

CE 103: Surveying

Lecture 2: Chain surveying

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Outline

- ❑ Chain surveying
- ❑ Location of ground features
- ❑ Optical square
- ❑ Basic problems of chaining
- ❑ Advantages and disadvantages of chain survey

□ Chain Surveying

Chain surveying is that type of surveying in which only linear measurements are made in the field. This type of surveying is suitable for surveys of small extent on open ground to secure data for exact description of the boundaries of a piece of land or to take simple details.

□ Survey Stations

- A survey station is prominent point on the chain line and can be either at the beginning of the chain line or at the end. Such station is known as main station. However, subsidiary or tie station can also be selected anywhere on the chain line. Every station should be located with respect to three permanent objects.

□ Survey Lines

- The lines joining the main survey stations are called main survey lines. The biggest of the main the survey line is called the base line and the various survey stations are plotted with reference to this.
- **Check lines** are the lines which are run in the field to check the accuracy of the work. The length of the check line measured in the field must agree with its length on the plan. A check line may be laid by joining the apex of the triangle to any point on the opposite side or by joining two points on any two sides of a triangle.
- A **tie line** is a line which joins subsidiary or tie stations on the main line. The main object of running a tie line is to take the details of nearby objects but it also serves the purpose of a check line.

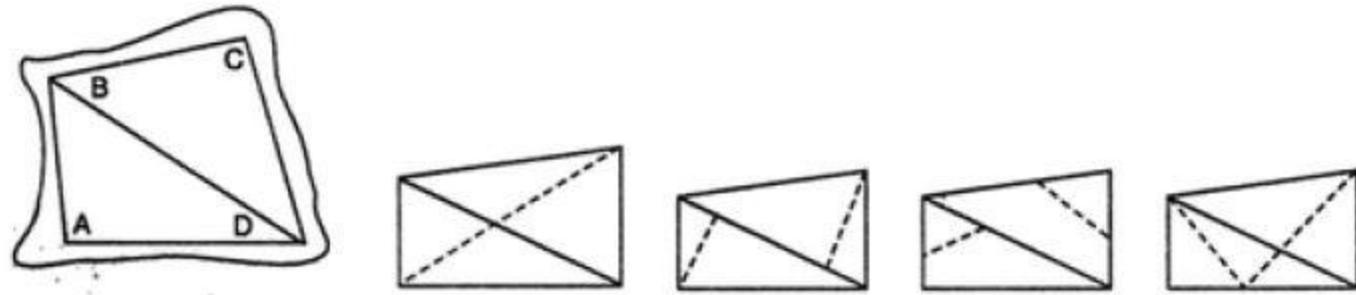


Figure 1: Check Lines

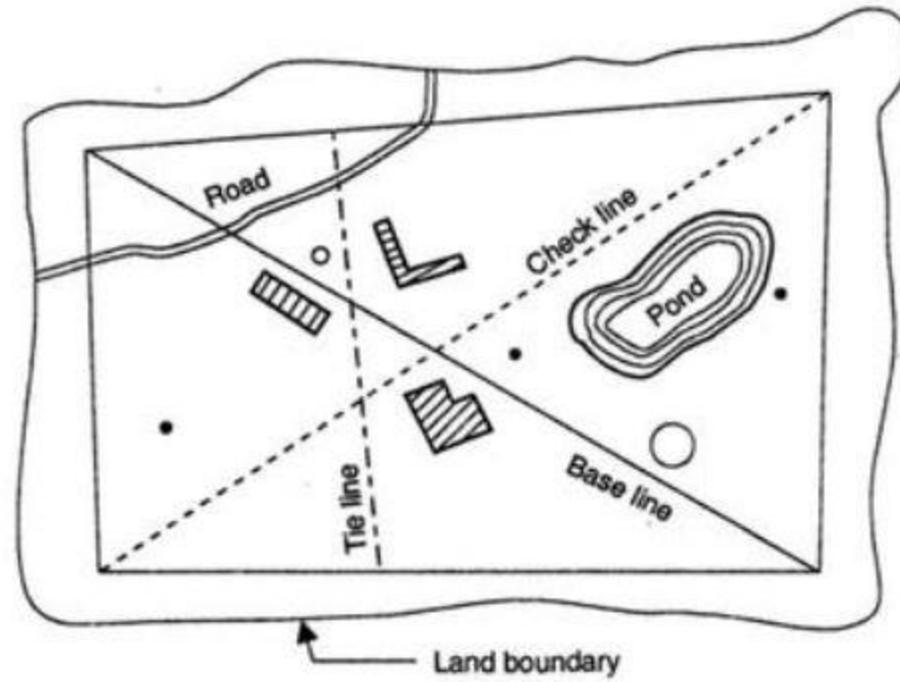


Figure 2

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3.5 Conditions to be fulfilled by survey lines or survey stations:

The survey stations should be so selected that a good system of lines is obtained fulfilling the following conditions :

- (1) Survey stations must be mutually visible.
- (2) Survey lines must be as few as possible so that the framework can be plotted conveniently.
- (3) The framework must have one or two base lines. If one base line is used, it must run along the length and through the middle of the area. If two base lines are used, they must intersect in the form of letter X.
- (4) The lines must run through level ground as possible.
- (5) The main lines should form well-conditioned triangles.
- (6) Each triangle or portion of skeleton must be provided with sufficient check lines
- (7) All the lines from which offsets are taken should be placed close to the corresponding surface features so as to get short offsets.
- (8) As far as possible, the main survey lines should not pass through obstacles.
- (9) To avoid trespassing, the main survey lines should fall within the boundaries of the property to be surveyed.

3.6 Locating ground features: Offsets

- An offset is the lateral distance of an object or ground feature measured from a survey line.
- The point or object is located by measurement of a distance and angle. When the angle of offset is 90° , it is called perpendicular offset and when the angle is other than 90° , it is called oblique offset.

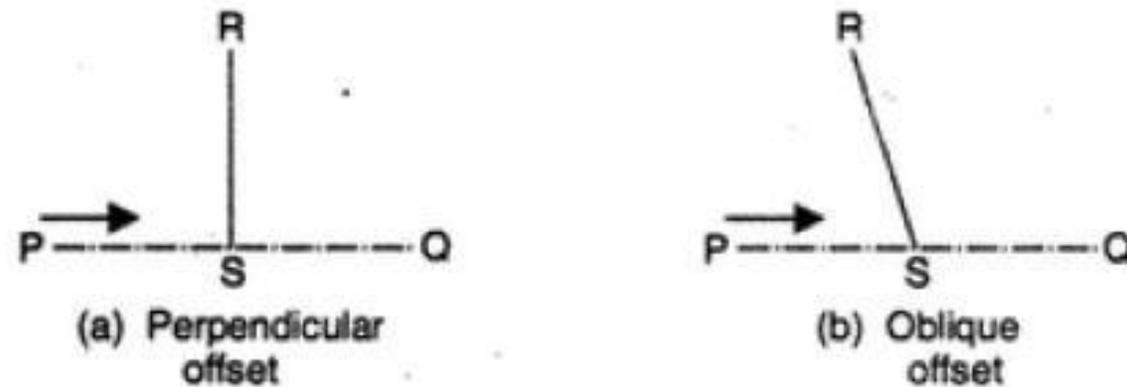


