Chapter : *Six*

Triangles

Competency Based Questions

✦ Multiple Choice Questions

1. O is a point on side PQ of a ΔPQR such that PO = QO = RO, then

(*a*) $RS^2 = PR \times QR$ (*b*) $PR^2 + QR^2 = PQ^2$
(*c*) $QR^2 = QO^2 + RO^2$ (*d*) $PO^2 + RO^2 = PR^2$

Ans. (*b*) $PR^2 + QR^2 = PQ^2$

2. In ABC, DE || AB, If CD = 3 cm, EC = 4 cm, BE = 6 cm, then DA is equal to

(*a*) 7.5 cm (*b*) 3 cm (*c*) 4.5 cm (*d*) 6 cm

Ans. (*c*) 4.5 cm

3. ΔABC is an equilateral Δ of side *a*. Its area will be

(*a*) $\frac{\sqrt{3}}{4}a^2$ (*b*) $\frac{\sqrt{3}}{4}a$ (*c*) $\frac{\sqrt{3}}{2}a^2$ (*d*) $\frac{\sqrt{3}}{2}a$

Ans. (*a*) $\frac{\sqrt{3}}{4}a^2$

4. In a square of side 10 cm, its diagonal =

(*a*) 15 (*b*) $10\sqrt{2}$ (*c*) 20 (*d*) 12

Ans. (*b*) $10\sqrt{2}$ cm

5. In a rectangle Length = 8 cm, Breadth = 6 cm. Then its diagonal is

(*a*) 9 cm (*b*) 14 cm (*c*) 10 cm (*d*) 12 cm

Ans. (*c*) 10 cm

6. In a rhombus if d_1 = 16 cm, d_2 = 12 cm, its area =

(*a*) 16×12 cm^2 (*b*) 96 cm^2
(*c*) 8×6 cm^2 (*d*) 144 cm^2

Ans. (*b*) 96 cm^2

7. In a rhombus if d_1 = 16 cm, d_2 = 12 cm, then the length of the side of the rhombus is

(*a*) 8 cm (*b*) 9 cm (*c*) 10 cm (*d*) 12 cm

Ans. (*c*) 10 cm

8. If in two Δs ABC and DEF, $\frac{AB}{DF} = \frac{BC}{FE} = \frac{CA}{ED}$, then

(*a*) $\Delta ABC \sim \Delta DEF$ (*b*) $\Delta ABC \sim \Delta EDF$
(*c*) $\Delta ABC \sim \Delta EFD$ (*d*) $\Delta ABC \sim \Delta DFE$

Ans. (*d*) $\Delta ABC \sim \Delta DFE$

9. It is given that $\Delta ABC \sim \Delta DEF$ and $\frac{BC}{EF} = \frac{1}{5}$. Then $\frac{ar(\Delta DEF)}{ar(\Delta ABC)}$ is equal to

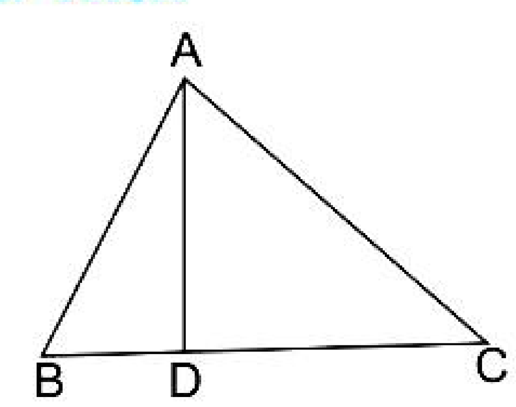
(*a*) 5 (*b*) 25 (*c*) $\frac{1}{25}$ (*d*) $\frac{1}{5}$

Ans. (*b*) 25

10. In $\angle BAC = 90°$ and $AD \perp BC$. Then

(*a*) $BD.CD = BC^2$
(*b*) $AB.AC = BC^2$
(*c*) $BD.CD = AD^2$
(*d*) $AB.AC = AD^2$

Ans. (*c*) $BD.CD = AD^2$



11. D and E are respectively the points on the sides AB and AC of a triangle ABC such that AD = 2 cm, BD = 3 cm, BC = 7.5 cm and DE || BC. Then, length of DE (in cm) is

