MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

HEIGHTS AND DISTANCES

Solved Examples

1. A vertical pole stands on the level ground. From a point on the ground, 25m away from

the foot of the pole , the angle of elevation of its top is found to be 60°. Find the height of the pole.

A. $25\sqrt{3}$

B. $50\sqrt{3}$

C. $55\sqrt{3}$

D. $65\sqrt{3}$

Answer: A

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2. A kite is flying, attached to a thread which is 165m long. The thread makes an angle of 30° with the ground. Find the height of the kite from the ground , assuming that there is no slack in the thread.

A. 185.5m

B. 82.5m

C. 166.5m

D. 175.5m

Answer: B

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3. The length of a string between a kite and a point on the ground is 85 metres. If the string makes an angle θ with the ground level such that $\tan\theta = \frac{15}{8}$, how high is the kite? Assume that there is no slack in the string.

A. 79 m

B. 76 m

C. 78 m

D. 75 m

Answer: D

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4. 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. 8.5m

B. 7.5m

C. 9.5m

D. 6.5m

Answer: B

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5. 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 ?

A. 60^0

B. 90^0

C. 45^0

D. 30^0

Answer: A

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6. If a 1 meter tall girl stands at a distance of 3 m from a lamp-post and casts a shadow of length $4.5m$ on the ground, then the height of the lamp-post is

A. 4.5 m

B. 3.5 m

C. 1.5 m

D. 2.5 m

Answer: D

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7. The shadow of a tower, when the angle of elevation of the summit is 45°, is found to be 10metres longer than when the angle of

elevation, when 60°. Find the height of the tower.

A. 21.67

B. 23.66

C. 22.68

D. 23.88

Answer: B

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8. A tower is 50 m high. Its shadow is x metres shorter when the sun's altitude is 45° than when it is 30°. Find the value of x correct to nearest cm.

A. 36.6 m

B. 32.5 m

C. 30.5 m

D. 31.5 m

Answer: A

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

A. 28.98 m

B. 25.98m

C. 32.98 m

D. 22.98 m

Answer: B

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10. 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 5 m, find the height of the tower.

A. 1.5 m

B. 3.5 m

C. 2.5 m

D. 4.5m

Answer: C

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11. Two pillars of equal height and on either side of a road, which is 100 m wide. The angles of elevation of the top of the pillars are 60° and 30° at a point on the road between the pillars. Find the height of each pillar.

A. 34.5 m

B. 25.4 m

C. 43.3 m

D. 75 m

Answer: C

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12. The angle of elevation of an aeroplane from a point P on the ground 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 aeroplane

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13. From the top of a building 60m high the angles of depression of the top and the bottom of a tower are observed to be $30^0 and 60^0$. Find the height of the tower.

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14. A man of a cliff observes a boat at an angle of depression of 30^0 which is approaching the shore to the point immediately beneath the observer with a uniform speed. Six minutes later, the angle of depression of the boat is found to be 60°. Find the time taken by the boat to reach the shore.

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15. As observed from the top of a 75 m high lighthouse from the sea-level, the angles of

depression of two ships are $30o$ and $45o$. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two sh

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16. Two ships are sailing in the sea on the two sides of a lighthouse. The angles of elevation of the top of the lighthouse as observed from the two ships are 30^o and 45^o respectively. If the lighthouse is 100 m high, the distance

between the two ships is (a) 173 m (b) 200 m (c) 273 m (d) 300 m

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17. From the top of a light house, the angles of depression of two ships on the opposite sides of its are observed to be $\alpha and \beta$. 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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18. If 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 take is β, prove that the height of the cloud is $\left(h\frac{\tan\beta+tan\alpha}{\tan\beta-tan\alpha}\right.$

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19. 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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20. A round balloon of radius r subtends an angleα 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 $r\sin(\beta)\cos ec\frac{\alpha}{2}$

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21. A boy whose eye level is $1.3m$ from the ground, spots a balloon moving with the wind in a horizontal line at same height from the ground. The angle of elevation of the balloon from the eyes of the boy at an instant is 60°. After 2 seconds, the angle of elevation reduces to 30°. If the speed of the wind is $29\sqrt{3}m/s$

then find the height of the balloon from the ground.

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22. An aeroplane when flying at a height of 4000 m from the ground passes vertically above another aeroplane at an instant when the angles of the elevation of the two planes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the aeroplanes at that instant.

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

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24. From a window (h metres high above the ground) of a house in a street, the angle of elevation and depression of the top and the foot of another house on the opposite side of the street are θ and ϕ respectively. Show that the height of the opposite house is $h(1 + \tan\theta \cot\phi)$ metres.

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25. From the top of a building 60m high the angles of depression of the top and the bottom of a tower are observed to be $30^0 and 60^0$. Find the height of the tower.

