Total lecture = 1.

Lecture-I

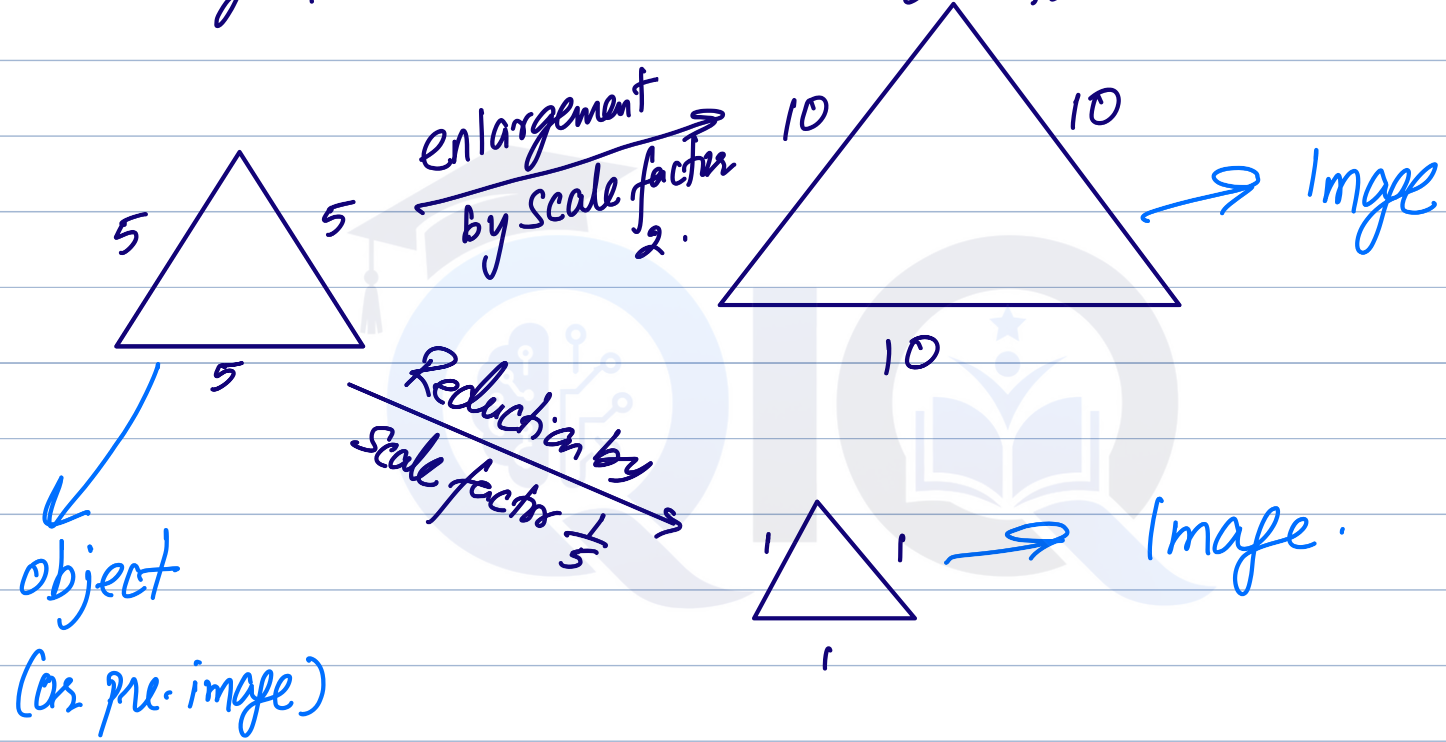
Similarity (As a size transformation)

#

i) Enlargement   ii) Reduction

Size Transformation

It is the process in which a given figure is enlarged or reduce by a scale factor k, such that the resulting figure is similar to the given figure.



Properties of Size Transformation

(i) In a size transformation, the shape of the given figure is preserved.
Thus, angle, perpendicularity, parallelism, etc., are preserved.

(ii) *Let k be the scale factor of a given size transformation. Then,*

$k > 1 \Rightarrow$ *The transformation is an* ***enlargement***.

$k < 1 \Rightarrow$ *The transformation is a* ***reduction.***

$k = 1 \Rightarrow$ *The transformation is an* ***identity transformation.***

(iii) ***Each side of the resulting figure = k times the corresponding side of the given figure.***

(iv) ***Area of the resulting figure = k^2 × (Area of the given figure).***

(v) In case of solids, we have

Volume of the resulting figure = k^3 × (Volume of the given figure).

Model

The model of a plane figure and the actual figure are similar to one another.
Let the model of a plane figure be drawn to the scale $1 : p$.

Then, **Scale Factor,** $k = \dfrac{1}{p}$.

(i) ***Length of the model = k × (Length of the actual figure).***

(ii) ***Area of the model = k^2 × (Area of the actual figure).***

(iii) ***Volume of the model = k^3 × (Volume of the actual figure).***

Map

Let the map of a plane figure be drawn to the scale $1 : p$.

Then, **Scale Factor,** $k = \dfrac{1}{p}$.

