Very Short Answer Type Questions

[1 Marks]

Que 1. Is construction of a triangle with sides 8 cm, 4 cm possible?

Sol. No, we know that in a triangle sum of two sides of a triangle is greater than the third side. So the condition is not satisfied.

Que 2. To divide the line segment AB in the ratio 5: 6, draw a ray AX such that $\angle BAX$ is an acute angle, then draw a ray BY parallel to AX and the point A_1, A_2, A_3… and B_1, B_2, B_3… are located at equal distances on ray AX and BY respectively. Then which points should be joined?

Sol. A_5 and B_6.

Que 3. To draw a pair of tangents to a circle which are inclined to each other at an angle of 60°, it is required to draw tangents at end points of those two radii of the circle. What should be the angle between them?

Sol. 120°

Que 4. In the given figure, by what ratio does P divides AB internally.

Sol. From **Fig. 9.1,** it is clear that there are 3 points at equal distance on AX and 4 points at equal distances on BY. Here P divides AB on joining A_3 B_4. So P divides internally by 3: 4.

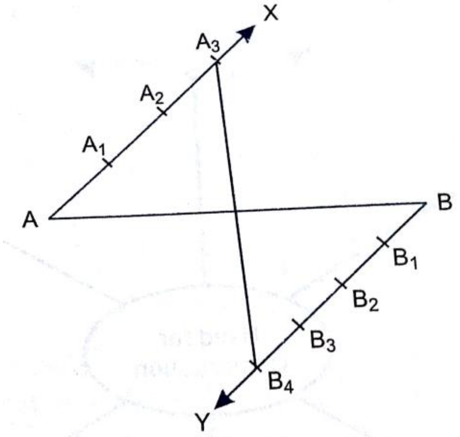

Fig. 9.1

Que 5. Given a triangle with side AB = 8 cm. To get a line segment AB' $= \frac{3}{4}$ of AB, in what ratio will line segment AB be divides?

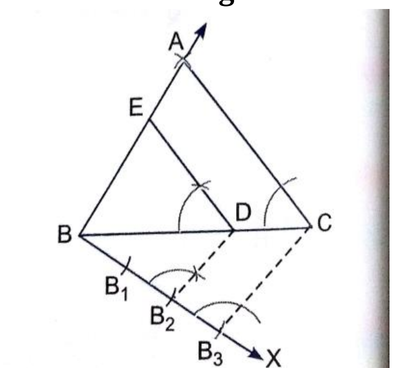

Fig. 9.2

Sol. Given: $AB = 8\ cm$

$$AB = \frac{3}{4}\ of\ AB$$

$$= \frac{3}{4} \times 8 = 6\ cm.$$

BB' $= AB - AB' = 8 - 6 = 2\ cm.$

⇒ AB': BB' = 6: 2 = 3: 1

Hence the required ratio is 3: 1.

Short Answer Type Questions – I & II
[2 and 3 marks]

Que 1. Construct a triangle of sides 4 cm, 5 cm and 6 cm and then a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

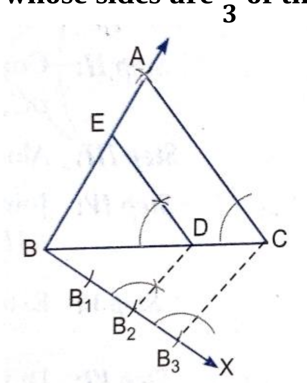

Fig. 9.3

Sol. Steps of construction:
Step I: Draw a line segment BC = 6 cm.
Step II: Draw an arc with B as centre and radius equal to 5 cm.
Step III: Draw an arc, with C as centre and radius equal to 4 cm intersecting the previous drawn arc at A.
Step IV: Join AB and AC, then ΔABC is the required triangle.
Step V: Below BC, make an acute angle CBX.
Step VI: Along BX, mark off three points at equal distance:

$B_1, B_2, B_3, such\ that\ BB_1 = B_1B_2 = B_2B_3.$

Step VII: Join B_3 C.
Step VIII: From B_2, draw $B_2D \parallel B_3C$, meeting BC at D.
Step IX: From D, draw ED || AC, meeting BA at E. Then we have ΔEDB which is the required triangle.

