



MATHS

BOOKS - NAGEEN MATHS (HINGLISH)

SOME APPLICATIONS OF TRIGONOMETRY

Examples

1. The length of the shadow of a vertical pole is

$\frac{1}{\sqrt{3}}$ times its height. Find the angle of

elevation .

A. 60°

B. 45°

C. 90°

D. 30°

Answer: A



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2. If a tower 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then what is the angle of elevation of the sun ?



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3. A ladder 15 metres long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, find the height of the wall.

A. 6.5m

B. 7.5m

C. 8.5m

D. 9.5m

Answer: B



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4. A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is

60° . Find the length of the string, assuming that there is no slack in the string.

A. $20\sqrt{3}$

B. $40\sqrt{3}$

C. $60\sqrt{3}$

D. $80\sqrt{3}$

Answer: B



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5. The shadow of a tower standing on a level plane is found to be 50 m longer when when sun's elevation is 30° than when it is 60° . Find the height of the tower.



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6. The angle of elevation of the top of a tower from a point on the ground is 30° . After walking $40\sqrt{3}$ m towards the tower, the angle

of elevation becomes 60° . Find the height of the tower.



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7. The shadow of a tower at a time is three times as long as its shadow when the angle of elevation of the Sun is 60° . Find the angle of elevation of the Sun at the time of the longer shadow.

A. 60°

B. 30°

C. 45°

D. 15°

Answer: B



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8. The angle of elevation of the top of a tower from two distinct points s and t from foot are complementary. Prove that the height of the tower is \sqrt{st} .



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9. A tree is broken by the wind. The top struck the ground at an angle of 30° and at a distance of 4 m from the root. Find the height of the tree before broken.



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10. From the top of a tower h m high, angles of depression of two objects, which are in line

with the foot of the tower are α and β ($\beta > \alpha$). Find the distance between the two objects.



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11. The angle of elevation of the top of an unfinished tower at a distance of 120 m from its base is 30° . How much higher must the tower be raised so that the angle of elevation of its top at the same point may be 60° ?



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12. A TV-tower stands vertically on a bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of the tower is 60° . From another point 20 m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the top of tower is 30° (see fig.) . Find the height of the tower and the width of the canal.



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13. Two man are on the opposite sides of a tower. They measure the angles of elevation the top of the tower as 30° and 60° . If the height of the tower is 150 m, find the distance between the two men.



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14. Two points A and B are on the same side of a tower and in the same straight line with its base. The angles of depression of these points from the top of the tower are 60° and 45°

respectively. If the height of the tower is 15 m, then find the distance between these points.



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15. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag staff of height h . At a point on the plane, the angles of elevation of the bottom and the top of the flag.



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16. From a point P on the ground the angle of elevation of the top of a tower is 30° and that of the top a flagstaff fixed on the top of the tower is 60° . If the length of the flagstaff is $5m$, find the height of the tower.



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17. The angle of elevation of the top of a vertical tower a point on the ground is 60°
From another point 10 m vertical above the

first, its angle of elevation is 45° . Find the height of the tower.



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18. The angles of depression of top and bottom of a 50 m high building from the top of a tower are 45° and 60° respectively. Find the height of the tower and the horizontal distance between the tower and the building. (Use $\sqrt{3} = 1.73$).



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19. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60° . From a point Y , 40 m vertically above X , the angle of elevation of the top Q of tower is 45° . Find the height of the tower PQ and the distance PX . (Use $\sqrt{3} = 1.73$).



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20. As observed from the top of a light house, 100 m high above sea level, the angles of

depression of a ship, sailing directly towards it, changes from 30° and 90° .



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21. An aeroplane is flying at a height of 300 m above the ground. Flying at this height, the angles of depression from the aeroplane of two points on both banks of a river in opposite directions are 45° and 60° respectively. Find the width of the river. [use $\sqrt{3} = 1.732$]



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22. A man observes a car from the top of a tower, which is moving towards the tower with a uniform speed. If the angle of depression of the car change from 30° and 45° in 12 minutes, find the time taken by the car now to reach the tower.



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23. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of tower from the foot of the building is 60° , If the tower is 50 m high, find the height of the building.



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24. A round balloon of radius r subtends an angle α at the eye of the observer while the angle of elevation of its centre is β Prove that

the height of the centre of the balloon is

$$r \sin \beta \operatorname{cosec} \left[\frac{\alpha}{2} \right]$$



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25. A plane is flying along a road with a constant speed of 600 km/h towards a point on the road. Its angle of elevation changes from 30° to 60° in 12 seconds. Find the vertical height of the plane.