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26. The angle of elevation of a jet plane from a point A on the grund is 60^0 . After and flight of 30 seconds, the angle of elevation changes to 30^0. If the jet plane is flying at a constant

height of $3600\sqrt{3}m$, find the speed of the jet plane.

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27. The angle of elevation of a fighter from point A on the ground is 60° After a flight of 15 seconds the angle of elevation changes to 30°.If the jet is fighting at a speed of 720km/hour. Find the constant height at which the jet is flying.

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28. A 1.2 m tall girl spots a ballon 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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29. A tree breaks due to storm and the broken part bends so that the top of the three touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is $9m$. Find the height of the tree.

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30. A person standing on the bank of a river observes that the angle of elevation of the top

of a tree standing on the opposite bank is 60^0. When he moves 40 metres away from the bank, he finds the angle of elevation to be 30°. Find the height of the tree and the width of the river.

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31. The angle of elevation of the top of a tower from two points on the ground at distances a metres and b metres from the base of the tower and in the same straight line are

complementary.Prove that height of the tower is $\sqrt{ab}$.

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32. 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 20 metre high building, finds the angle of elevation of the same bird to be 45°. Both the boy and the girl are on opposite sides of the bird. Find the distance of bird from the girl.

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33. A 1.5 m tall boy is standing at some distance from a 30 m tall building. The angle of elevation from his eyes to the top of the building increases from $30o$ to $60o$ as he walks towards the building. Find the distance he walked towards the build

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Exercise 14

1. A tower stands vertically on the ground. From a point on the ground, 20m away from the foot of the tower, the angle of elevation of the top of the tower is $60o$. What is the height of the tower?

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2. A kite is flying at a height of 75 metres from the ground level, attached to a string inclined

at $60o$ to the horizontal. Find the length of the string to the nearest metre.

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3. An observer $1.5m$ tall is 30 m away from a chimney. The angle of elevation of the top of the chimney from his eye is 60° . Find the height of the chimney.

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4. The anlge of the elevation of the top of a tower from two points at distances of 5 metre and 20 metres from the base of the tower and in the same straight line with it, are complementary. Find the height of the tower.

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5. The angle of elevation of the top of a tower at a distance of 120 m from a point A on the ground is 45°. If the angle of elevation of the

top of a flagstaff fixed at the top of the tower, at A is 60°, then find the height of the flagstaff. [Use $\sqrt{3} = 1.732$.]

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6. From a point on the ground 40 m away from the foot of a tower, the angle of elevation of the top of the tower is 30°. The angle of elevation of the top of a water tank(on the top of tower) is 45°.find the height of the tower and depth of tank

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7. A vertical tower stands on a horizontal plane and is surmounted by vertical flagstaff to height 6m. At a point on the plane, the anglea elevation of the bottom of flagsteff is 30° and that of the top of the flagstaff is 60°. Find the height of the tower. [Use $\sqrt{3} = 1.732$]

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8. A status 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 the pedestal . (Use $\sqrt{3} = 1.73$)

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9. The angle of elevation of the top of an unfinished tower at a distance of $75m$ 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°? [Take $\sqrt{3} = 1.732$.]

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10. On a horizontal plane there is a vertical tower with a flag pole 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 flag pole are $60^0 and 30^0$ respectively. Find the height of the tower and the flag pole mounted on it.

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11. Two poles of equal heights are standing opposite to each other on either side of the road which is 80 m wide. From a point P between them on the road, the angle of

elevation of the top of one pole is 60° and the angle of depression from the top of another pole is 30° find the height of pole and distances of the point P from the poles.

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12. Two men are on opposite sides of a tower. They measure the angles of elevation of the top of the tower as 30° and45° respectively. If the height of the tower is 50metres, find the

distance between the two men. [Take $\sqrt{3} = 1.732$]

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13. From the top of a tower $100m$ high, a man observes two cars on the opposite sidesof the tower and in same straight line with itsbase, with angles of depressoin 30° and 45° respectively. Find the distance between the cars . [Take $\sqrt{3} = 1.732$]

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14. 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 $30o$, which is approaching the foot of the tower with a uniform speed. Six seconds later, the angle of depres

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15. 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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16. 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 60°. If the tower is 60 m high, find the height of the building.

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17. The horizontal distance between two towers is 60 metres. The angle of depression of the top of the first tower when seen from the top of the second tower is 30° . If the

height of the second tower is 90metres. Find the height of the first tower. [Use $\sqrt{3} = 1.732$]

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18. The angle of elevation of the top of a chimney from the top of a tower is $60o$ and t he angle of depression of the foot of the chimney from the top of the tower is $30o$. If the height of the tower is 40 m, find the height of the chimney. According to pollution control norms, the minimum height of a

smoke emitting chimney should be 100 m. State if the height of the above mentioned chimney meets the pollution norms. What value is discussed in this question?

