ENGINEERING GRAPHICS

Topic:
Scales

https://www.youtube.com/watch?v=7YpDxBpmQOM

https://www.youtube.com/watch?v=kBydiwa-KGM

https://www.youtube.com/watch?v=mf2Yph7dtGU

https://www.youtube.com/watch?v=-hTHelcMrFs

https://www.youtube.com/watch?v=avmqZzwWz4k

https://www.youtube.com/watch?v=61nUJd3FB84

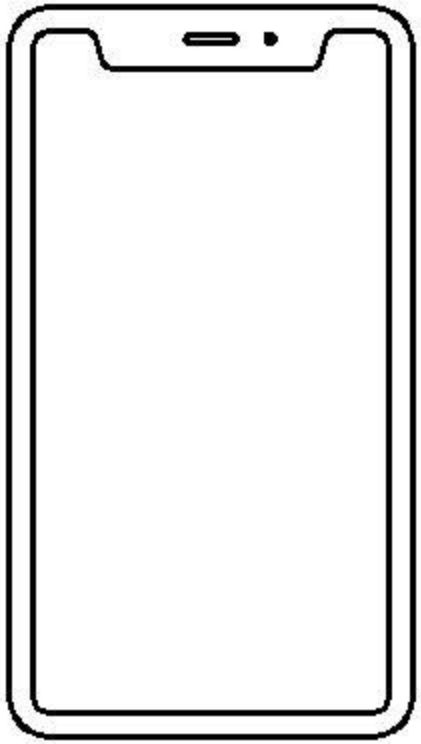
https://www.youtube.com/watch?v=NbQlu0Dss3I

https://www.youtube.com/watch?v=u1PGNqUTMco

Scales

It is always possible or convenient to make the linear dimensions on a drawing the same size as the corresponding real dimensions on the object drawn. For eg. Drawing of a mobile phone.

Scales



NOTES:-

1. THIS IS A DUMMY DRAWING MADE FOR ENGINEERING STUDENTS.
2. THIS DRAWING BELONGS TO KSG ENGINEERING YOUTUBE CHANNEL.

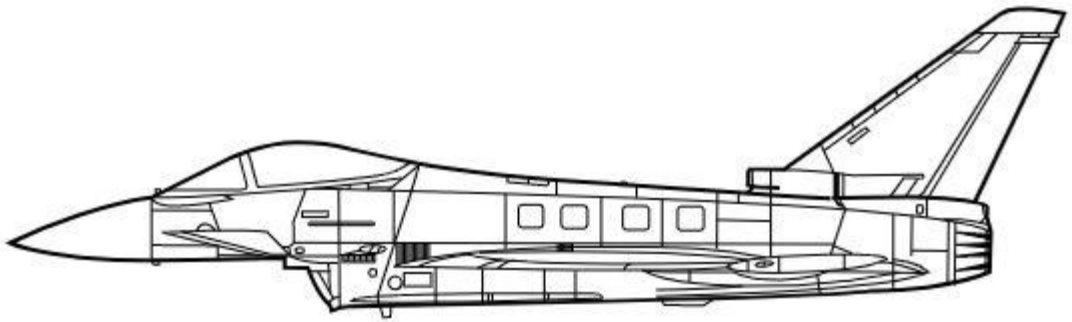
TITLE

DUMMY DRAWING

Scales

Drawing of very big object, like aeroplane, must perforce, be drawn considerably smaller than the object so that the drawing can be read and handled with convenience.

Scales



NOTES:-

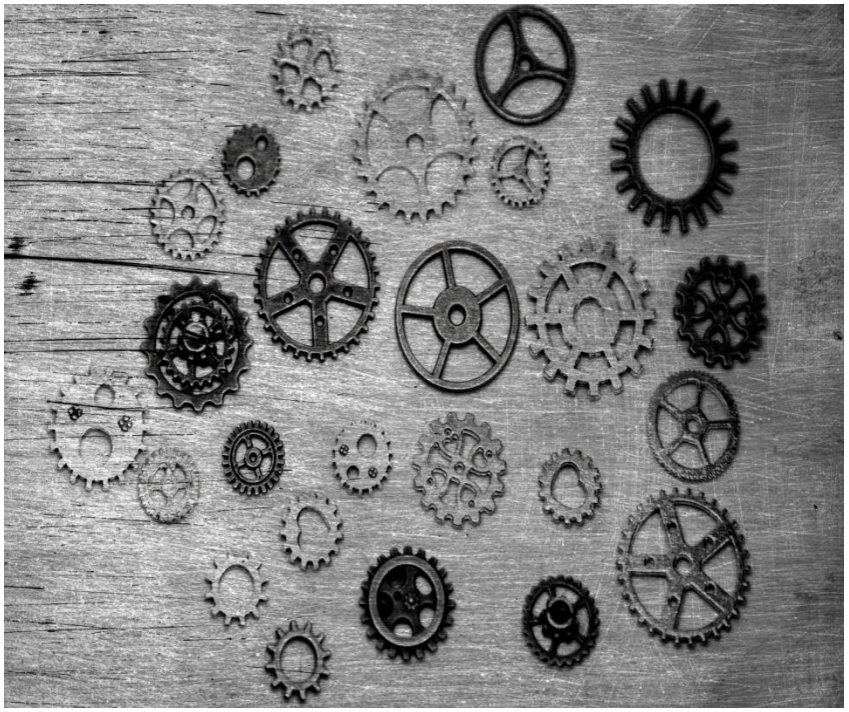
1. THIS IS A DUMMY DRAWING MADE FOR ENGINEERING STUDENTS.

