**Al-Mustaqbal University / College of Engineering & Technology**
**Department (اسم القسم)**
**Class(first stage)**
**Subject (plane *Surveying* ) / Code (uomu023022)**
**Lecture(م.م بنين محمد هلال)**
**2ˢᵗterm – Lecture No.1 & Lecture Name (*General basic of surveying*)**

## *General basic of surveying*

### *Surveying*

Surveying has been defined as the science, art, and technology of measuring distances, angles, and positions on or near the surface of the earth.

### *Measurements and Errors*   القياسات والاخطاء

### *units of measurement*

1. linear measurement units          وحدات القياس الخطية

2. angular units of measurement          وحدات القياس الزاوية

### 1- linear measurement units

Two different systems are in use for specifying units of observed

quantities, the metric and English systems.

### 1.1. Metric system

Because of its widespread adoption, the metric system is called the International System of Units, abbreviated SI.

### Length measurements

☐ The basic unit employed for length measurements in the metric or SI system is the meter.

☐ Subdivisions of the meter (m) are the millimeter (mm), centimeter cm), and decimeter (dm).

1 meter (m)= 1000 millimeter (mm)=100 centimeter (cm)
1 meter (m)= 10 decimeter (dm)= $10^{-3}$ kilometer (km)

kilometer (km) = 1000 m.

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## Area measurements

☐ Areas in the metric system are specified using the square meter (m²).

☐ Large areas are given in hectares (ha)

1 ha = 10,000 m²

Dunam = 2500 m² = 0.25 ha

## Volume measurements

The cubic meter (m3) is used for volumes in the SI system.

## 1.2English system

☐ The basic unit employed for length measurements in the English system is the foot.

☐ (mile, ft, inch)

$$1 \text{ foot (ft)}(') = 12 \text{ inch(in)}('') = 1/3 \text{ yard(yd)}$$
$$1 \text{ mile (mil)} = 5280 \text{ ft}$$
$$1 \text{ inch} = 2.54 \text{ centimeters (basis of international foot)}$$
$$1 \text{ foot} = 0.3048 \text{ m (basis of international foot)}$$

*Example*

1- Convert the following distances (4129.574 m) given in meters to feet
2- Convert the following distances (537.52 ft) given in feet to meters:

*Sol/* 1-13548.47 ft        2-163.836 m

• In the English system, areas are given in square feet or square yards. Large areas are given in acre.

$$\text{Acre} = 4840 \text{ yd}^2 = 43560 \text{ ft}^2$$

• Volumes in the English system can be given in cubic feet or cubic yards.

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## 2- Angular units of measurement    وحدات القياس الزاوية

There are three systems used for angles, namely the sexagesimal, the

centesimal and radians.

## 2.1 Sexagesimal system (degree (°))

- subdivide a circle into 360°(degree). One degree (1°) equals 60' (min), and one
  min (1') equals 60" (sec).
- 1°=60'
- 1'=60"

For example

45°30'20"

## 2.2 Centesimal system (grad (g))

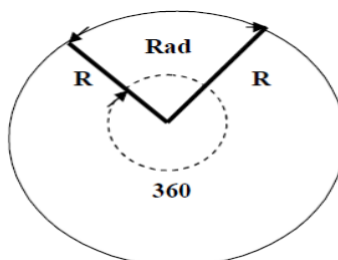- subdivide a circle into 400 grads
- 1g=100 centigrade (cg)
- 1cg=100 cent centigrade (ccg)

For example

**82ᵍ46ᶜᵍ91ᶜᶜᵍ**

## *2.3 Radians system (rad)*

the angle subtended at the center of a circle by an arc of a length equal to the radius of
the circle

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*Note*

1- Degrees, minutes, and seconds, or the radian, are accepted

for angles.

2- $2\pi$ rad$=360° = 400$ g

## Relation between sexagesimal and radians system

1 rad$= 180°/\pi$

- To transform radians to degrees, multiply by $180°/\pi$

$$\text{angle (degree)}= \frac{180°}{\pi} * \text{angle (rad)}$$

- To transform degrees to radians, multiply by $\pi/180°$

$$\text{angle (rad)}= \frac{\pi}{180°} * \text{angle (degree)}$$

## Relation between Centesimal and radians system

- To transform degrees to grad, multiply by 400/360

$$\text{angle (grad)}= \frac{400}{360} * \text{angle (degree)}$$

- To transform grad to degrees, multiply by 360/400

$$\text{angle (degree)}= \frac{360}{400} * \text{angle (grad)}$$

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### Example 1

1- An angle of 2.053 rad. Convert this angle to degree

$$\text{angle (degree)} = \frac{180°}{\pi} * \text{angle (rad)}$$

$$\text{angle (degree)} = \frac{180°}{\pi} * 2.053 = 117.628° = 117°37'41''$$

0.628*60=37.68'

0.68*60=40.8''=41''

2- An angle of 12°15'26''. Convert this angle to radian.

$$\text{angle (rad)} = \frac{\pi}{180°} * \text{angle (degree)}$$

$$rad = \frac{\pi}{180}(12 + \frac{15}{60} + \frac{26}{3600})$$

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3- An angle of 142°22′15″. Convert this angle to centesimal and radians system

$$\left(\frac{15}{60} + 22\right) = 22.25'$$

$$\left(\frac{22.25'}{60} + 142\right) = 142.3708°$$

angle (rad)= $\frac{\pi}{180°}$ * angle (degree)

angle (rad)= $\frac{\pi}{180°}$ * 142.3708° = 2.48584 $rad$

angle (grad)= $\frac{400}{360}$ * angle (degree)

angle (grad)= $\frac{400}{360}$ * 142.3708° = 158.18977 $grad$

## Example 2

1- An angle of 324.4625 grad. Convert this angle to Sexagesimal system (degree,minute, second)

$$\text{angle (degree)}= \frac{360}{400} * \text{angle (grad)}$$

$$\text{angle (degree)}= \frac{360}{400} * 324.4625 = 292.01625°$$

$$0.01625 * 60 = 0.975 \ min$$

$$0.975 * 60 = 58.5 \ sec$$

$$292°00'58.5''$$