CHAPTER

6 Triangles

CASE STUDY / PASSAGE BASED QUESTIONS

Syllabus

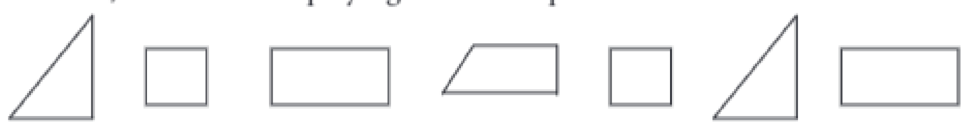
Definitions, examples, counter examples of similar triangles.

1. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
2. (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
4. (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.
6. (Motivate) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
7. (Prove) In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

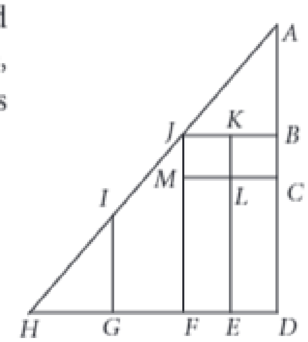
1

Cardboard Pieces Activity

In a classroom, students were playing with some pieces of cardboard as shown below.



All of a sudden, teacher entered into classroom. She told students to arrange all pieces. On seeing this beautiful image, she observed that ΔADH is right angled triangle, which contains



(i) right triangles ABJ and IGH.

(ii) quadrilateral $GFJI$

(iii) squares $JKLM$ and $LCBK$

(iv) rectangles $MLEF$ and $LCDE$.

After observation, she ask certain questions to students. Help them to answer these questions.

(i) If an insect (small ant) walks 24 m from H to F, then walks 6 m to reach at M, then walks 4 m to reach at L and finally crossing K, reached at J. Find the distance between initial and final position of insect.

(a) 25 m (b) 26 m (c) 27 m (d) 28 m

(ii) If m, n and r are the sides of right triangle ABJ, then which of the following can be correct?

(a) $m^2 + n^2 = r^2$ (b) $m^2 + n^2 + r^2 = 0$

(c) $m^2 + n^2 = 2r^2$ (d) none of these

(iii) If $\Delta ABJ \sim \Delta ADH$, then which similarity criterion is used here?

(a) AA (b) SAS (c) AAS (d) SSS

(iv) If $\angle ABJ = 90^\circ$ and B, J are mid points of sides AD and AH respectively and $BJ \parallel DH$, then which of the following option is false?

(a) $\Delta ABJ \sim \Delta ADH$ (b) $2BJ = DH$ (c) $AJ^2 = JB^2 + AB^2$ (d) $\dfrac{AB}{BD} = \dfrac{AJ}{AH}$

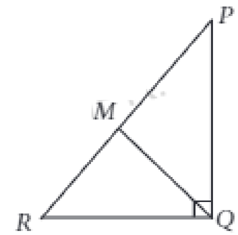
(v) If ΔPQR is right triangle with $QM \perp PR$, then which of the following is not correct?

(a) $\Delta PMQ \sim \Delta PQR$

(b) $QR^2 = PR^2 - PQ^2$

(c) $PR^2 = PQ + QR$

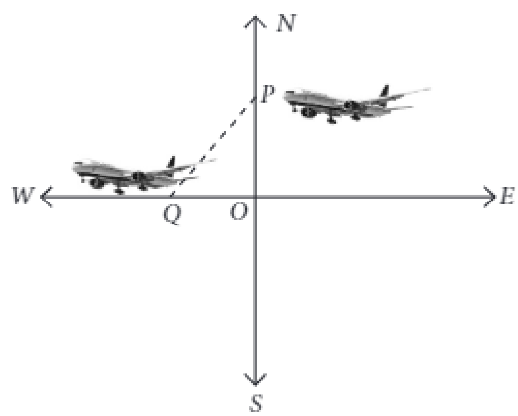
(d) $\Delta PMQ \sim \Delta QMR$



2

Application of Pythagoras Theorem

An aeroplane leaves an airport and flies due north at a speed of 1200 km /hr. At the same time, another aeroplane leaves the same station and flies due west at the speed of 1500 km/hr as shown below. After $1\frac{1}{2}$ hr both the aeroplanes reaches at point P and Q respectively.



Based on the above information, answer the following questions.