TITLE

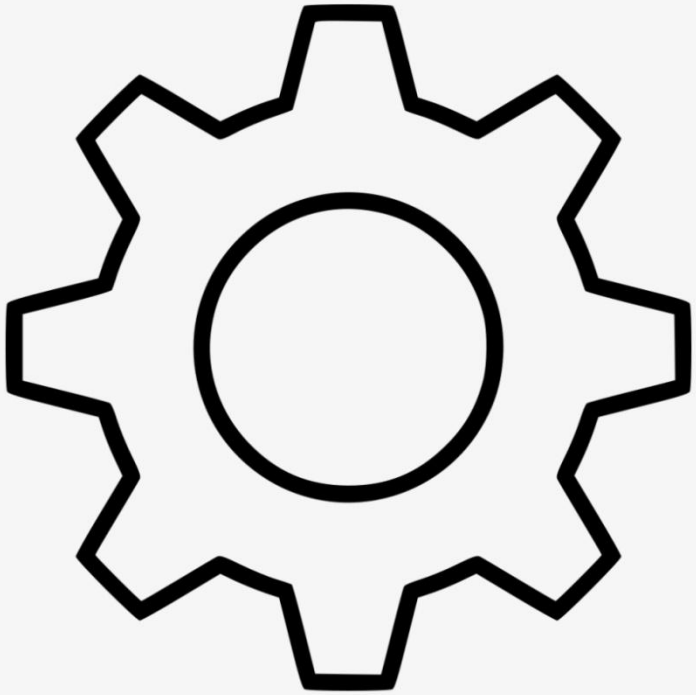
DUMMY DRAWING

Scales

Where as, details of small precision instruments, watches etc.; are made larger than their real size so that the drawing can be read clearly.



Scales



NOTES:-

1. THIS IS A DUMMY DRAWING MADE FOR ENGINEERING STUDENTS.

TITLE

DUMMY DRAWING

Scales

- **The proportion by which the drawing of a given object is enlarged or reduced is called the *scale* of the drawing.**

Representative Fraction

- **The scale of a drawing is indicated by a ratio, called the *Representative Fraction* (RF) or *Scale Factor*.**

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}}$$

- **The terms ‘scale’ and ‘RF’ are synonymous. The scale is most commonly expressed in the format *X* :*Y* while RF is expressed in the format *X*/*Y*.**

Examples

- **Example 1: 6m length of airplane is drawn as 6cm on the drawing.**

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{6\text{ cm}}{6\text{ m}}$$

$$= \frac{6\text{ cm}}{6 \times 100\text{ cm}} = \frac{1}{100}$$

- **RF = 1/100 (Size of the drawing is reduced by 100 times)**
- **Scale = 1:100**
- **Reducing scale**

Examples

- **Example 2: 6mm diameter of gear is drawn as 6cm on the drawing.**

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{6\text{ cm}}{6\text{ mm}}$$

$$= \frac{6 \times 10\text{ mm}}{6\text{ mm}} = \frac{10}{1}$$

- **RF = 10/1 (Size of the drawing is enlarged by 10 times)**
- **Scale = 10:1**
- **Enlarging Scale**

Examples

- **Example 3: 15cm length of mobile is drawn as 15cm on the drawing.**

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{15\text{ cm}}{15\text{ cm}}$$

$$= \frac{1}{1}$$

- **RF = 1/1 (Full Size)**
- **Scale = 1:1**
- **Full Scale**

Sizes of Scale

1. **Reducing Scale.**
2. **Enlarging Scale.**
3. **Full Scale.**

Sizes of Scale

1. Reducing Scale

When huge objects are to be drawn, they are reduced in size on the drawing. The scales used for these objects are called *reducing scales*. It is clear that the length of the object on the drawing is less than the actual length of the object. Reducing scales are mentioned in the format 1 :*Y*, where *Y* is greater than 1. Hence, RF < 1.

For eg:- 1:2 means drawing made to one HALF of the actual size.

Objects like multi-storeyed buildings, bridges, boilers, huge machinery, ships, aeroplanes, etc., are drawn to reducing scales.

Sizes of Scale

2. Enlarging Scale

When smaller objects are to be drawn, they often need to be enlarged. The scales used in such cases are called *enlarging scales*. Obviously, the length of an object on the drawing is more than the corresponding actual length of the object. Enlarging scales are mentioned in the format *X* : 1, where *X* is greater than 1. Clearly, RF > 1.

For eg: - 2:1 means drawing made to twice the actual size

Enlarging scales are used for objects like screws and gears used in small electronic gadgets, wristwatch parts, resistors, transistors, ICs.

Sizes of Scale

3. Full Scale

When an object is drawn on the sheet to its actual size, it is said to be drawn to *full scale*. As the length on the drawing is equal to the actual length of the object, the full scale is expressed as 1:1. Obviously, for full scale, RF = 1.