(*a*) 2.5 (*b*) 3 (*c*) 5 (*d*) 6

Ans. (*b*) 3

12. If $\Delta ABC \sim \Delta DEF$ and ΔABC is not similar to ΔDEF then which of the following is not true?

(*a*) BC.EF = AC.FD (*b*) AB.ED = AC.DE
(*c*) BC.DE = AB.EE (*d*) BC.DE = AB.FD

Ans. (*c*) BC.DE = AB.EE

13. If in two triangles DEF and PQR, $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true?

(*a*) $\frac{EF}{PR} = \frac{DF}{PQ}$ (*b*) $\frac{DE}{QR} = \frac{EF}{RP}$
(*c*) $\frac{DE}{QR} = \frac{DF}{PQ}$ (*d*) $\frac{EF}{RP} = \frac{DE}{QR}$

Ans. (*b*) $\frac{DE}{QR} = \frac{EF}{RP}$

14. If $\Delta ABC \sim \Delta PQR$, $\frac{BC}{QR} = \frac{1}{3}$, then $\frac{ar(PRQ)}{ar(BCA)} =$

(*a*) 9 (*b*) 3 (*c*) 1/3 (*d*) 1/9

Ans. (*a*) 9

15. If $\Delta ABC \sim \Delta QRP$, $\frac{ar(ABC)}{ar(PQR)} = \frac{9}{4}$, AB = 18 cm and BC = 15 cm, then PR is equal to

(*a*) 10 cm (*b*) 12 cm (*c*) $\frac{20}{3}$ cm (*d*) 8 cm

Ans. (*a*) 10 cm

16. If in triangles ABC and DEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar, if

(*a*) $\angle B = \angle E$ (*b*) $\angle A = \angle D$
(*c*) $\angle B = \angle D$ (*d*) $\angle A = \angle F$

Ans. (*c*) $\angle B = \angle D$

✦ Assertion-Reason Questions

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

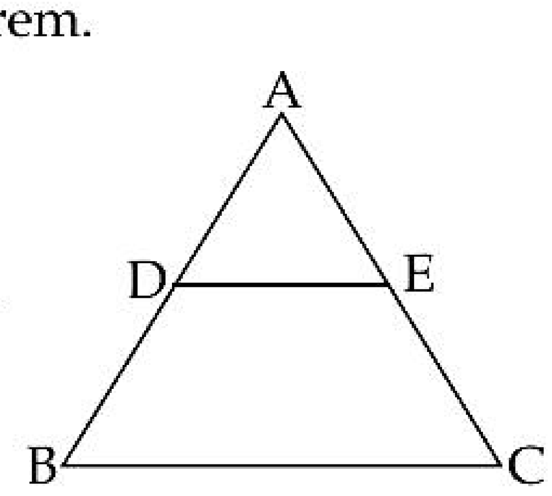
(*a*) *Both Assertion (A) & Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).*
(*b*) *Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).*
(*c*) *Assertion (A) is true but Reason (R) is false.*
(*d*) *Assetion (A) is false but Reason (R) is true.*

1. **Assertion:** If in a ΔABC, a line DE || BC, intersects AB in D and AC in E, then $\frac{AB}{AD} = \frac{AC}{AE}$.
Reason: If a line is drawn parallel to one side of a triangle intersecting the other two sides, then the other two sides are dividend in the same ratio.

Ans. (*a*) **Both A and R are true and R is the correct explanation of A.**

Explanation: It is Thale's Theorem.

Given. DE || BC



$$\frac{AD}{DB} = \frac{AE}{EC}$$ ...[By Thale's Theorem

$$\Rightarrow \frac{DB}{AD} = \frac{EC}{AE}$$

$$\Rightarrow 1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$$

$$\Rightarrow \mathbf{\frac{AB}{AD} = \frac{AC}{AE}}$$ **(Hence proved)**

2. **Assertion:** $\Delta ABC \sim \Delta DEF$ such that ar(ΔABC) = 36 cm^2 and ar(ΔDEF) = 49 cm^2 then, AB : DE = 6 : 7
Reason: If $\Delta ABC \sim \Delta DEF$,
then $\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{AB^2}{DE^2} = \frac{BC^2}{EF^2} = \frac{AC^2}{DF^2}$

Ans. (*a*) **Both A and R are true and R is the correct explanation of A.**

Explanation: As we know, $\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{AB^2}{DE^2}$

$\Rightarrow \frac{36}{49} = \frac{AB^2}{DE^2}$ $\Rightarrow \frac{AB}{DE} = \frac{6}{7}$ $\therefore$ **AB : DE = 6 : 7**

3. **Assertion:** ΔABC is an isosceles triangle right angled of C, then $AB^2 = 2AC^2$.
Reason: In right ΔABC, right angled at B, $AC^2 = AB^2 + BC^2$.