Justification:
Since DE || CA

$$\therefore \quad \Delta ABC \sim \Delta EBD \quad and \quad \frac{EB}{AB} = \frac{BD}{BC} = \frac{DW}{CA} = \frac{2}{3}$$

Hence, we have the new ΔEBD similar to the given $\Delta ABC,$ whose sides are equal to $\frac{2}{3}$ rd of the corresponding sides of$\Delta ABC.$

Que 2. Draw a line segment of length 7.6 cm and divides it in the ratio 5: 8. Measure the two parts.

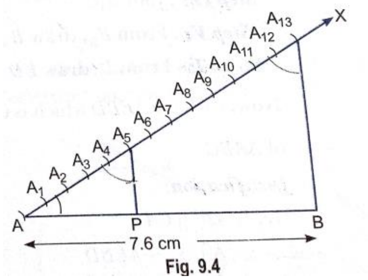

Fig. 9.4

Sol. Steps of construction:
Step I: Draw a line segment AB = 7.6 cm
step II: Draw any ray AX making an acute angle $\angle BAX$ with AB.
Step III: On ray AX, starting from A, mark 5 + 8 = 13 equal arcs.

$AA_1, A_1A_2, A_2A_3, A_3A_4, \ldots A_{11}A_{12}$ *and* $A_{12}A_{13}$.

Step IV: Join A_{13} B.
Step V: From A_5, draw A_5 P || A_{13} B, meeting B at P.
Thus, P divides AB in the ratio 5: 8. On measuring the two parts. We find AP = 2.9 cm and PB = 4.7 (approx.).

Justification:
In $\Delta ABA_{13,}$ PA || BA_{13}
∴ By Basic proportionality theorem

$$\frac{AP}{PB} = \frac{AA_5}{A_5A_{13}} = \frac{5}{8}$$

$$\Rightarrow \quad \frac{AP}{PB} = \frac{5}{8} \qquad \therefore \quad AP : PB = 5 : 8$$

Que 3. Construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then draw another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle.

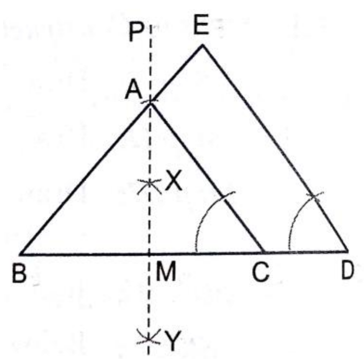

Fig. 9.5

Sol. Steps of construction:
Step I: Draw BC = 8 cm.
Step II: Construct XY, the perpendicular bisector of line segment BC, meeting BC at M.
Step III: Along MP, cut-off MA = 4 cm.
Step IV: Join BA and CA, Then ΔABC so obtained is the required ΔABC.
Step V: Extend BC to D, such that BD = 12 cm $\left(= \frac{3}{2} \times 8\ cm\right)$.
Step VI: Draw DE || CA, meeting BA produced at E. Then ΔEBD is the required triangle.

Justification:
Since, DE || CA

$$\therefore \quad \Delta ABC \sim \Delta EBD \quad and \quad \frac{EB}{AB} = \frac{DE}{CA} = \frac{BD}{BC} = \frac{12}{8} = \frac{3}{2}$$

Hence, we have the new triangle similar to the given triangle whose are $1\frac{1}{2}\ i.e., \frac{3}{2}$ times the corresponding sides of the isosceles ΔABC.

Que 4. Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60°$. Then construct a triangle whose sides are $\frac{3}{4}th$ of the corresponding sides of the triangle ABC.

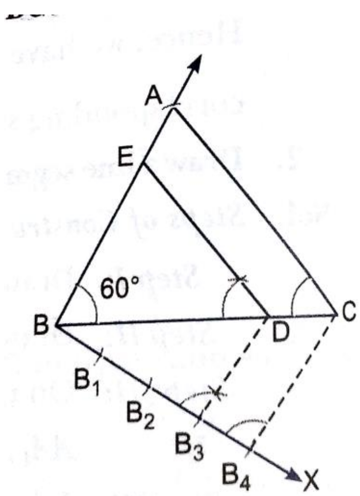

Fig. 9.6

Sol. Steps of construction:
Step I: Construct a ΔABC in which BC = 6 cm, AB = 5 cm and$\angle ABC = 60°$.
Step II: Below BC, make an acute $\angle CBX$.
Step III: Along BX, mark off four arcs:
$B_1, B_2, B_3\ and\ B_4$ such that
$BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.
Step IV: Join B_4 C.
Step V: From B_3, draw B_3 D || B_4 C, meeting BC at D.

