Majmaah University   **College of Engineering**

Civil and Environmental Engineering Department   **2018-19/2**


Sheet (2)

Scales

Note: *You are required to submit your answers in a report with hand writing within one week of receiving this sheet.*

Guides

1. Large if greater than 1 cm = 10 m (RF > 1/1000) 1:1000
2. Intermediate if between 1 cm = 10 m and 1 cm = 100 m (1:1000) and (1:10000)
3. Small if < 1 cm = 100 m (1:10000)

Types of scales

1) RF = Representative Factor
   Fraction: example: 1/1000
   Proportion: example 1:1000
   Simple (plain scale):
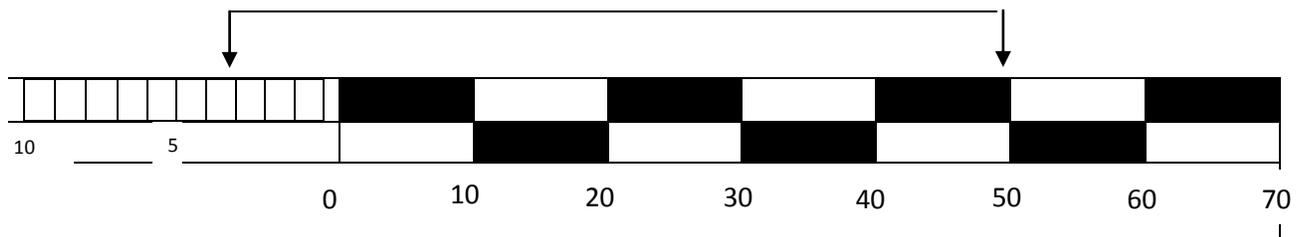
Plain scale 1:1000

2) Diagonal scale

In plain scale only units and tenths could be shown whereas in diagonal scales it is possible to show units, tenths and hundredths. Units and tenths are shown as in plain scale. To show hundredths; principle of similar triangles is used. If AB is a small length and its tenths are to be shown, it can be done as shown in the Figure below.

Example: Draw the line AC of convenient length at right angles to AB. Divide it into 10 parts.
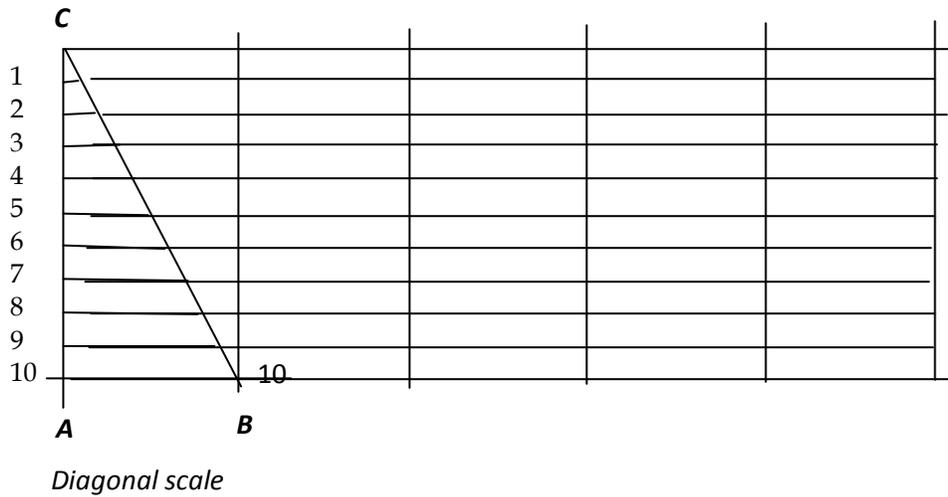
Diagonal scale

Solved examples:

1- *Write a proportional scale that expresses the relation: 1 cm on the map equal 0.5 km on nature?*

Solution:
Scale = 1 cm to 0.5 km, thus 1:0.5 x 1000 x 100
Scale = 1:50000

2- *The distance between two cities is 200 km. If this distance appears on a map as line of length equal 5 cm. Find the scale of this map?*

Solution:
True distance = 200 km
Distance on the map = 5 cm

Convert the 200 km to cm
Thus; 200 x 1000 x 100 = 20000000 cm
$$Scale = \frac{distance\ on\ the\ map\ (cm)}{true\ distance\ (cm)}$$

$$Scale = \frac{5}{20000000} = \frac{1}{4000000}$$

3- *The distance between two cities on a map is measured is 10 cm. If this distance was drawn with scale 1: 1000000. Calculate the true distance.*

