# 102001208 ENGINEERING GRAPHICS

## Engineering Scales

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## Outline

- Introduction
- Representative Factor (RF) or Scale Factor
- Unit Conversion - Metric
- Unit Conversion - British
- Types of Scale
- **Problem Solution – Plain Scale**
- Problem Solution – Diagonal Scale

## Introduction

- Can we draw Map of India on a paper / notebook / drawing sheet / sketch book in actual dimensions ?

## Introduction

- How objects having Large/Small dimensions are required to drawn ?
  - Map of Motherland INDIA
  - Ant or Corona Virus

## Introduction

- We can take the scale, like example
  - 1 km actual distance
    = 1 mm on drawing
  - 0.1 mm actual distance
    = 10 cm on drawing

## Introduction

- 1 km actual distance
  = 1 mm on drawing

(Dimensions are reduced on Drawing – Reducing Scale)

## Introduction

- 0.1 mm actual distance
  = 10 cm on drawing

(Dimensions are increased on Drawing – Enlarging Scale)

## Introduction

- When we take the scale, we are required to find out
  - How much dimensions are required to be reduced OR
  - How much dimensions are required to be increased

## Introduction

- These change in dimensions are defined by a ratio known as Scale Factor or Representative Factor (RF)

## Representative Factor (RF)

$$\text{Representative Factor} = \frac{\text{Dimension of Object in Drawing}}{\text{Actual Dimension of Object}}$$

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$$\text{Representative Factor} = \frac{\text{Dimension (Length) of Object in Drawing}}{\text{Actual Dimension (Length) of Object}}$$

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$$\frac{1}{1000}, \frac{1}{10}, \frac{1}{500}, \frac{1}{7000} \ \textit{etc.}\ \text{are Reducing Scale}$$

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Denoted also as: 1:1000, 1:10, 1:500, 1:7000 etc.

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$\frac{1000}{1}, \frac{10}{1}, \frac{500}{1}, \frac{7000}{1}$ *e*tc. are Enlarging Scale

Denoted also as : 1000 : 1, 10 : 1, 500 : 1, 7000 : 1 etc.

## Representative Factor (RF)

If, $\text{RF} = \frac{1}{1}$ or 1:1 Then Scale is known as_____

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If, $RF = \frac{1}{1}$ or 1:1 Then Scale is known as_____

Full Size Scale,

means Drawing and Objects are of Same Size.

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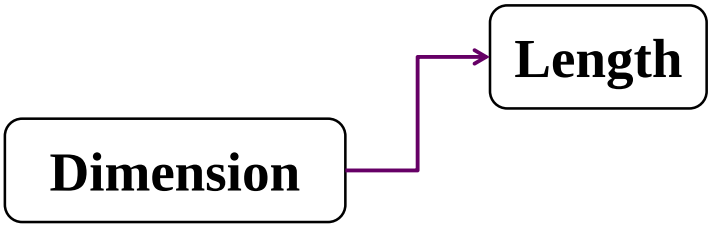


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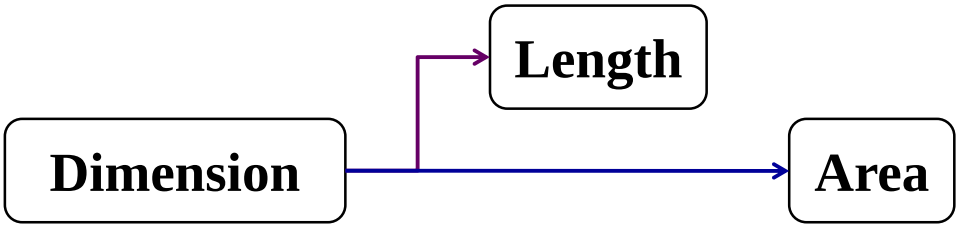

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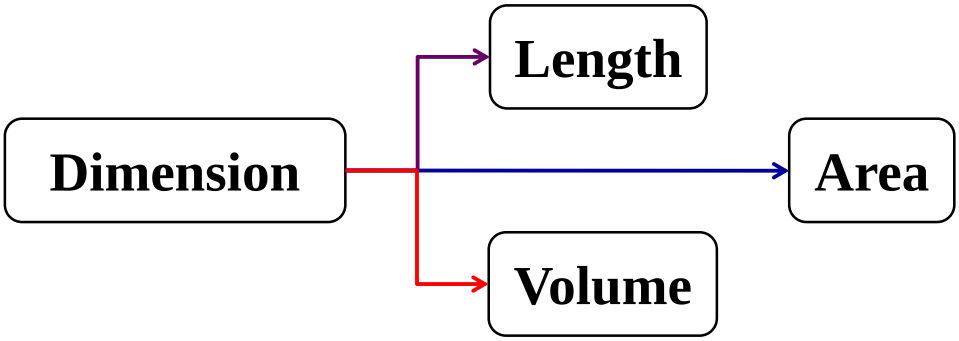


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$$\text{Representative Factor} = \frac{\text{Dimension of Object in Drawing}}{\text{Actual Dimension of Object}}$$

If Dimension in Area is given

$$\text{RF} = \sqrt{\frac{\text{Area of Object in Drawing}}{\text{Actual Area of Object}}}$$

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If Dimension in Volume is given

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$$\text{Representative Factor} = \frac{\text{Dimension of Object in Drawing}}{\text{Actual Dimension of Object}}$$

If Dimension in Volume is given

$$RF = \sqrt[3]{\frac{\text{Volume of Object in Drawing}}{\text{Actual Volume of Object}}}$$

## Unit Conversion - METRIC

| |
|---|
| 1 kilometre (km) =10 hectometres (hm) |
| 1 hectometre (hm)=10 decametres (dam) |
| 1 decametre (dam) =10 metres (m) |
| 1 metre (m) = 10 decimetres (dm) |
| 1 decimetre (dm) = 10 centimetres (cm) |
| 1 centimetre (cm) =10 millimetres (mm) |

## Unit Conversion - British

| | |
|---|---|
| 1 mile | = 8 furlongs |
| 1 furlong | = 220 yards |
| 1 yard | = 3 feet |
| 1 foot | = 12 inches |
| 1 inch | = 2.54 centimetres |

## Types of Scales

- Plain Scale
- Diagonal Scale
- Vernier Scale
- Comparative Scale
- Scale of Cords

## Types of Scales

- Plain Scale
  - For Dimension up to single Decimal
- Diagonal Scale
  - For Dimension up to two Decimal

## Types of Scales

- Vernier Scale
  - For Dimension upto two Decimal
- Comparative Scale
  - For comparing two units
- Scale of Cords
  - For measuring/constructing angles

## Plain Scale - Steps

- Calculate RF (Length, Area, Volume)
- Calculate Length of Scale (LOS)

$$\text{LOS} = \text{RF} \times \text{Max. Dimensions to be Measured}$$

## Plain Scale - Steps

- Draw a Horizontal Line Equivalent to LOS
- Divide the Horizontal Line as per Max. Dimensions to be measured
  - Very Important

# Plain Scale

Draw a scale 1 cm = 1 m to read decimeters, to measure maximum distance of 6 m. Show on it a distance of 4 m and 6 dm.