(i) Distance travelled by aeroplane towards north after $1\frac{1}{2}$ hr is

(a) 1800 km (b) 1500 km (c) 1400 km (d) 1350 km

(ii) Distance travelled by aeroplane towards west after $1\frac{1}{2}$ hr is

(a) 1600 km (b) 1800 km (c) 2250 km (d) 2400 km

(iii) In the given figure, $\angle POQ$ is

(a) 70° (b) 90° (c) 80° (d) 100°

(iv) Distance between aeroplanes after $1\frac{1}{2}$ hr , is

(a) $450\sqrt{41}$ km (b) $350\sqrt{31}$ km

(c) $125\sqrt{12}$ km (d) $472\sqrt{41}$ km

(v) Area of ΔPOQ is

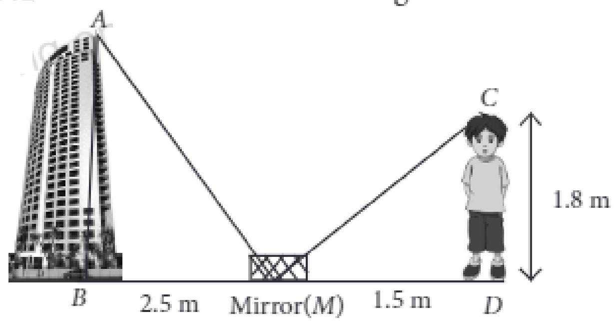
(a) 185000 km^2 (b) 179000 km^2

(c) 186000 km^2 (d) 2025000 km^2

3

Measurement of Height

Rohit's father is a mathematician. One day he gave Rohit an activity to measure the height of building. Rohit accepted the challenge and placed a mirror on ground level to determine the height of building. He is standing at a certain distance so that he can see the top of the building reflected from mirror. Rohit eye level is at 1.8 m above ground. The distance of Rohit from mirror and that of building from mirror are 1.5 m and 2.5 m respectively.



Based on the above information, answer the following questions.

(i) Two similar triangles formed in the above figure is

(a) ΔABM and ΔCMD (b) ΔAMB and ΔCDM (c) ΔABM and ΔCDM (d) None of these

(ii) Which criterion of similarity is applied here?

(a) AA similarity criterion (b) SSS similarity criterion

(c) SAS similarity criterion (d) ASA similarity criterion

(iii) Height of the building is

(a) 1 m (b) 2 m (c) 3 m (d) 4 m

(iv) In ΔABM, if $\angle BAM = 30°$, then $\angle MCD$ is equal to

(a) 40° (b) 30° (c) 65° (d) 90°

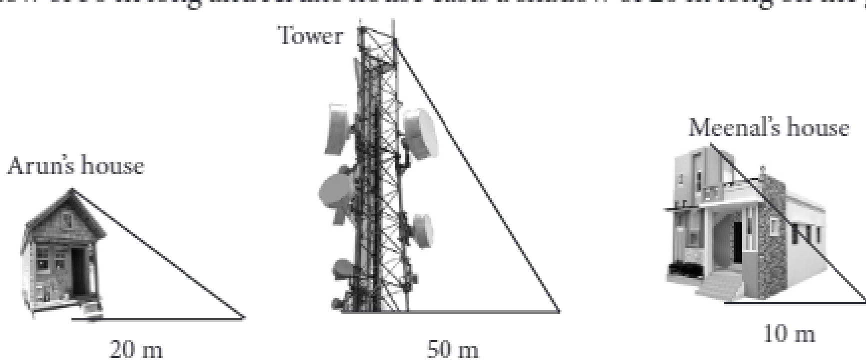
(v) If ΔABM and ΔCDM are similar where $CD = 6$ cm, $MD = 8$ cm and $BM = 24$ cm, then AB is equal to

(a) 16 cm (b) 18 cm (c) 12 cm (d) 14 cm

4

Application of Similar Triangles

Meenal was trying to find the height of tower near his house. She is using the properties of similar triangles. The height of Meenal's house is 20 m. When Meenal's house casts a shadow of 10 m long on the ground, at the same time, tower casts a shadow of 50 m long and Arun's house casts a shadow of 20 m long on the ground as shown below.



Based on the above information, answer the following questions.

(i) What is the height of tower?

(a) 100 m (b) 50 m (c) 15 m (d) 45 m

(ii) What will be the length of shadow of tower when Meenal's house casts a shadow of 15 m?

(a) 45 m (b) 70 m (c) 75 m (d) 72 m

(iii) Height of Arun's house is

(a) 80 m (b) 75 m (c) 60 m (d) 40 m

(iv) If tower casts a shadow of 40 m, then find the length of shadow of Arun's house.

(a) 18 m (b) 16 m (c) 17 m (d) 14 m

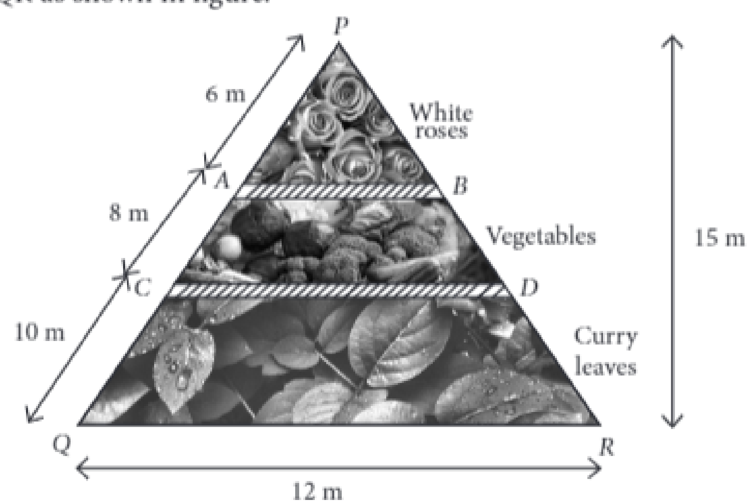
(v) If tower casts a shadow of 40 m, then what will be the length of shadow of Meenal's house?