Full scales are used for objects like mobile phone, calculators, etc.

Types of Scale

1. Plain Scale or Simple Scale
2. Diagonal Scale

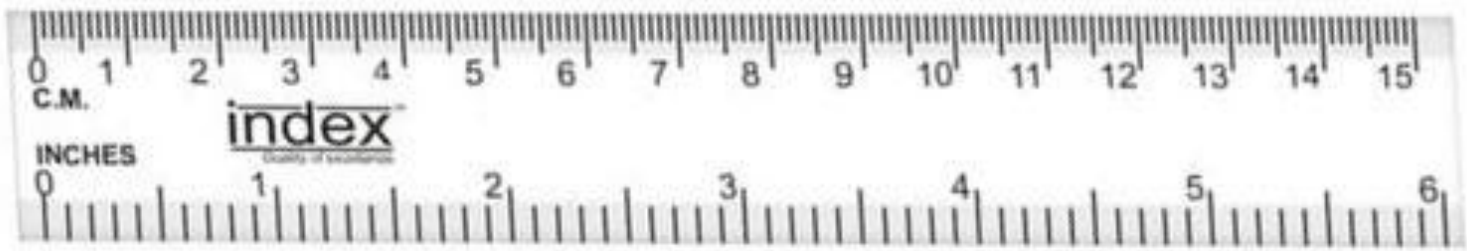
Types of Scale

1. **Plain Scale:**

   It is a line divided into suitable number of equal parts or units, the first part of which is subdivided into small parts.

   It represents either 2 main units or 1 unit and its sub division (fractions).

   It can measure lengths up to 1 decimal place. (eg: 3.5 m, 2.7 cm)



Types of Scale

2. Diagonal Scale:

In diagonal scale the smallest unit on plain scale is further subdivided by using diagonal principle.

It represents either 3 units or only one unit and its fractions up to second place of decimal point.

It can measure lengths upto 2 decimal place. (eg: 3.56 m, 2.78 cm)

Conversions

1 Km	=	10	Hectometer
1 Hectometer	=	10	Decameter
1 Decameter	=	10	Meter
1 Meter	=	10	Decimeter
1 Decimeter	=	10	Centimeter
1 Centimeter	=	10	Millimeters

Plain Scale Problem 1

Construct a Plain Scale to show meters & decimeters when 1 m is represented by 2.5 cm. The scale should be long enough to measure up to 6 m. Mark off 3.3 m & 5.6 m on the scale.

1. Calculate Representative Factor,

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{2.5\text{ cm}}{1\text{ m}}$$

$$RF = \frac{2.5\text{ cm}}{1 \times 100\text{ cm}} = \frac{1}{40}$$

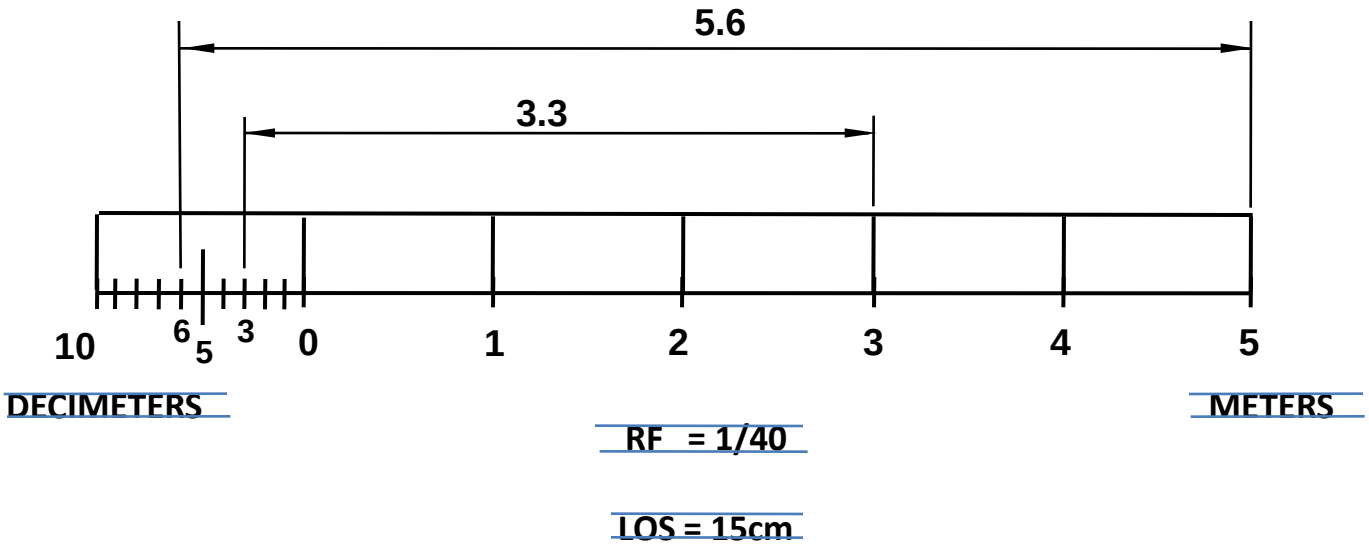
2. Calculate length of scale (L.O.S),

LOS = RF x Maximum length of scale = 1/40 x 6 m = 1/40 x 600 cm

= 15 cm

Plain Scale Problem 1

Construct a Plain Scale to show meters & decimeters when 1 m is represented by 2.5 cm. The scale should be long enough to measure up to 6 m. Mark off 3.3 m & 5.6 m on the scale.



