# 2. Scale

RF = $\frac{\text{measurement on paper in cm.}}{\text{measurement on field in cm.}}$

→ RF :- It is define as ratio off measurement on paper in cm to measurement on field in cm.

Following scale into RF

(1) 2 : 6 km

$RF = \frac{2\ cm}{6\ km}$

$= \frac{1\ cm}{3\ km}$

$= \frac{1\ cm}{3000\ m}$

$= \frac{1\ cm}{300000\ cm}$

$= \frac{1}{300000}$

(2) $\frac{1}{4}$ : 2 m

1 : 8 m

$RF = \frac{1\ cm}{8\ m}$

$RF = \frac{1\ cm}{800\ cm}$

$RF = \frac{1}{800}$

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3) $1 : \frac{5}{2}$ km

$1 : 2.5$ km

$= \frac{1}{2.5 \text{ km} \times 1000}$

$= \frac{1}{2500 \text{ m}}$

$= \frac{1}{250000}$

4) $2 : \frac{3}{8}$

$\frac{2}{\frac{3}{8}}$

* 50 m line measure on field is representable by 3 cm on paper Find out Scale and RF.

3 cm : 50 m

1 : 16.67 m

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RF = $\frac{1}{16.67\ m}$

$= \frac{1}{16.67 \times 100}$

$= \frac{1}{1667}$

* 2 km long line is represented by 12 c on plan. find scale and RF of the plan.

12 : 2 km

$\frac{1}{0.167\ km}$

RF = $\frac{1}{0.167 \times 1000\ m}$

$= \frac{1}{167\ m}$

$= \frac{1}{16700}$

* ~~repor~~ reduction factor

$\frac{\text{Area on paper in } cm^2}{\text{Area on field in } cm^2}$

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* An area of 14145 $m^2$ is represented on paper by 8.5 cm × 6.5 cm on plan find out RF of that plan.

$$= \frac{8.5 \times 6.5\ cm^2}{14145\ m^2}$$

$$= \frac{55.25\ cm^2}{14145\ m^2}$$

$$= \frac{1\ cm^2}{256\ m^2}$$

$$= \frac{1\ cm}{16\ m} \times \frac{1\ cm}{16\ m}$$

Scale 1 : 16 m

$$RF = \frac{1\ cm}{16\ m}$$

$$= \frac{1\ cm}{1600\ cm}$$

$$RF = \frac{1}{1600}$$

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A plot of 12 m x 3 m is representate on plan by 1 $cm^2$ find out scale & RF their plan.

$$= \frac{1\ cm^2}{12m \times 3m}$$

$$= \frac{1\ cm^2}{36\ m^2}$$

$$= \frac{1\ cm^2}{36\ m^2}$$

$$= \frac{1\ cm}{1.73\ m\ 6} \times \frac{1\ cm}{1.73\ m\ 6}$$

Scale 1 : 6 m

$$RF = \frac{1\ cm}{6\ m}$$

$$= \frac{1\ cm}{600\ cm}$$

$$RF = \frac{1}{600}$$

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Q An area of 93750 $m^2$ is represented by rectangle of 6 × 6.25 cm on a map. Find out Scale & RF of the map.

$$= \frac{6 \times 6.25 \text{ cm}}{93750 \text{ m}^2}$$

$$= \frac{37.5 \text{ cm}^2}{93750 \text{ m}^2}$$

$$= \frac{1 \text{ cm}^2}{2500 \text{ m}^2}$$

$$= \frac{1 \text{ cm}}{50 \text{ m}} \times \frac{1 \text{ cm}}{50 \text{ m}}$$

Scale 1 : 50m

$$RF = \frac{1 \text{ cm}}{50 \text{ m}}$$

$$= \frac{1 \text{ cm}}{5000 \text{ cm}}$$

$$RF = \frac{1}{5000}$$

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Date
Page

## * Types of Scale :-

- Plain Scale
- diagonal Scale
- Chroed Scale
- Vernier Scale

### 1) Plain Scale :

**Ex-1** construct a plain Scale 1 cm & 3 m and show 47 m on it.

→ Draw a line of 20 cm long, which can be able to show 60 m (Scale 1 & 3m).

