Case Study Questions on Chapter 9 Some Applications of Trigonometry for Class 10

Case Study 1: Anita's Rooftop Sign Board

Anita bought a new building for her business in a prime location and decided to install a rooftop advertisement sign board for rental income. From a point P on the ground, the angle of elevation of the roof of the building is 30°, and the angle of elevation of the top of the signboard is 45°. Point P is 24 m from the base of the building.

(i) The height of the building (without thesignboard)) is closest to:

(a) 24 m
(b) 13.85 m
(c) 41.6 m
(d) 12 m

Solution:

$\tan 30° = AB/24 \rightarrow AB = 24/\sqrt{3} = 24\sqrt{3}/3 = 8\sqrt{3} \approx 13.85$ m.

Answer: (b) 13.85 m

(ii) Find the height of the building, including the signboard.

Solution:

$\tan 45° = AC/24$

$\Rightarrow AC = 24$ m (since $\tan 45° = 1$).

Total height = 24 m

(iii) Fill in the Blank

The height of the sign board alone is _____ m.

Solution:

Signboard height = $AC - AB = 24 - 13.85 \approx 10.15$ m (often rounded to 10 m)

(iv) Find the distance of point P from the top of the sign board.

Solution:

$\cos 45° = AP/PC$

$\Rightarrow 1/\sqrt{2} = 24/PC$

$\Rightarrow PC = 24\sqrt{2} \approx 33.94$ m

Case Study 2: The Ship and the Cliff

A man stands on the deck of a ship, 12 m above the water level. He observes the angle of elevation of the top of a cliff to be 60°, and the angle of depression of the base of the cliff to be 30°. Take $\sqrt{3} = 1.732$.

(i) Find the distance of the cliff from the ship.

Solution:

Using the angle of depression triangle (base of cliff, 30°): tan 30° = 12/x is the wrong setup here; instead, cot 30° gives the horizontal distance directly: distance = $12 \times \sqrt{3} = 12 \times 1.732 \approx 20.78$ m

(ii) The height of the cliff above the water level is:

(a) 12 m

(b) 36 m

(c) 48 m

(d) 20.78 m

Solution:

(i) $\tan 60° = (h - 12)/20.78$

$\Rightarrow \sqrt{3} \times 20.78 = h - 12$

$\Rightarrow 36 = h - 12 \rightarrow h = 48$ m.

Answer: (c) 48 m

(iii) True/False

The portion of the cliff above the man's eye level (36 m) is taller than the portion below it (12 m).

Solution:

36 m is indeed greater than 12 m. Answer: True