Plain Scale Problem 2

Construct a Plain Scale to show kilometers & hectometers when 2.5 cm is equal to 1 km. The scale should be long enough to measure up to 6 km. Mark off 2.7 km, 3.9 km & 4.5 km on the scale.

1. Calculate Representative Factor,

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{2.5\text{ cm}}{1\text{ Km}}$$

$$RF = \frac{2.5\text{ cm}}{1 \times 1{,}00{,}000\text{ cm}} = \frac{1}{40{,}000}$$

2. Calculate length of scale (L.O.S),

LOS = RF x Maximum length of scale

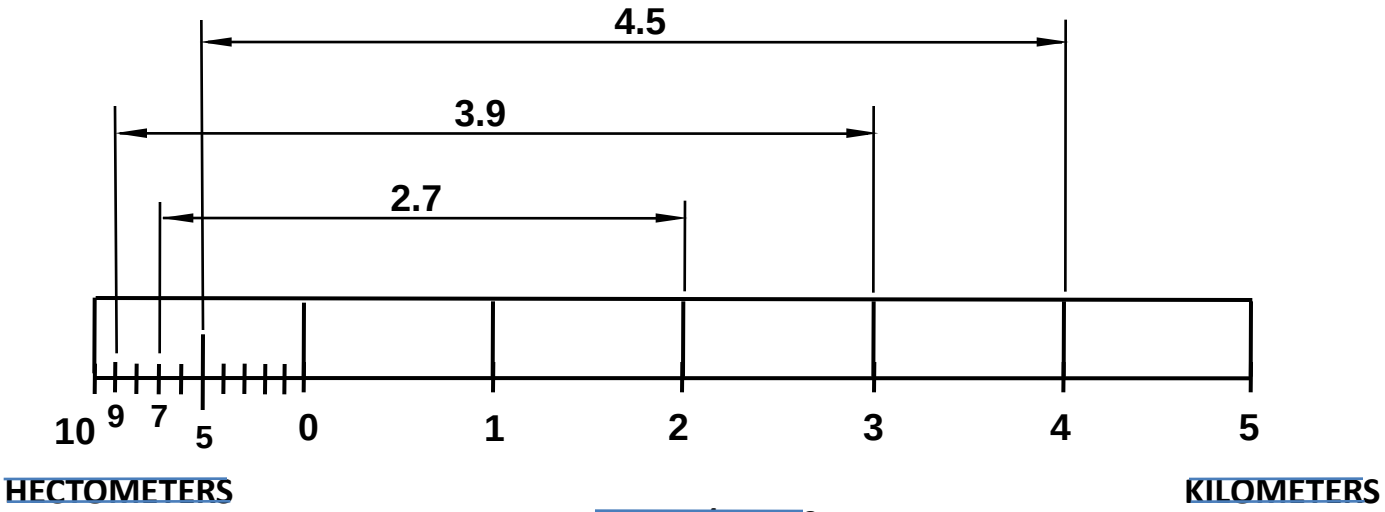
= 1/40,000 x 6 km

= 1/40,000 x 6,00,000 cm

= 15 cm

Plain Scale Problem 2

Construct a Plain Scale to show kilometers & hectometers when 2.5 cm is equal to 1 km. The scale should be long enough to measure up to 6 km. Mark off 2.7 km, 3.9 km & 4.5 km on the scale.



RF = 1/40,000

LOS = 15cm

Plain Scale Problem 3

Construct a Plain Scale to read centimeters & decimeters. The scale should be long enough to measure up to 7 decimeters. The R.F. of scale is 1/5. Mark off 6.5 decimeter on the scale.

