MATHS

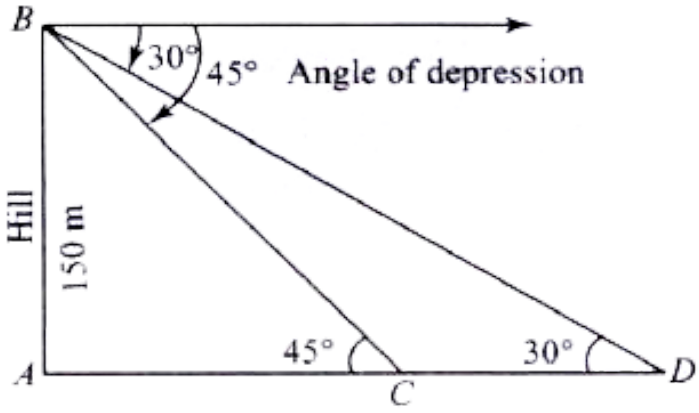
BOOKS - CENGAGE

HEIGHTS AND DISTANCES

Worked Examples

1. The height of a hill is 150 m. From the top of the hill the angles of depression of two objects lying towards east to the hill are 45°

and 30°. Find the distance btween the objects.



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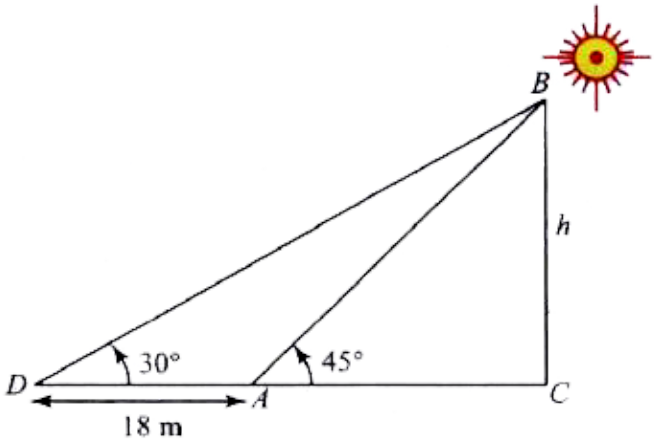
2. The shadow of a tower standing in a level plane is found to be 18 m shorter when the sun's altitude changes from 30° to 45°. Show

that the height of the tower is $9\left(1+\sqrt{3}\right)$ m.



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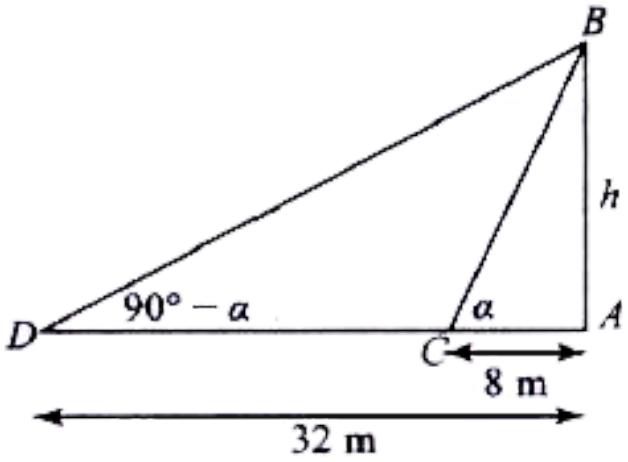
3. The angles of elevatio of the top of a tower from two points 8 m and 32 m from the base and in the same straight line with it are

complementary. Find the heigt of the tower.



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Test Yourself Level 1

1. Find the anle of elevaton of the sun when the length of the shadow of a pole is $\sqrt{3}$ times

the height of the pole.

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2. The angle of elevation of the top of a tower at a point on the ground 20 m from the foot of the tower is 30°. What is the height of the tower?

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3. From the top of a building 30 m tall, the angle of depression of the object on the ground is 60°. How far is the object from the buildings?

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Test Yourself Level 2

1. The angles of depresion of two ships from the top of a lighthouse are 45° and 30°

towards east. If the ships are 100 m apart, find the height of the lighthouse.

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2. Two pillars of equal height are on either side of a roadway which is 30 m wide. At a point on the roadway between the pillars, the elevations of the top of the pillars are 60° and 30°. Find the height of the pillars and the position of the point.

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3. A person standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is 60°, when he retires 14 m from the bank, he finds the angle to be 30°. Find the height of the tree and the breadth of the river.

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Test Yourself Level 3

1. The upper part of a tree broken by the wind makes an angle of 60° with the ground and the distance from the foot to the point where the top of the tree meets the ground is 20m. What was the height of the tree?

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2. A person walking along a straight road observes that at the consecutine kilometre stones the abgles of elevation of a hill in front

of him are 30° and 45°. Find the height of the hill.

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3. From the top of a tower 100 m high, the angles of depression of the top and botton of a pole are observed to be 45° and 60°, respectively. Find the height of the pole if the pole and the tower stand on the sample plane.

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4. Aman on deck of a ship is 12 m above the water level. He observes that the angle of the elevation of the top of a cliff is 45° and the angle of depression of its base is 30°. Calculate the distance of the cliff from the ship and the height of the cliff.