Ans. (*a*) **Both A and R are true and R is the correct explanation of A.**

Explanation: In an isosceles ΔABC, right angled at C is

$AB^2 = AC^2 + BC^2$ ...[Using pythagoras theorem

$AB^2 = AC^2 + AC^2$ ...[$\because$ AC = BC

$\therefore$ $\mathbf{AB^2 = 2AC^2}$

4. **Assertion:** Two similar triangles are always congruent.
Reason: If the areas of two similar triangles are equal then the triangles are congruent.

Ans. (*d*) **Assetion (A) is false but Reason (R) is true.**

Explanation: All conguent figures are similar but the similar figures **need not to be congruent**.

5. **Assertion:** In the ΔABC, AB = 24 cm, BC = 10 cm and AC = 26 cm, then ΔABC is a right angle triangle.
Reason: If in two triangles, their corresponding angles are equal, then the triangles are similar.

Ans. (*b*) **Both A and R are true but R is not the correct explanation of A.**

Explanation: $AB^2 + BC^2 = (24)^2 + (10)^2 = 576 + 100$

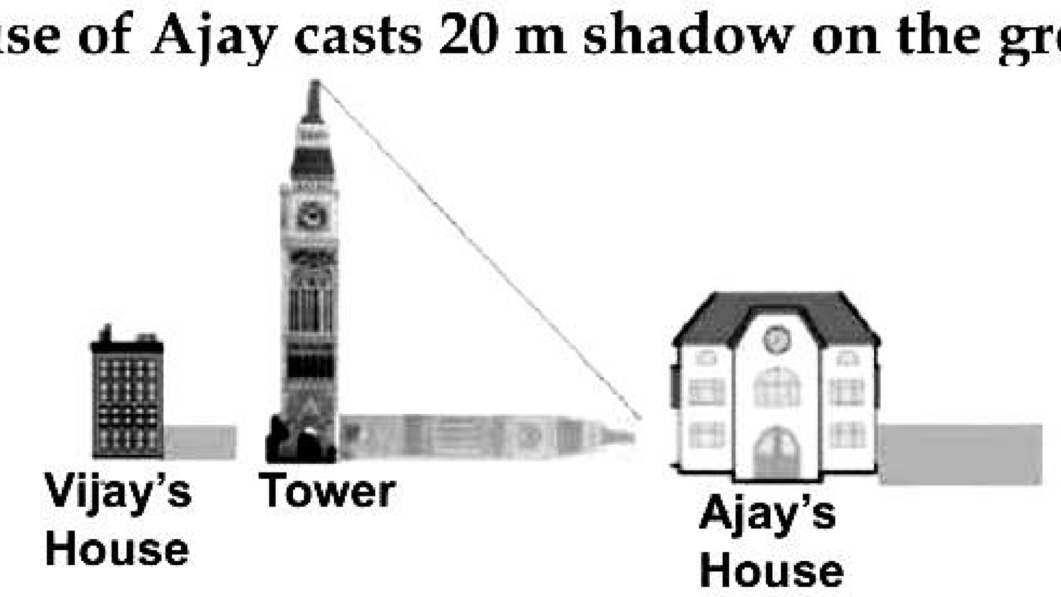
$\Rightarrow 676 = AC^2$ $\therefore$ $\mathbf{AB^2 + BC^2 = AC^2}$

Hence, ABC is a right angled triangle.

Also, two triangle are similar if their corresponding angles are equal.

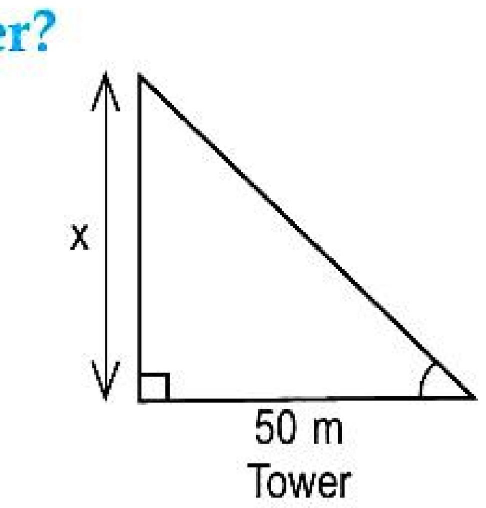
✦ Case Based Questions

I. Vijay is trying to find the average height of a tower near his house. He is using the properties of similar triangles. The height of Vijay's house if 20 m when Vijay's house casts a shadow 10m long on the ground. At the same time, the tower casts a shadow 50 m long on the ground and the house of Ajay casts 20 m shadow on the ground.