(a) 7 m (b) 9 m (c) 4 m (d) 8 m

5

Gardening in the Backyard

In the backyard of house, Shikha has some empty space in the shape of a ΔPQR. She decided to make it a garden. She divided the whole space into three parts by making boundaries AB and CD using bricks to grow flowers and vegetables where $AB || CD || QR$ as shown in figure.



Based on the above information, answer the following questions.

(i) The length of AB is

(a) 3 m (b) 4 m (c) 5 m (d) 6 m

(ii) The length of CD is

(a) 4 m (b) 5 m (c) 6 m (d) 7 m

(iii) Area of whole empty land is

(a) 90 m^2 (b) 60 m^2 (c) 32 m^2 (d) 72 m^2

(iv) Area of ΔPAB is

(a) $\frac{45}{4} m^2$ (b) $\frac{45}{8} m^2$ (c) $\frac{8}{45} m^2$ (d) $\frac{4}{45} m^2$

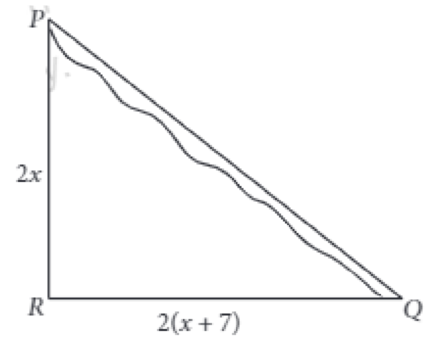
(v) Area of ΔPCD is

(a) $\frac{12}{245} m^2$ (b) $\frac{245}{12} m^2$ (c) $\frac{243}{8} m^2$ (d) $\frac{245}{8} m^2$

6

Inspection of Road

Minister of a state went to city Q from city P. There is a route via city R such that $PR \perp RQ$. $PR = 2x$ km and $RQ = 2(x + 7)$ km. He noticed that there is a proposal to construct a 26 km highway which directly connects the two cities P and Q.



Based on the above information, answer the following questions.

(i) Which concept can be used to get the value of x?

(a) Thales theorem
(b) Pythagoras theorem
(c) Converse of thales theorem
(d) Converse of Pythagoras theorem

(ii) The value of x is

(a) 4 (b) 6 (c) 5 (d) 8

(iii) The value of PR is

(a) 10 km (b) 20 km (c) 15 km (d) 25 km

(iv) The value of RQ is

(a) 12 km (b) 24 km (c) 16 km (d) 20 km

(v) How much distance will be saved in reaching city Q after the construction of highway?

(a) 10 km (b) 9 km (c) 4 km (d) 8 km

7

Class teacher draw the shape of quadrilateral on board. Ankit observed the shape and explored on his notebook in different ways as shown below.

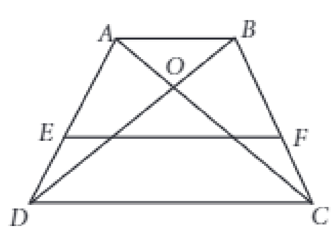


Fig. 1

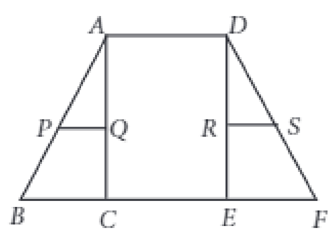


Fig. 2

Based on the above information, answer the following questions.

(i) In fig. 1, if $ABCD$ is a trapezium with $AB \parallel CD$, E and F are points on non-parallel sides AD and BC respectively such that $EF \parallel AB$, then $\frac{AE}{ED} =$

(a) $\frac{BE}{CD}$ (b) $\frac{AB}{CD}$ (c) $\frac{BF}{FC}$ (d) None of these

(ii) In fig. 1, if $AB \parallel CD$, and $DO = 3x - 19$, $OB = x - 5$, $OC = x - 3$ and $AO = 3$, then the value of x can be

(a) 5 or 8 (b) 8 or 9 (c) 10 or 12 (d) 13 or 14

(iii) In fig. 1, if $OD = 3x - 1$, $OB = 5x - 3$, $OC = 2x + 1$ and $AO = 6x - 5$, then the value of x is

