THE O.P. GUPTA
ADVANCED MATH CLASSES
Mathematics (Standard & Basic)
Topic - Some Applications of Trigonometry

RTS-09

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RANKERS
TEST SERIES FOR X
Max. Marks - 40
Time - 90 Minutes

SECTION A
*Followings multiple choice questions are of **1 Mark** each (Q01-10).*
Select the correct option in each one of them.

Q01. If the angle of elevation from the ground to the top of a tower increases, what happens to the distance from the base of the tower (assuming the height of tower is constant)?

(A) It increases (B) It decreases
(C) It remains the same (D) It depends on the shape of the tower

Q02. The angle of depression from the top of a lighthouse to a boat at sea is 45°. What can we infer about the horizontal distance and the height of the lighthouse?

(A) The horizontal distance is equal to the height of the lighthouse
(B) The horizontal distance is double the height of the lighthouse
(C) The horizontal distance is unrelated to the height
(D) The horizontal distance is half the height of the lighthouse

Q03. Which of the following statements is true about the use of angles of elevation and angles of depression in problems?

(A) Angles of elevation are always measured above the horizontal line, while angles of depression are always measured below it
(B) Angles of elevation and depression are completely independent and cannot be used together
(C) The angle of depression from an object is never equal to the angle of elevation from another point
(D) Angles of elevation are only used when measuring uphill, and angles of depression are used when measuring downhill

Q04. The angle of elevation of the top of a tower from a point on the ground is 30°. If the distance between the point and the base of the tower is 100 m, the height of the tower (in m) is

(A) 50 (B) $100\sqrt{3}$ (C) $\frac{100}{\sqrt{3}}$ (D) 100

Q05. A ladder leaning against a wall makes an angle of 60° with the ground. If the foot of the ladder is 4 m away from the wall, then the length of the ladder is

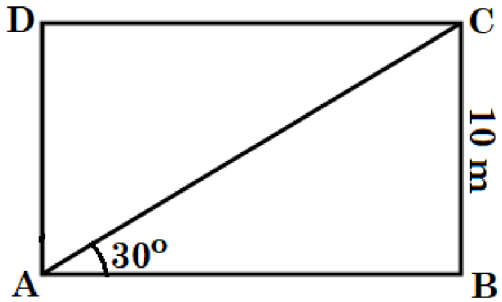
(A) 4 m (B) 8 m (C) $4\sqrt{3}$ m (D) $2\sqrt{3}$ m

Q06. The angle of depression of a boat from the top of a lighthouse 50 m high is 30°. The distance of the boat from the base of the lighthouse is

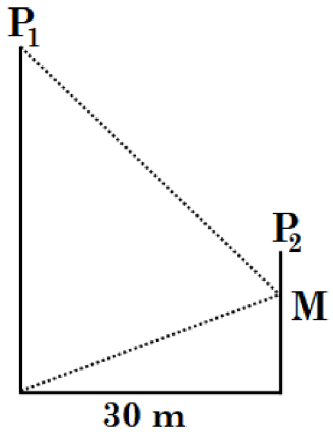
(A) $50\sqrt{3}$ m (B) 100 m (C) $\frac{50}{\sqrt{3}}$ m (D) $25\sqrt{3}$ m

Q07. In the following figure, the perimeter of rectangle ABCD is

(A) 40 m (B) $10(\sqrt{3}+1)$ m
(C) $20(\sqrt{3}+1)$ m (D) 60 m



Q08. Two poles P_1 and P_2 stand 30 m apart on the ground (see the figure). M is a point on pole P_2 such that the two ends of pole P_1 subtend a right angle at the point M and the angle of elevation of the top of pole P_1 from the point M is 60°.