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5. 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.

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6. The pilot of an aeroplane at an altitutde of 200 m observes the angle of depression of opposite points on the two banks of a river to be 45° and 60°. Find the width of the river.

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7. From the top of a lighthouse, the angle of depression of two stations on opposite sides of it at a distance a apart are α and β. Find the height of the lighthouse.

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8. The angle of elevation of an aeroplane from a point on the ground is 45°. After 15 s the angle changes to 30°. If the plane is flying at a height of 2500m, find the speed of the plane.

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9. The horizontal distance between two towers is 60 m and the angular depression of the top of the second tower which is 150 m high is 30° . The height of the first is

A. 120m

B. $10\left(15+2\sqrt{3}\right)m$

C. $10\left(15+2\sqrt{3}\right)m$

D. $10\left(15+\sqrt{3}\right)m$

Answer: B

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Test Yourself Level 3 Multiple Choice Questions

1. The angle of elevation of a tower at a point d metres away from its base is 30° .If the tower is 20 metres high, then d is equal to

A. $10\sqrt{3}m$

B. $20\sqrt{3}m$

C. $\frac{20}{\sqrt{30}m}$

D. $10m$

Answer: B

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2. A person standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is 60°. When he retreats 40 m from the bank, he finds the angle to be 30°.The breadth of the river is

A. 20m

B. 40m

C. 30m

D. 60m

Answer: A

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3. From a 60m high tower, angle of depression of the top and bottom of a house are α and β

respectively. If the height of the house is $\frac{60\sin(\beta-\alpha)}{x}$, then the value of x is

A. $\sin\alpha\sin\beta$

B. $\cos\alpha\cos\beta$

C. $\sin\alpha\cos\beta$

D. $\cos\alpha\sin\beta$

Answer: D

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4. A tree of height 100 feet subtends a right angle at the top of another tree.If the height of the other tree is 64 metres then the distance between the two trees is

A. 48 m

B. 36 m

C. 54 m

D. 72 m

Answer: A

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5. An observer ina boat finds the angle of elevation of a tower standing on the top of a cliff as 60° and that of the top of cliff as 30°. If the height of the twoer is 60 m then the height of the cliff is

A. $60\sqrt{3}m$

B. $30m$

C. $20\sqrt{3}m$

D. None of these

Answer: B

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6. 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 l m just above A is β. The height of the tower is

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

B. $l \cot \alpha \cot \beta$

C. $l \tan \alpha \tan \beta$

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

Answer: D

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7. The angle of elevation of a tower from a point A due south of its is 30° and from a point B due west of it is45°. If the hegiht of the tower is 100 m, then AB=

A. 150m

B. 200m

C. 173.2m

D. 141.4m

Answer: B

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8. The angle of elevation of the sun, when the shadow of a pole is $\sqrt{3}$ times its heigh is

A. 60°

B. 30°

C. 45°

D. 15°

Answer: B

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9. A ladder rests against a wall so that its top touches the roof of the house. If the ladder makes an angle of 60° with the horizontal,

and height of the house be $6\sqrt{3}$m then the length of the ladder is

A. $12\sqrt{3}m$

B. $3\sqrt{3}m$

C. $\frac{12}{\sqrt{3}}m$

D. $12m$

Answer: D

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10. If the angle of elevation of two towers from the middle point of the line joining their feet are 60° and 30° then the ratio of their heights is

A. $2:1$

B. $1:\sqrt{2}$

C. $3:1$

D. $1:\sqrt{3}$

Answer: C

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11. The base of cliff is circular. For the extremities of a diameter of the base, the angle of elevation of the top of the cliff is 30° and 60°. If the height of the cliff is 500 metres,then the diameter of the base of the cliff is

A. $1000\sqrt{3}m$

B. $2000\sqrt{3}m$

C. $1000/\sqrt{3}m$

D. $2000\sqrt{3}m$

Answer: B

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12. The angle of elevation of the top of a tower from top of a house is60° and the angle of depresion of its base is 30°. If the horizontal distance between the house and the tower is 12 m, then the hight of the tower is

A. $48\sqrt{3}m$

B. $\frac{16}{\sqrt{3}}m$

C. $24\sqrt{3}m$

D. $16\sqrt{3}m$

Answer: D

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13. The angle of depression of a ship from the top of a 30 m hight tower is 60°. The distance of ship from the base of the tower is

A. 30m

B. $30\sqrt{3}m$

C. $10\sqrt{3}m$

D. 10m

Answer: C

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14. A 6 metres high flatstaff placed on the top of a tower throws a shadow of $2\sqrt{3}$ m on the

ground. The angle (in degrees) that the sun makes with the ground is

A. 60°

B. 80°

C. 75°

D. None of these

Answer: A

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15. The angles of elevation of a cliff from a point A on the ground and a point B, 100 m vertically above A are α and β, respectively. The heigth of the cliff is