(i) ***Length in the map = k × (Actual length).***

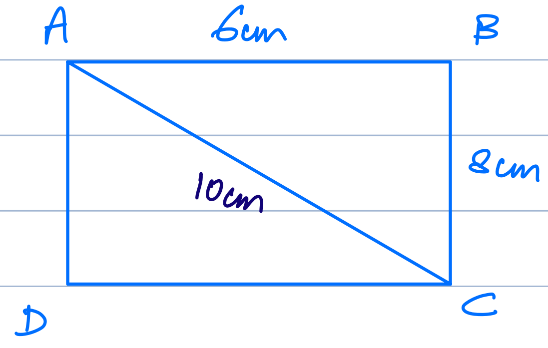
(ii) ***Area in the map = k^2 × (Actual area).***

On a map drawn to a scale of 1 : 50000, a rectangular plot of land ABCD has the following dimensions : AB = 6 cm, BC = 8 cm and all angles are right angles. Find:

(i) the actual length of the diagonal distnace AC of the plot in km

(ii) the actual area of the plot in sq km **(2018)**

Sol^n: $K = \frac{1}{50,000}$.



$\because$ Length of the map = K (Actual length)

$\therefore$ $10 = \frac{1}{50,000}$ (Actual length of AC)

$\Rightarrow$ Actual length of AC = 500,000 cm = 5 Km

$\left\{ \begin{array}{l} 1\text{km} = 1000\text{m} \\ 1\text{m} = 100\text{ cm} \\ \Rightarrow 1\text{Km} = 100,000\text{ cm} \end{array} \right\}$

$\because$ Area of the map = K^2(Actual Area)

$\therefore$ $48\text{cm}^2 = \left(\frac{1}{50,000}\right)^2$ (Actual Area)

Actual Area $= 48 \times 50,000 \times 50000\ \text{cm}^2$.

$= \frac{48 \times \cancel{50,000} \times \cancel{50,000}}{\underset{2}{\cancel{100,000}} \times \underset{2}{\cancel{100,000}}}\ \text{Km}^2 = 12\ \text{Km}^2$.

A model of a ship is made to a scale 1 : 300.

(i) The length of the model of the ship is 2 m. Calculate the length of the ship.

(ii) The area of the deck of the ship is 180000 m^2. Calculate the area of the deck of the model.

(iii) The volume of the model is 6.5 m^3. Calculate the volume of the ship. **(2016)**

Sol:- $K = \frac{1}{300}$.

i) $\because$ length of the model = K (Actual length)

$\therefore$ $2m = \frac{1}{300}$ (length of the ship) $\Rightarrow$ length of the ship = 600m.

ii) Area of the deck of the mode $= \left(\frac{1}{300}\right)^2 (180000\ m^2) = \frac{180000}{300 \times 300} m^2$

$= 2m^2$.

iii) $6.5m^3 = \left(\frac{1}{300}\right)^3$ volume of the ship

$6.5 \times 300 \times 300 \times 300\ m^3$ = Volume of the ship.

$\Rightarrow$ $\boxed{175500000\ m^3 = \text{Volume of the ship}}$ Ans

(or)

Volume of the ship $= \frac{175500000}{1000 \times 1000 \times 1000} Km^3$

$= \underline{0.1755\ Km^3}$ Ans

The model of a building is constructed with scale factor 1 : 30.

(i) *If the height of the model is 80 cm, find the actal height of the building in metres.*

(ii) *If the actual volume of the tank on the top of the building is 27m³, find the volume of the tank on the top of the model.* **(2009, 2019)**

Sol^n:- i) $K = \frac{1}{30} \rightarrow$ $80\ cm = \frac{1}{30}$ (Actual height)

Actual height $= 2400 cm = \underline{24m}$. Ans

ii) Volume of the model $= \left(\frac{1}{30}\right)^3 (27)\ m^3 = \frac{\cancel{27} \times 100 \times 10\cancel{0} \times 10\cancel{0}\ cm^3}{\cancel{30} \times 3\cancel{0} \times 3\cancel{0}}$

$= \underline{1000 cm^3}$ Ans

$1 cm = \frac{1}{100} m \rightarrow 1 cm^3 = \left(\frac{1}{100}\right)^3 m^3 \Rightarrow 1000 cm^3 = \frac{\cancel{1000}}{100 \times 100 \times \cancel{100}} m^3$

$= \frac{1}{1000} m^3 = 0.0\underline{01} m^3$ Ans

5. On a map, drawn to a scale of 1 : 25000, a triangular plot LMN of land has the following measurements :

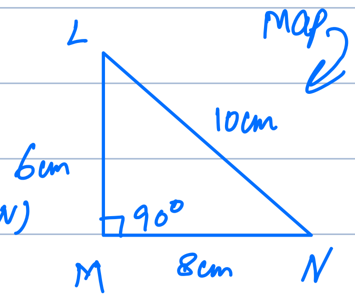
LM = 6 cm, MN = 8 cm and $\angle LMN = 90°$. Calculate :

(i) the actual lengths of MN and LN in kilometres,

(ii) the actual area of the plot in sq. km.

Sol^n:

$K = \frac{1}{25000}$



i) Length of map MN = K (Actual length of MN)

$8 = \frac{1}{25000}$ (Actual length of MN)

Actual length of MN = (25000×8) cm = 200,000 cm = 2 km

Length of map LN = K (Actual length of LN)

Actual length of LN = 10×25000 = 250,000 cm = 2.5 km

ii) Area of map = K^2 (Actual Area)

$\Rightarrow$ Actual = $25000 \times 25000 \times 24$ cm^2 = $\frac{\cancel{25000} \times \cancel{25000} \times 24}{\cancel{100,000} \times \cancel{100,000}}$ km^2

4 4

= 1.5 km^2.