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26. A bird is sitting on the top of an 80 m high tree. From a point on the ground, the angle of elevation of the bird is 45° . The bird flies away horizontally in such a way that it remained at a constant height from the ground. After 2 seconds, the angle of elevation of the bird from the same point is 30° . Find the speed of flying of the bird. (Take $\sqrt{3} = 1.732$).



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27. The angle of elevation of the top of a tower from a point on the same level as the foot of tower is ϕ . On moving 'a' metres towards the foot of tower, the angle of elevation becomes 45° and again on moving b metres in the same direction, the angle of elevation becomes $(90^\circ - \phi)$. Find the height of the tower.



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28. The angle of elevation of a cloud from a point 'h' metres above a lake is α and the angle of depression of its reflection in the lake is β . Prove that the distance of the cloud from the point of observation is $\frac{2h \sec \alpha}{\tan \beta - \tan \alpha}$.



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29. A man standing on the deck of a ship, which is 10m 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.



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30. Two stations due south of a leaning tower which leans towards the north are at distances a and b from its foot. If α and β are the elevations of the top of the tower from these stations then prove that its inclination θ

to the horizontal is given by

$$\cot \theta = \frac{b \cot \alpha - a \cot \beta}{b - a}$$



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31. At the foot of a mountain, the elevation of its summit is 45° . After ascending 1000 m towards the mountain up a slope of 30° inclination, the elevation is found to be 60° . find the height of the mountain.



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32. The angle of elevation of the bottom of a window 10 m above the ground level from a point on the ground is 30° . A pole projecting outwards from the bottom of the window makes an angle of 30° with the wall. If the angle of elevation of the top of the pole observed from the same point on the ground is 60° , find the length of the pole to the nearest whole number.



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33. An observer 1.5 metres tall is 20.5 m away from a tower 22 metres high. Determine the angle of elevation of the top of the tower from the eye of the observer.



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34. The angle of elevation of the top of a tower 30 m high from the foot of another tower in the same plane is 60° and the angle of elevation of the top of the second tower

from the foot of the first tower is 30° . Find the distance between the two towers and also the height of the other tower.



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35. A ladder rests against a vertical wall at inclination α to the horizontal. Its foot is pulled away from the wall through a distance p so that its upper end slides q down the wall and then ladder make an angle β to the horizontal show that
$$\frac{p}{q} = \frac{\cos \beta - \cos \alpha}{\sin \alpha - \sin \beta}.$$



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36. From a window (h meter above ground) the angle of elevation of other house is θ and angle of depression is ϕ . Find the height of the house.



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37. A statue, 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is

60° and from the same point the angle of elevation of the top of the pedestal is 45° .

Find the height of



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38. Two poles of equal heights are standing opposite to each other on either side of the road which is 80m wide. From a point between them on the road the angles of elevation of the top of the poles are 60° and 30°

respectively. Find the height of the poles and the distances of the point from the poles.



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39. The angle of elevation of the top of a tower from two points at a distance of 4 m and 9 m from base of the tower and in the same straight line with it are complementary. Prove that the height of the tower is 6 m.

OR

The angles of elevation of the top of a tower

from two points at a distance of 4 m and 9 m from the base of the tower of the tower and in the same straight line with it are 60° and 30° respectively. Find the height of the tower.



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40. From the top of a 7m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45° . Determine the height of the tower.



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41. A 1.2 m tall girl spots a balloon moving with wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After some time, the angle of elevation reduces to 30° . Find the distance travelled by the balloon during the interval.



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42. A straight highway leads to the foot of a tower. A man standing at the top of the tower observes a car at an angle of depression of 30° , which is approaching the foot of the tower with a uniform speed. Six seconds later, the angle of depres



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Exercise

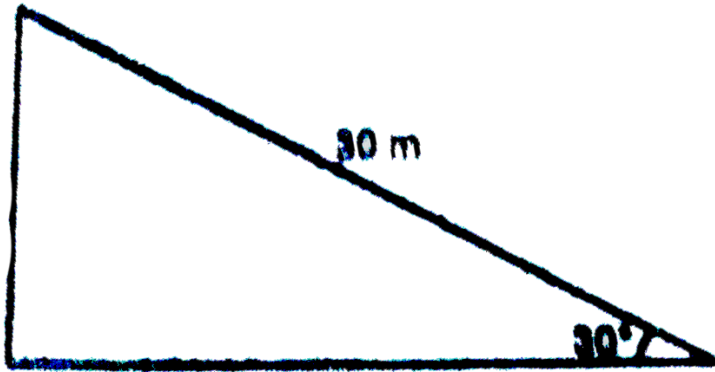
1. The length of the shadow of a pole at a time is $\sqrt{3}$ times its height. Find the sun's altitude