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19. 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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20. The angle of elevation of the top of a tower from a point A on the ground is 30^0. On moving a distance of 20 metres towards the foot of the tower to a point B the angle of elevation increases to 60^0. Find the height of the ttower and the distance of the tower from the point A.

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21. The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 30°. Find the height of the tower.

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22. The angles of the depression of the top and bottom of the tower is seen from the top

of a $60\sqrt{3}$ cliff are 45^{α} and 60^{α} respectively.

Find the height of the tower.

A. 43.92

B. 42

C. 82

D. None

Answer: A

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23. A man on the deck of a ship, 16 m above water level, observes that the angles of elevation and depression repectively of the top and bottom of a cliff are 60° and 30°. Calculate the distance of the cliff from the and height of the cliff.

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24. 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 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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25. The angle of the elevation of an aeroplane from a point on the ground is 45°. After flying for 15 seconds, the elevation changes to 30° . If the aeroplane is flying at a height of 2500 metres. Find the speed of the aeroplane.

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26. The angle of elevation of a tower from a point on the same level as the foot of the tower is 30^0. On advancing 150 metres towards the foot of the tower, the angle of elevation of the tower becomes 60^0. Show that the height of the tower is 129.9 metres (Use $\sqrt{3} = 1.732$).

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27. As observed from the top of a lighthouse, 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 60°. Determine the distance travelled by the ship during the period of observation. [Use $\sqrt{3} = 1.732$].

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28. From a point on a bridge across a river, the angles of depression of the banks on opposite

sides of the river are $30o$and $45o$, respectively. If the bridge is at a height of 3 m from the banks, find the width of the river.

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29. If the angles of elevation of the top of a tower from two points at distances a and b from the base and in the same straight line with it are complementary then the height of the tower is

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30. A ladder of length 6 metres makes an angle of 45° with the floor while leaning against one wall of a room. If the foot of the ladder is kept fixed on the floor and it is made to lean against the opposite wall of the room, it makes an angle of 60° with the floot. Find the distance between two walls of the room.

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31. From the top of a vertical tower, the angles of depression of two cars, in the same straight line with the base of the tower, at an instant are found to be 45° and 60°. If the cars are 100 m apart and are on the same side of the tower, find the height of the tower.

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32. An electrician has to repair an electric fault on a pole of height 4m. He needs to reach a

point 1.3m below the top of the pole to undertake the repair work. What should be the length of the ladder that he should use which when inclined at an angle of $60o$ to the horizontal would enable him to reach the required position?

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33. From the top of a building AB , 60 m high, the angles of depression of the top and bottom of a vertical lamp post CD are

observed to be $30o$ and $60o$ respectively. Find the height of the lamp post.

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34. 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 toreach the tower.

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35. An aeroplane id flying at a height of 300 m above the ground. Fying at this height , theangles 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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36. From a point on the ground the angles of elevation of the bottom and top of a transmission tower fixed at the top of 20m high building are $45o$ and $60o$ respectively. Find the height of the transmission tower.

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37. From the top of the hill; the angle of depressions of two consecutive kilometre

stones due east are found to be 30° and 45° .

Find the height of the hill.

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38. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3}:1$, what is the angle of elevation of the Sun?

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Multiple Choice Questions Mcq

1. If the height of a vertical pole is equal to the length of its shadow on the ground, the angle of elevation of the sun is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: C

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2. If the height of a vertical pole is $\sqrt{3}$ times the length of its shadowon the ground then the angle of elevation of the sun at that time is

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C

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3. If the length of the shadow of a tower is $\sqrt{3}$ times its height of then the angle of elevation of the sun is

A. 45°

B. 30°

C. 60°

D. 90°

Answer: B

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4. If a pole 12 m high casts a shadow $4\sqrt{3}m$ long on the ground then the sun's elevation is

A. 60°

B. 45°

C. 30°

D. 90°

Answer: A

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5. The shadow of a 5-m-long stick is 2m long. At the same time, the length of the shadow of a $12.5m$ high tree is

A. $3m$

B. $3.5m$

C. $4.5m$

D. $5m$

Answer: D

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6. A ladder makes an anglesof 60° with the ground when placed against a wall. If the foot of the ladder is $2m$ away from the wall, the length of the ladder is

A. $\frac{4}{\sqrt{3}}m$

B. $4\sqrt{3}m$

C. $2\sqrt{2}m$

D. $4m$

Answer: D

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7. A ladder 15m long makes an angle of 60° with the wall. Find the height of the point , where the ladder touches the wall.

A. $15\sqrt{3}$

B. $\frac{15\sqrt{3}}{2}m$

C. $\frac{15}{2}m$

D. $15m$

Answer: C

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8. The angle of elevation of the top of a tower from a point on the ground, which is 30m away from the foot of the tower, is 30°. Find the height of the tower.