1. Calculate Representative Factor,

$$RF = \frac{1}{5}$$

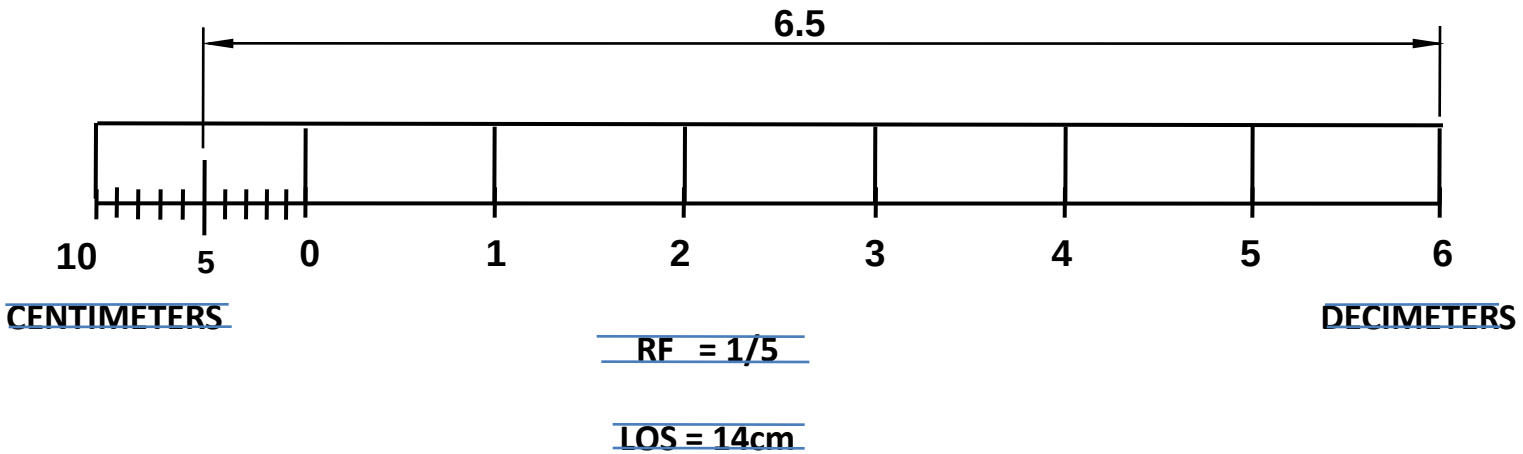
2. Calculate length of scale (L.O.S),

LOS = RF x Maximum length of scale

= 1/5 x 7 dm
= 1/5 x 7 x 10 cm
= 14 cm

Plain Scale Problem 3

Construct a Plain Scale to read centimeters & decimeters. The scale should be long enough to measure up to 7 decimeters. The R.F. of scale is 1/5. Mark off 6.5 decimeter on the scale.



Diagonal Scale Problem 1

Construct a diagonal scale to show meters, decimeters & centimeters when 1 m is represented by 5 cm. Consider maximum length of scale as 4 m. Mark off 2.58 m & 3.09 m.

1. Calculate Representative Factor,

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{5\text{ cm}}{1\text{ m}}$$

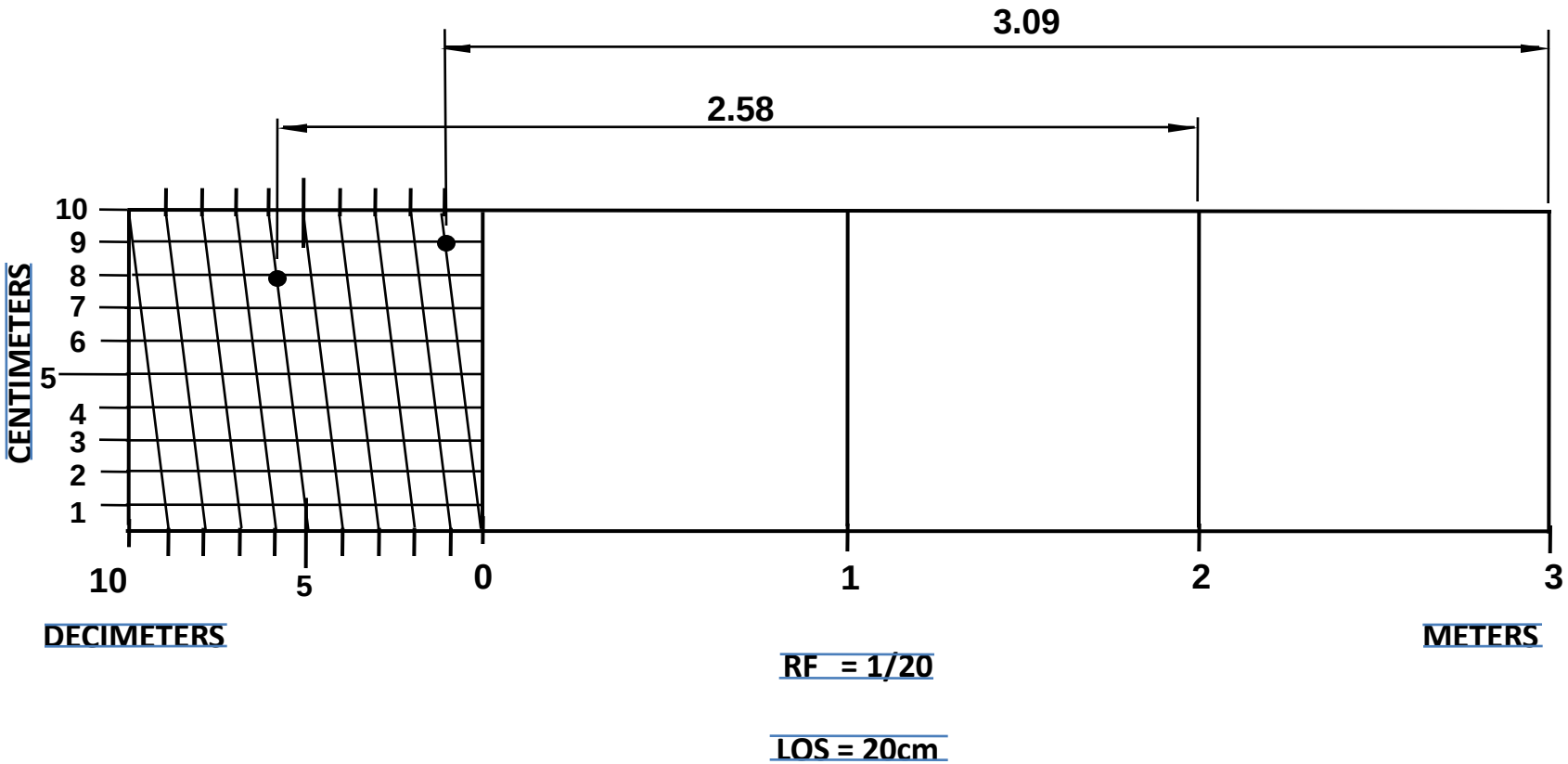
$$RF = \frac{5\text{ cm}}{1 \times 100\text{ cm}} = \frac{1}{20}$$