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$$RF = \frac{1\ \text{cm}}{1\ \text{m}}$$

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$$RF = \frac{1\ \text{cm}}{1\ \text{m}} = \frac{1\ \text{cm}}{100\ \text{cm}}$$

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$$\text{RF} = \frac{1}{100}$$

$$\text{LOS} = \text{RF} \times \text{Max. Dimensions to be Measured}$$

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$$RF = \frac{1}{100}$$

$$LOS = RF \times \text{Max. Dimensions to be Measured}$$

$$LOS = \frac{1}{100} \times 6\,\text{m}$$

Draw a scale 1 cm = 1 m to read decimeters, to measure maximum distance of 6 m. Show on it a distance of 4 m and 6 dm.

$$RF = \frac{1}{100}$$

$$LOS = RF \times \text{Max. Dimensions to be Measured}$$

$$LOS = \frac{1}{100} \times 6\,\text{m} = \frac{1}{100} \times 600\,\text{cm}$$

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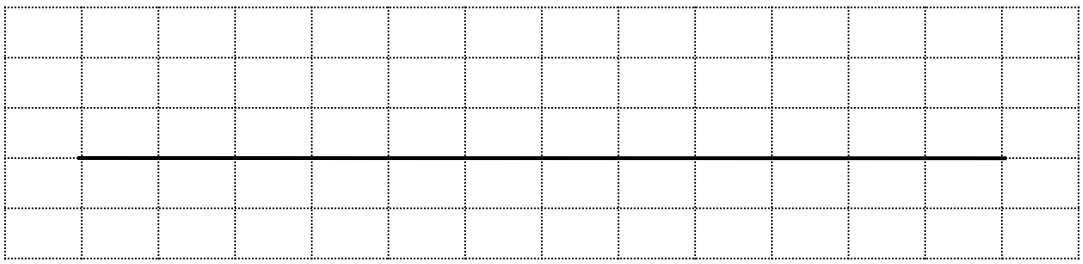

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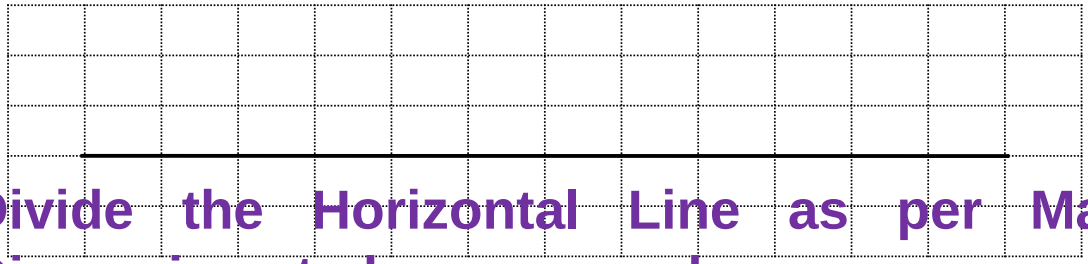


**Divide the Horizontal Line as per Max. Dimensions to be measured**

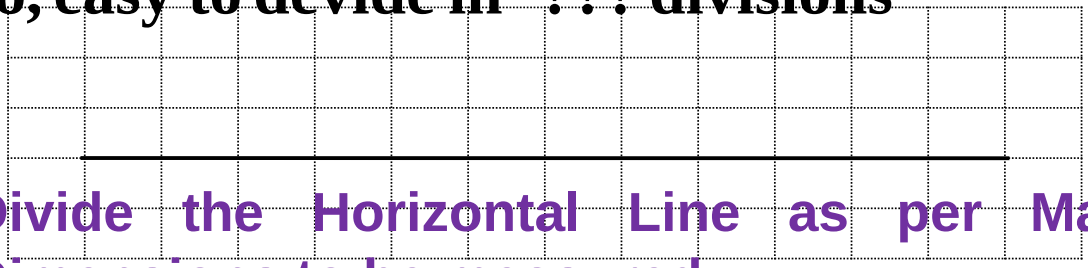
Draw a scale 1 cm = 1 m to read decimeters, to measure maximum distance of 6 m. Show on it a distance of 4 m and 6 dm.

$$RF = \frac{1}{100}$$

**6 cm line shows 6m**

$$LOS = 6\ cm$$

**So, easy to devide in ??? divisions**



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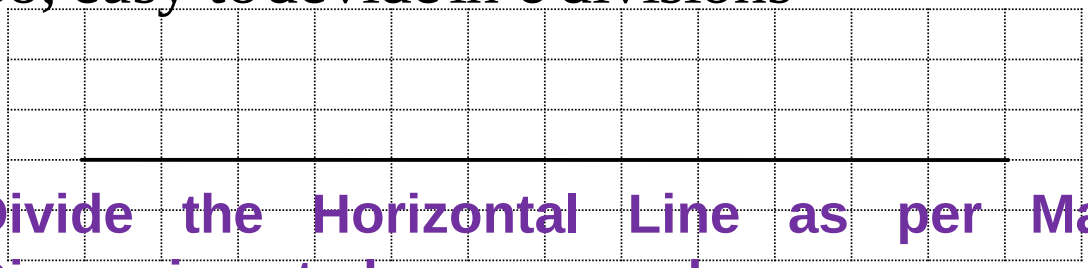

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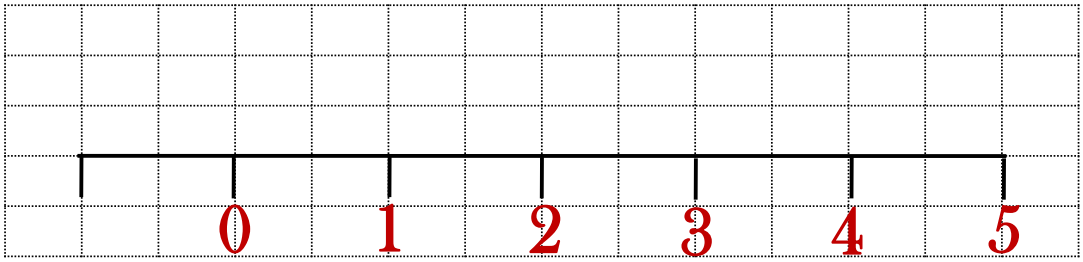


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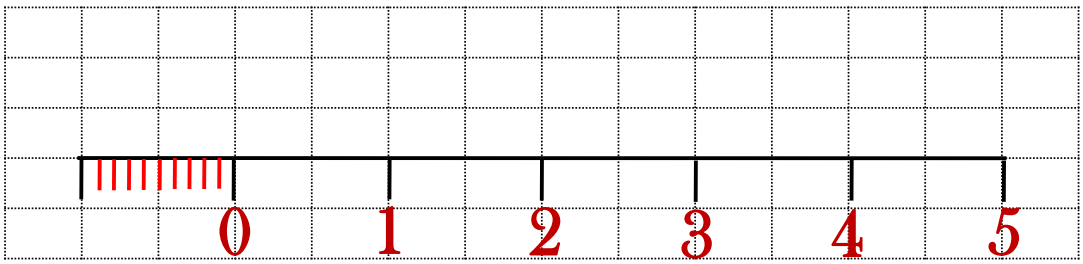