(*i*) **What is the height of the tower?**

(*a*) 20 m
(*b*) 50 m
(*c*) 100 m
(*d*) 200 m



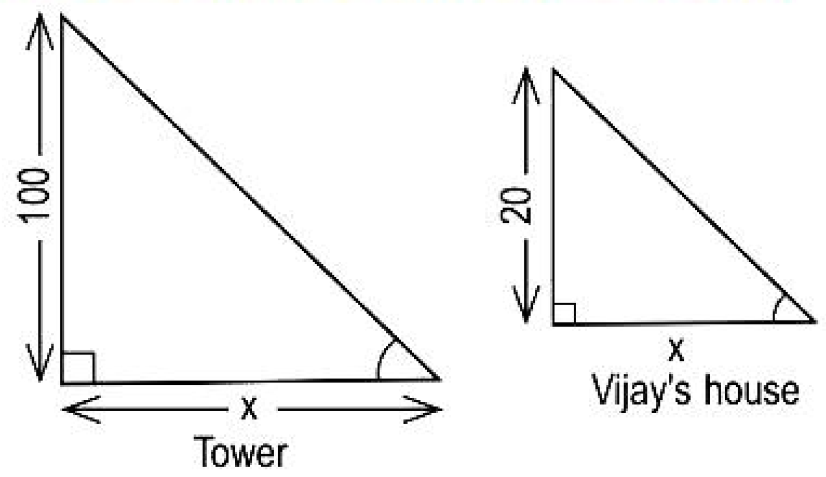
Ans. (*c*) 100 m

Explanation: $\frac{x}{20} = \frac{50}{10}$ ...[Similar Δs Property

$\Rightarrow$ $\mathbf{x = 100\ m}$

(*ii*) **What will be the length of the shadow of the tower when Vijay's house casts a shadow of 12 m?**

(*a*) 75 m
(*b*) 50 m
(*c*) 45 m
(*d*) 60 m



Ans. (*d*) 60 m

Explanation: $\frac{x}{12} = \frac{100}{20}$ ...[Similar ∆s property

$\Rightarrow$ $\mathbf{x = 60}$ **m**

(*iii*) **What is the height of Ajay's house?**

(*a*) 30 m (*b*) 40 m (*c*) 50 m (*d*) 20 m

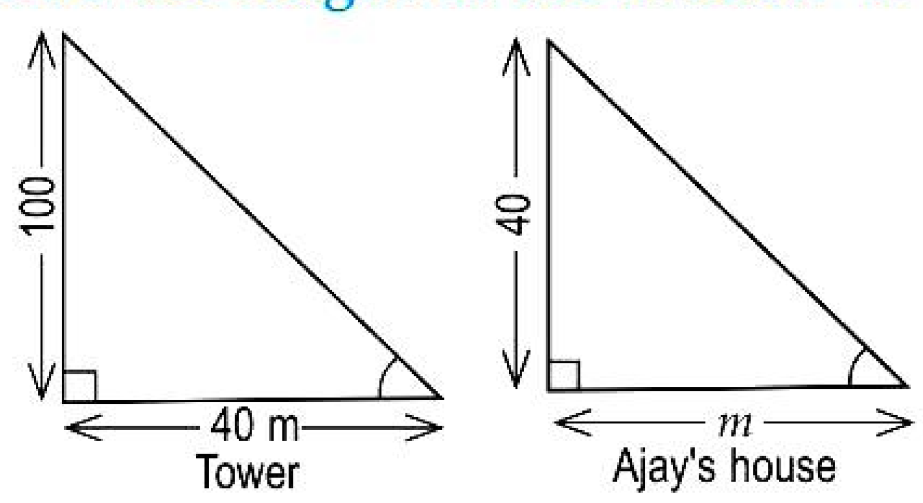
Ans. (*b*) 40 m

Explanation: From point (*i*) and point (*iii*),

$\Rightarrow \frac{y}{20} = \frac{20}{10}$ $\Rightarrow$ $\mathbf{y = 40}$ **m**

(*iv*) **When the tower casts a shadow of 40 m. At same time what will be the length of the shadow of Ajay's house?**