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2. A circus artist is climbing a 30 m rope, which is tightly stretched and tied from the top of a vertical pole to the ground. Find the height of the pole to the ground. Find the height of the angle made by the rope with the ground level

is 30°), as shown in the figure.



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3. The angle of elevation of the top of a tower from a point on the ground, which is 40 m

away from the foot of the tower is 30° . Find the height of the tower.



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4. The angle of elevation of the top of a tower from a point on the ground, which is 25 m away from the foot of between the ship and tower.



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5. The angle of depression of a ship from the top a tower of height 50 m is 30° . Find the horizontal distance between the ship and tower.



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6. The angle of depression between a flying kite and 'a' point on the ground is 60 m. If the string makes 30° . Find the horizontal distance between the ship and tower.





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7. The angle of depression of a ship from the top of a tower of height 50 m is 30° . Find the horizontal distance between the boat and the bridge.



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8. The upper part of a tree broken over by wind, makes an angle of 30° with the ground. If the length of the upper part is $8\sqrt{3}$

metres then what was the height of the tree before broken ?



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9. In a violent storm, a tree got bent by the wind. The top of the tree meets the ground at an angle of 30° , at a distance of 30 metres from the root. At what height from the bottom did the tree bent? What was the original height of the tree? (Use $\sqrt{3} = 1.73$)



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10. The angle of elevation of the top of a tower from a point on the ground is 30° . After walking 45 m towards the tower, the angle of elevation becomes 45° . Find the height of the tower.



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11. There are two points on the horizontal line passing through the foot of a tower in the same side of the tower. The angle of

depression of these point from the top of the tower are 45° and 60° respectively. Find the distance between the two point if the height if the tower is 150 metres.



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12. From the top of a light house, the angles of depression of two ships on the opposite sides of its are observed to be α and β . If the height of the light house be h metres and the line joining the ships passes through the foot of

the light house, show that the distance

between the ship is $\left(h \frac{\tan \alpha + \tan \beta}{\tan \alpha \tan \beta} \right)$



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13. From the top of a light-house, the angles of depression of two ships on the opposite sides are observed to be 30° and 45° . If the height of the light-house, is 90 m and the line joining the two ships passes through the light-house, then find the distance between the ships.



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14. An aeroplane, when 3000 m high, passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from the same point on the ground are 45° and 60° respectively. Find the vertical distance between the two planes.



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15. The angle of elevation of the top of an incomplete temple, at a point 30 m away from its foot, is 30° . How much more high the temple must be constructed so that the angle of elevation of its top at the same point be 45° .



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16. The angle of elevation of the top of an incomplete tower, at a point 40m away from

its foot, is 45° . How much more high the tower must be constructed so that the angle of elevation of its top at the same point be 45° ?



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17. On a straight line passing through the foot of a tower, two points C and D are at distances of 4 m and 16 m from the foot respectively. If the angles of elevation from C and D of the

top of the tower are complementary, then find the height of the tower.



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18. The angle of elevation of the top of a tower from the foot of a house, situated at a distance of 20 m from the tower is 60° . From the top of the top of the house the angle of elevation of the top of the tower is 45° . Find the height of house and tower.

A. $14.64m, 34.64m$

B. $13m$, $34.64m$

C. $14.64m$, $32m$

D. None

Answer: A



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19. There is a $7m$ high statue standing on a cliff. At a point P on the ground, the angle of elevation of the foot of the statue is α . After walking 34 metres towards the cliff from that

point, the angle of elevation of the top of the statue is $(90^\circ - \alpha)$, find the height of the cliff if $\tan \alpha = \frac{1}{2}$.



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20. The distance between two towers is 140 m while seeing from the top of the second tower, the angle of elevation of first tower is 30° . If the height of the second tower is 60 m, then find the height of the first tower.



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21. A temple and a flagstaff surmounted at its top, each subtends equal angle of 30° at a point on the ground. If the height of the temple is 10 m, find the height of the flagstaff.