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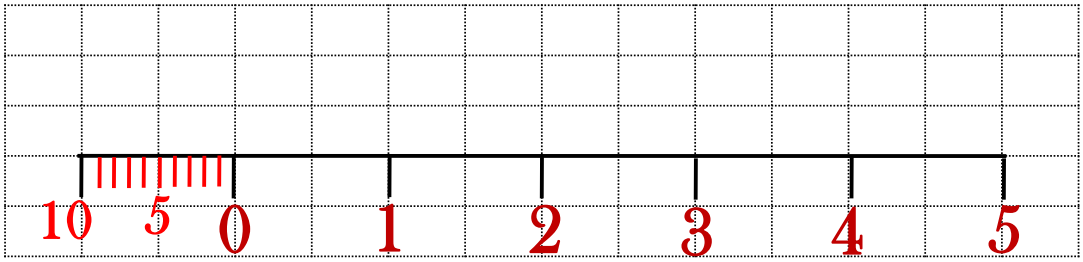


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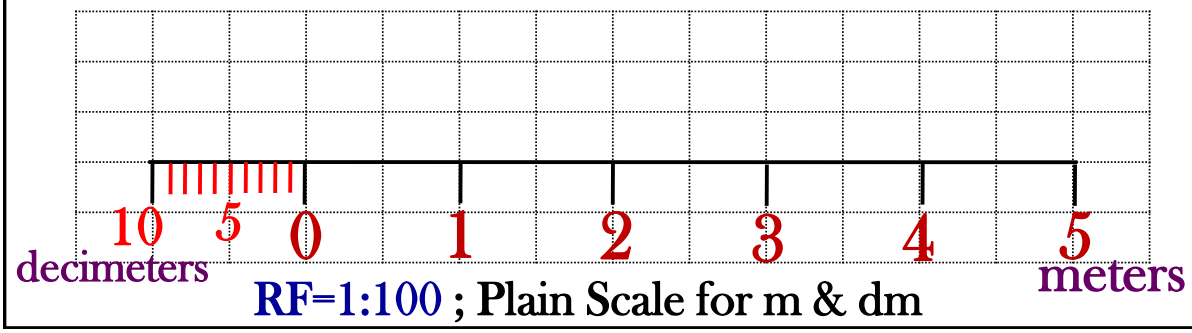


RF=1:100 ; Plain Scale for m & dm

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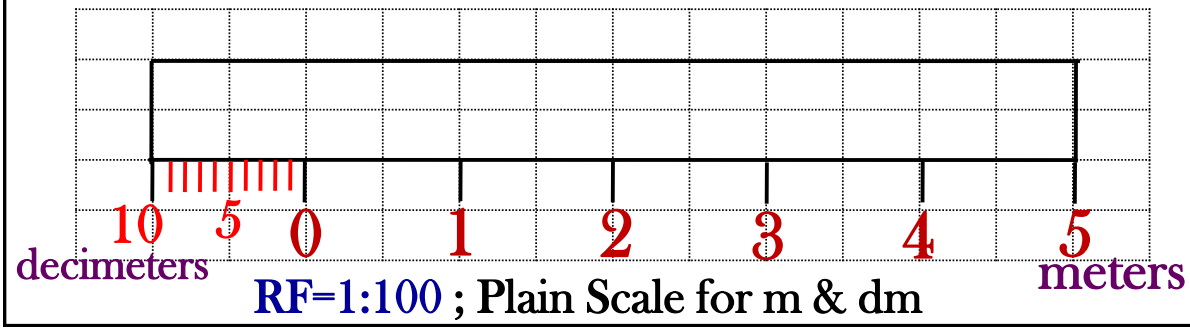


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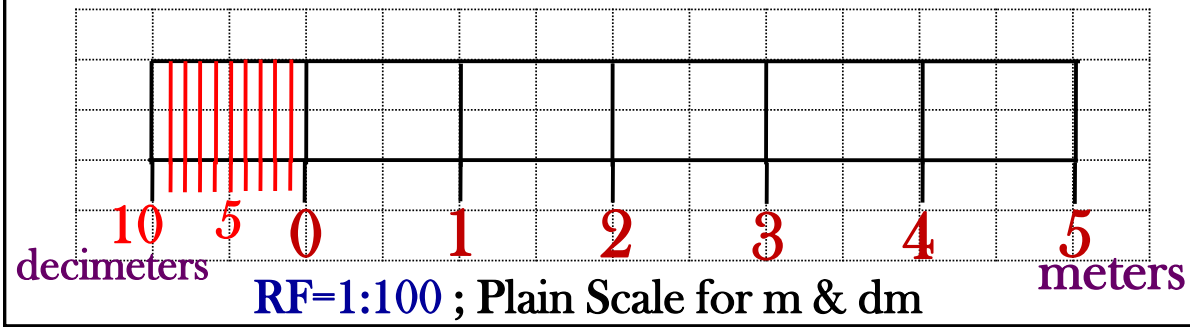


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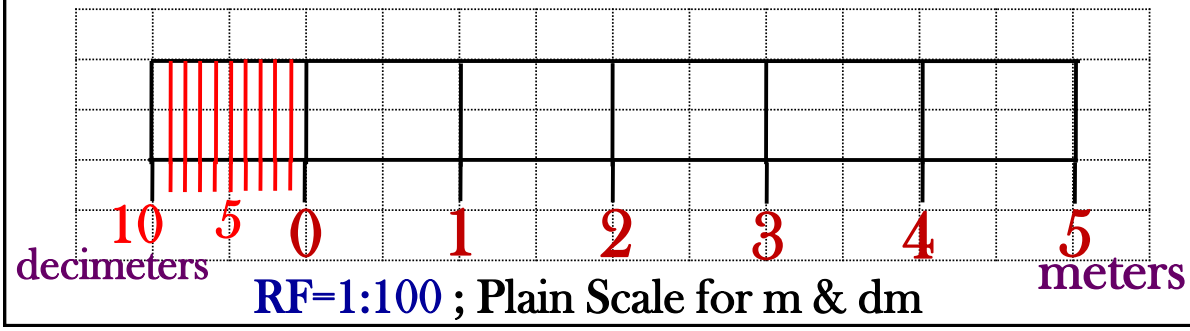