The height of pole P_1 (in metres) is given by

(A) $20\sqrt{3}$ (B) $40\sqrt{3}$

(C) $60\sqrt{3}$ (D) $120\sqrt{3}$

*Followings are **Assertion-Reason based questions** (Q09 & 10).*

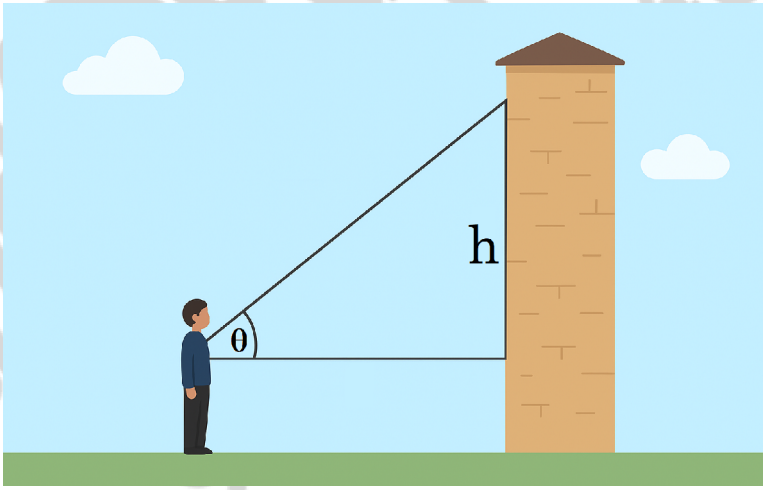
In the following questions, a statement of Assertion (**A**) is followed by a statement of Reason (**R**). Choose the correct answer out of the following choices.

(A) Both **A** and **R** are true and **R** is the correct explanation of **A**.
(B) Both **A** and **R** are true and **R** is not the correct explanation of **A**.
(C) **A** is true but **R** is false.
(D) **A** is false but **R** is true.

Q09. **Assertion (A) :** The angle of elevation of the sun is 60°. The length of the shadow of a tower is 20 m. The height of the tower is $20\sqrt{3}$ m.

Reason (R) : The angles of elevation are always measured below the horizontal line, while angles of depression are always measured above it.

Q10. **Assertion (A) :** The diagram given below shows a tower of height 'h' standing on the level ground. An observer on the ground finds the angle of elevation to the top of the tower as θ. If the height of observer is negligible as compared to the tower, the distance from the point of observation to the base of the tower is '$h\cot\theta$'.



Reason (R) : The angle of depression is the angle between the horizontal line from an observer's eye and the line of sight to an object below that observer.

$[1\times10=10$

SECTION B

*Followings are of **2 Marks** each (Q11-12).*

Q11. A lighthouse is 80 m high. A sailor on a boat sees the top of the lighthouse at an angle of elevation of 30°. Find the distance of the boat from the base of the lighthouse.

Q12. (a) The shadow of a flagstaff is three times as long as the shadow of the flagstaff when the sun rays meet the ground at an angle of 60°. Find the angle between the sun rays and the ground at the time of longer shadow.

OR

(b) Find the angle of elevation of the top of a pole of height $40\sqrt{3}$ m from a point 40 m away from its foot.

$[2\times2=4$

SECTION C

*Followings are of **3 Marks** each (Q13-16).*

Q13. An airplane at an altitude of 1200 m finds that two ships are sailing towards it in the same direction. The angles of depression of the ships as seen from the airplane are 60° and 30° respectively. Find the distance between these two ships.

Q14. (a) A man observes the angle of elevation of the top of a hill to be 45°. After walking 100 m towards the hill, he finds the angle to be 60°. Find the height of the hill.

OR

(b) A man, standing on the bank of a river, observes that the angle subtended by a tree on the opposite bank is 60°. When he moves 20 m away from the bank, he observes the angle to be 30°. Find the height of the tree and the width of the river.

Q15. An airplane pilot, at an altitude of 200 m, observes the angles of depression of two opposite points on the two banks of a river to be 45° and 60°. Find the width of the river.

Q16. As observed from the top of a light house, 100 m above the sea level, the angle of depression of a boat, sailing directly towards it, changes from 30° to 45°. Determine the distance travelled by the boat during the period of observation.