2. Calculate length of scale (L.O.S),

LOS = RF x Maximum length of scale = 1/20 x 4 m
= 1/20 x 4 x 100 cm
= 20 cm

Diagonal Scale Problem 1

Construct a diagonal scale to show meters, decimeters & centimeters when 1 m is represented by 5 cm. Consider maximum length of scale as 4 m. Mark off 2.58 m & 3.09 m.



RF = 1/20

LOS = 20cm

Diagonal Scale Problem 2

The distance between two stations is 100 Km and it is represented on a map by a line of 2.5 cm. Draw a diagonal scale showing single Km. Mark off 409 Km & 573 Km on the scale.

1. Calculate Representative Factor,

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{2.5 \text{ cm}}{100 \text{ km}}$$

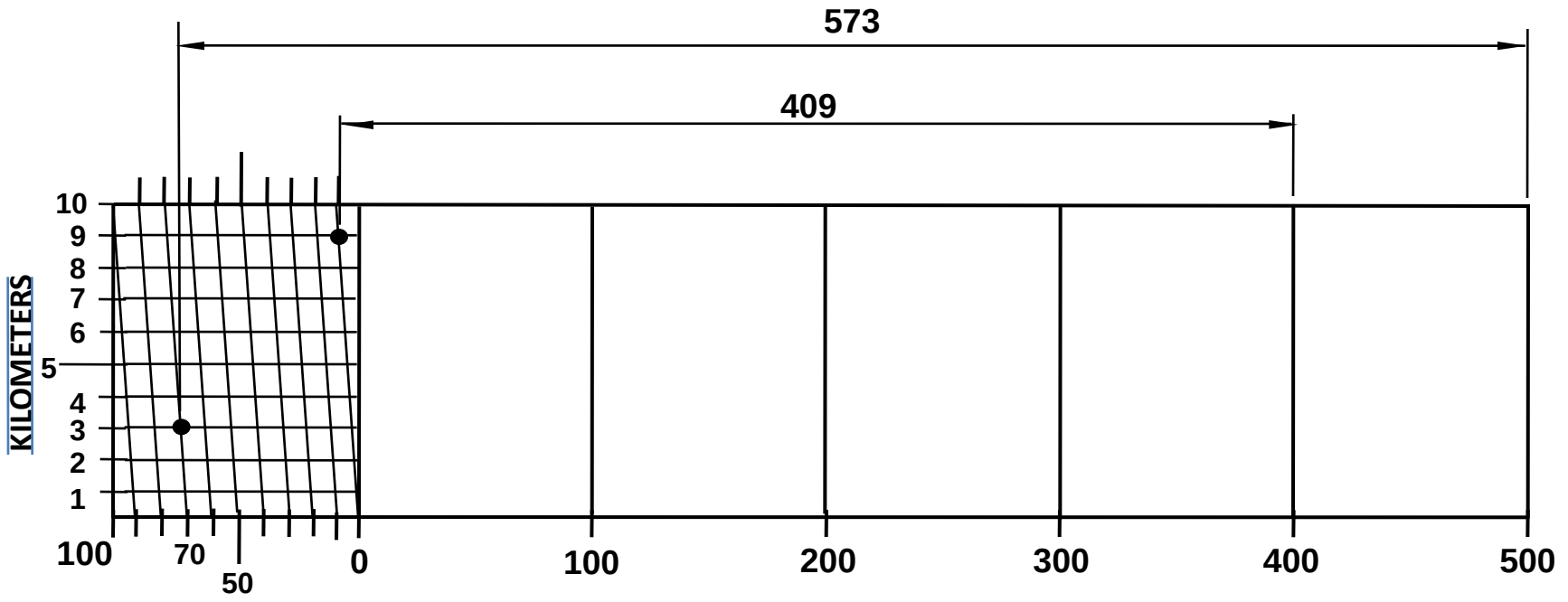
$$RF = \frac{2.5 \text{ cm}}{100 \times 100{,}000 \text{ cm}} = \frac{1}{40{,}00{,}000}$$

2. Calculate length of scale (L.O.S),

$$LOS = RF \times \text{Maximum length of scale} = 1/40{,}00{,}000 \times 600 \text{ km}$$
$$= 1/40{,}00{,}000 \times 600 \times 100{,}000 \text{ cm}$$
$$= 15 \text{ cm}$$

Diagonal Scale Problem 2

The distance between two stations is 100 Km and it is represented on a map by a line of 2.5 cm. Draw a diagonal scale showing single Km. Mark off 409 Km & 573 Km on the scale.