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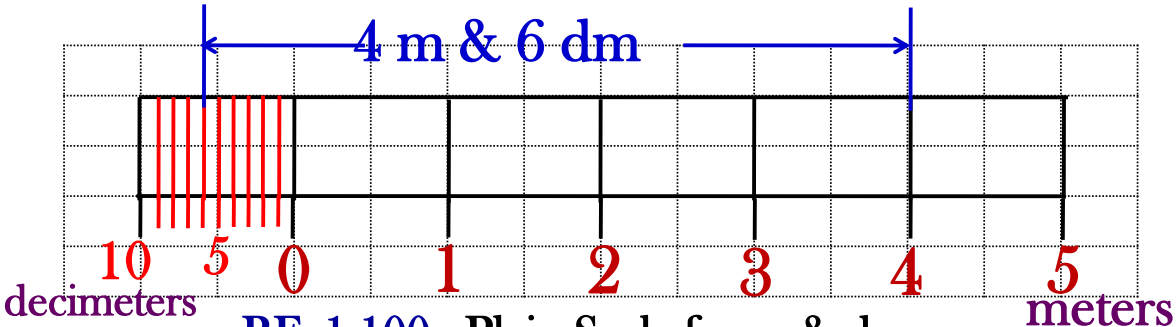


RF=1:100 ; Plain Scale for m & dm

## Plain Scale

In a map a 36 km distance is shown by a line 45 cms long. Calculate the R.F. and construct a plain scale to read kilometers and hectometers, for max. 12 km. Show a distance of 8.3 km on it.

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$$RF = \frac{45\ \text{cm}}{36\ \text{km}}$$

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$$RF = \frac{45\ \text{cm}}{36\ \text{km}} = \frac{45\ \text{cm}}{36*1000*100\ \text{cm}}$$

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$$RF = \frac{45 \text{ cm}}{36 \text{ km}} = \frac{45 \text{ cm}}{36*1000*100 \text{ cm}} = \frac{1}{80000}$$

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$$RF = \frac{1}{80000}$$

$$LOS = RF \times \text{Max. Dimensions to be Measured}$$

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$$LOS = \frac{1}{80000} \times 12\ \text{km} = \frac{1}{80000} \times 12 * 1000 * 100\ \text{cm}$$

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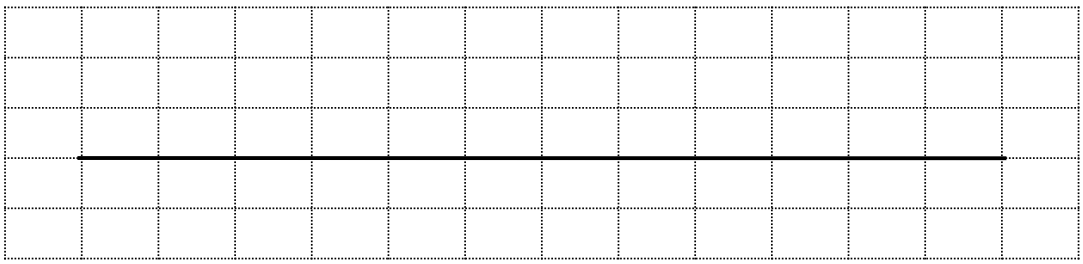

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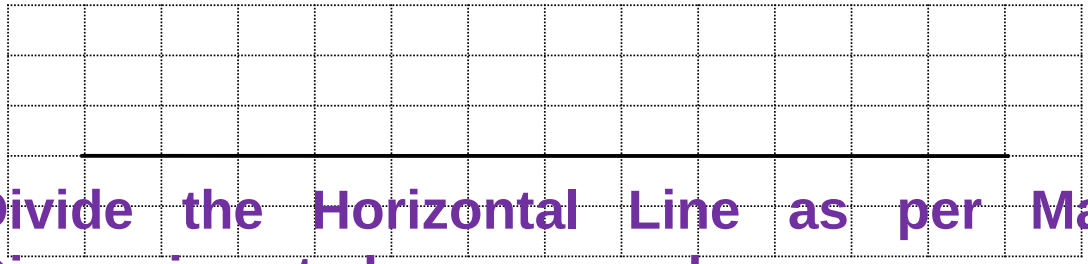

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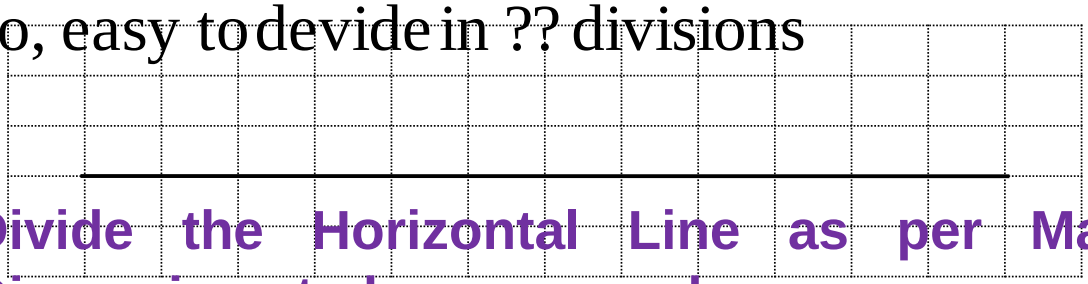
$$RF = \frac{1}{80000}$$

15 cm line shows 12 km

$$LOS = 15\ cm$$

So, easy to devide in ?? divisions



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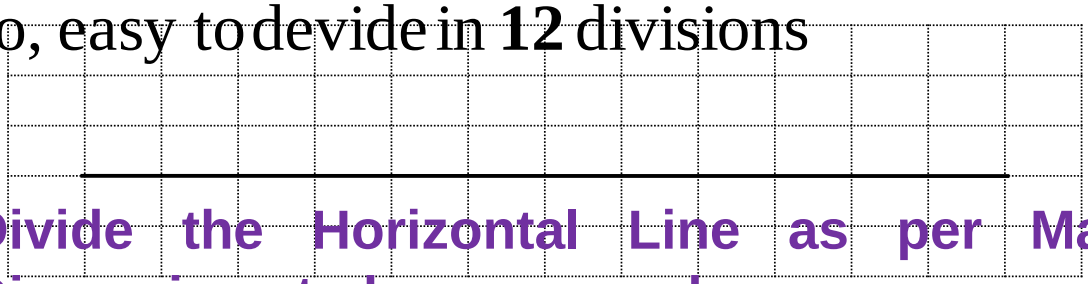

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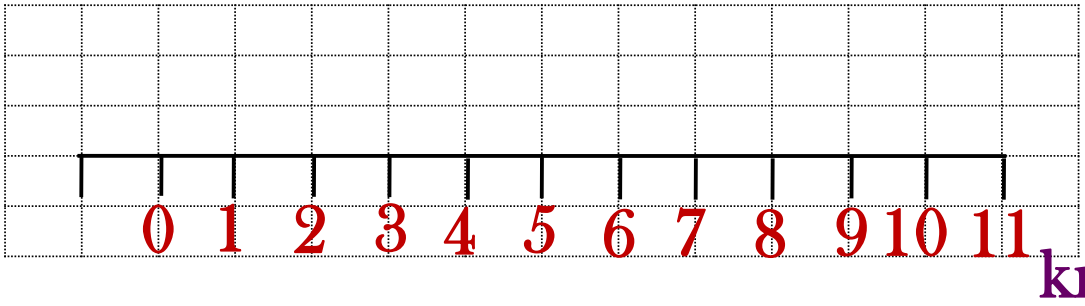


