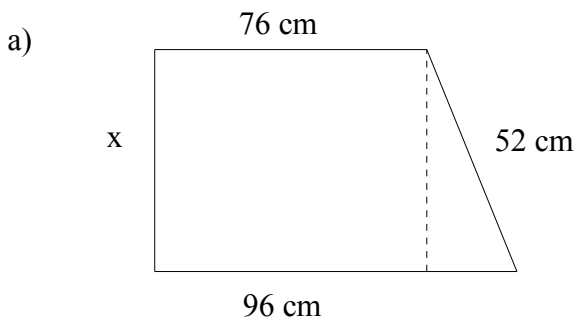
6. Calculate the height of an isosceles triangle whose sides measures 8 cm, 5 cm and 5 cm.

7. Find the height of an isosceles triangle whose base measures 20 cm and whose equal sides measure 26 cm each.

8. The height perpendicular to an uneven side of an isosceles triangle is 30 cm and the triangle's base is 32 cm. Find the length of the two equal sides.

9. The two equal sides of an isosceles triangle measure 50 cm and the height perpendicular to its uneven side is 38 cm. Find the length of its base.

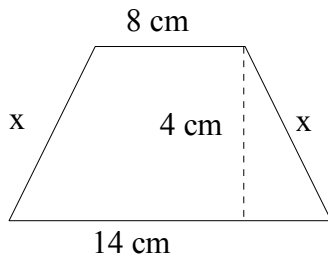
10. Find the length of the unknown side of this right-angled trapezium:



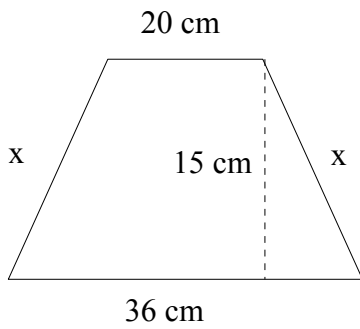
11. The bases of a right-angled trapezium measure 20 m and 38 m. Its height is 13 cm. Calculate its perimeter.

12. Find the length of the unknown sides of this isosceles trapezium:

a)



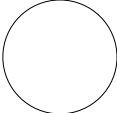
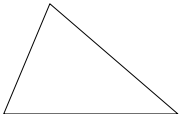
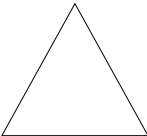

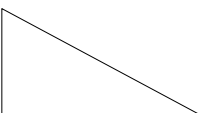
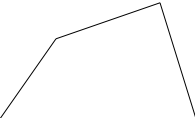


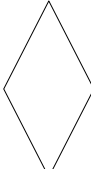
b)

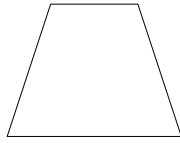
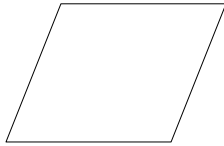
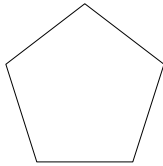
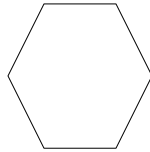
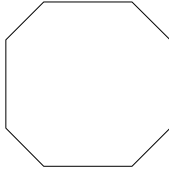


13. The bases of an isosceles trapezium measure 23 cm and 58 cm. The two equal sides measure 21 cm. Calculate its height.

14. Calculate the length of the sides of a rhombus with known diagonals of 48 cm and 20 cm.

2-D Shapes:

NAME		ILLUSTRATION	NOTES
Circle			Symmetrical at any diameter.
Triangle			Three straight sides
	Equilateral triangle		Three equal sides and three equal angles (60°)
	Isosceles triangle		Two equal sides and two equal angles
	Right-angled triangle		One angle equals 90°
Quadrilateral			Four straight sides
	Square		Four equal sides and four right angles
	Rectangle		Opposite equal sides and four right triangle
	Rhombus		Four equal sides and parallel opposite sides

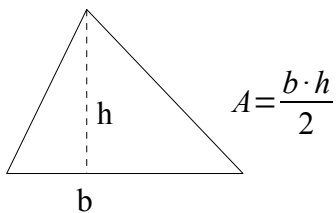
	Trapezium		One pair of opposite parallel sides
	Parallelogram		Both pairs equal and parallel opposite sides
Pentagon			Five sides (equal if regular)
Hexagon			Six sides (equal if regular)
Octagon			Eight sides (equal if regular)

A **polygon** is a plane shape completely enclosed by three or more straight lines (edges).