Figure 3: Offsets

3.7 Setting out right angles using optical square



Figure 4: Optical Square

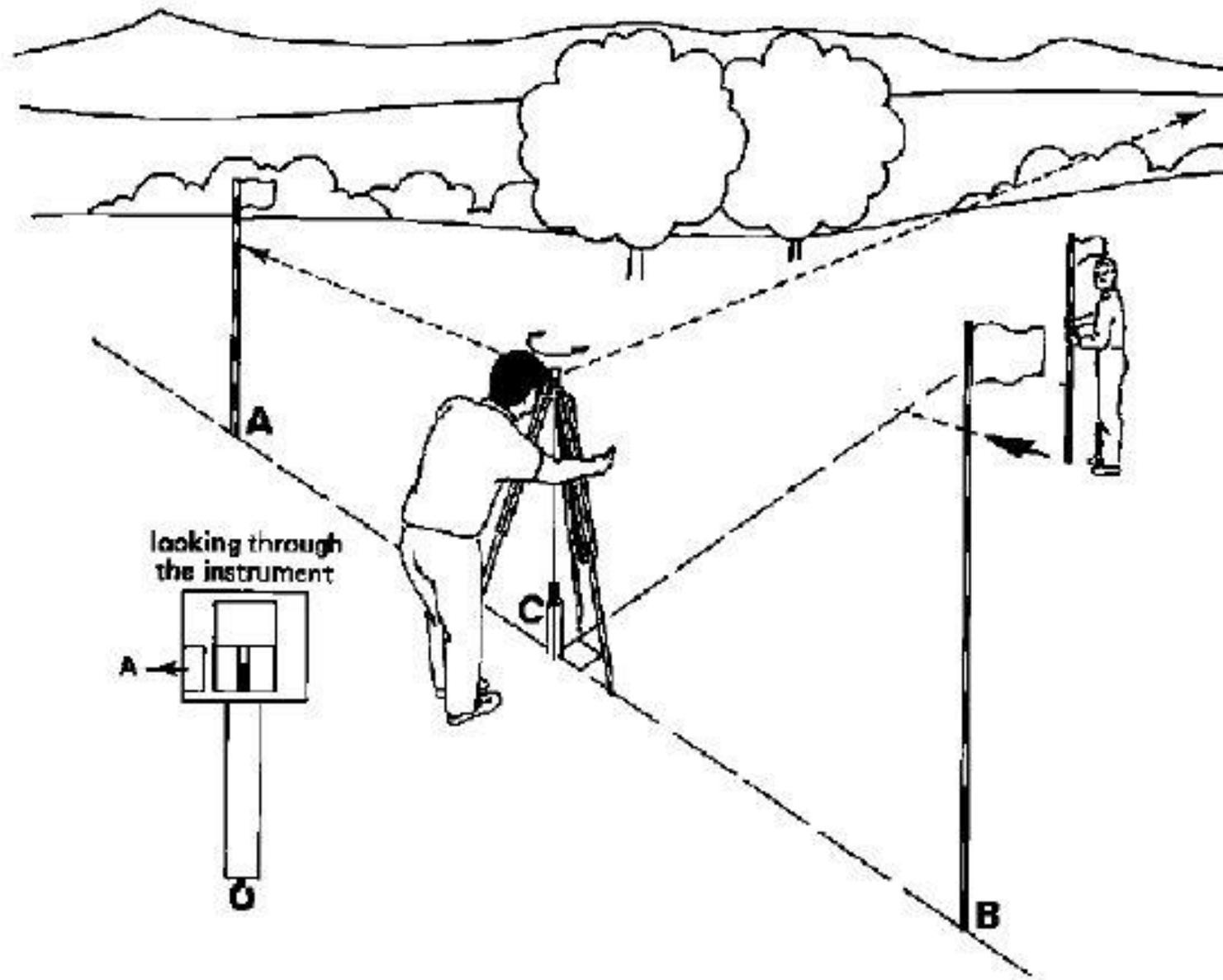


Figure 7

3.8 Basic problems in chaining

- 1) To erect a perpendicular to a chain line from a point on it:

The 3-4-5 method:

Let it be required to erect a perpendicular to the chain line at a point C in it [Figure 13]. Establish a point E at a distance of 3 m from C. Put the 0 end of the tape (10 m long) at E and the 10 m end at C. The 5m and 4m marks are brought together to form a loop of 1 m. The tape is now stretched tight by fastening the ends E and C. The point D is thus established. Angle DCE will be 90° . One person can set out a right angle by this method.

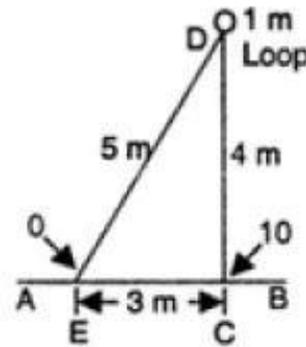


Figure 13

- 2) To drop a perpendicular to a chain line from a point outside it:

Select any point E on the line. With D as centre and DE as radius, draw an arc to cut the chain line in F . Bisect EF at C . CD will be perpendicular to AB . (Figure 14)

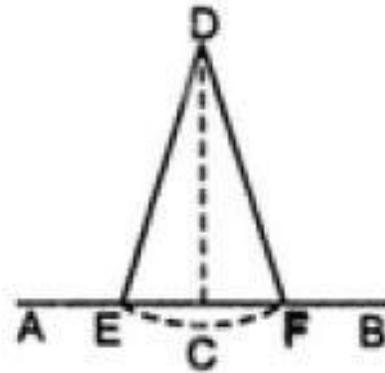


Figure 24

3) To run a Parallel to Chain Line through a given Point :

Let it be required to run a parallel to a chain line AB through a given point C .

i) **First method** [Figure 15]: Through C, drop a perpendicular CE to the chain line. Measure CE. Select any other point F on line and erect a perpendicular FD. Make $FD = EC$. Join C and D.