Step VI: From D, draw ED || AC. Meeting BA at E.

Now, we have ΔEBD which is the required triangle whose sides are $\frac{3}{4}th$ of the corresponding sides of ΔABC.

Justification:
Here, DE || CA
∴ $\Delta ABC \sim \Delta EBD$

And $\frac{EB}{AB} = \frac{BD}{BC} = \frac{DE}{CA} = \frac{3}{4}$

Hence, we get the new triangle similar to the given triangle whose sides are equal to $\frac{3}{4}th$ of the corresponding sides of ΔABC.

Que 5. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

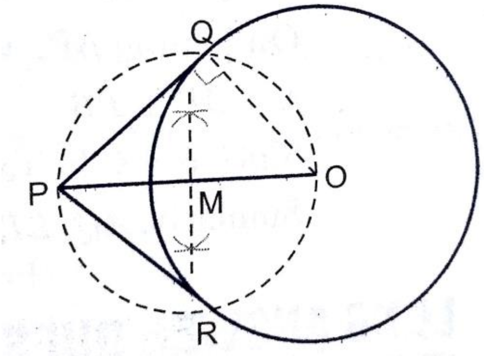

Fig. 9.7

Sol. Steps of construction:
Step I: Take a point O and draw a circle of radius 6 cm.
Step II: Take a point P at a distance of 10 cm from the centre O.
Step III: Join OP and bisect it. Let M be the mid-point.
Step IV: With M as centre and MP as radius, draw a circle to intersect the circle at Q and R.
Step V: Join PQ and PR. Then, PQ and PR are the required tangents. On measuring, we find, PQ = PR = 8 cm.

Justification:
On joining OQ, we find that $\angle PQO = 90°$, as $\angle PQO$ is the angle in the semicircle.
∴ $PQ \perp OQ$
Since OQ is the radius of the given circle, so PQ has to be a tangent to the circle.
Similarly, PR is also a tangent to the circle.

Long Answer Type Questions

[4 marks]

Que 1. Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{5}{3}$ of the corresponding sides of the triangle ABC (i.e., of scale factor $\frac{5}{3}$).

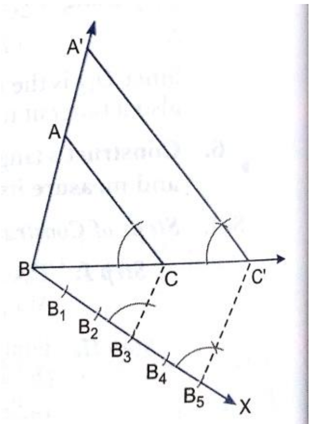

Fig. 9.10

Sol. Steps of construction:

Step I: Draw any ray BX making an acute angle with BC on the side opposite to the vertex A.

Step II: From B cut off 5 arcs

$B_1, B_2, B_3 B_4 \text{ and } B_5 \text{ on } BX \text{ so that}$

$BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5.$

Step III: Join B_3 to C and draw a line through B_5 parallel to B_3 C, intersecting the extended line segment BC at C'.

Step IV: Draw a line through C' parallel to CA intersecting the extended line segment BA at A' (see figure). Then, A' BC' is the required triangle.

Justification:

Note that $\Delta ABC \sim \Delta' BC'$.   (Since AC || A' C')

Therefore, $\frac{AB}{A'B} = \frac{AC}{A'C'} = \frac{BC}{BC'}$

But, $\frac{BC}{BC'} = \frac{BB_3}{BB_5} = \frac{3}{5},$

Therefore, $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{5}{3}.$

Que 2. Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q.

Sol.