Solution:
True distance = ?
Distance on the map = 10 cm
Scale = 1: 1000000

$$Scale = \frac{distance\ on\ the\ map\ (cm)}{true\ distance\ (cm)}$$

$$\frac{1}{1000000} = \frac{10}{x}$$

X = 1000000 x 10 = 10000000 cm = <u>100 km</u>

4- *A rectangular piece of land of 1200 m². If this land drawn with scale 1: 200. If the length of that land was found as 20 cm. Calculate its width.*

<u>Solution:</u>
True area = 1200 m²
Length of the land on the map = 20 cm
Scale = 1: 200
Required: true width of the land

$$Scale = \frac{length\ of\ the\ line\ on\ the\ map\ (cm)}{true\ length\ (cm)}$$

$$\frac{1}{200} = \frac{20\ (cm)}{true\ length\ (cm)}$$

True length of the land = 200 x 20 = 4000 cm = 40 m

Area of rectangular shape = length x width

1200 = 40 x width

<u>Width = 30 m</u>

5- *A rectangular piece of land of 875 m². If this land drawn with scale 1: 100. If its width appears as 25 cm on that map. Calculate its true length.*

Solution:

True area = 875 m²

Width of the land on the map = 25 cm

Scale = 1: 100

Required: true length of the land

$$Scale = \frac{width\ on\ the\ map\ (cm)}{true\ width\ (cm)}$$

$$\frac{1}{100} = \frac{25\ (cm)}{true\ width\ (cm)}$$

True width of the land = 100 x 25 = 2500 cm = 25 m

Area of rectangular shape = length x width

875 m² = Length x 25 m

Length = 35 m

6- *A map is drawn using a scale 1 cm represents 6 m. What is the length of a line (on that map) that measures 62 meter in nature?*

Solution:

Scale = 1 cm to 6 m, thus 1:600

True length of the line = 72 m

Required: length of the line on the map

$$Scale = \frac{length\ on\ the\ map\ (cm)}{length\ on\ nature\ (true\ length)\ (cm)}$$

$$\frac{1}{600} = \frac{x}{7200}$$

$$X = \frac{7200}{600} = \underline{12 \ cm}$$

7- A distance measured on a map and found to be 5 cm. If this distance equivalent to 2 km on nature. What is the distance on the same map that represents 800 m on nature?

Solution:

True distance = 2 km

Distance on the map = 5 cm

$$Scale = \frac{length \ on \ the \ map \ (cm)}{length \ on \ nature \ (true \ length) \ (cm)}$$

$$Scale = \frac{5 \ (cm)}{200000 \ (cm)} = 1: \ 40000$$

$$\frac{1}{40000} = \frac{x}{80000}$$

$$X = 2 \ cm$$

Another solution

5 cm   2 km

X   800 m

$$X = \frac{5 \ x \ 800}{2000} = 2 \ cm$$

Problems (Homework)

1) *The distance between AlMajmaah and Al-Qussiem is measured as 148 km. If this distance is drawn on a map as 4.6 cm. find the scale of the map.*

2) *A map is drawn with scale 1:800000. If the distance between two cities on that map equals 12.5 cm. find the true distance between the two cities in Km.*

3) *A map is drawn with scale 1:25000. If the distance between two cities on that map equals 8.4 cm. find the true distance between the two cities in miles.*

4) *If the distance between Almajmah and AlGhat is 45 km. Find the distance between them on a map that drawn with scale 1: 500000*

5) *A map is drawn with a scale 1:300000 if the distance between 2 cities on that map is found as 18 cm. How much the distance between the two cities in kilometers?*

6) *If the distance between two cities is 280 km. find the distance between them (in cm) on a map with scale 1:400000*

7) *The distance between two cities is 148km and the distance between them on a map is 1.6 cm. Find the scale of the map.*

8) *A piece of land appears as rectangular shape of 60m x 40 m. If it is drawn on a map with scale 1:200. Calculate the area of that land on the map.*

9) *If the length of a road is 420 km and its length on a map equal 7 cm. Calculate the scale of that map.*

10) *A picture was taken for a man where the scale of the picture was 1:20. What is the true tall of the man if his length on that picture was measured as 8.8 cm.*

11) *Construct a plain scale of RF $\frac{1}{1000}$ and indicate 42 m on it.*

12) *Construct a simple graphic scale of $\frac{1}{500}$, accurate to 1 m, and indicate 53 m on it.*

13) *Construct a diagonal scale of RF $\frac{1}{400}$ and indicate 28.8 m on it*

14) *Construct a scale of RF $\frac{1}{1000}$ accurate to 0.5 m and indicate 44.5 m on it.*

15) *Construct a scale of RF $\frac{1}{2500}$ accurate to 0.5 m and indicate 37.5 m on it.*

Good Luck