$[3 \times 4 = 12$

SECTION D

*Followings are of **5 Marks** each (Q17-18).*

Q17. A boy is standing on the deck of a ship, which is 10 m above water level. He observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill as 30°. Calculate the distance of the hill from the ship and the height of the hill.

Q18. (a) There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. A and B are points directly opposite to each other on two banks, and in line with the tree. If the angles of elevation of the top of the tree from A and B are respectively 30° and 45°, find the height of the tree.

OR

(b) A round balloon of radius r subtends an angle α at the eye of an observer while the angle of elevation of its center is β. Prove that the height of the center of balloon is $r \sin\beta \operatorname{cosec}\left(\frac{\alpha}{2}\right)$.

$[5 \times 2 = 10$

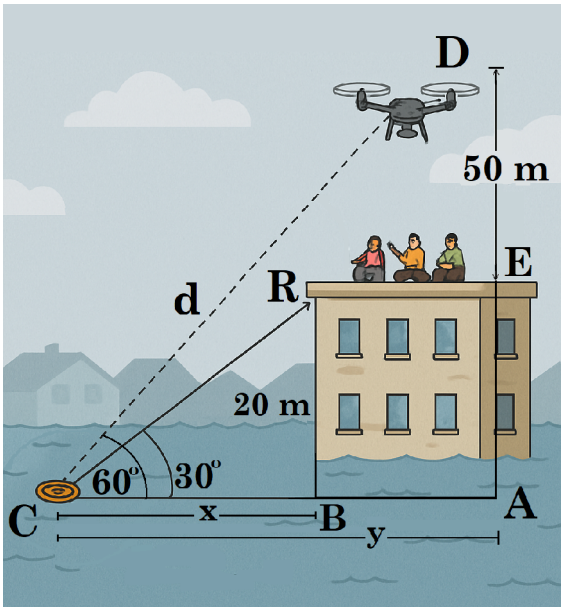
SECTION E

*Following is a case-study based question of **4 Marks** (Q19); having three sub-parts (i), (ii) and (iii).*

Q19. During severe floods in Punjab, rescue teams are using drones to locate stranded families and deliver food packets. A drone flies above a flooded area at a certain height, while the control team at ground level (C) observes both the rooftop (R) where people are trapped and the drone's position (D) using angles of elevation as shown in the figure below.

- **D** : Drone flying at a height of 50 m above the rooftop
- **R** : Rooftop where stranded people are located
- **C** : Control point on the ground

Also $\angle RCB = 30^\circ$,
$\angle DCA = 60^\circ$,
$RB = 20$ m,
$DE = 50$ m,
$CB = x$ m,
$CA = y$ m,
$CD = d$ m.



Based on the information given, answer the following questions.

(i) (a) From point C, the angle of elevation to the rooftop R is 30°. Find the distance BC (in m).

OR

(b) From point C, the angle of elevation to the drone D is 60°. Find the direct distance 'd' from the control point to the drone.

(ii) Find the distance $(y-x)$ in m.

(iii) If the angle of elevation to the rooftop R is 45° from the control point, then find the distance BC (in m).

[Use $\sqrt{3}=1.73$, wherever required.]

$[2+1+1=4$

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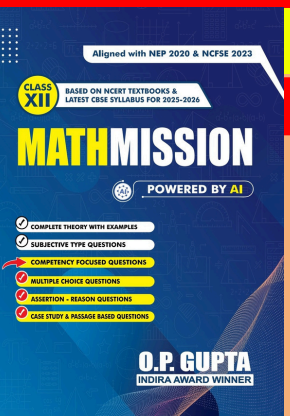

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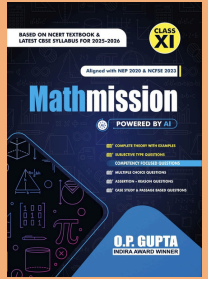

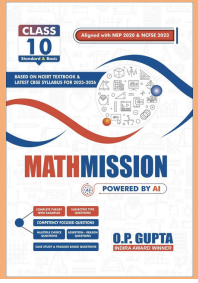

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