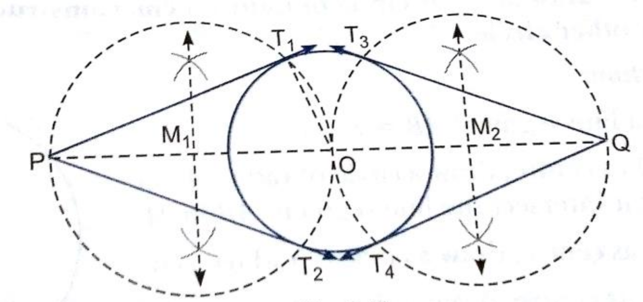

Fig. 9.11

Steps of Construction:
Step I: Taking a point O as centre, draw a circle of radius 3 cm.
Step II: Take two points P and Q on one of its extended diameter such that OP = OQ = 7 cm.
Step III: Bisect OP and OQ and let M_1 and M_2 be the mid-points of OP and OQ respectively.
Step IV: Draw a circle with M_1 as centre and M_1 P as radius to intersect the circle at T_1 and T_2.
Step V: Join PT_1 and PT_2.
Then, PT_1 and PT_2 are the required tangents. Similarly, the tangents QT_3 and QT_4 can be obtained.

Justification: On joining OT_1, we find $\angle PT_1O = 90°$, as it is an angle in the semicircle.

$\therefore \qquad PT_1 \perp OT_1$.
Since OT_1 is a radius of the given circle, so PT_1 has to be a tangents to the circle.
Similarly, PT_2, QT_3 and QT_4 are also tangents to the circle.

Que 3. Let ABC be a right triangle in which AB = 6 cm, BC = 8 cm and $\angle B = 90°$. BD is the perpendicular from B on AC. The circle through B, C, D is drawn. Construct the tangents from A to this circle.

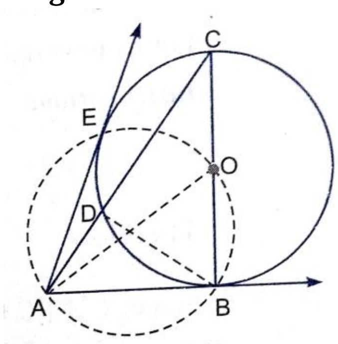

Fig. 9.12

Sol. Steps of Construction:
Step I: Draw ΔABC and perpendicular BD from B on AC.
Step II: Draw a circle with BC as diameter. This circle will pass through D.
Step III: Let O be the mid-point of BC. Join AO.
Step IV: Draw a circle with AO as diameter. This circle cuts the circle drawn in step II at B and

E.
Step V: Join AE. AE and AB are desired tangents drawn from A to the circle passing through B, C and D.

Que 4. Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct another triangle whose sides are $\frac{5}{3}$ times the corresponding sides of the given triangle.

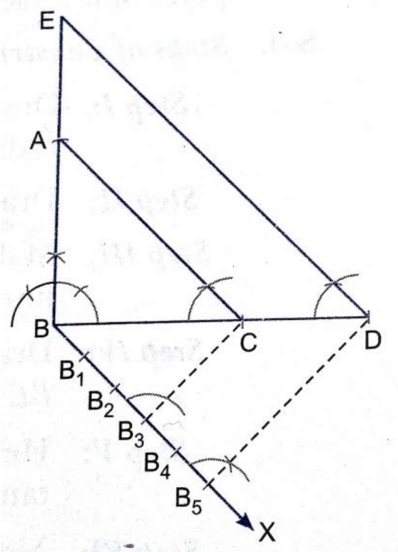

Fig. 9.13

Sol. Steps of Construction:
Step I: Construct a ΔABC in which BC = 4 cm, $\angle B = 90°$ and BA = 3 cm.
Step II: Below BC, make an acute $\angle CBX$.
Step III: Along BX, mark off five arcs: B_1, B_2, B_3, B_4 and B_5 such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.
Step IV: Join B_3C.
Step V: From B_5, draw $B_5D \parallel B_3C$, meeting BC produced at D.
Step VI: From D, draw ED || AC, meeting BA produced at E. Then EBD is the required triangle whose sides are $\frac{5}{3}$ times the corresponding sides of ΔABC.

Justification:
Since, DE || CA

$\therefore \quad \Delta ABC \sim \Delta EBD \quad$ and $\quad \frac{EB}{AB} = \frac{BD}{BC} = \frac{DE}{CA} = \frac{5}{3}$

Hence, we have the new triangle similar to the given triangle whose sides are equal to $\frac{5}{3}$ times the corresponding sides of ΔABC.