(a) 0 (b) 1 (c) 2 (d) 3

(iv) In fig. 2, in ΔABC, if $PQ \parallel BC$ and $AP = 2.4$ cm, $AQ = 2$ cm, $QC = 3$ cm and $BC = 6$ cm, then $AB + PQ$ is equal to

(a) 7.2 cm (b) 5.9 cm (c) 2.6 cm (d) 8.4 cm

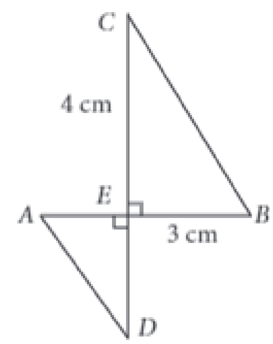
(v) In fig. 2, in ΔDEF, if $RS \parallel EF$, $DR = 4x - 3$, $DS = 8x - 7$, $ER = 3x - 1$ and $FS = 5x - 3$, then the value of x is

(a) 1 (b) 2 (c) 8 (d) 10

8

Diwali Decoration

Ankita wants to make a toran for Diwali using some pieces of cardboard. She cut some cardboard pieces as shown below. If perimeter of ΔADE and ΔBCE are in the ratio 2 : 3, then answer the following questions.



(i) If the two triangles here are similar by SAS similarity rule, then their corresponding proportional sides are

(a) $\frac{AE}{CE} = \frac{DE}{BE}$ (b) $\frac{BE}{AE} = \frac{CE}{DE}$

(c) $\frac{AD}{CE} = \frac{BE}{DE}$ (d) None of these

(ii) Length of BC =

(a) 2 cm (b) 4 cm (c) 5 cm (d) None of these

(iii) Length of AD =

(a) 10/3 cm (b) 9/4 cm (c) 5/3 cm (d) 4/3 cm

(iv) Length of ED =

(a) 4/3 cm (b) 8/3 cm (c) 7/3 cm (d) Can't be determined

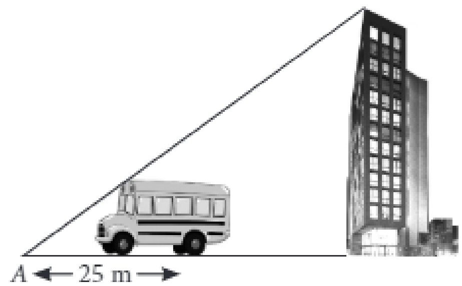
(v) Length of AE =

(a) $\frac{2}{3} \times BE$ (b) $\sqrt{AD^2 - DE^2}$ (c) $\frac{2}{3} \times \sqrt{BC^2 - CE^2}$ (d) All of these

9

Aruna visited to her uncle's house. From a point *A*, where Aruna was standing, a bus and building come in a straight line as shown in the figure.

Based on the above information, answer the following questions.



(i) Which similarity criteria can be seen in this case, if bus and building are considered in a straight line?

(a) AA (b) SAS (c) SSS (d) ASA

(ii) If the distance between Aruna and the bus is twice as much as the height of the bus, then the height of the bus is

(a) 40 m (b) 12.5 m (c) 15 m (d) 25 m

(iii) If the distance of Aruna from the building is twelve times the height of the bus, then the ratio of the heights of bus and building is

(a) 3 : 1 (b) 1 : 4 (c) 1 : 6 (d) 2 : 3

(iv) What is the ratio of the distance between Aruna and top of bus to the distance between the tops of bus and building?

(a) 1 : 5 (b) 1 : 6 (c) 2 : 5 (d) Can't be determined

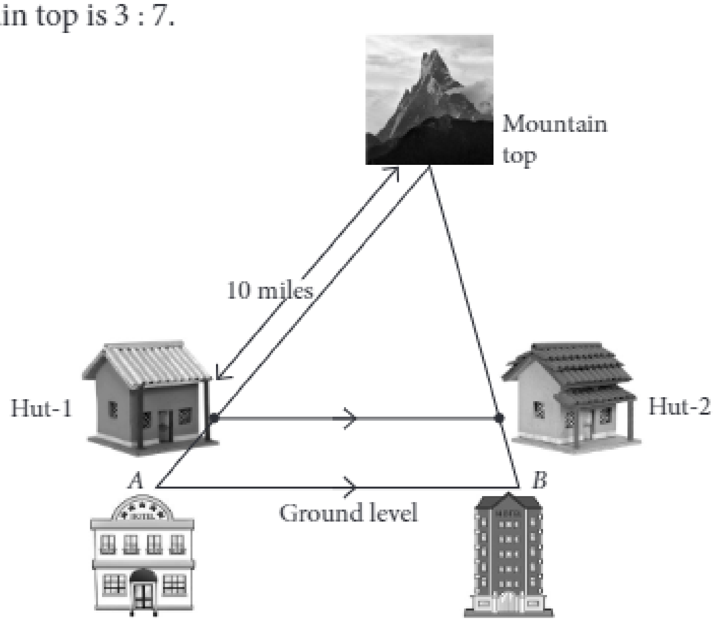
(v) What is the height of the building?