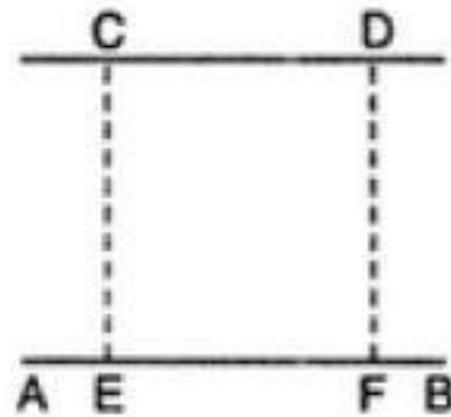


Figure 15

ii) **Second method** [Figure 16]: Select any point F on the chain line. Join CF and bisect at G. Select any other point E on the chain line. Join EG and prolong it to D such that $EG = GD$. Join C and D.

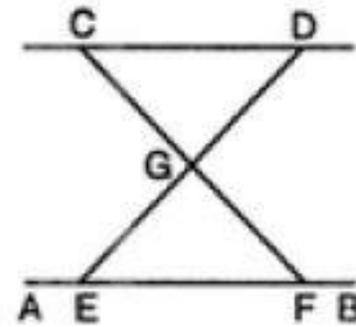


Figure 16

3.9 Obstacles in chaining

1) Vision free but chaining obstructed:

Select two points A and B on either side. Set out equal perpendiculars AC and BD. Measure CD ; then $CD = AB$ [Figure 17].

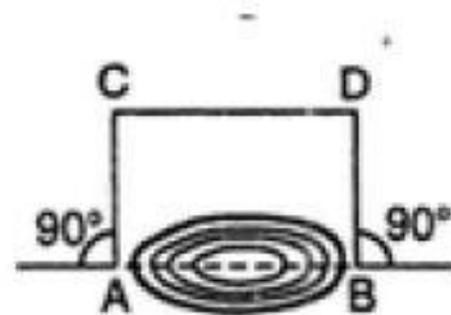


Figure 17

Vision obstructed but chaining free:

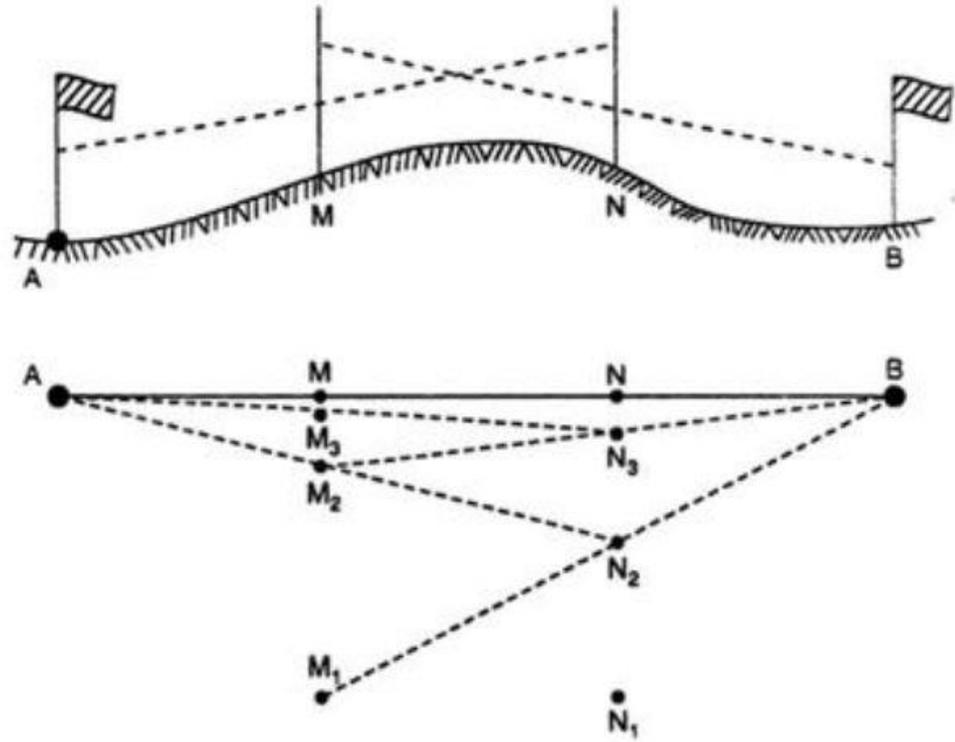


Figure 18

Both vision and chaining are obstructed :

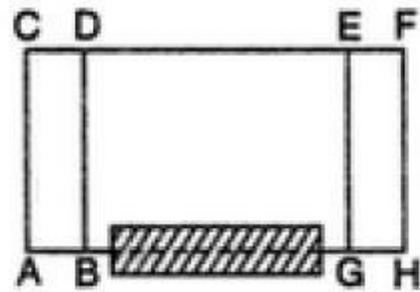


Figure 19

Procedure for chain survey

- The entire procedure can be divided into three major groups-
 - Fieldwork
 - Record Keeping
 - Plotting of map
- Fieldwork includes reconnaissance, selection of station, measurement of lines and taking offsets of different objects in the field.

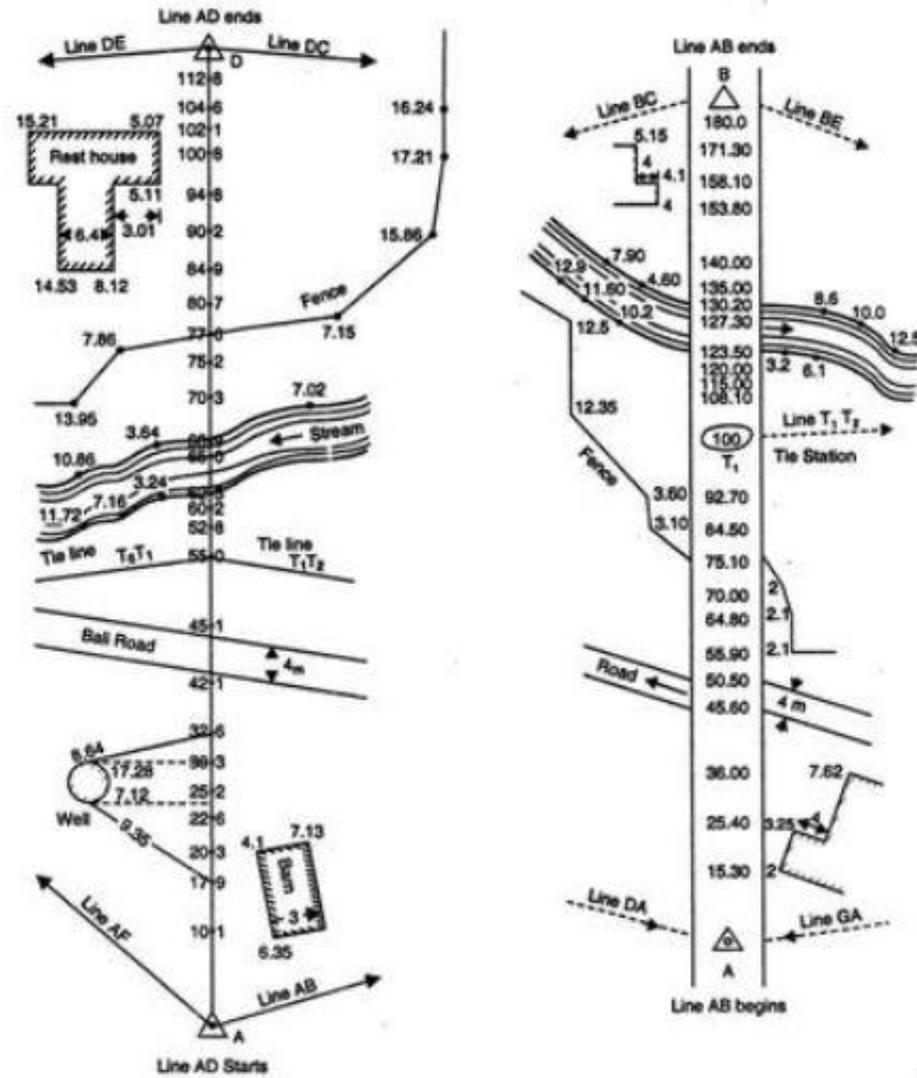


Figure 20: Field book : Left-single line booking and Right- Double line booking

Advantages and disadvantages of chain survey

- Advantages:

- Use of simple instrument.
- Easy to plot.

