MATHS

BOOKS - MCGROW HILL EDUCATION

MATHS (HINGLISH)

HEIGHTS AND DISTANCES

Illustrative Examples

1. If the height of a pole is $2\sqrt{3}$ metres and the length of its shadow is 2 metres, find the angle

of elevation of the sun.

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2. A ladder leaning against a wall makes an angle of $60o$ with the ground. If the length of the ladder is 19 m, find the distance of the foot of the ladder from the wall.

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3. The angle of elevation of the top of a tower at a point on the ground is $30o$. On walking 24 m towards the tower, the angle of elevation becomes $60o$. Find the height of the tower.

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4. A man standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is $60o$. When he retires

36 m from the bank, he finds the angle to be $30o$. Find the breadth of the river.

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5. A man on the top of a tower, standing on the seashore, finds that a boat coming towards him takes 10 minutes for the angle of depression to change from $30o$ to $60o$. Find the time taken by the boat to reach the shore from the position.

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6. There are two temples, one on each bank of a river, just opposite to each other. One temple is 54 m high. From the top of this temple, the angles of depression of the top and the foot of the other temple are $30o$ and $60o$ respectively. Find the width of the river and the height of the other temple.

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Multiple Choice Questions

1. Angle of elevation and depression

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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2. From a point P on a level ground, the angle of elevation of the top of a tower is $30o$. If the tower is 100 m high, the distance of point P from the foot of the tower is (a) 149 m (b) 156 m (c) 173 m (d) 200 m

A. 149 m

B. 156 m

C. 173 m

D. 200 m

Answer: C

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3. The angle of elevation of a ladder leaning against a wall is $60o$ and the foot of the ladder is 4.6 m away from the wall. The length of the ladder is: (a) 2.3 m (b) 4.6 m (c) 7.8 m (d) 9.2 m

A. 2.3 m

B. 4.6 m

C. 7.8 m

D. 9.2 m

Answer: D

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4. An observer 1.6 m tall is $20\sqrt{3}$ m away from a tower. The angle of elevation from his eye to the top of the tower is $30o$. The height of the tower is: (a) 21.6 m (b) 23.2 m (c) 24.72 m (d) None of these

A. 21.6 m

B. 23.2 m

C. 24.72 m

D. None of these

Answer: A

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5. 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 $30o$ and $45o$ 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

A. 173 m

B. 200 m

C. 273 m

D. 300 m

Answer: C

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6. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of $30o$ with the mans eye. The man walks some distance towards the tower to watch its top and the angle of elevation becomes $60o$. What is the distance between the base of the tower and the point P ? $4\sqrt{3}$ units (b) 8 units (c) 12 units (d) Data inadequate

A. $4\sqrt{3}$ times

B. 8 units

C. 12 units

D. None of these

Answer: D

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7. The angle of elevation of the top of a tower from a certain point is $30o$. If the observer moves 20 m towards the tower, the angle of elevation of the top of the tower increases by

$15o$. The height of the tower is (a) 17.3 m (b) 21.9 m (c) 27.3 m (d) 30 m

A. 17.3 m

B. 21.9 m

C. 27.3 m

D. 30 m

Answer: C

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8. A man is watching from the top of a tower a boat speeding away from the tower. The boat makes an angle of depression of $45o$ with the mans eye when at a distance of 60 metres from the tower. After 5 seconds, the angle of depression becomes $30o$. What is the approximate speed of the boat, assuming that it is running in still water? (a) 32 kmph (b) 36 kmph (c) 38 kmph (d) 40 kmph (d) 42 kmph

A. 32kmph

B. 36 kmph

C. 38 kmph

D. 40 kmph

Answer: A

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9. On the same side of a tower, two objects are located. When observed from the top of the tower, their angles of depression are $45o$ and $60o$. If the height of the tower is 150m, find the distance between the objects.

A. 63.5 m

B. 76.9 m

C. 86.7 m

D. 90 m

Answer: A

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10. A man on the top of a vertical tower observes a car moving at a uniform speed coming directly towards it. If it takes 12

minutes for the angle of depression to change from $30^0 \rightarrow 45^0$, how soon after this will the car reach the tower? Give your answer to the nearest second.

A. 14 min. 35 sec.

B. 15 min. 49 sec.

C. 16 min. 23 sec

D. 18 min. 5 sec.

Answer: C

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11. The top of a 15 metre high tower makes an angle of elevation of $60o$ with the bottom of an electric pole and angle of elevation of $30o$ with the top of the pole. What is the height of the electric pole? (a) 5 metres (b) 8 metres (c) 10 metres (d) 12 metres (e) None of these

A. 5 metres

B. 8 metres

C. 10 metres

D. 12 metres

Answer: C

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12. The angle of elevation of the top of an incomplete vertical pillar at a horizontal distance of 100 m from its base is 45°. If the angle of elevation of the top of the complete pillar at the same point is to be 60°, then the height of the incomplete pillar is to be increased by

A. $50\sqrt{2}$ metres

B. 100 metres

C. $100\left(\sqrt{3}-1\right)$ metres

D. $100\left(\sqrt{3}+1\right)$ metres

Answer: C

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13. If a flag-staff of 6 m height placed on the top of a tower throws a shadow of $2\sqrt{3}$ m

along the ground, then what is the angle that the sun makes with the ground?