(a) 50 m (b) 75 m (c) 120 m (d) 30 m

10

Mountain Trekking

Two hotels are at the ground level on either side of a mountain. On moving a certain distance towards the top of the mountain two huts are situated as shown in the figure. The ratio between the distance from hotel *B* to hut-2 and that of hut-2 to mountain top is 3 : 7.



Based on the above information, answer the following questions.

(i) What is the ratio of the perimeters of the triangle formed by both hotels and mountain top to the triangle formed by both huts and mountain top?

(a) 5 : 2 (b) 10 : 7 (c) 7 : 3 (d) 3 : 10

(ii) The distance between the hotel *A* and hut-1 is

(a) 2.5 miles (b) 29 miles (c) 4.29 miles (d) 1.5 miles

(iii) If the horizontal distance between the hut-1 and hut-2 is 8 miles, then the distance between the two hotels is

(a) 2.4 miles (b) 11.43 miles (c) 9 miles (d) 7 miles

(iv) If the distance from mountain top to hut-1 is 5 miles more than that of distance from hotel *B* to mountain top, then what is the distance between hut-2 and mountain top?

(a) 3.5 miles (b) 6 miles (c) 5.5 miles (d) 4 miles

(v) What is the ratio of areas of two parts formed in the complete figure?

(a) 53 : 21 (b) 10 : 41 (c) 51 : 33 (d) 49 : 51

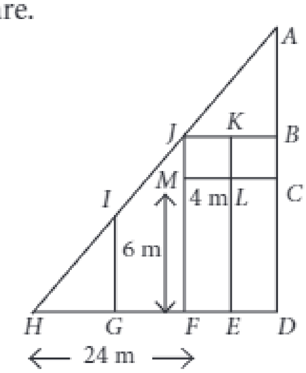
HINTS & EXPLANATIONS

1. **(i) (b):** As *JKLM* is a square.

$\therefore$ $ML = JM = 4$ m

So, $JF = 6 + 4 = 10$ m

Required distance between initial and final position of insect = HJ



$= \sqrt{(HF)^2 + (JF)^2}$

$= \sqrt{(24)^2 + (10)^2}$

$= \sqrt{676} = 26$ m

(ii) (a): By Pythagoras, $n^2 + m^2 = r^2$

(iii) (a): In ΔABJ and ΔADH

$\angle B = \angle D = 90°$

$\angle A = \angle A$ (common)

$\therefore$ By AA similarity criterion, $\Delta ABJ \sim \Delta ADH$.

(iv) (d): Since, $\Delta ABJ \sim \Delta ADH$ [By AA similarity criterion]

$\therefore$ $\dfrac{AB}{AD} = \dfrac{AJ}{AH}$

(v) (c): Since, $PR^2 = PQ^2 + QR^2$ [By Pythagoras theorem]

2. **(i) (a):** Speed = 1200 km/hr

Time $= 1\frac{1}{2}$ hr $= \frac{3}{2}$ hr

$\therefore$ Required distance = Speed × Time

$= 1200 \times \frac{3}{2} = 1800$ km

(ii) (c): Speed = 1500 km/hr

Time $= \frac{3}{2}$ hr

$\therefore$ Required distance = Speed × Time

$= 1500 \times \frac{3}{2} = 2250$ km

(iii) (b): Clearly, directions are always perpendicular to each other.

$\therefore$ $\angle POQ = 90°$

(iv) (a): Distance between aeroplanes after $1\frac{1}{2}$ hour

$= \sqrt{(1800)^2 + (2250)^2} = \sqrt{3240000 + 5062500}$

$= \sqrt{8302500} = 450\sqrt{41}$ km

(v) (d): Area of $\Delta POQ = \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 2250 \times 1800 = 2250 \times 900 = 2025000 \text{ km}^2$

3. **(i) (c):** Since, $\angle B = \angle D = 90°$, $\angle AMB = \angle CMD$

($\because$ Angle of incident = Angle of reflection)

$\therefore$ By similarity criterion, $\Delta ABM \sim \Delta CDM$

(ii) (a)

(iii) **(c)** : $\because \Delta ABM \sim \Delta CDM$

$$\therefore \frac{AB}{CD} = \frac{BM}{DM} \Rightarrow \frac{AB}{1.8} = \frac{2.5}{1.5}$$

$$\Rightarrow AB = \frac{2.5 \times 1.8}{1.5} = 3 \text{ m}$$

(iv) **(b)**: Since, $\Delta ABM \sim \Delta CDM$

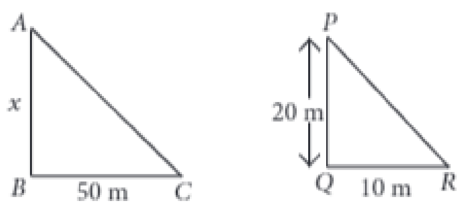
$\therefore \angle A = \angle C = 30°$

[$\because$ Corresponding angles of similar triangles are also equal]

