Some Applications of Trigonometry

Assertion & Reason Type Questions

In the following questions, a statement of Assertion (A) is followed by a statement of a Reason (R). Choose the correct option:

a. Both Assertion (A) and 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. Assertion (A) is false but Reason (R) is true

Q 1. Assertion (A): If the length of shadow of a vertical pole is equal to its height, then the angle of elevation of the Sun is 45°.

Reason (R): Trigonometric ratio, tangent is defined as

 $tan \theta = \frac{Perpendicular}{Base}$

Answer:

(a) Assertion (A): Let BC= h m be the height of the pole and AB = Im be the length of the shadow. Let the Sun makes an angle 0 from point A. Given that, h=l

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Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Q 2. Assertion (A): The angle of elevation of the top of a tower is 60°. If the height of the tower and its base is tripled then angle of elevation of its top will also be tripled. **Reason (R):** In an equilateral triangle of side $3\sqrt{3}$ cm, the length of the altitude is 4.5 cm.

Answer:

 \Rightarrow

(d) Assertion (A): Let BC = h units be the height of tower and AB = bTower units be the base of the tower. $\tan 60^\circ = \frac{BC}{AB}$ Then $\tan 60^\circ = \frac{h}{h}$(1) If we tripled the height and base of tower *i.e.*, BC = 3hand AB = 3b, then angle will be $\tan \theta = \frac{BC}{AB} = \frac{3h}{3b} \implies \tan \theta = \frac{h}{b}$ $\tan \theta = \tan 60^{\circ}$ (from eq. (1)) \Rightarrow $\theta = 60^{\circ}$,

which is not tripled the original angle.

So, Assertion (A) is false.

Reason (R): Let ABC be an equilateral triangle. Then

 $AB = BC = CA = 3\sqrt{3} cm$



Let h be the altitude of an equilateral triangle.

$$\therefore \qquad BD = DC = \frac{3\sqrt{3}}{2} cm$$

In right-angled $\triangle ADB$, use Pythagoras theorem,

$$AD = \sqrt{(AB)^2 - (BD)^2} = \sqrt{(3\sqrt{3})^2 - \left(\frac{3\sqrt{3}}{2}\right)^2}$$
$$= \sqrt{27 - \frac{27}{4}} = \sqrt{\frac{81}{4}} = \frac{9}{2} = 4.5 \text{ cm}$$

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So, Reason (R) is true.

Hence, Assertion (A) is false but Reason (R) is true.

Q 3. Assertion (A): Suppose a bird was sitting on a tree. A person was sitting on a ground and saw the bird,

which makes an angle such that $\tan \theta = \frac{12}{5}$. The

distance from bird to the person is 13 units.

Reason (R): In a right-angled triangle, $(Hypotenuse)^2 = (Side)^2 + (Base)^2$.

Answer :

(a) Assertion (A): Given
$$\tan \theta = \frac{12}{5}$$

 $\Rightarrow \qquad \tan \theta = \frac{12}{5} = \frac{BC}{AB}$
Let BC = 12k and AB = 5k,
where k is a constant.
In right-angled $\triangle ABC$, use $A = \frac{12}{5} = \frac{12}{5}$
Pythagoras theorem,
 $AC = \sqrt{(AB)^2 + (BC)^2}$
 $= \sqrt{(5k)^2 + (12k)^2}$
 $= \sqrt{25k^2 + 144k^2} = \sqrt{169k^2}$
 $= 13k = 13$ units (Consider $k = 1$)

So, Assertion (A) is true.

Reason (R): It is a true relation that In a right-angled triangle, (Hypotenuse) (Side)² + (Base)²

So, Reason (R) is true.

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Q 4. Assertion (A): The angle of elevation of the top of the tower is 30° and the horizontal distance from the observer's eye to the foot of the tower is 50 m,

then the height of the tower will be $\frac{50}{3}\sqrt{3}$ m.

Reason (R): While using the concept of angle of elevation/depression, triangle should be a right angled triangle.

Answer : (a) Assertion (A): Let A be the position of observer eye and BC = hm be the height of the tower.



Let AB = 50 m be distance between observer's eye and foot of the tower. In right-angled Δ ABC,

 $\tan 30^{\circ} = \frac{BC}{AB}$ $\Rightarrow \qquad \frac{1}{\sqrt{3}} = \frac{h}{50}$ $\Rightarrow \qquad h = \frac{50}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{50}{3} \times \sqrt{3} \text{ m}$

So, Assertion (A) is true.

Reason (R): It is true to say that while solving the problem of angle of elevation/depression, triangle should be a right-angled triangle.

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).







Q.5. Assertion (A) : In the figure, if BC = 20 m, then height AB is 11.56 m.



Reason : $\tan \theta = \frac{AB}{BC} = \frac{\text{perpendicular}}{\text{base}}$ where θ is the angle $\angle ACB$.

Answer: (a)

Both the assertion and reason are correct, reason is the correct explanation of the assertion.

$$\tan 30^{\circ} = \frac{AB}{BC} = \frac{AB}{20}$$

 $AB = \frac{1}{\sqrt{3}} \times 20 = \frac{20}{1.73} = 11.56 \,\mathrm{m}$

Q.6. Assertion (A) : If the length of shadow of a vertical pole is equal to its height, then the angle of elevation of the sun is 45°

Reason (R) : According to pythagoras theorem, $h^2 = l^2 + b^2$, where h = hypotenuse, l = length and b = base.

Answer: (b)

Both Assertion and Reason are correct, but Reason is not the correct explanation of the Assertion.