→ Divide these line into 6 equal parts so each part represent 10 m.

→ Mark the line from 0 to 50 m on right side and 0 to 10m left side.

→ Divide the left part into 10 equal sub-parts so each part represent 1 m.

→ Mark 47 m on that Scale. As shown in figure.

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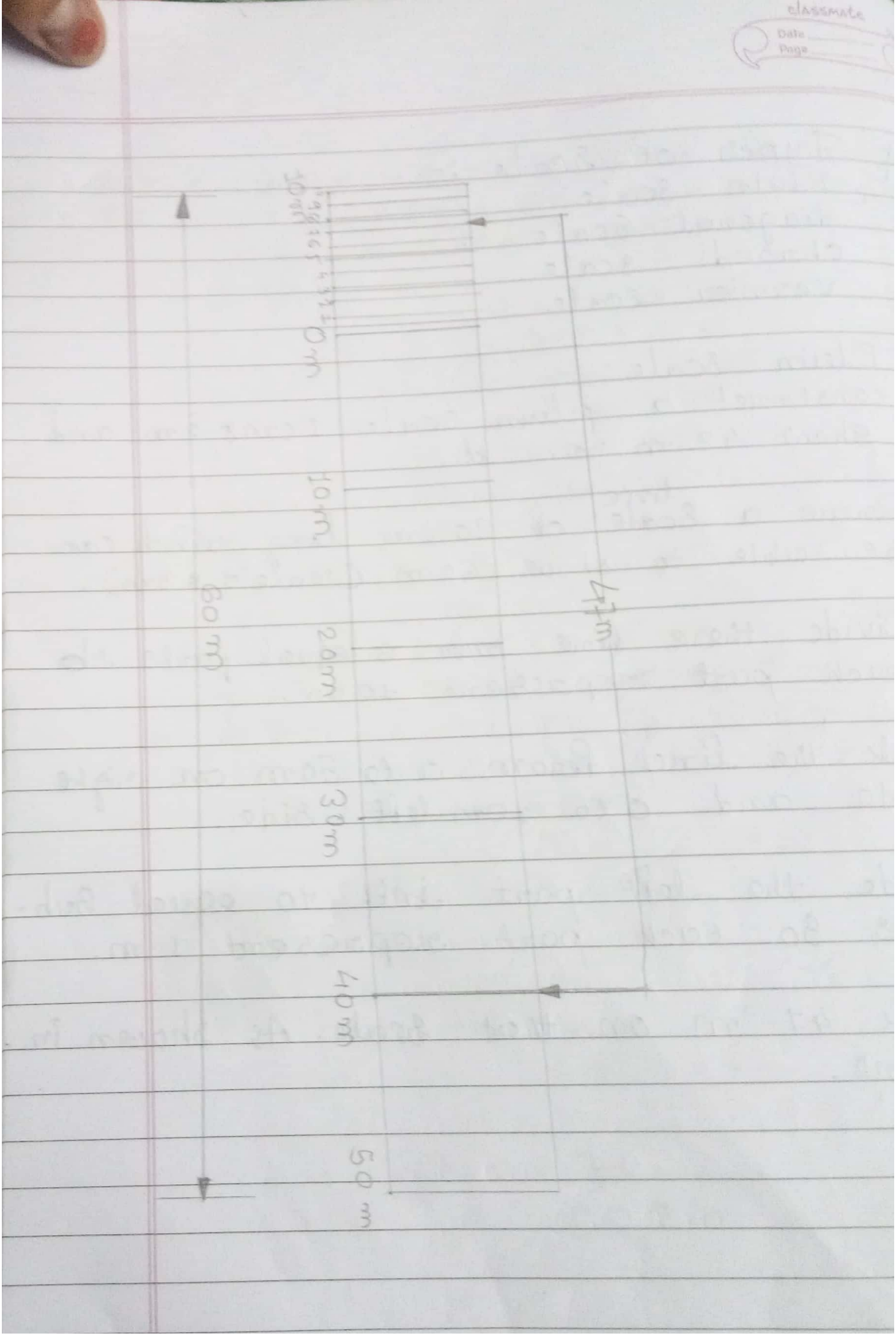

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Ex-2 construct a scale having RF = $\frac{1}{1500}$ and show 108 m on it.