- Disadvantages:

- Chain survey is not applicable for undulation land.
- Chain survey is not suitable for crowded city with large number of building and obstacles because it cannot be divided into well connected triangles.

Ex8-2 A survey line AB crosses a river. A line AP is run perpendicular to the survey line having length 200m. Another line PB is set at right angle to QP such that the point Q lies on the survey line at the extension of BA and at a distance of 50m from A. Compute the distance AB.

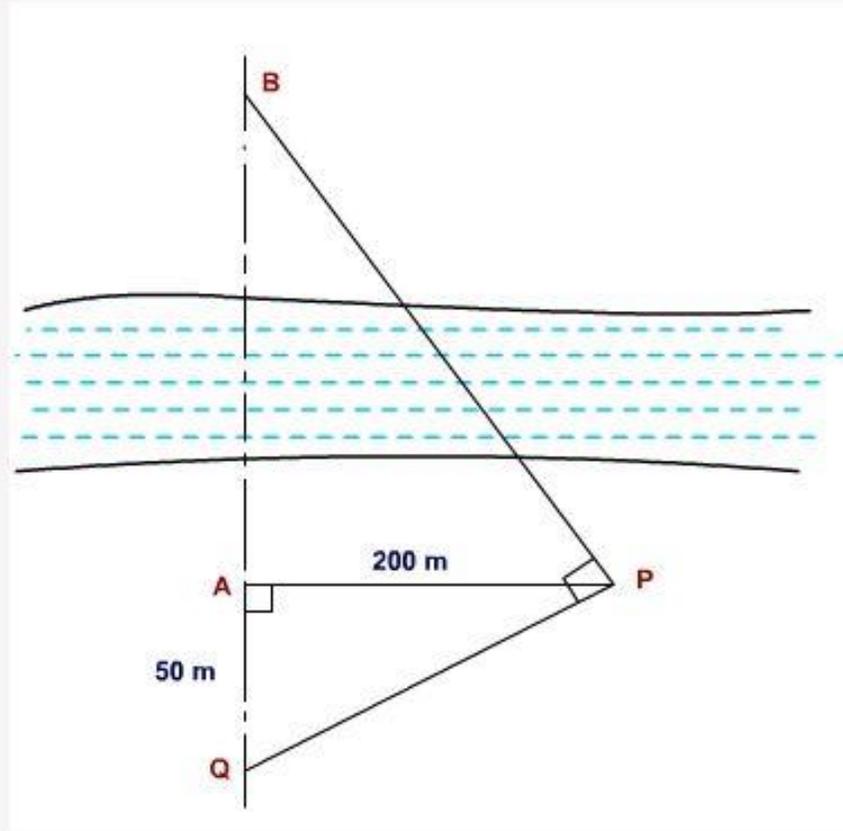


Figure Ex8-2

Solution : Refer Figure for Ex8-2

$$\text{From, } \frac{AB}{AP} = \frac{AP}{AQ}$$
$$\therefore AB = \frac{AP^2}{AQ} = \frac{200^2}{50} = 800;$$

Ex9-1 A 30m steel tape is corrected for temperature to $\pm 2^\circ \text{C}$, a random error of $\pm 0.03\text{m}$ results. Comparison with a standard tape may expose an error of $\pm 0.02 \text{ m}$ and error in measurement of tension with $\pm 3\text{kg}$ may result in an error of $\pm 0.01 \text{ m}$, what is the possible error result in measurement under this condition. Find the amount of error involved in a distance of 300m measured by the tape.

$$E_{\text{total}} = \pm \sqrt{(.03)^2 + (.02)^2 + (.01)^2}$$
$$= \pm 0.0374 \text{ m (in one tape length)}$$

$$\text{Standard error in measured distance} = E_{\text{total}} \times \frac{AP}{AQ}$$