(*a*) 16 m
(*b*) 32 m
(*c*) 20 m
(*d*) 8 m

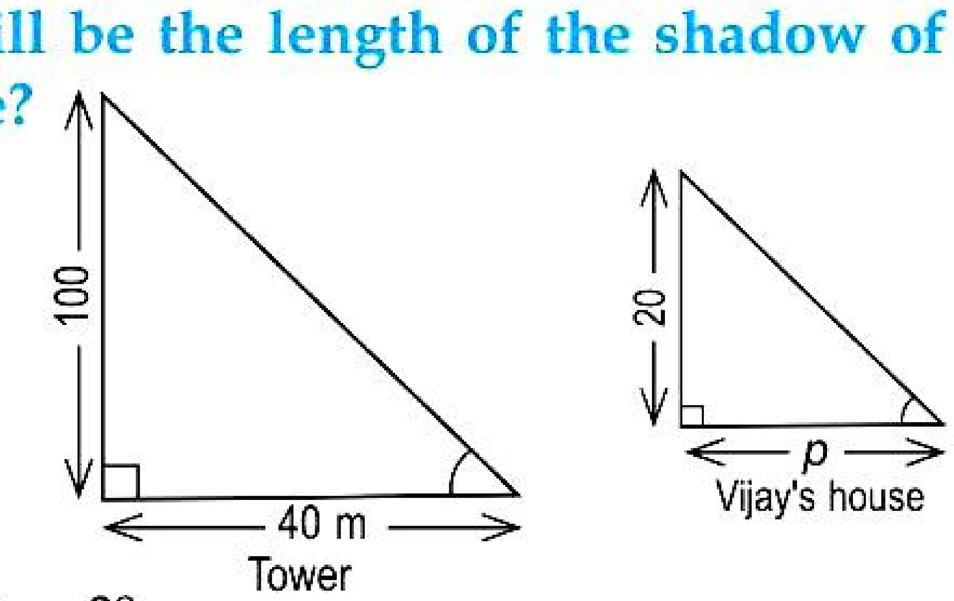


Ans. (*a*) 16 m

Explanation: $\frac{m}{40} = \frac{40}{100}$ $\Rightarrow$ $100\,m = 1600$ $\therefore$ $\mathbf{m = 16}$ **m**

(*v*) **When the tower casts a shadow of 40 m, same time what will be the length of the shadow of Vijay's house?**

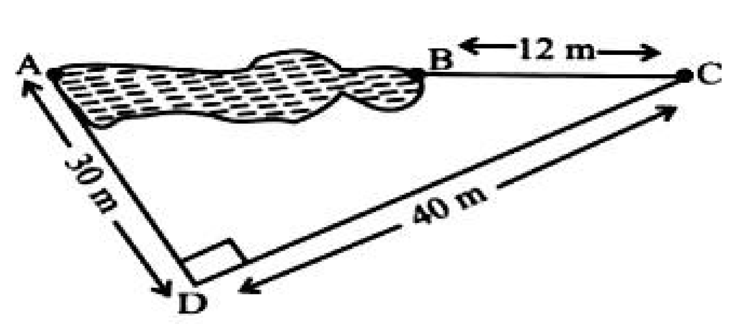
(*a*) 15 m
(*b*) 32 m
(*c*) 16 m
(*d*) 8 m



Ans. (*d*) 8 m

Explanation: $\frac{p}{40} = \frac{20}{100}$ $\Rightarrow$ $\mathbf{p = 8}$ **m**

II. Rohan wants to measure the distance of a pond during the visit to his native place. He marks points A and B on the opposite edges of a pond as shown in the figure below. To find the distance between the points, he makes a right-angled triangle using rope connecting B with another point C which are at distance of 12m, connecting C to point D at a distance of 40 m from point C and the connecting D to the point A which is are a distance of 30 m from D such that ∠ADC = 90°.