In a map a 36 km distance is shown by a line 45 cms long. Calculate the R.F. and construct a plain scale to read **kilometers and hectometers**, for max. 12 km. Show a distance of 8.3 km on it.

$$RF = \frac{1}{80000}$$

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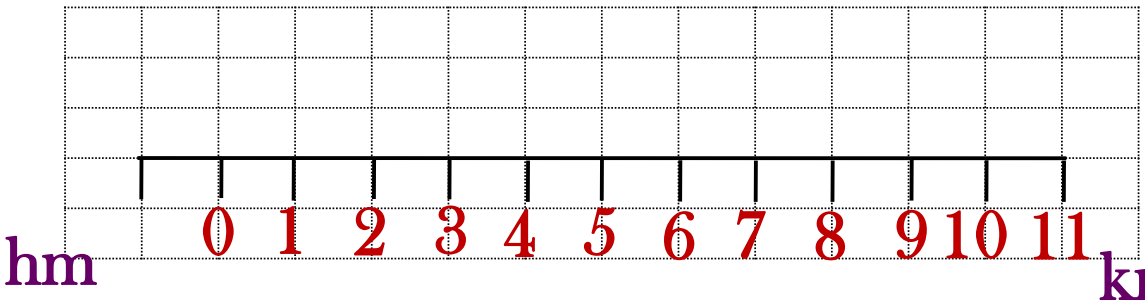

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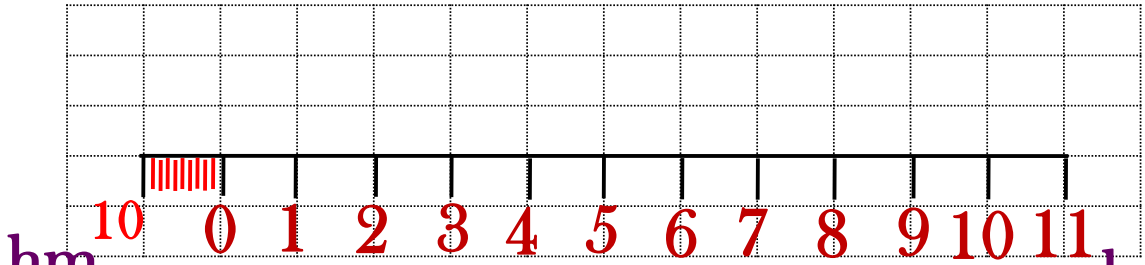


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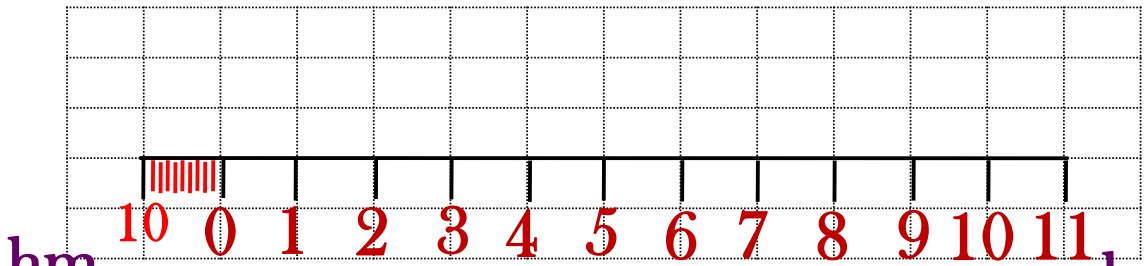


RF=1:80000 ; Plain Scale for km & hm

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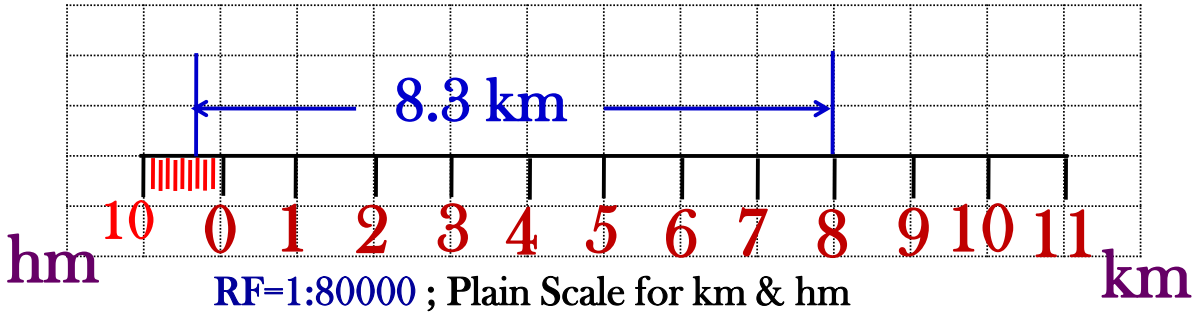


RF=1:80000 ; Plain Scale for km & hm

## Plain Scale

Construct a plain scale of R.F 1:560 showing meters. The scale should be long enough to measure up to 56 meters show distance 38 meters on the scale.

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Representative Factor

$$= \frac{\text{Dimension (Length) of Object in Drawing}}{\text{Actual Dimension (Length) of Object}}$$

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$$RF = \frac{1}{560}$$

$$LOS = RF \times \text{Max. Dimensions to be Measured}$$

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$$LOS = \frac{1}{560} \times 56\text{m} = \frac{1}{560} \times 56 * 100\,\text{cm}$$

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Construct a plain scale of R.F 1:560 showing meters. The scale should be long enough to measure up to 56 meters show distance 38 meters on the scale.

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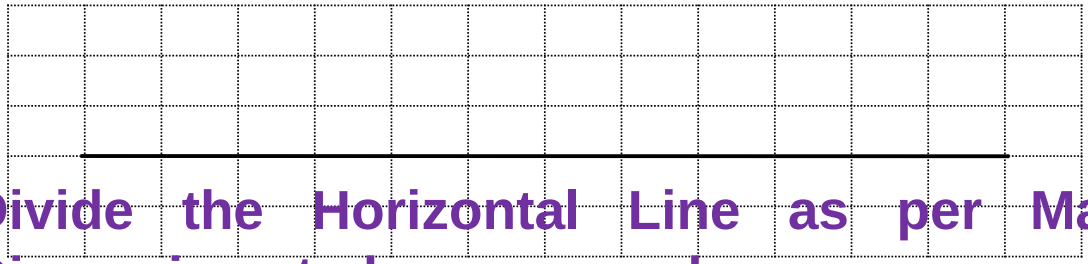