(v) **(b)**: Since, $\Delta ABM \sim \Delta CDM$

$$\therefore \frac{AB}{CD} = \frac{BM}{MD} \Rightarrow \frac{AB}{6} = \frac{24}{8} \Rightarrow AB = 18 \text{ cm}$$

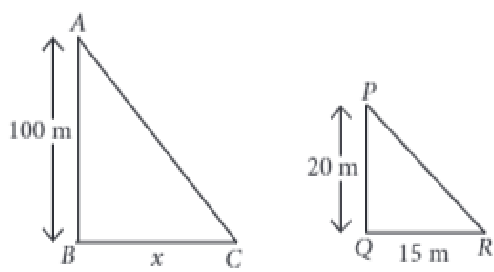
4. **(i)** **(a)**: Since, $\Delta ABC \sim \Delta PQR$



$$\therefore \frac{AB}{PQ} = \frac{BC}{QR} \Rightarrow \frac{x}{20} = \frac{50}{10} \Rightarrow x = 100$$

Thus, height of tower is 100 m.

(ii) **(c)** : Since, $\Delta ABC \sim \Delta PQR$

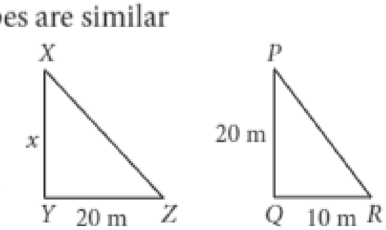


$$\therefore \frac{100}{20} = \frac{x}{15} \Rightarrow x = \frac{1500}{20} = 75 \text{ m}$$

(iii) **(d)**: Since, the shapes are similar

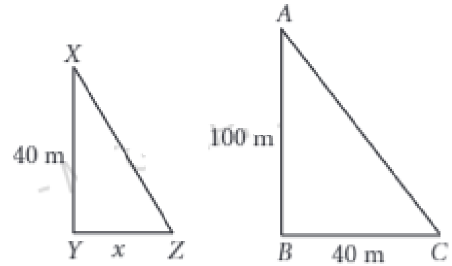
$$\therefore \frac{x}{20} = \frac{20}{10}$$

$$\Rightarrow x = \frac{20 \times 20}{10} = 40 \text{ m}$$



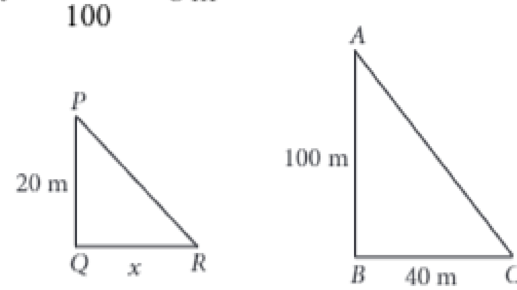
(iv) **(b)**: Since, the shapes are similar, so, $\frac{40}{100} = \frac{x}{40}$

$\Rightarrow x = 16$ m



(v) **(d)**: Since, the shapes are similar, so, $\frac{20}{100} = \frac{x}{40}$

$$\Rightarrow x = \frac{20 \times 40}{100} = 8 \text{ m}$$



5. **(i)** **(a)**: In ΔPAB and ΔPQR,

$\angle P = \angle P$ (Common)

$\angle A = \angle Q$ (Corresponding angles)

By AA similarity criterion, $\Delta PAB \sim \Delta PQR$

$$\therefore \frac{AB}{QR} = \frac{PA}{PQ} \Rightarrow \frac{AB}{12} = \frac{6}{24} \Rightarrow AB = 3 \text{ m}$$

(ii) **(d)**: Similarly, ΔPCD and ΔPQR are similar.

$$\therefore \frac{PC}{PQ} = \frac{CD}{QR} \Rightarrow \frac{14}{24} = \frac{CD}{12} \Rightarrow CD = 7 \text{ m}$$

(iii) **(a)**: Area of whole empty land

$$= \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 12 \times 15 = 90 \text{ m}^2$$

(iv) **(b)**: Since, $\Delta PAB \sim \Delta PQR$.

$$\therefore \frac{ar(\Delta PAB)}{ar(\Delta PQR)} = \left(\frac{PA}{PQ}\right)^2 = \left(\frac{6}{24}\right)^2 = \frac{1}{16}$$

$$\Rightarrow ar(\Delta PAB) = \frac{1}{16} \times 90 = \frac{45}{8} \text{ m}^2$$

$[\because ar(\Delta PQR) = 90 \text{ m}^2]$

(v) **(d)**: Since, $\Delta PCD \sim \Delta PQR$.