RF = 1/40,00,000

LOS = 15cm

Diagonal Scale Problem 3

Construct a scale to represent kilometers, hectometers & spaces of 125 decimeters when a distance of 1 km is represented by 3 cm. Consider maximum length of scale as 5 km. Mark off a distance of 4 km 3 hm 5 dm on the scale.

1. Calculate Representative Factor,

$$RF = \frac{\text{Length of a line in the drawing}}{\text{Actual length of the line on the object}} = \frac{3\text{ cm}}{1\text{ km}}$$

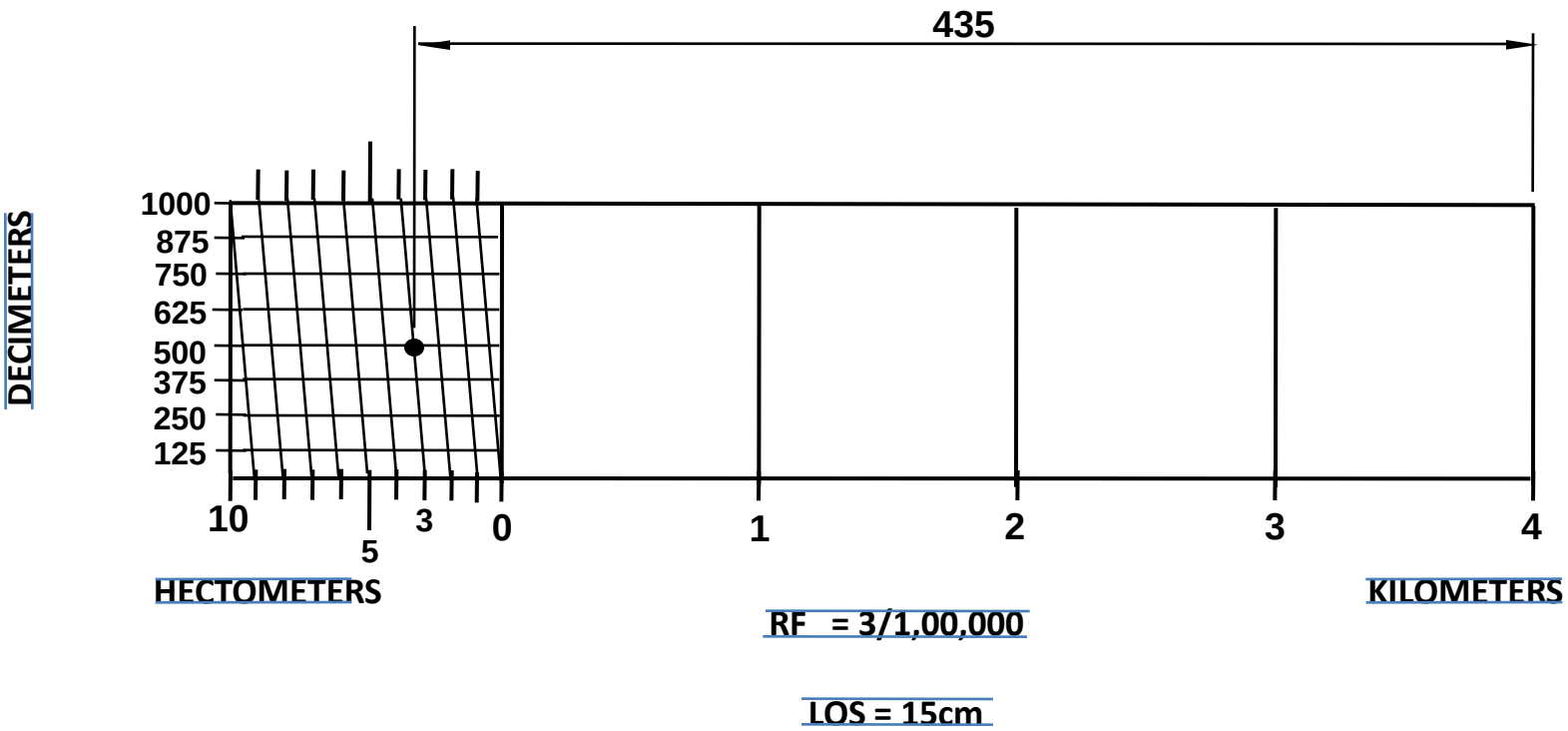
$$RF = \frac{3\text{ cm}}{1 \times 100{,}000\text{ cm}} = \frac{3}{1{,}00{,}000}$$

2. Calculate length of scale (L.O.S),

$$LOS = RF \times \text{Maximum length of scale} = 1/1{,}00{,}000 \times 5\text{ km}$$
$$= 1/1{,}00{,}000 \times 5 \times 100{,}000\text{ cm}$$
$$= 15\text{ cm}$$

Diagonal Scale Problem 3

Construct a scale to represent kilometers, hectometers & spaces of 125 decimeters when a distance of 1 km is represented by 3 cm. Consider maximum length of scale as 5 km. Mark off a distance of 4 km 3 hm 5 dm on the scale.



Diagonal Scale Problem 4

Construct a diagonal scale of RF = 1/2.5, showing centimeters and millimeters and long enough to measure upto 20 cm.