1:15 m

→ Draw a line of 7.3 cm long which can be able to show 110 m (scale 1:15m)

→ Divide these line into 11 equal parts so each part represent 10 m.

→ Mark the line from 0 to 100 m on right side and ot 10 m left side.

→ Divide the left part into 5 equal sub-parts so each part represent 2 m.

→ Mark 108 m on that scale. As shown in figure.

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Surveying

Examples of error due to incorrect chain:-

(A) correction to measured length

$$l = l' \left(\frac{L'}{L}\right)$$

$L$ = True length of chain i.e 20m or 30m
$L'$ = Incorrect / actual length of chain

For example 20 m chain is 10 cm short

$L' = 20 - 0.10$
$= 19.90$ m

$l$ = true length of line / actual length
$l'$ = measured length of line
~~actual length~~

Ex-1 The length of survey line measured with 20m chain was found 327 m If the chain was 3cm long find true length of line.

$L = 20$ m
$l' = 327$ m
$L' = 20.03$ m

$$l = l' \left(\frac{L'}{L}\right)$$

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$$l = 327\left(\frac{20.03}{20}\right)$$

$$l = 327\,(1.0015)$$

$$l = 327.49$$

Ex-2 For A 30 m chain was found 5 cm short before Survey work the length measured with this chain was 500 m after Survey work the chain was found 8 cm long find true length of l

$L = 30$ m

$l' = 500$ m

① $L' = 29.95$ m (5cm short)

② $L' = 30.08$ m (8cm long)

$L' = 30.015$

$$l = l'\left(\frac{L'}{L}\right)$$

$$l = 500\left(\frac{30.015}{30}\right)$$

$$l = 500\,(1.0005)$$

$$l = 500.25$$

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Ex-3 A 20 m chain was found 10 cm too l
after chaining a distance of 1800 m i
was found 20 cm too long at the e
of work. For a total distance of 2800
if the chain was 10 cm too short at
begning of work. find true distance
of line.

$L = 20\,m$

① From 0 to 1800 m

$$L' = 19.90 + \frac{20.10}{2} = 20\,m$$

$$l_1 = l'\left(\frac{L'}{L}\right)$$

$$l_1 = 1800\left(\frac{20}{20}\right)$$

$$l_1 = 1800$$

② From 1800 to 2800 m , $l' = 1000$

$$L' = \frac{20.10 + 20.20}{2} = 20.15\,m$$

$$l_2 = l'\left(\frac{L'}{L}\right)$$

$$l_2 = 1000\left(\frac{20.15}{20}\right)$$

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$$l = 327\left(\frac{20.03}{20}\right)$$

$$l = 327\,(1.0015)$$

$$l = 327.49$$

Ex-2 For A 30 m chain was found 5 cm short before Survey work the length measured with this chain was 500 m after Survey work the chain was found 8 cm long find true length of lin

$L = 30$ m

$l' = 500$ m

① $L' = 29.95$ m (5cm short)

② $L' = 30.08$ m (8cm long)

$L' = 30.015$

$$l = l'\left(\frac{L'}{L}\right)$$

$$l = 500\left(\frac{30.015}{30}\right)$$

$$l = 500\,(1.0005)$$

$$l = 500.25$$

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$l_2 = 1007.5\ m$

$l = l_1 + l_2$
$= 2807.5\ m$

(B) correction to area

$$A = A' \left(\frac{L'}{L}\right)^2$$

$A$ = true area
$A'$ = measured area
$L'$ = Actual length of chain
$L$ = True length of chain

Ex-1 The plan of plot was prepare by 30 m chain Area of plot on plan is 300 $cm^2$ if RF = 1/100 and chain was 0.2 m short then find true area of plot.