HOTS (Higher Order Thinking Skills)

Que 1. Draw a circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circle.

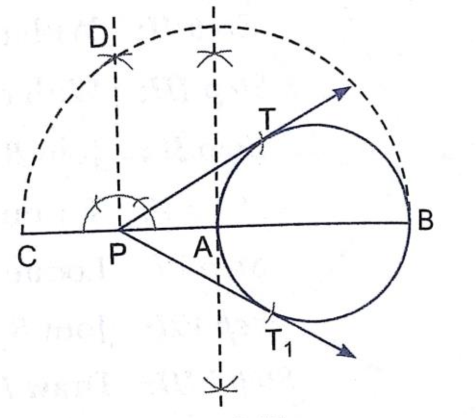

Fig. 9.17

Sol. Steps of Construction:
Step I: Draw a circle with the help of a bangle.
Step II: Let P be the external point from where the tangents are to be drawn to the given circle. Through P, draw a secant PAB to intersect the circle at A and B (say).
Step III: Produce AP to a point C, such that AP = PC, i.e., P is the mid-point of AC.
Step IV: Draw a semicircle with BC as diameter.
Step V: Draw PD ⊥ CB, intersecting the semicircle at D.
Step VI: With P as centre and PD as radius, draw arcs to intersect the given circle at T and T.
Step VII: Join PT and PT_1. Then, PT and PT_1 are the required tangents.

Que 2. Draw a ΔABC with side BC = 7 cm, $\angle B = 45°, \angle A = 105°$. Then construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides of ΔABC.

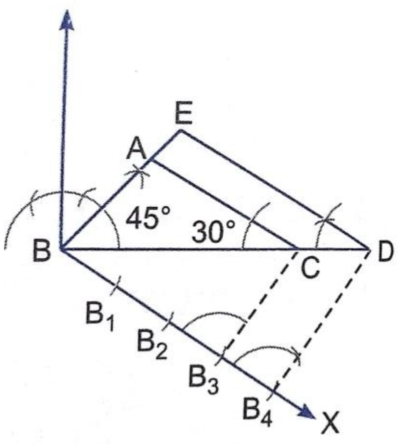

Fig. 9.18

Sol. Step of Construction:
Step I: Construct a ΔABC in which BC = 7 cm,

$\angle B = 45°, \angle C = 180° - (\angle A + \angle B)$

$= 180° - (105° + 45°) = 180° - 150° = 30°$.

Step II: Below BC, makes an acute angle $\angle CBX$.

Step III: Along BX, mark off four arcs: B_1, B_2, B_3, and B_4 such that $BB_1 = B_1 B_2 = B_2 B_3 = B_3 B_4$.

Step IV: Join B_3 C.

Step V: From B_4, draw $B_4 D || B_3 C$, meeting BC produced at D.

Step VI: From D, draw ED||AC, meeting BA produced at E. Then EBD is the required triangle whose sides are $\frac{4}{3}$ times the corresponding sides of ΔABC.

Justification:

Since, DE||CA. ∴ $\Delta ABC \sim \Delta EDB$ and $\frac{EB}{AB} = \frac{BD}{BC} = \frac{DE}{CA} = \frac{4}{3}$

Hence, We have the new triangle similar to the given triangle.

Whose sides are equal to $\frac{4}{3}$ times the corresponding sides of ΔABC.

Que 3. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.

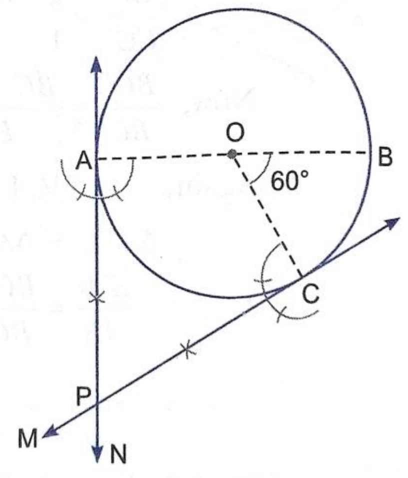

Fig. 9.19

Sol. Steps of Construction:

Step I: Draw a circle with centre O and radius 5 cm.