$$\therefore \frac{ar(\Delta PCD)}{ar(\Delta PQR)} = \left(\frac{PC}{PQ}\right)^2 = \left(\frac{14}{24}\right)^2 = \left(\frac{7}{12}\right)^2$$

$$\Rightarrow ar(\Delta PCD) = \frac{90 \times 49}{144} = \frac{245}{8} \text{ m}^2$$

6. **(i)** **(b)**

(ii) **(c)** : Using Pythagoras theorem, we have

$PQ^2 = PR^2 + RQ^2$

$\Rightarrow\ (26)^2 = (2x)^2 + (2(x+7))^2 \Rightarrow 676 = 4x^2 + 4(x+7)^2$
$\Rightarrow\ 169 = x^2 + x^2 + 49 + 14x \Rightarrow x^2 + 7x - 60 = 0$
$\Rightarrow\ x^2 + 12x - 5x - 60 = 0$
$\Rightarrow\ x(x+12) - 5(x+12) = 0 \Rightarrow (x-5)(x+12) = 0$
$\Rightarrow\ x = 5, x = -12$
$\therefore\ x = 5$ [Since length can't be negative]

(iii) (a): $PR = 2x = 2 \times 5 = 10$ km

(iv) (b): $RQ = 2(x+7) = 2(5+7) = 24$ km

(v) (d): Since, $PR + RQ = 10 + 24 = 34$ km
Saved distance = 34 – 26 = 8 km

7. (i) (c)

(ii) (b): Since, $\Delta AOB \sim \Delta COD$ [By AA similarity criterion]

$\therefore \frac{AO}{OC} = \frac{BO}{OD} \Rightarrow \frac{3}{x-3} = \frac{x-5}{3x-19}$
$\Rightarrow\ 3(3x-19) = (x-5)(x-3)$
$\Rightarrow\ 9x - 57 = x^2 - 3x - 5x + 15 \Rightarrow x^2 - 17x + 72 = 0$
$\Rightarrow\ (x-8)(x-9) = 0 \Rightarrow x = 8$ or 9

(iii) (c): Since, $\Delta AOB \sim \Delta COD$ [By AA similarity criterion]

$\therefore \frac{AO}{OC} = \frac{BO}{OD} \Rightarrow \frac{6x-5}{2x+1} = \frac{5x-3}{3x-1}$
$\Rightarrow\ (6x-5)(3x-1) = (5x-3)(2x+1)$
$\Rightarrow\ 18x^2 - 6x - 15x + 5 = 10x^2 + 5x - 6x - 3$
$\Rightarrow\ 8x^2 - 20x + 8 = 0 \Rightarrow 2x^2 - 5x + 2 = 0$
From options, $x = 2$ is the only value that satisfies this equation.

(iv) (d): Since $\Delta APQ \sim \Delta ABC$ [By AA similarity criterion]

$\therefore\ \frac{AP}{AB} = \frac{AQ}{AC} = \frac{PQ}{BC} \Rightarrow \frac{2.4}{AB} = \frac{2}{5} = \frac{PQ}{6}$

$\therefore\ AB = \frac{2.4 \times 5}{2} = 6$ cm and $PQ = \frac{2 \times 6}{5} = 2.4$ cm

$\therefore\ AB + PQ = 6 + 2.4 = 8.4$ cm

(v) (a): Since, $\Delta DRS \sim \Delta DEF$ (By AA similarity criterion)

$\therefore\ \frac{DE}{DR} = \frac{DF}{DS} \Rightarrow \frac{DE}{DR} - 1 = \frac{DF}{DS} - 1$

$\Rightarrow\ \frac{DE - DR}{DR} = \frac{DF - DS}{DS} \Rightarrow \frac{ER}{DR} = \frac{FS}{DS}$

$\Rightarrow\ \frac{DR}{ER} = \frac{DS}{FS} \Rightarrow \frac{4x-3}{3x-1} = \frac{8x-7}{5x-3}$
$\Rightarrow\ 20x^2 - 12x - 15x + 9 = 24x^2 - 8x - 21x + 7$
$\Rightarrow\ 4x^2 - 2x - 2 = 0 \Rightarrow 2x^2 - x - 1 = 0$
Only option (a) *i.e.*, $x = 1$ satisfies this equation.

8. **(i) (b):** If ΔAED and ΔBEC, are similar by SAS similarity rule, then their corresponding proportional sides are $\frac{BE}{AE} = \frac{CE}{DE}$

(ii) (c): By Pythagoras theorem, we have

$BC = \sqrt{CE^2 + EB^2} = \sqrt{4^2 + 3^2} = \sqrt{16+9}$
$= \sqrt{25} = 5$ cm

(iii) (a): Since ΔADE and ΔBCE are similar.