A. 60°

B. 30°

C. 45°

D. None of these

Answer: A

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14. A tree is broken by wind, its upper part touches the ground at a point 10 metres from the foot of the tree and makes an angle of 45° with the ground . The entire length of the tree is

A. 15 metres

B. $10\left(\sqrt{2}+1\right)$ metres

C. 20 metres

D. $10\left(1+\frac{\sqrt{3}}{2}\right)$ metres

Answer: C

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15. A man standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is $60o$. When he retires 36 m from the bank, he finds the angle to be $30o$. Find the breadth of the river.

A. $12\sqrt{3}$ m

B. 18 m

C. 12 m

D. 27 m

Answer: B

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16. From the top of a lighthouse, 100 m high, the angle of depression of a boat is $\tan^{-1}\left(\frac{5}{12}\right)$. What is the distance between the boat and the lighthouse?

A. 120 m

B. 180 m

C. 240 m

D. None of these

Answer: C

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17. If the height of a pole is $2\sqrt{3}$ metres and the length of its shadow is 2 metres, find the angle of elevation of the sun.

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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18. A 30 metres long ladder is placed against a wall 15 m high such that it just reaches the top

of the wall. The angle made by the ladder with the horizontal is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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19. If the angles of elevation of the top of a tower from two points distance s and $t(s > t)$ from its foot are 30° and 60° respectively, then the height of the tower is

A. $\sqrt{s+t}$

B. $\sqrt{st}$

C. $\sqrt{s-t}$

D. $\sqrt{\frac{s}{t}}$

Answer: B

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20. Length of the shadow of a person is x when the angle of elevation of the sun is 45°. If the length of the shadow increased by $\left(\sqrt{3}-1\right)x$, then the angle of elevation becomes

A. 15°

B. 18°

C. 25°

D. 30°

Answer: D

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21. From the top of the cliff 150 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60°, respectively. The height of the tower is

A. 100 m

B. $50\sqrt{3}m$

C. $133\frac{1}{3}$

D. $100\left(\sqrt{3}-1\right)$

Answer: A

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22. The upper part of a tree, broken by the wind makes an angle of 60^{o} with the ground and the distance from the roots to the point where the top of the tree meets the ground is 20 m. The length of the broken part of the tree is

A. 20 m

B. 40 m

C. $20\sqrt{3}$ m

D. $40\sqrt{3}$ m

Answer: B

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23. A man on the top of a tower, standing on the seashore, finds that a boat coming towards him takes 10 minutes for the angle of

depression to change from $30o$ to $60o$. Find the time taken by the boat to reach the shore from the position.

A. 20 minutes

B. 15 minutes

C. 10 minutes

D. 5 minutes

Answer: B

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24. A tower subtends an angle α at a point A in the plane of its base and the angle of depression of the foot of the tower at a point b ft just above A is β. Then the height of the tower is

A. $b \tan \alpha \cot \beta$

B. $b \cot \alpha \cot \beta$

C. $b \tan \alpha \tan \beta$

D. $b \cot \alpha \tan \beta$

Answer: A

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25. A flag staff of 5m high stands on a building of 25m high. At an observer at a height of 30 m. The flag staff and the building subtend equal angles . The distance of the observer from the top of the flag staff is

A. $\frac{5\sqrt{3}}{2}$

B. $5\sqrt{\frac{3}{2}}$

C. $5\sqrt{\frac{2}{3}}$

D. None of these

Answer: B

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26. An aeroplane flying at a height 300 metre above the ground passes vertically above another plane at an instant when the angles of elevation of the two planes from the same point on the ground are 60° and 45° respectively. Then the height of the lower plane from the ground in metres is

A. $100\sqrt{3}$

B. $\frac{100}{\sqrt{3}}$

C. 50

D. $150\left(\sqrt{3}+1\right)$

Answer: A

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27. At a point on level ground, the angle of elevation of a vertical tower is found to be such that its tangent is $5/12$. On walking 192

metres towards the tower, the tangent of the angle of elevation is $3/4$. Find the height of the tower.