**Divide the Horizontal Line as per Max. Dimensions to be measured**

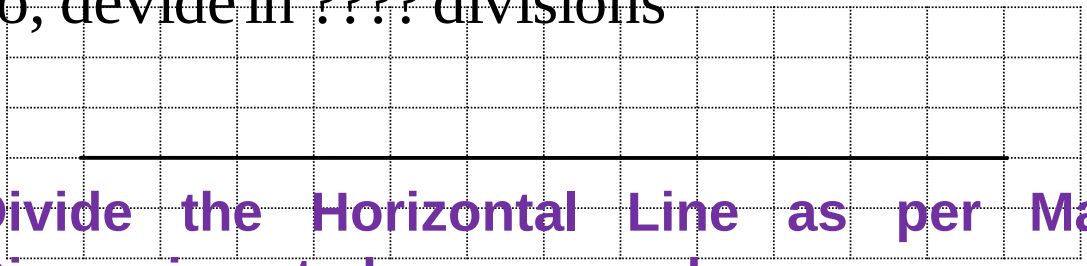
Construct a plain scale of R.F 1:560 showing meters. The scale should be long enough to measure up to 56 meters show distance 38 meters on the scale.

$$RF = \frac{1}{560}$$

10 cm line shows 56 m

$$LOS = 10 \text{ cm}$$

So, devide in ???? divisions



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$$RF = \frac{1}{560}$$

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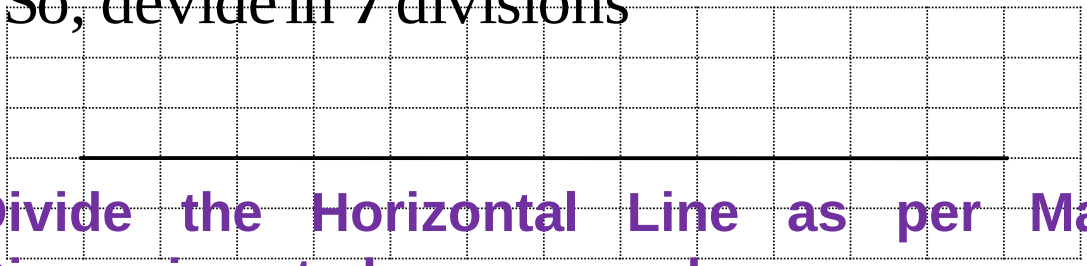
So, devide in 7 divisions



**Divide the Horizontal Line as per Max. Dimensions to be measured**

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$$RF = \frac{1}{560}$$

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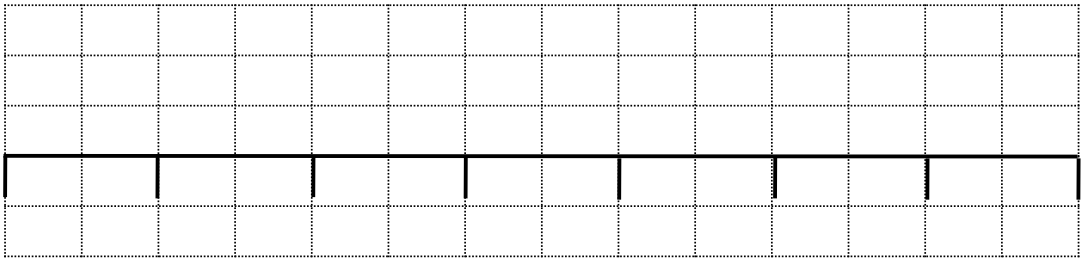

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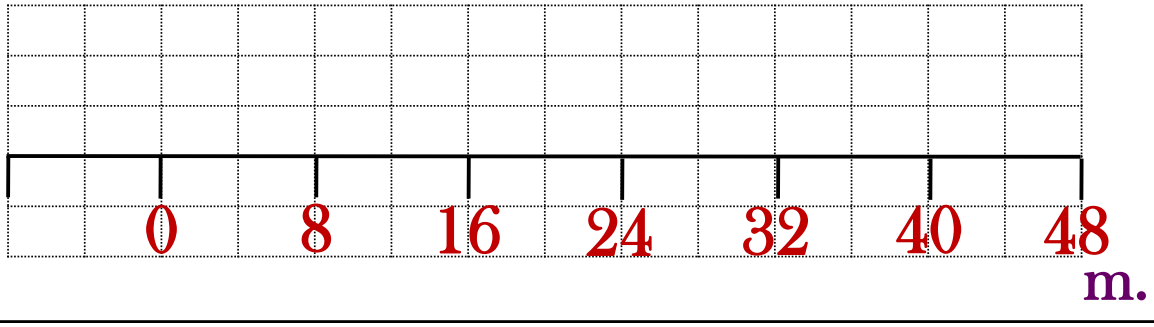

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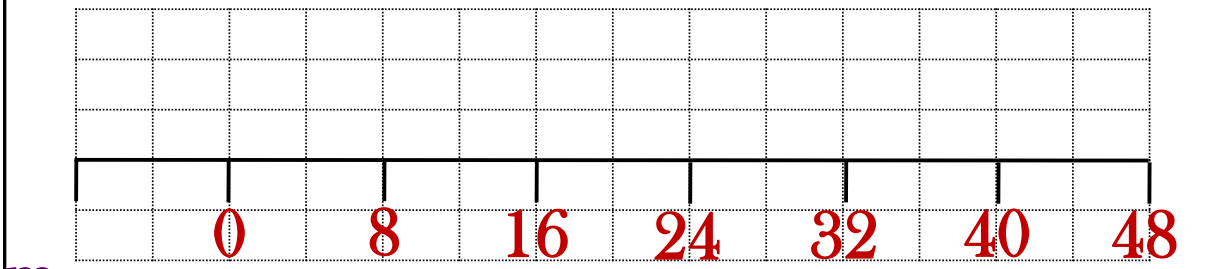


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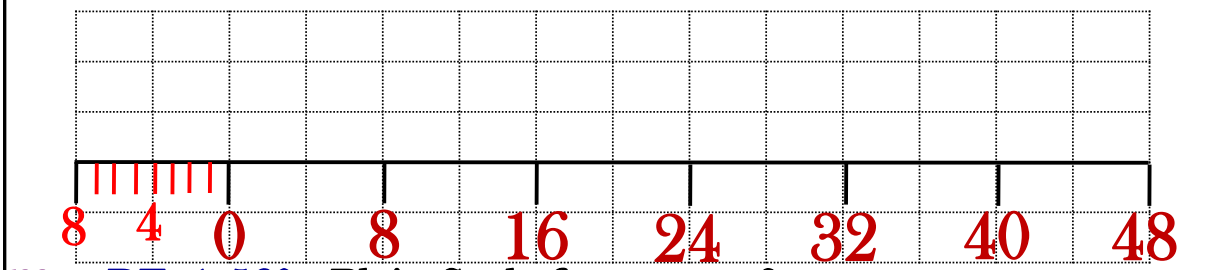


RF=1:560 ; Plain Scale for meters & meters

Construct a plain scale of R.F 1:560 showing meters. The scale should be long enough to measure up to 56 meters show **distance 38 meters** on the scale.