A. $30m$

B. $10\sqrt{3}m$

C. $10m$

D. $30\sqrt{3}m$

Answer: B

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9. The angle of depression of a car parked on the road from the top of the 150 m high tower is 30°. Find the distance of the car from the tower.

A. $50\sqrt{3}m$

B. $150\sqrt{3}m$

C. $150\sqrt{2}m$

D. $75m$

Answer: B

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10. A kite is flying at a height of 30m from the ground. The length of string from the kite to the ground is 60m. Assuming that three is no

slack in the string, the angle of elevation of the kite at the ground is:

A. 45°

B. 30°

C. 60°

D. 90°

Answer: B

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11. From the top of a cliff 30 metres high, the angle of elevation of the top of a tower is found to be equal to the angle of depression of the foot of the tower. The height of the tower is

A. $20m$

B. $40m$

C. $60m$

D. $80m$

Answer: A

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12. If a 1.5 m-tall girl stands at a distance of 3 m from a lamp-post and casts a shadow of length $4.5m$ on the ground, then the height of the lamp-post is

A. $1.5m$

B. $2m$

C. $2.5m$

D. $2.8m$

Answer: C

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13. The length of the shadow of a tower standing on level ground four to be $2x$ metres longer when the sun's elevation is 30° than where it was 45°. The height of the tower is

A. $\left(2\sqrt{3}x\right)m$

B. $\left(3\sqrt{2}x\right)m$

C. $\left(\sqrt{31}\right)xm$

D. $\left(\sqrt{3}+1\right)xm$

Answer: D

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14. The length of a vertical rod and its shadow are in the ratio $1:\sqrt{3}$. The angle of elevation of the sun is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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15. A pole casts a shadow of length $2\sqrt{3}$ m on the ground when the sun's elevation is 60°. The height of the pole is

A. $4\sqrt{3}m$

B. $6m$

C. $12m$

D. $3m$

Answer: B

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16. In the following figure, a tower AB is 20 m high and BC, its shadow on the ground, is $20\sqrt{3}$ m long. Find the Sun's altitude.

A. 30°

B. 45°

C. 60°

D. none of these

Answer: A

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17. The tops of two towers of height x and y, standing on level ground, subtend angles of

30° and 60° respectively at the centre of the line joining their feet, then find $x : y$.

A. $1:1$

B. $2:1$

C. $1:3$

D. $3:1$

Answer: C

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18. The angle of elevation of the top of a tower from a point on the ground, which is 30m away from the foot of the tower, is 30° . Find the height of the tower.

A. 30 m

B. $10\sqrt{3}m$

C. $20m$

D. $10\sqrt{2}m$

Answer: B

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19. The string of a kite is 100 metres long and it makes an angle of 60° with the horizontal. Find the height of the kite, assuming that there is no slack in the string.

A. $50\sqrt{3}m$

B. $100\sqrt{3}m$

C. $50\sqrt{2}m$

D. $100m$

Answer: A

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20. If the angles of elevation of the top of a tower from two points at distances a and b from the base and in the same straight line with it are complementary then the height of the tower is

A. $\sqrt{\frac{a}{b}}$

B. $\sqrt{ab}$

C. $\sqrt{a+b}$

D. $\sqrt{a-b}$

Answer: B

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21. On the level ground, the angle of elevation of a tower is 30°. On moving 20 m nearer, the angle of elevation is 60°. The height of the tower is

A. 10 m

B. $10\sqrt{3}m$

C. $15m$

D. $20m$

Answer: B

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22. In a rectangle, the angle between a diagonal and a side is 30° and the length of

this diagonal is 8 m. The area of the rectangle is

A. $16cm^2$

B. $\frac{16}{\sqrt{3}}cm^2$

C. $16\sqrt{3}cm^2$

D. $8\sqrt{3}cm^2$

Answer: C

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23. From the top of a hill, the angles of depression of two consecutive kilometre stones due east are found to be 30° and 45°. Find the height of the hill.

A. $\frac{1}{2}(\sqrt{3}-1)km$

B. $\frac{1}{2}(\sqrt{3}+1)km$

C. $(\sqrt{3}-1)km$

D. $(\sqrt{3}+1)km$

Answer: B

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24. If the elevation of the sun changes from 30° to 60° then the difference between the lengths of shadow of a pole 15 m high, is

A. $7.5m$

B. $15m$

C. $10\sqrt{3}m$

D. $5\sqrt{3}m$

Answer: C

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25. An observer $1.5m$ tall is 28.5 m away from a tower and the angle of elevation of the top of the tower from the eye of the observer is 45°. The height of the tower is

A. $27m$

B. $30m$

C. $28.5m$

D. none of these

Answer: B

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