(*i*) **Which property of geometry will be used to find the distance AC?**

(*a*) Similarity of triangles
(*b*) Thales' Theorem
(*c*) Pythagoras' Theorem
(*d*) Area of similar triangles

Ans. (*c*) Pythagoras' Theorem

(*ii*) **What is the distance AC?**

(*a*) 50 m (*b*) 12 m (*c*) 100 m (*d*) 70 m

Ans. (*a*) 50 m

Explanation: $AC^2 = AD^2 + CD^2$

$\Rightarrow$ $AC^2 = (30)^2 + (40)^2$ ...[By Pythagoras' theorem

$\Rightarrow$ $AC = \sqrt{2500}$ $\therefore$ **AC = 50 m**

(*iii*) **Which of the following does not form a Pythagoras' triplet?**

(*a*) (7, 24, 25) (*b*) (15, 8, 17)
(*c*) (5, 12, 13) (*d*) (21, 20, 28)

Ans. (*d*) (21, 20, 28)

Explanation: 21, 20, 28

Because $21^2 + 20^2 = (28)^2$ $\Rightarrow$ $441 + 400 = (28)^2$

Here, $841 \neq (28)^2$

(*iv*) **Find the length AB?**

(*a*) 12 m (*b*) 38 m (*c*) 50 m (*d*) 100 m

Ans. (*b*) 38 m

Explanation: AC – BC = AB $\therefore$ AB =50 – 12 = **38 m**

(*v*) **Find the length of the rope used.**

(*a*) 120 m (*b*) 70 m (*c*) 82 m (*d*) 22 m

Ans. (*c*) 82 m

Explanation: 30 + 40 + 12 = **82 m**

III. A scale drawing of an object is the same shape as the object but of different size. The scale of the drawing is a comparison of the length used on the drawing to the length it represents. The scale is written as a ratio. The ratio of two corresponding sides in similar figures is called the scale factor.

Scale factor = $\frac{\textbf{length in image}}{\textbf{corresponding length in object}}$

If one shape can become another using revising, then the shapes are similar. Hence, two shapes are similar when one can become the other after a resize, flip, slide or turn. In the photograph below showing the side-view of a train engine. Scale factor is 1 : 200. This means that a length of 1 cm on the photograph above corresponds to a length of 200 cm or 2 m, of the actual engine. The scale can also be written as the ratio of two lengths.

(*i*) **If the length of the model is 11 cm, then the overall length of the engine in the photograph above, including the couplings (mechanism used to connect) is:**

(*a*) 22 cm (*b*) 220 cm (*c*) 220 m (*d*) 22 m

Ans. (*d*) 22 m

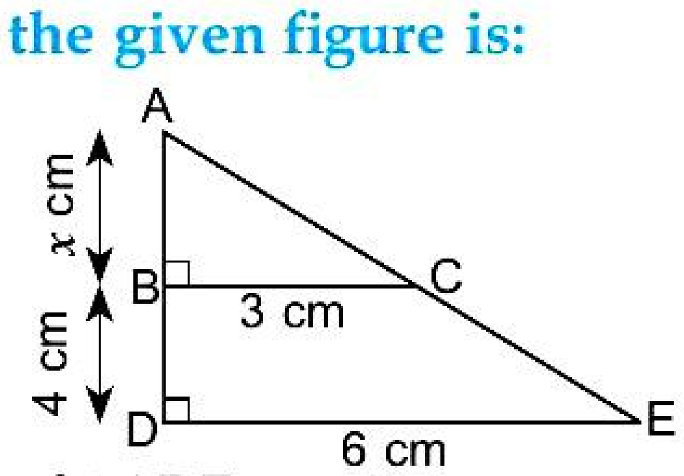
Explanation: 11 cm × 200 cm = 2200 cm = $\frac{2200}{100}$ m = **22m**

(*ii*) **What will affect the similarity of any 2 polygons?**
(*a*) They are flipped horizontally
(*b*) They are dilated by a scale factor
(*c*) They are translated down
(*d*) They are not the mirror image of one another.
Ans. (*d*) They are not the mirror image of one another.

(*iii*) **What is the actual width of the door if the width of the door in photograph is 0.35 cm?**
(*a*) 0.7 m (*b*) 0.7 cm (*c*) 0.07 cm (*d*) 0.07m
Ans. (*a*) 0.7 m
Explanation: 1 cm = 200 cm
0.35 cm × 200 cm = 70 cm = $\frac{70}{100}$ = **0.7 m**

(*iv*) **If two similar triangles have a scale factor 5 : 3 which statement regarding the two triangles is true?**
(*a*) The ratio of their perimeters is 15 : 1
(*b*) Their altitudes have a ratio 25 : 15
(*c*) Their medians have a ratio 10 : 4
(*d*) Their angle bisectors have a ratio 11 : 5
Ans. (*b*) Their altitudes have a ratio 25 : 15