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22. A 7 m long flagstaff is fixed on the top of a tower on the horizontal plane. From a point on the ground, the angles of elevation of the top and bottom of the flagstaff are

45° and 30° respectively. Find the height of the tower.



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23. At one side of a road, there is a house and on the other side there is a tower. House and tower are on the same horizontal plane. The angle of depression of the top and foot of the house, from the top of the tower are 30° and 45° respectively. If the height of

the house is 10 m, then find the distance between the house and the tower.



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24. A tower subtends an angle of 60° at a point on the plane passing through its foot and at a point 20 m vertically above the first point, the angle of depression of the foot of tower is 45° . Find the height of the tower.



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25. An aeroplane is flying over two houses which are at a distance of 300 m from each other. If at some moment from the aeroplane the angle of depression of two houses on the same side are 45° and 60° , at what height the plane is flying ?



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26. From the top of a 96 m tower, the angles of depression of two cars, on the same side of the tower are α and β respectively. If

$\tan \alpha = \frac{1}{4}$ and $\tan \beta = \frac{1}{7}$, then find the distance between two cars.



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27. The angle of elevation of the top of a vertical tower, from a point in the horizontal plane passing through the foot of the tower is θ . On moving towards the tower 192 metres, the angle of elevation becomes ϕ . If $\tan \theta = \frac{5}{12}$ and $\tan \phi = \frac{3}{4}$, then find the height of the tower.



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28. The upper part of a tree broken over by the wind makes an angle of 60° with the ground and the horizontal distance from the foot of the tree to the point where the top of the tree meets the ground is 10 metres. Find the height of the tree before broken.



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29. From a boat, which is moving towards a bridge, the angle of elevation of bridge is 30° . After 10 minutes, the angle of elevation becomes 60° . Find how much more time will take the boat to reach at the bridge?



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30. The angle of elevation of the top of a building from the foot of the tower is 60° . After a flight of 15 seconds, the angle of

elevation changes to 30° . If the aeroplane is flying at a constant height of $1500\sqrt{3}$ m find the speed of the plane in km/hr.



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31. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 45° . If the tower is 30 m high, find the height of the building.



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32. A flagstaff on the top of tower 80 m high, subtends an angle $\tan^{-1}\left(\frac{1}{9}\right)$ at point on the ground 100 m from the tower. The height of flagstaff is



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Revision Exercise Short Answer Questions

1. A pole of height 6 m casts a shadow $2\sqrt{3}$ m long on the ground. Find the sun's elevation.



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2. Find the angle of elevation of the sun when the shadow of a pole 'h' metres high is $\sqrt{3}h$ metres long.



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3. The angle of elevation of the top of a tower from a point 40 m away from its foot is 60° .

Find the height of the tower.



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4. The height of a light house is 40 m. The angle of depression of a ship from the top of the light house is 60° . Find the distance of ship from the light house.



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5. A man goes 80 m on an inclined cliff inclined at 45° from the horizontal. Find the vertical height of the man from the ground.



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Revision Exercise Long Answer Questions

1. An aeroplane is flying above a horizontal road between the two consecutive kilometer's stones. These stones are on the opposite sides

of the aeroplane. The angles of depression of these stones from the aeroplane are 30° and 60° . Find the height of the aeroplane from the road.



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Long Answer Questions

1. From a window, 60 metres high above the ground, of a house in a street, the angles of elevation and respectively. Show that the

height of the opposite house is $60(\sqrt{3} + 1)$ metres.



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2. On a horizontal plane, there is a vertical tower with a flagpole on the top of the tower. At a point, 9 metres away from the foot of the tower, the angle of elevation of the top and bottom of the flagstaff are 60° and 30° respectively. Find the height of the tower and the flagpole mounted on it. (Use $\sqrt{3} = 1.732$)



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3. A boy standing on a horizontal plane finds a bird flying at a distance of 100 m from him at an elevation of 30° . A girl standing on the roof of a 20 m high building finds the angle of elevation of the same bird to be 45° . Boy and girl are on the opposite sides of the bird. Find the distance of the bird from the girl.



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4. The angle of elevation of the top of a tower as observed from a point on the ground is α and on moving 'a' metres towards the tower, the angle of elevation is β . Prove that the height of the tower is $\frac{a \tan \alpha \tan \beta}{\tan \beta - \tan \alpha}$.



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5. The angle of elevation of a cloud from a point 60m above a lake is 30° and the angle of

depression of the reflection of cloud in the lake is 60° . Find the height of the cloud.



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