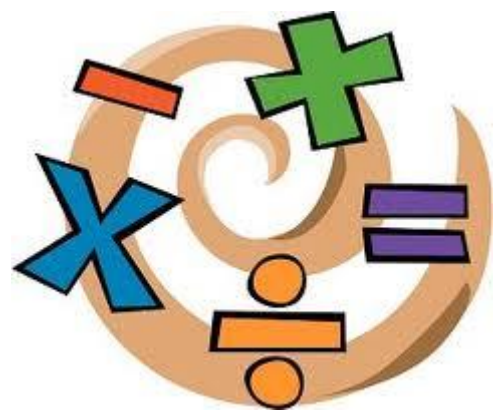# Star Art Education Company

F.5 Mathematics

Teaching Notes and Examples:

- Review on 3D Area and Volume

- Advanced compound and quadratic inequalities

- 2D Application of Trigonometry

- Measures of Dispersion

- Equation of Circle

2D Application of Trigonometry

Key learning objectives:
1. Using Sine and Cosine functions in non-right-angled triangles to solve for the sides and angles
2. Using special formula to calculate the area of triangles

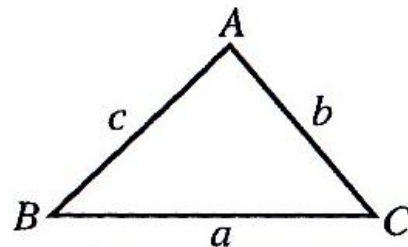## Objective 1: Solve for sides and angles in non-right-angled triangle

Sine Law (or called as Sine Formula)

In ΔABC, consider each side of the triangles and its opposite angles,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

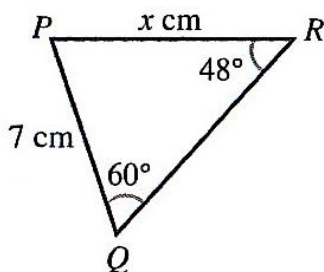or $$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Sine Law can be used to find an unknown side or angle of a triangle in the following cases:

a. One side and two angles are known   (**1S2A**)   OR

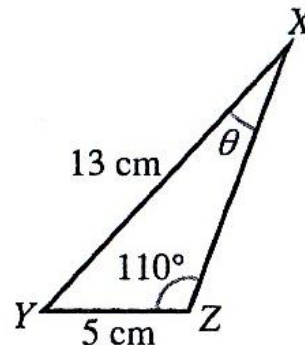b. Two sides and a non-included angle are known   (**2S1A**)

Example 1:

Solve for the unknowns in the figures:

In ΔPQR, we have 1S2A,   In ΔXYZ, we have 2S1A,

Cosine Law (or called Cosine Formula)

In ΔABC,

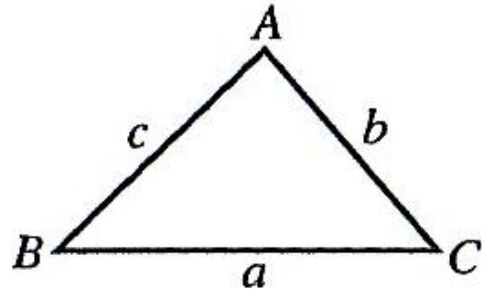$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$

OR

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$
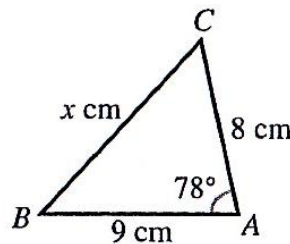
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Cosine Law can be used to find an unknown side or angle of a triangle in the following cases:

a. Two sides and their included angle are known   (**2S1A**)   OR
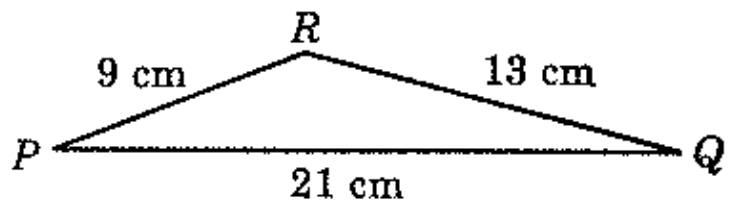
b. Three sides are known (**3S**)

Example 2:

Find x in ΔABC and the smallest angle in ΔPQR

In ΔABC, we have 2 sides and 1 incl. angle

In ΔPQR, we have 3 sides,

Equation of Circle

Key learning objectives:
1. Find the equation of circle with given centre and a point
2. Find the centre and radius with given equation
3. Find the intersection points of straight line and circle
4. Identify the equation of tangent to a circle

Objective 1: Find the equation of circle with given centre and a point

General Form of a circle:

$$x^2 + y^2 + Dx + Ey + F = 0$$

Note:
- **The coefficient of x^2 and y^2 must be 1**
- D, E and F are important in finding the radius and centre

The concept of constructing the equation is to use the property of:

Radius = Distance between a point on circle and centre

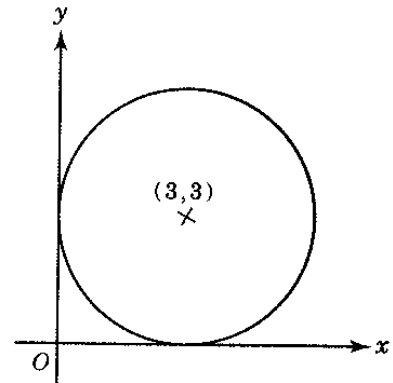Try to identify the following in doing every circle equation questions:

1. Centre

2. Radius

Example 1:
a. Find the radius of the circle with centre at (2, -5) and passing through (4, -3).
b. Find the equation of the circle in part a. Give the answer in general form

Example 2:

In the figure, the centre of the circle is at (3, 3). Find the equation of the circle in the general form

Example 3:

The line segment joining the two points (-3, -5) and (-7, 1) is a diameter of a circle.

a. Find the coordinates of the centre and the radius of the circle

b. Express the equation of circle in general form

(Leave your answers in surd form if necessary)

Example 4 (3 points on the circle):

Find the equation of the circle passing through the three points (0, 0), (0, 4) and (3, 1)