(*v*) **The length of AB in the given figure is:**
(*a*) 8 cm
(*b*) 6 cm
(*c*) 4 cm
(*d*) 10 cm



Ans. (*c*) 4 cm
Explanation: In ΔABC and ΔADE,
Using Thales' Theorem, $\frac{x}{x+4} = \frac{3}{6} = \frac{1}{2}$ ∴ $x = 4$

IV. Raman is stitching a kite shaped patch on the cushion cover. Few questions came to his mind while stitching the patch. Give answers to his questions by looking at the figure:

(*i*) **Raman stitched the white thread at what angles to each other?**
(*a*) 30° (*b*) 60° (*c*) 90° (*d*) 120°
Ans. (*c*) 90°

(*ii*) **Which is the correct similarity criteria applicable for smaller triangles in the upper part of this kite?**
(*a*) RHS (*b*) AAA (*c*) SSA (*d*) SAS
Ans. (*d*) SAS

(*iii*) **Sides of two similar triangles are in the ratio 2 : 9. The corresponding altitudes of these triangles are in the ratio**
(*a*) 2 : 3 (*b*) 2 : 9 (*c*) 81 : 16 (*d*) 16 : 81
Ans. (*b*) 2 : 9

(*iv*) **Triangles stitched at the tail of the kite are congruent to each other and are similar to the lower part of the kite in the ratio 2 : 9. If one side of the smaller triangle is of 4 cm, then the corresponding side of the kite's lower triangle will be**
(*a*) 12 cm (*b*) 15 cm (*c*) 18 cm (*d*) 8 cm
Ans. (*c*) 18 cm
Explanation: Using similar Δs criteria, $\frac{2}{9} = \frac{4}{x}$ ∴ x **= 18 cm**

(*v*) **What is the area of the kite formed by two perpendicular strings of length 8 and 12 cm?**
(*a*) 48 cm^2 (*b*) 14 cm^2 (*c*) 24 cm^2 (*d*) 96 cm^2
Ans. (*a*) 48 cm^2
Explanation: Ar(Δ) = $\frac{1}{2}$ × *Base* × *height* = $\frac{1}{2}$ × 12 × 8 = **48 cm^2**

V. Kunal crossed the Truss bridge. He thought about the need of Truss bridge. Truss bridges have supporting structures constructed in triangular shapes. Triangles are used in supporting the structure of the bridges because they evenly distribute the weight without changing the proportions. When force is applied on a rectangular shape, it will flatten out. He thought about triangles and about their similar properties.

(*i*) **Equilateral triangle has all sides equal. What is the measure of each angle of such triangle?**
(*a*) 30° (*b*) 60° (*c*) 90° (*d*) 45°
Ans. (*b*) 60°

(*ii*) **Which is not the correct similarity criteria for the two similar triangles?**
(*a*) AAA Similarity (*b*) SAS Similarity
(*c*) SSS Similarity (*d*) RHS Similarity
Ans. (*d*) RHS Similarity

(*iii*) **The height of an equilateral triangle of side 12 cm is:**
(*a*) $2\sqrt{3}$ (*b*) $4\sqrt{3}$ (*c*) $6\sqrt{3}$ (*d*) $8\sqrt{3}$
Ans. (*c*) $6\sqrt{3}$ cm
Explanation: Area of Equilateral Δ = $\frac{\sqrt{3}}{4}(a)^2$
$= \frac{\sqrt{3}}{4}(12)^2 = \frac{\sqrt{3}}{4} \times 12 \times 12 = 36\sqrt{3}$
Also, Ar(Eq. Δ)= $\frac{1}{2} \times B \times h$
$\Rightarrow 36\sqrt{3} = \frac{1}{2} \times 12 \times AD$ ∴ **AD = $6\sqrt{3}$**

(*iv*) **'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'—this theorem is called:**
(*a*) Pythagoras' theorem
(*b*) Thales' theorem (B.P.T.)
(*c*) Converse of Thales' theorem
(*d*) Converse of Pythagoras' theorem
Ans. (*b*) Thales' theorem (B.P.T.)

(*v*) **In ΔABC and ΔDEF, it is given that $\frac{AB}{DE} = \frac{BC}{FD}$, then**
(*a*) ∠B = ∠E (*b*) ∠A = ∠D
(*c*) ∠B = ∠D (*d*) ∠A = ∠F
Ans. (*c*) ∠B = ∠D