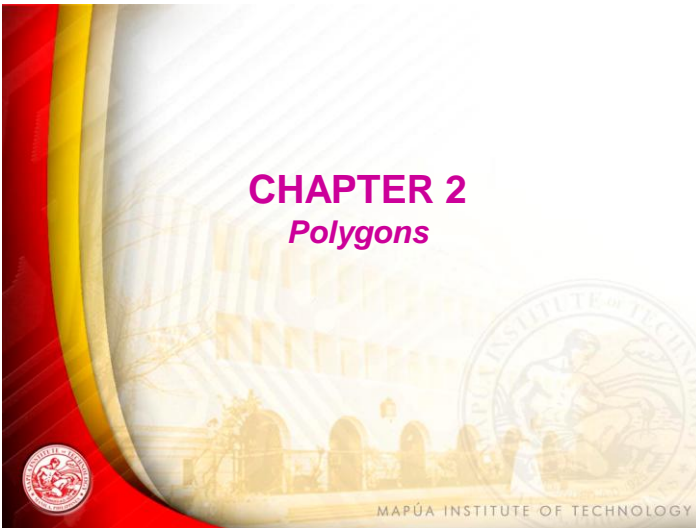


CHAPTER 2

Polygons



Basic Concepts

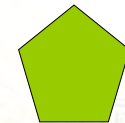
Polygon : 2-dimensional closed figure bounded by straight line segments