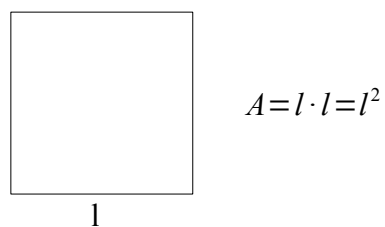
A **vertex** (vertices in plural) is a point where two edges of a polygon meet to form a corner.

Areas of the most important 2-D shapes:

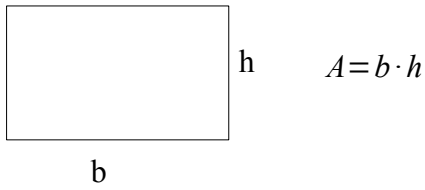
Triangle:



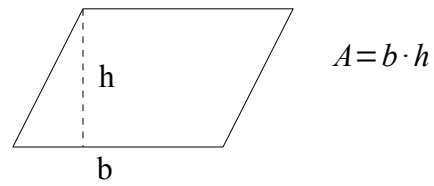
Square:



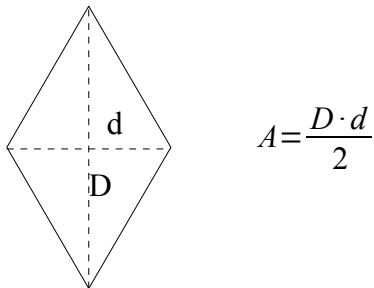
Rectangle:



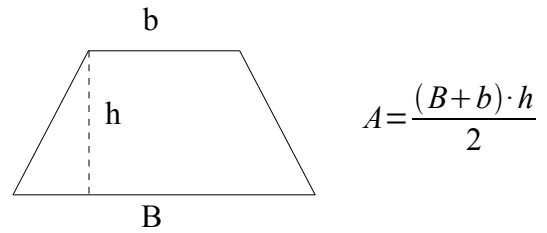
Parallelogram:



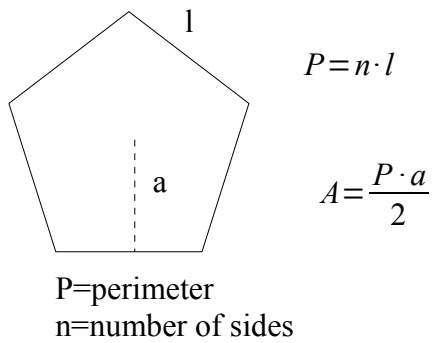
Rhombus:



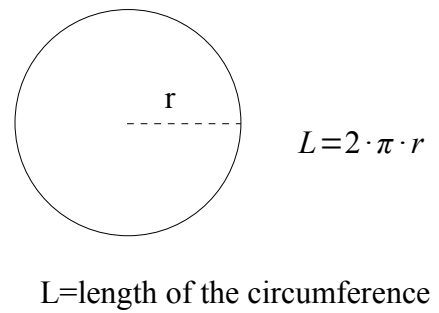
Trapezium:



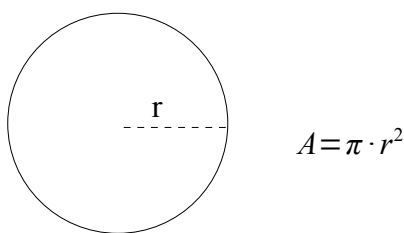
Regular Polygon:



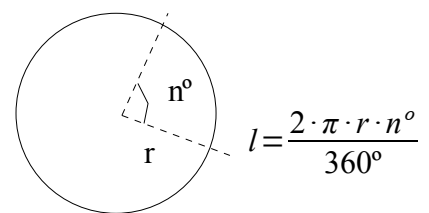
Circumference:



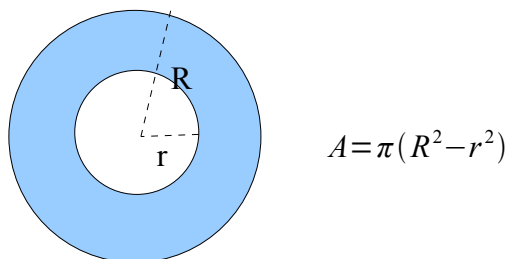
Circle:



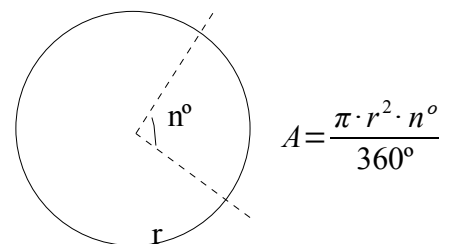
Arc of a circumference:



Annulus:



Sector of a circle:

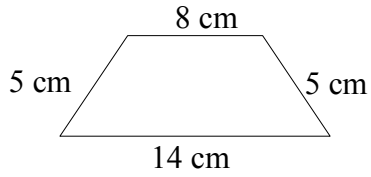


Activities.



1. Calculate the area of an equilateral triangle whose side is 6 cm long.
2. Calculate the area of a right triangle whose hypotenuse is 13 cm and one of the legs is 5 cm.
3. Calculate the area of an isosceles triangle with even sides of 10 cm and uneven side of 6 cm.
4. Calculate the area of a rectangle with diagonal of 15 cm and base of 12 cm.
5. Calculate the perimeter and area of a rhombus whose diagonals are 16 and 12 cm.

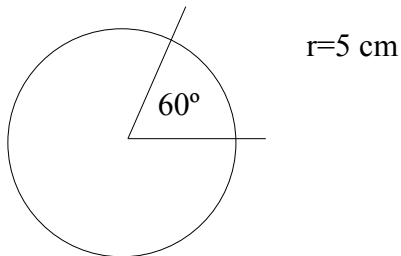
7. Calculate the area of the following isosceles trapezium:



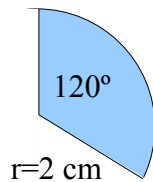
8. Calculate the area of a regular hexagon knowing its side is 8 cm.

9. Calculate the length of a circumference whose radius is 4 cm. What is the area of the inside circle?

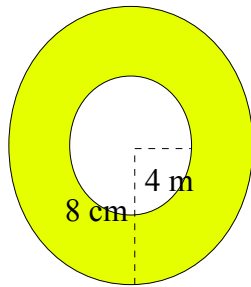
10. Calculate the length of the arc of the circumference:



11. Calculate the area of the sector:



12. Calculate the following area:



Keywords:

Pythagoras theorem=Teorema de Pitágoras

hypotenuse=hipotenusa

leg=cateto

Right-angle triangle=triángulo rectángulo

circle=círculo

circumference=circunferencia

equilateral triangle=triángulo equilátero

isosceles triangle=triángulo isósceles

square=cuadrado

rectangle=rectángulo

parallelogram=paralelogramo

rhombus=rombo

trapezium=trapecio

arc of circumference=arco de circunferencia

sector of a circle= sector de un círculo

annulus=corona circular

length=longitud

base=base

height=altura

diagonal=diagonal

edges, sides= lados

vertex, vertices= vértice, vértices

perimeter=perímetro

area=area

apothem=apotema

radius=radio

diameter=diámetro