A. 170 m

B. 175 m

C. 180 m

D. 185 m

Answer: C

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28. The straight roads intersect at an angle of 60^{o}. A bus on one road is 2 km away from the intersection and a car on tire other road is 3 km away from the intersection. Then, the direct distance between the two vehicles, is

A. 1 km

B. $\sqrt{2}km$

C. 4 km

D. $\sqrt{7}$ km

Answer: D

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29. A flagstaff 10 m high stands at the centre of a equilateral triangle, which is horizontal. At the top of the flagstaff each side subtends at an angle of 60°. The length of each side of the triangle is

A. $6\sqrt{3}$

B. $4\sqrt{6}$

C. $5\sqrt{6}$

D. $6\sqrt{5}$

Answer: C

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30. A tree is broken by wind, its upper part touches the ground at a point 10 m from the foot of the tree and makes an angle of 60° with the ground. The entire length of the tree is

A. 15 m

B. 20 m

C. $\left(10+\frac{20}{3}\right)\sqrt{3}m$

D. $\left(10+\frac{\sqrt{3}}{2}\right)$ m

Answer: C

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31. From the top of a light house, the angles of depression of two stations on opposite sides of it at a distance a apart are α and β. Find the height of the light house.

A. $\frac{a}{\cot\alpha\cot\beta}$

B. $\frac{a}{\cot\alpha+\cot\beta}$

C. $\frac{a\cot\alpha\cot\beta}{\cot\alpha+\cot\beta}$

D. $\frac{a\tan\alpha\tan\beta}{\cot\alpha+\cot\beta}$

Answer: B

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32. A flag staff on the top of the tower 80 mt of height subtends an angle $\tan^{-1}(1/9)$ at a

point on the ground 100 mt from the foot of the tower. The height of the flag staff is

A. 20 m

B. 30 m

C. 40 m

D. 25 m

Answer: A

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33. An aeroplane flying horizontally 900 m above the ground is observed at an elevation of 60°. After 10 seconds, the elevation changes to 30°. The uniform speed of the aeroplane (in km/hr) is

A. 120

B. $180\sqrt{3}$

C. $216\sqrt{3}$

D. $50\sqrt{3}$

Answer: C

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34. From the top of the house 18m high, if the angle of elevation of the top of a tower is 45° and the angle of depression of the foot of the tower is 30°, then the height of the tower is

A. $18\sqrt{3}$ m

B. $18\left(\sqrt{3}+1\right)$ m

C. $18\left(\sqrt{3}-1\right)m$

D. $6\sqrt{3}$m

Answer: B

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35. If the angle of elevation of an object from a point 100 m above a lake is found to be 30° and the angle of depression of its image in lake is 45°, then the height of the object above the lake is

A. $100\left(2-\sqrt{3}\right)m$

B. $100\left(2+\sqrt{3}\right)\mathrm{m}$

C. $100\left(\sqrt{3}-1\right)$ metres

D. $1000\left(\sqrt{3}+1\right)$ m

Answer: B

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36. A tower subtends an angle α at a point A in the plane of its base and the angle of depression of the foot of the tower at a point b ft just above A is β. Then the height of the tower is

A. $b \tan \alpha \cot \beta$

B. $b \cot \alpha \tan \beta$

C. $b \tan \alpha \tan \beta$

D. $b \cot \alpha \cot \beta$

Answer: A

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37. 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. a+b

B. $\sqrt{a+b}$

C. $a \times b$

D. $a\sqrt{b}$

Answer: B

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38. A boat is rowed away from a cliff 150 m high. At the top of the cliff, the angle of depression of the boat changes from 60° to 45° in 2.5 minutes. The speed of the boat (in m/sec) is

A. $1 + \frac{1}{\sqrt{3}}$

B. $1 - \frac{1}{\sqrt{3}}$

C. $\sqrt{3} + 3$

D. $2\sqrt{3} - 3$

Answer: B

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39. From the top of a church spire 96 m high, the angle of depression of two vehicles on the road, at the same level as the base of the spire and on the same side of it are x° and y°, where $\tan x^\circ = \frac{1}{4}$ and $\tan y^\circ = \frac{1}{7}$.The distance between the vehicles is:

A. 384 m

B. 672 m

C. 288 m

D. None of these

Answer: C

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40. A flagstaff of height $\frac{1}{5}$ of the height of a tower is mounted on the top of a tower. If the angle of elevation of the top of the flagstaff as seen from the ground is 45° and the angle of elevation of the top of a tower as seen from the same place is 8, then the value of $\tan\theta$ is:

A. $\frac{5}{6}$

B. $\frac{6}{5}$

C. $\frac{5\sqrt{3}}{6}$

D. $\frac{4}{5}$

Answer: A

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41. The angles of elevation of the tops of two vertical towers as seen from the middle point of the line joining the foot of the towers are

$60^\circ, 30^\circ$ respectively. The ratio of the heights of the towers is

A. $2:1$

B. $\sqrt{3}:1$

C. $3:2$

D. $3:1$

Answer: D

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