3 sides



4 sides



5 sides



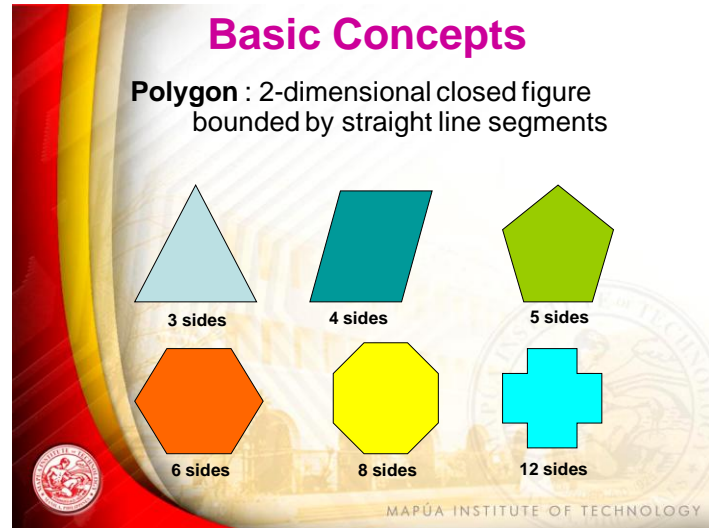
6 sides



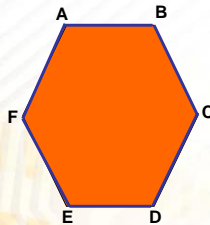
8 sides



12 sides

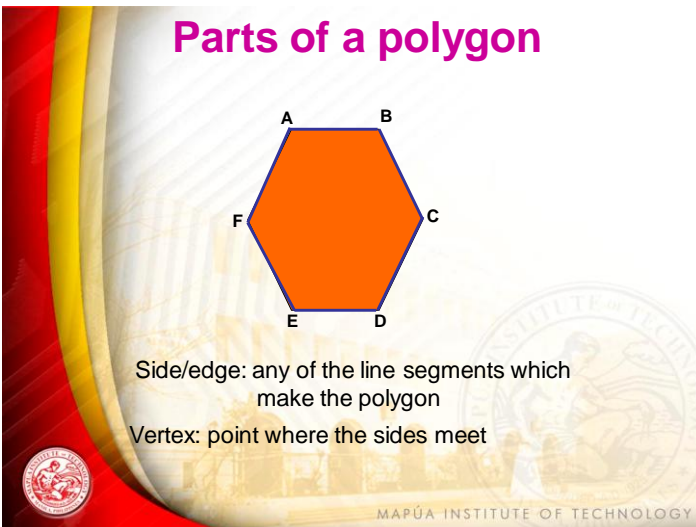


Parts of a polygon

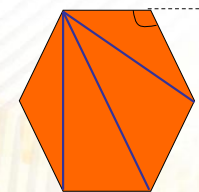


Side/edge: any of the line segments which make the polygon

Vertex: point where the sides meet



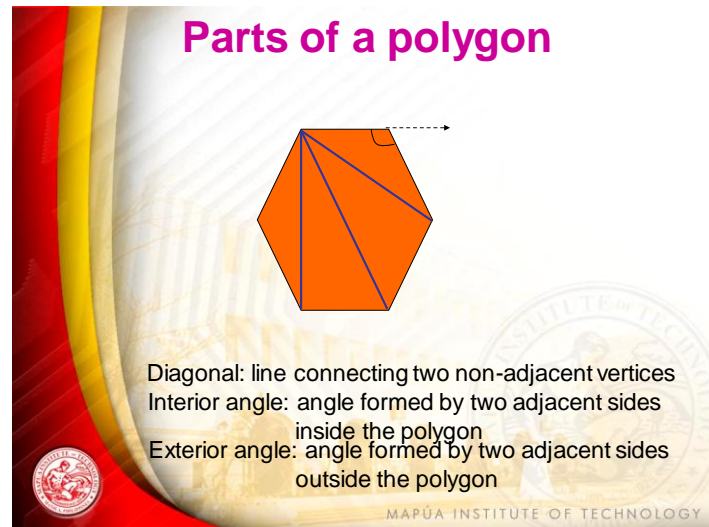
Parts of a polygon



Diagonal: line connecting two non-adjacent vertices

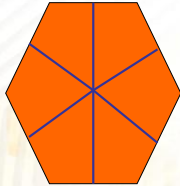
Interior angle: angle formed by two adjacent sides inside the polygon

Exterior angle: angle formed by two adjacent sides outside the polygon



Parts of a polygon

(Regular Polygon)



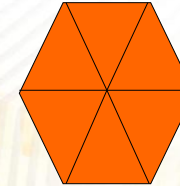
Apothem: segment connecting the center of a polygon and the midpoint of the side, it is perpendicular bisector of the side



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Parts of a polygon

(Regular Polygon)



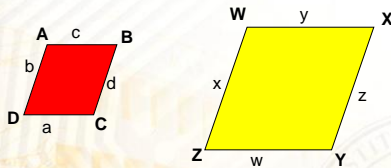
Central Angle: angle subtended by a side about the center



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Similar polygons

Polygons whose corresponding interior angles are congruent and whose corresponding sides are proportional



$$\angle A \cong \angle W; \angle B \cong \angle X; \angle C \cong \angle Y; \angle D \cong \angle Z$$

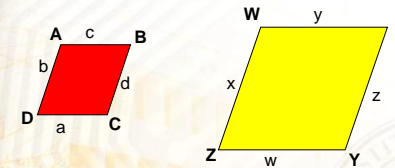
$$\frac{a}{w} = \frac{b}{x} = \frac{c}{y} = \frac{d}{z}$$



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Similar polygons

Polygons whose corresponding interior angles are congruent and whose corresponding sides are proportional

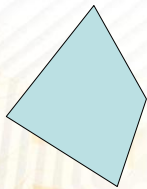


$$\frac{A_1}{A_2} = \left(\frac{a}{w}\right)^2 = \left(\frac{b}{x}\right)^2 = \left(\frac{c}{y}\right)^2 = \left(\frac{d}{z}\right)^2$$

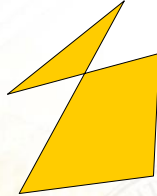


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Types of polygons



Simple polygon
- Unique interior region

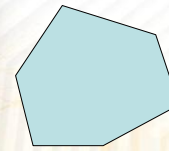


Complex polygon
- multiple interior region

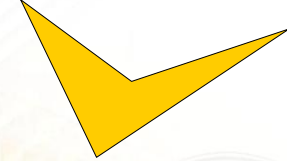


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Types of polygons



Convex polygon: no internal angle greater than 180°



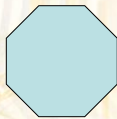
Concave polygon: at least one angle is greater than 180°



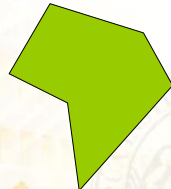
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Types of polygons

If the sides of the polygon are of equal length and its interior angles are all congruent, then the polygon is **regular**. Otherwise, it is **irregular**.



regular



irregular



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Names of Polygon

Polygons are named according to their number of sides. A polygon with n sides is called an n -gon.

- | | |
|-----|-------------------------|
| n | Polygon |
| 3 | triangle, trigon |
| 4 | Quadrilateral, Tetragon |
| 5 | Pentagon |
| 6 | Hexagon |
| 7 | Heptagon |
| 8 | Octagon |
| 9 | Nonagon, enneagon |
| 10 | Decagon |



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Names of Polygon

Example: (Naming of Polygon)

Given the number of sides, construct the name for 28 and 46 sided polygon

$$28 = 20 + 8$$

icosa + octagon = icosaoctagon

$$46 = 40 + 6$$

tetracon + hexagon = tetraconhexagon

Formulas

Perimeter: $P = sn$; s – length of side,
n - number of sides

Area: $A = \frac{1}{2} Pa$ or $A = \frac{s^2 n}{4} \cot\left(\frac{180^\circ}{n}\right)$

a - apothem

Number of diagonals: $d = \frac{n}{2}(n-3)$

Number of triangles: $t = n - 2$

Central Angle: $\theta_c = \frac{360^\circ}{n}$ Interior Angle: $\theta_i = \left(\frac{n-2}{n}\right)180^\circ$

Sum of interior angles: $I_s = (n-2)180^\circ$

Exercises

1. A regular polygon has 170 diagonals and 2.4 cm side length. What is its area?
2. The areas of two similar polygons are 64 sq. units and 100 sq. units, find the corresponding side of the smaller polygon.