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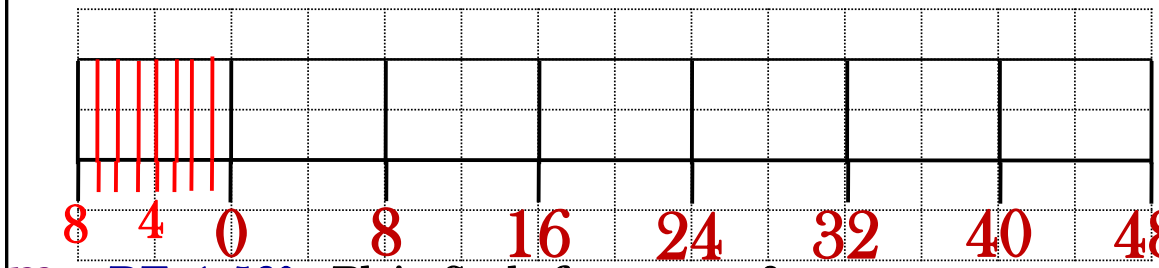


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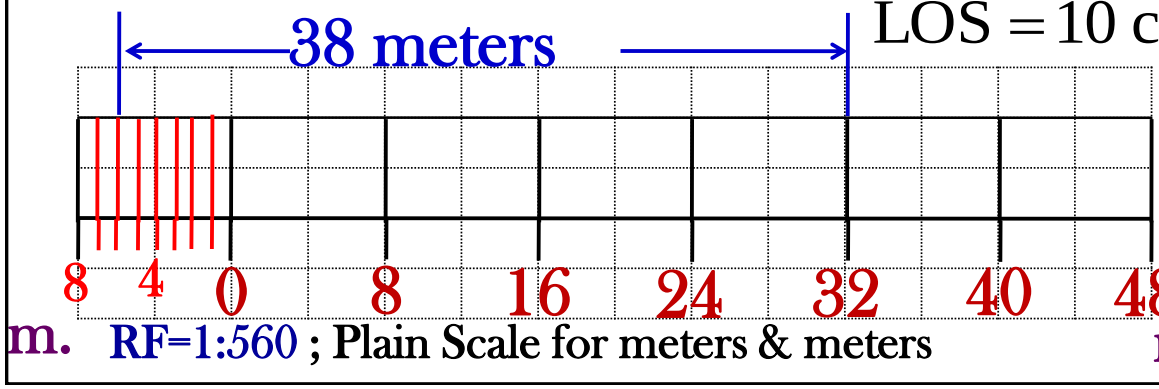

## Plain Scale

Construct a plain scale of RF = 1/84480 to read miles and furlongs, and long enough to measure up to 6 miles. Show 4 miles and 4 furlongs on it.

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$$LOS = \frac{1}{84480} \times 6\text{miles} = \frac{1}{84480} \times 6 * 8 * 220 * 3 * 12\,\text{inch}$$

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$$LOS = \frac{1}{84480} \times 6\text{miles} = \frac{1}{84480} \times 6 * 8 * 220 * 3 * 12\,\text{inch}$$

$$LOS = 4.5\,\text{inch}$$

Construct a plain scale of RF = 1/84480 to read miles and furlongs, and long enough to measure up to 6 miles. Show 4 miles and 4 furlongs on it.

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$$LOS = 4.5\,\text{inch} = 11.43\ \text{cm}$$

Construct a plain scale of RF = 1/84480 to read miles and furlongs, and long enough to measure up to 6 miles. Show 4 miles and 4 furlongs on it.

$$RF = \frac{1}{84480}$$

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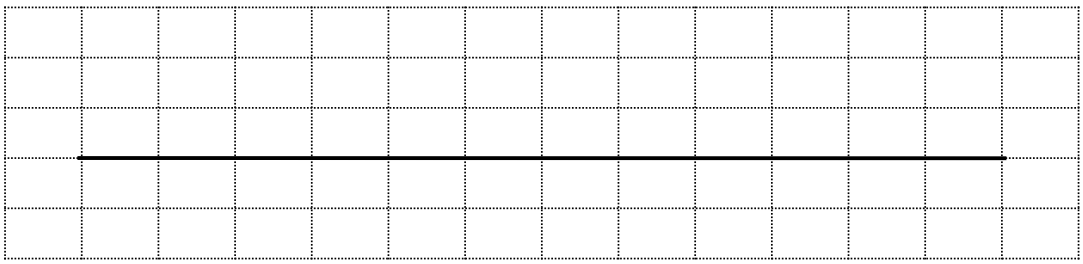

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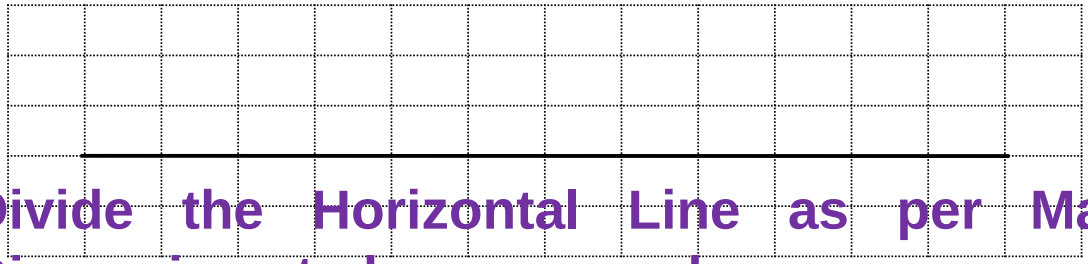

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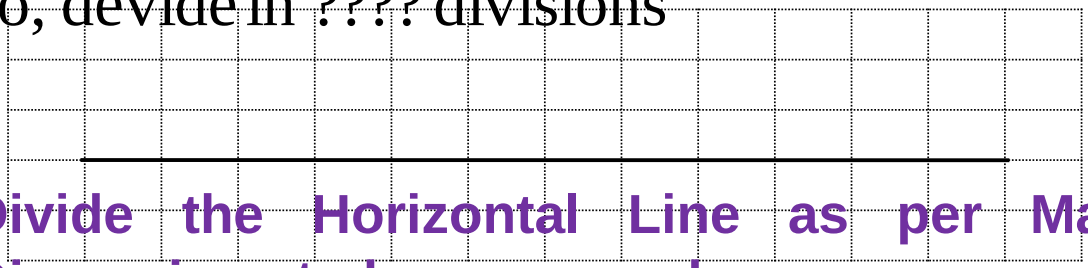
4.5 inch line shows 6 miles