$L = 30\ m$
RF = 1/100

$A' = 300\ m^2$, $L' = 29.8$ m

Area of plan = 300 $cm^2$
$= 300 \times 100 \times 100$ cm
$= 3000000 / 3 \times 10^6$ cm
$= 300\ m^2 = A'$

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$$L = \frac{612.5 \times 30}{610}$$

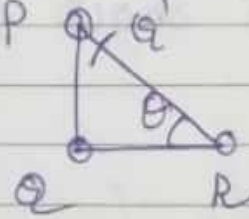
$$= 30.12$$

(C) Correction in volume

$$V = V' \left(\frac{L'}{L}\right)^3$$

V = Tone volume
V' = measured volume
L' = Actual length of chain
L = Tone length of chain

* Hypotensual allowance :-




$PQ' = HA$

$PR \neq QR$

$H.A. = l(\sec\theta - 1)$

Eg-1 Calculate H.A. of 20m chain with the angle of 20°.

$$H.A. = l\left(\frac{1}{\cos\theta} - 1\right)$$

$$= 20\,(0.064)$$

$$= 1.28\ m$$

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Exc-2 Calculate H.A. for 15 m lin
with 45° angle.

$$H.A. = l\left(\frac{1}{\cos\theta} - 1\right)$$

$$= 15\,(0.414)$$

$$= 6.21\ m$$

## Diagonal Scale

Ex-1 Construct a diagonal scale if sca
1 cm = 20 m and show 338 m on it

Exc. Construct a scale having RF = 1/250
& show 228 m on it

1 : 2500
1 : 25 m

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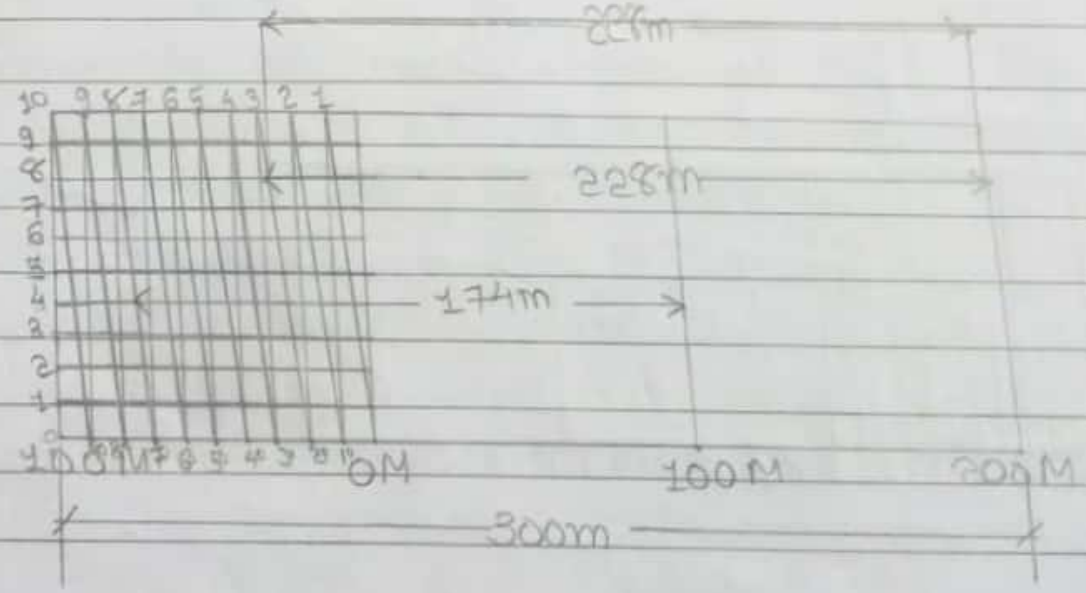
1) Draw a line of 12 cm which represents 300m.
2) Divide this line into 3 equal parts so, each part represents 100m.
3) Divide left part into 10 equal sub-parts. so, each sub-part represent 10m.
4) Give 4 cm height to the scale.
5) Divide left part horizontally into 10 sub-parts.
6) Draw Diagonal line from 0 to 10 m onwards as shown in figure.
7) show 228 m on construction scale.

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