1. Calculate Representative Factor,

$$RF = \frac{1}{2.5}$$

2. Calculate length of scale (L.O.S),

LOS = RF x Maximum length of scale = 1/2.5 x 20 cm

= 8 cm

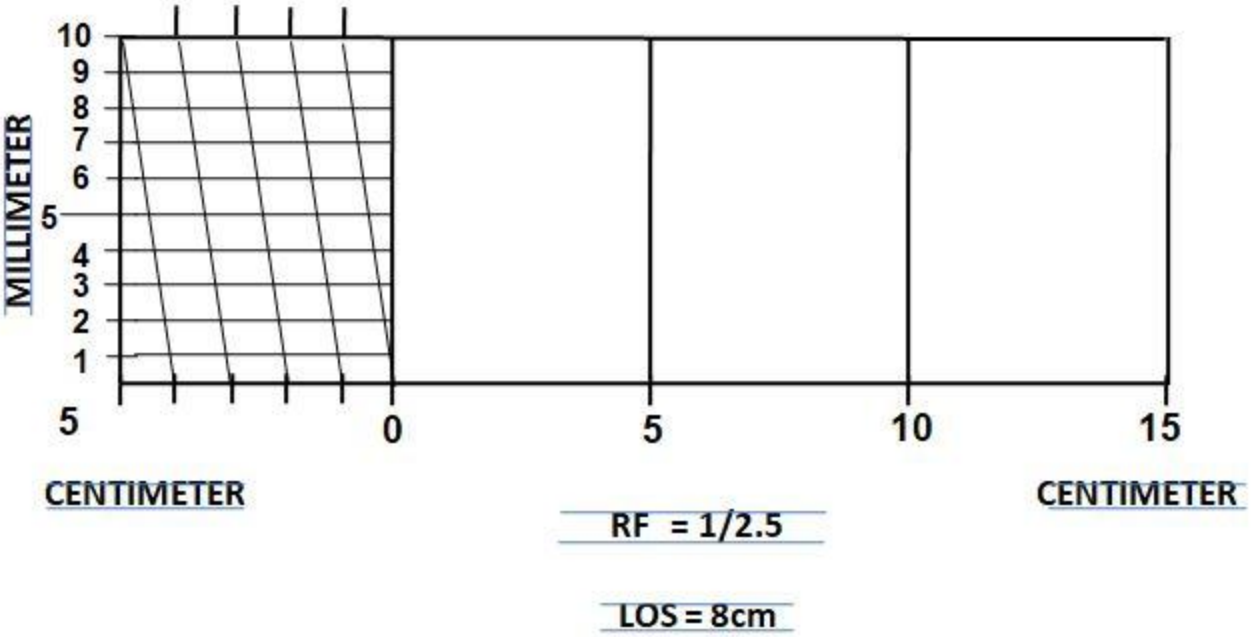
Diagonal Scale Problem 4

Construct a diagonal scale of RF = 1/2.5, showing centimeters and millimeters and long enough to measure upto 20 cm.

8 cm = 20 cm
Divide by 4
2 cm = 5 cm

5 parts
4 mm = 1 cm

10 parts
5 mm = 1 mm



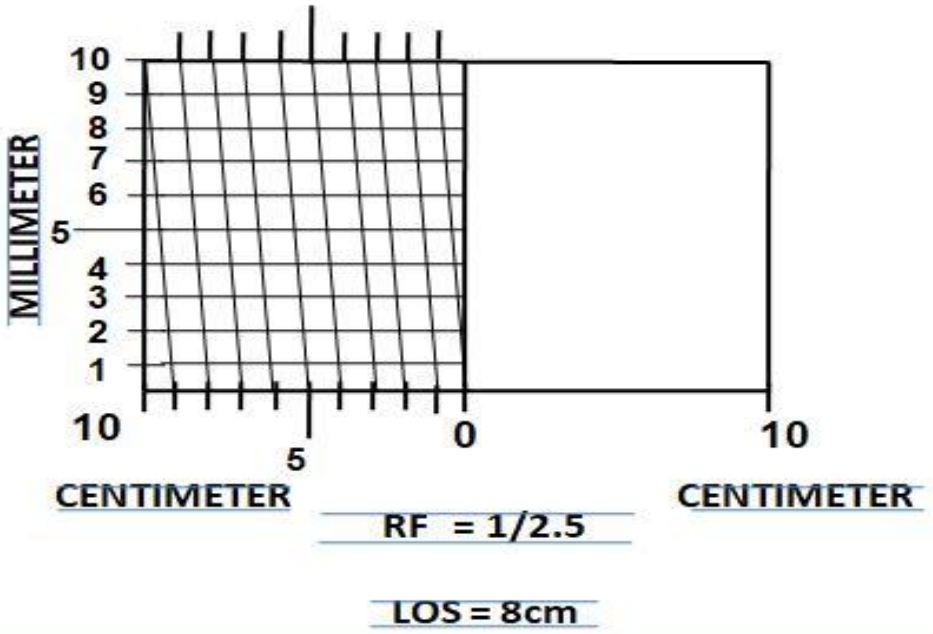
Diagonal Scale Problem 4

Construct a diagonal scale of RF = 1/2.5, showing centimeters and millimeters and long enough to measure upto 20 cm.

8 cm = 20 cm
Divide by 2
4 cm = 10 cm

10 parts
4 mm = 1 cm

10 parts
5 mm = 1 mm



Thanks