So, devide in ???? divisions

$$LOS = 4.5\ \text{inch}$$



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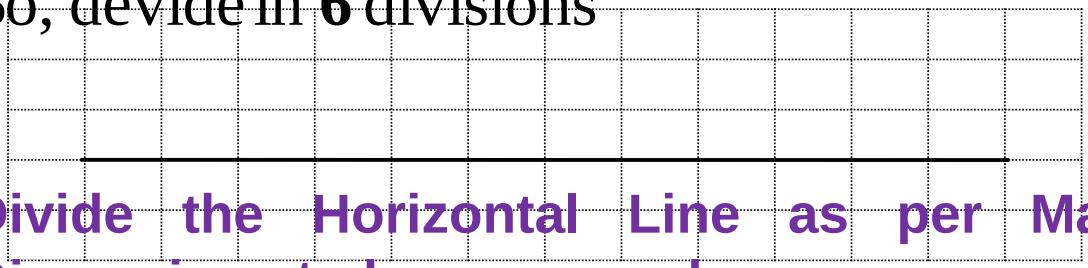
So, devide in **6** divisions



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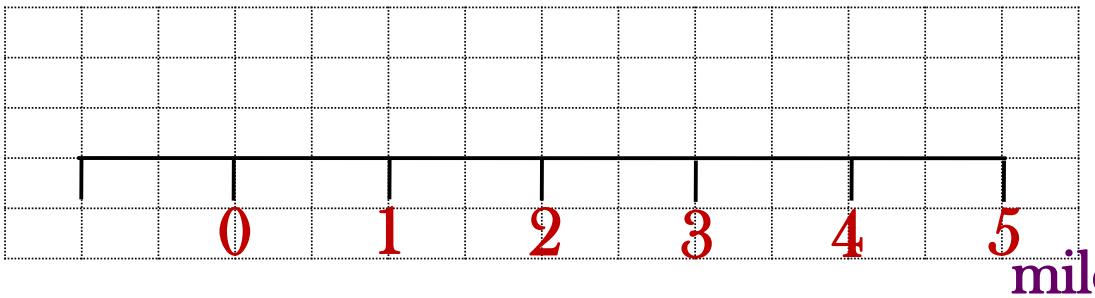

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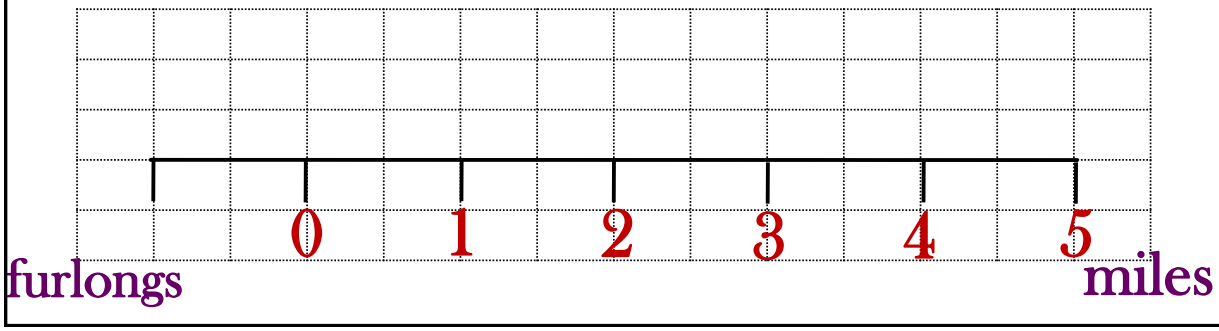


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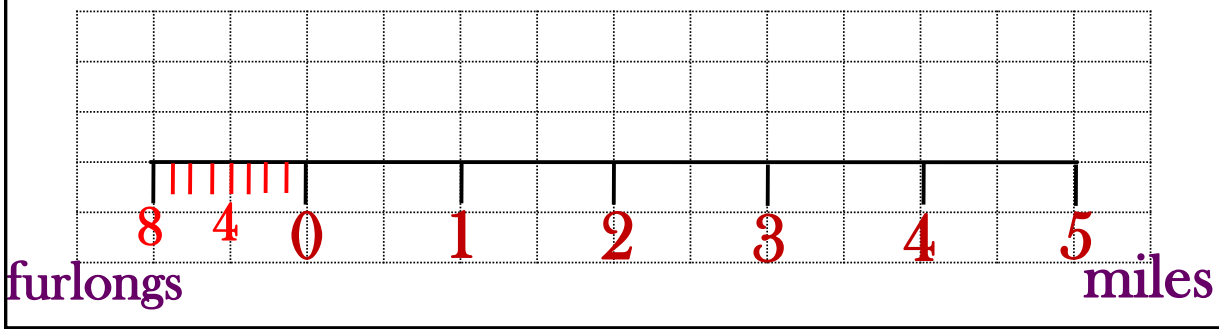

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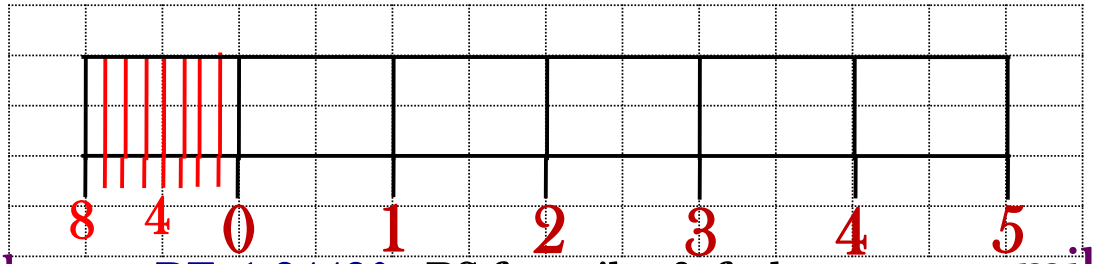


RF=1:84480 ; PS for miles & furlongs

Construct a plain scale of RF = 1/84480 to read miles and furlongs, and long enough to measure up to 6 miles. Show **4 miles and 4 furlongs** on it.

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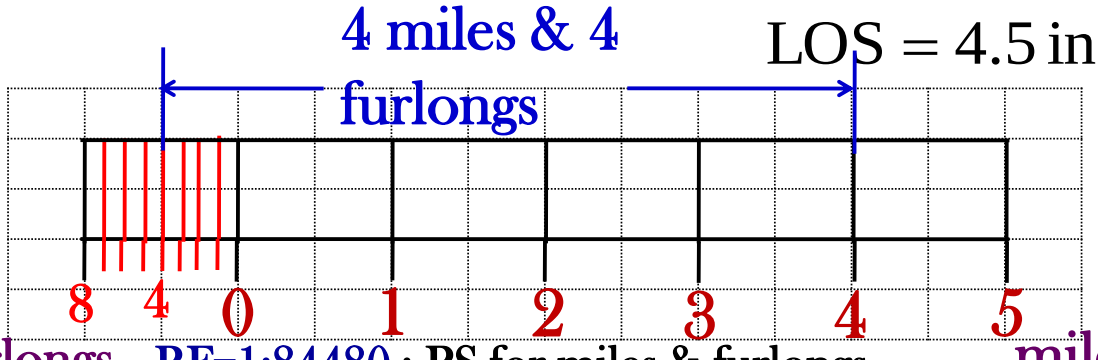


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# QUESTIONS ?

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# THANK YOU.

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If you are headed in the right direction,

each step, no matter how small,

is getting you closer to your goal.