$\therefore\ \frac{\text{Perimeter of } \Delta ADE}{\text{Perimeter of } \Delta BCE} = \frac{AD}{BC}$

$\Rightarrow\ \frac{2}{3} = \frac{AD}{5} \Rightarrow AD = \frac{5 \times 2}{3} = \frac{10}{3}$ cm

(iv) (b): $\frac{\text{Perimeter of } \Delta ADE}{\text{Perimeter of } \Delta BCE} = \frac{ED}{CE}$

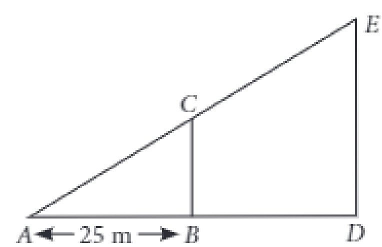
$\Rightarrow\ \frac{2}{3} = \frac{ED}{4} \Rightarrow ED = \frac{4 \times 2}{3} = \frac{8}{3}$ cm

(v) (d): $\frac{\text{Perimeter of } \Delta ADE}{\text{Perimeter of } \Delta BCE} = \frac{AE}{BE} \Rightarrow \frac{2}{3} BE = AE$

$\Rightarrow\ AE = \frac{2}{3}\sqrt{BC^2 - CE^2}$

Also, in ΔAED, $AE = \sqrt{AD^2 - DE^2}$

9. Let BC represents the height of bus and DE represents the height of building.



(i) (a): In ΔABC and ΔADE,
$\angle A = \angle A$ (Common)
$\angle B = \angle D$ (Corresponding angles)
$\therefore\ \Delta ABC \sim \Delta ADE$ (By AA similarity criteria)

(ii) (b): We have, $AB = 2BC$

$\Rightarrow\ BC = \frac{25}{2} = 12.5$ m

So, height of bus = 12.5 m

(iii) (c): We have, $AD = 12\ BC$
$\Rightarrow\ AD = 12 \times 12.5 = 150$ m
$\because\ \Delta ABC \sim \Delta ADE$

$\therefore\ \frac{AB}{AD} = \frac{BC}{DE} \Rightarrow \frac{BC}{DE} = \frac{25}{150} = \frac{1}{6}$

So, ratio of heights of bus and building is 1 : 6.

(iv) **(a):** Since, $\Delta ABC \sim \Delta ADE$

$$\Rightarrow \frac{AB}{AD} = \frac{AC}{AE} \Rightarrow \frac{AC}{AE} = \frac{1}{6}$$

$$\Rightarrow \frac{AC}{AE - AC} = \frac{1}{6-1} \Rightarrow \frac{AC}{EC} = \frac{1}{5}$$

$\therefore$ Required ratio = 1 : 5

(v) **(b):** Height of the building = DE

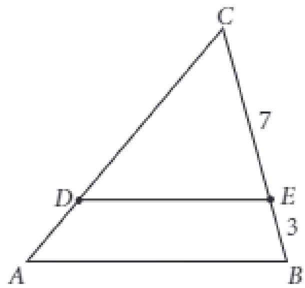
Now, $\frac{BC}{DE} = \frac{1}{6}$

$\Rightarrow DE = 6BC = 6 \times 12.5 = 75$ m

10. (i) **(b):** Let ΔABC is the triangle formed by both hotels and mountain top. ΔCDE is the triangle formed by both huts and mountain top.

Clearly, $DE \parallel AB$ and so

$\Delta ABC \sim \Delta DEC$ [By AA-similarity criterion]



Now, required ratio = Ratio of their corresponding sides $= \frac{BC}{EC} = \frac{10}{7}$ *i.e.*, 10 : 7.

(ii) **(c):** Since, $DE \parallel AB$, therefore

$$\frac{CD}{AD} = \frac{CE}{EB} \Rightarrow \frac{10}{AD} = \frac{7}{3} \Rightarrow AD = \frac{10 \times 3}{7} = 4.29 \text{ miles}$$

(iii) **(b):** Since, $\Delta ABC \sim \Delta DEC$

$\therefore \frac{BC}{EC} = \frac{AB}{DE}$ [$\because$ Corresponding sides of similar triangles are proportional]

$$\Rightarrow \frac{10}{7} = \frac{AB}{8} \Rightarrow AB = \frac{80}{7} = 11.43 \text{ miles}$$

(iv) **(a):** Given, $DC = 5 + BC$.

Clearly, $BC = 10 - 5 = 5$ miles

Now, $CE = \frac{7}{10} \times BC = \frac{7}{10} \times 5 = 3.5$ miles

(v) **(d):** Clearly, the ratio of areas of two triangles (*i.e.*, ΔABC to ΔDEC)

$$= \left(\frac{BC}{EC}\right)^2 = \left(\frac{10}{7}\right)^2 = \frac{100}{49}$$

$$\therefore \text{ Required ratio} = \frac{ar(\Delta CDE)}{ar(EBAD)} = \frac{49}{100-49} = \frac{49}{51}$$