Step II: Draw any diameter AOB.

Step III: Draw a radius OC such that $\angle BOC = 60°$.

Step IV: At C, we draw CM ⊥ OC and at A, we draw AN ⊥ OA.

Step V: Let the two perpendicular intersect each other at P. Then, PA and PC are required tangents.

Justification:

Since OA is the radius, so PA has to be a tangent to the circle. Similarly, PC is also tangent to the circle.

$$\angle APC = 360° - (\angle OAP + \angle OCP + \angle AOC)$$
$$= 360° - (90° + 90° + 120°) = 360° - 300° = 60°$$

Hence, tangents PA and PC are inclined to each other at an angle of 60 °.

Value Based Questions

Que 1. Puneet prepared two posters on 'National Integration' for decoration on Independence Day on triangular sheets (say ABC and DEF). The sides AB and AC and the perimeter P_1 of ΔABC are respectively three times the corresponding sides DE and DF and the perimeter P^2 of ΔDEF. Are the two triangular sheets similar? If yes, find $\frac{ar(\Delta ABC)}{ar(\Delta DEF)}$.

What values can be inculcated through celebration of national festivals?

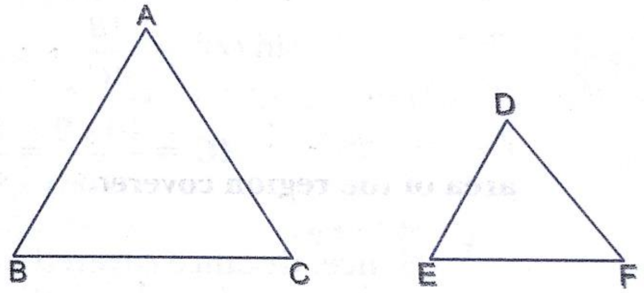

Fig. 4

Sol. In ΔABC and DEF

AB = 3 DE, AC = 3DF and $P_1 = 3p_2$

∴ $\frac{AB}{DE} = 3; \ \frac{AC}{DF} = 3$

And $P_1 = 3p_2 \Rightarrow BC = 3EF$

⇒ $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = 3$

⇒ ΔABC ~ΔDEF (By SSS similarity)

⇒ $\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \left(\frac{AB}{DE}\right)^2 = (3)^2 = 9$

Unity of nation, fraternity, Patriotism.

Que 2. A man steadily goes 4 m due East and then 3 m due North.
(i) Find the distance from initial point to last point.
(ii) Which mathematical concept is used in this problem?
(iii) What is its value?

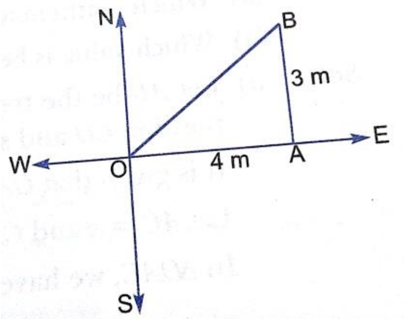

Fig. 5

Sol. (i) Let the initial position of the man be O and his final position be B. Since man goes 4 m due East and then 3 m due North. Therefore, ΔA0B is a right triangle right angled at A such that $OA = 4\ m\ and\ AB = 3m$

By Pythagoras Theorem, we have

$$OB^2 = OA^2 + AB^2$$

$$OB^2 = (4)^2 + (3)^2 = 16 + 9 = 25$$

$$OB = \sqrt{25} = 5\ m.$$

Hence, the man is at a distance of 5 m from the initial position.

(ii) Right-angled triangle, Pythagoras Theorem.

(iii) Knowledge of direction and speed saves the time.

Que 3. Two trees of height x and y are p metres apart.

(i) Prove that the height of the point of intersection of the line joining the top of each tree to the foot of the opposite tree is given by $\frac{xy}{x+y}m$.

(ii) Which mathematical concept is used in this problem?

(iii) What is its value?

Sol. (i) Similar to solution Q. 5, page 161.

(ii) Similarity of triangles.

(iii) Trees are helpful to maintain the balance in the environment. They should be saved at any cost.