A. $\frac{100 \cot \alpha}{\cot \alpha - \cot \beta}$

B. $\frac{100 \cot \beta}{\cot \alpha - \cot \beta}$

C. $\frac{100 \cot \beta}{\cot \beta - \cot \alpha}$

D. $\frac{100 \cot \beta}{\cot \beta + \cot \alpha}$

Answer: C

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16. Two men are on the opposite sides of tower. They measure the angles of elevation of the top of the tower as 45° and 30°. If the height of the tower is 40 m then the distance between the men is

A. 40m

B. $40\sqrt{3}m$

C. 68.280m

D. 109.28m

Answer: D

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17. The angle of elevation of the top of a pole from any point A on the ground is 15°. On walking 40 metres towards the pole, the angle becomes 30°. The height of the pole is

A. 40 m

B. $20m$

C. $20\sqrt{3}m$

D. $\frac{40}{\sqrt{3}}m$

Answer: B

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18. The shadow of a tower standing on a level ground is x metres long when the sun's altitude is 30°, while it is y metres long when the sun's altitude is 60°. If the height of the tower is $45\frac{\sqrt{3}}{2}$m then the value of x-y is

A. 45m

B. $45\sqrt{3}m$

C. $\frac{45}{\sqrt{3}}m$

D. $45\frac{\sqrt{3}}{2}$m

Answer: A

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19. For a man the angle of elevation of the highest point of a temple due east of his is 60°. On walking 240 metres towards north,

the angle of elevation is reduced to 30°. The height of the temple is

A. $60\sqrt{6}m$

B. $60m$

C. $50\sqrt{3}m$

D. $30\sqrt{3}m$

Answer: A

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Olympiad And Ntse Level Exercises

1. The angle of elevation of the top of a tower at point on the ground is 30°. If on walking 20 metres towards the tower, the angle of elevation become 60° then the height of the tower is

A. 10 metres

B. $\frac{10}{\sqrt{3}}$ metres

C. $10\sqrt{3}$m

D. None of these

Answer: C

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2. An observer on the top of a tree, finds the angle of depression of a car moving towards the tree to be 30°. After 3 minutes, this angle becomes 60°. After how much more time, the car will reach the tree

A. 4 minutes

B. $4\frac{1}{2}$ minutes

C. $1\frac{1}{2}$ minutes

D. 2 minutes

Answer: C

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3. The length of the shadow of a pole inclined at 10° to the vertical towards the sun is 2.05 metres. When the elevation of the sun is 38°., the length of the pole is

A. $\frac{2.05\sin 38^\circ}{\sin 42^\circ}$

B. $\frac{2.05\sin 42^\circ}{\sin 38^\circ}$

C. $\frac{2.05\cos 38^\circ}{\cos 42^\circ}$

D. None of these

Answer: A

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4. An aeroplane flying horizontally 1 km above the ground is observed at an elevation of 60° and after 10 secons the elevation, it is

observed to be 30°. The uniform speed of the aeroplane (in km/h) is

A. 240

B. $240\sqrt{3}$

C. $60\sqrt{3}$

D. None of these

Answer: B

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5. The base of a cliff is circular. From the extremities of a diameter of the base the angle of elevation of the top of the cliff are 30° and 60°. If the height of the cliff is 500 metres, then the diameter of the base of the cliff is

A. $1000\sqrt{3}m$

B. $2000\sqrt{3}m$

C. $1000/\sqrt{3}m$

D. $2000\sqrt{3}m$

Answer: B

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6. For a man the angle of elevation of the highest point of the temple situated east of him is 60°. On walking 240 metres to north, the angle of elevation is reduced to 30°.The height of the temple is

A. $60\sqrt{6}m$

B. $650m$

C. $50\sqrt{3}m$

D. $30\sqrt{6}m$

Answer: A

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7. A vertical tower stands on a declivity which is inclined at 15° to the horizon. From the foot of the tower, a man ascends the declivity from 870 feet an them finds that the tower

subtends a angle of 30°. Then the height of the tower is

A. $40\left(\sqrt{6}-\sqrt{2}\right)$

B. $20\left(\sqrt{6}-\sqrt{2}\right)$

C. $40\left(\sqrt{3}-\sqrt{2}\right)$

D. None of these

Answer: A

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8. A flagstaff stands in the centre of a rectangular field whose diagonal is 1200 m and subtends angle 15° and 45° at the mid points of the sides of the field. The height of the flagstaff is

A. 200m

B. $300\sqrt{2+\sqrt{3}}m$

C. $300\sqrt{2-\sqrt{3}}m$

D. 400 m

Answer: C

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9. A vertical pole consists of two parts, the lower part being one third of the whole. At a point in the horizontal plane through the base of the pole and at a distance 20 metres from it, the upper part of the pole subtends an angle whose tangent is 1/2. Find the possible height of the pole.

A. 20m

B. 45m

C. 60m

D. A and C

Answer: C

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10. The angle of elevation of a stationarly cloud from a point 2500 m above a lake is 15° and the angle of depression of its reflection in the lake is 45°. Then find the height of cloud above the lake level.

A. $1000\sqrt{3}m$

B. $1500\sqrt{3}m$

C. $2500\sqrt{3}m$

D. $3000\sqrt{3}m$

Answer: C

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