



MATHS

BOOKS - CALCUTTA BOOK HOUSE

MATHS (BENGALI ENGLISH)

**APPLICATION OF TRIGONOMETRIC
RATIOS: HEIGHTS AND DISTANCES**

Example 1 Very Short Answer Type Question Vsa

1. A. Multiple choice questions (MCQ) :

(i) If the angle of elevation of the top of a mobile tower from a distance of 10 metres from its foot is 60° , then height of the tower is

A. 10 metres

B. $10\sqrt{3}$ metres

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

D. 100 metres

Answer:



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2. In the adjoining figure, the value of θ is

A. 30°

B. 45°

C. 60°

D. 75°

Answer:



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3. At what angle an observer observes a box lying on ground from the roof of a three-story building, so that the height of building is equal to the distance of the box from the building ?

A. 15°

B. 30°

C. 45°

D. 60°

Answer:



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4. Height of a tower is $100\sqrt{3}$ metres. The angle to elevation of the top the tower from a point at a distance of 100 metres of foot of the tower is

A. 30°

B. 45°

C. 60°

D. None of these

Answer:



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5. If the length of the shadow on the ground of a post is $\sqrt{3}$ times of its height, the angle of elevation of the sun is

A. 30°

B. 45°

C. 60°

D. None of these

Answer:



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6. B. Write 'true' or 'false' :

In $\angle ABC$, $\angle B = 90^\circ$, If $AB = BC$, then $\angle C = 60^\circ$.



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7. PQ is the height of a building, QR is the base, the angle of depression from a point P at

the point R is $\angle SPR$, So, $\angle SPR = \angle PRQ$.



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8. C. Fill in the balnks :

the suns angle of elevation increases from 30° to 60° , the length of shadow of a post _____.



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9. If the angle of elevation of sun is 45° , the length of shadow and length of post are_____.



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10. Fill in the blanks

If the angle of elevation of sun is _____ 45° ,
then the length of shadow of a tower will be
less than the height of the tower.



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Example 2 Shor Answer Type Question Sa

1. If the angle of elevation of a kite is 60° and the length of thread is $20\sqrt{3}$ meters, calculate the height of kite above the ground.



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2. AC is the hypotenuse with of 100 meters of a right-angled triangle ABC and if $AB = 50\sqrt{3}$ meters, then find the value of $\angle C$.



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3. A tree breaks due to storm and its top touches the ground in such a manner that the distance from the top of the tree to the base of the tree and present height are equal. Calculate how much angle is made by the top of the tree with the base.



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4. In right-angled triangle ABC , $\angle B = 90^\circ$, D is such a point on AB that $AB : BC : BD = \sqrt{3} : 1 :$

1. Find the value of $\angle ACD$.



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5. If the ratio between length of shadow of a tower and height of tower is $\sqrt{3} : 1$, then find the angle of elevation of the sun.



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6. The length of the shadow of a tower is 9 metres when the sun's angle of elevation is 30° . Calculate the height of the tower.



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Example 3 Long Answer type Question La

1. A palm tree stands on the bank of a river. A post is fixed in the earth on the other bank just opposite to the palm tree. On moving $7\sqrt{3}$ metres from the post along the bank, it is found that the tree makes an angle of 60° at that point with respect to this bank. Find the width of the river.



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2. Two houses stand just on the opposite sides of a road of a village. A ladder that stands against the wall of the first house is at a distance of 6 metres from the house and makes an angle of 30° with the horizontal line. But if the ladder stands against the wall of the second house keeping its foot at the same point, it makes an angle of 60° with the horizontal line.

(a) Find the length of the ladder.

(b) Calculate the distance of the foot of the

ladder from the foot of the wall of the second house.

(c) Find the width of the road.

Find the height where the top of the ladder is fixed against the wall of the second house.



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3. If the angle of elevation of the top of a chimney from a point on the horizontal plane passing through the foot of the chimney is 60° and the angle of elevation from another

point on the same plane at a distance of 24 metres away from the first point is 30° . Calculate the height of the chimney.

$$[\sqrt{3} = 1.732(\text{approx}).]$$



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4. Answer any One question : The length of the shadow of a post becomes 3 meters smaller when the angle of elevation of the Sun increases from 45° to 60° . Find the height of the post.



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5. When the top of a chimney of a factory is seen from a point on the roof of the three storied building of $9\sqrt{3}$ metre height, the angle of elevation is 30° . If the distance between the factory and chimney is 30 metres, calculate the height of the chimney.



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6. The bottom of a light house and bottom of the mast of two ships are on the same straight line and the angles of depression from the light house at the bottom of mast of two ships are 60° and 30° respectively. If the distance of the points at the bottom of the light house and the bottom of the mast of first ship is 150 metres, calculate how far will the mast of the other ship from the light house be and what will the height of light house be.



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7. From a point on the roof of five-storied building the angle of elevation of the top of a monument and that of angle of depression of the foot of the monument are 60° and 30° respectively. If the height of the building is 16 metres, calculate the height of the monument and the distance of the building from the monument.



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8. Shib is flying kite having the length of thread 250 metres, when the thread makes an angle 60° with the horizontal line and when the thread makes an angle of 45° with the horizontal line. Calculate in each case what is the height of kite from the ground. Also find in which of the two cases will the kite be at a greater height from the other.



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9. A passenger of an aeroplane observes that Howrah station is at one side of the plane and Saheed Minar is just on the opposite side. The angles of depression of Howrah station and Saheed Minar from the passenger of aeroplane are 60° and 30° respectively. If the aeroplane is at a height of $545\sqrt{3}$ metres at that time, find the distance between Howrah station and Saheed Minar.



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10. The length of the flag at the roof of three-storied building is 3.3 metres. From any point of road, the angles of elevation of the top and foot of the flagpost are 50° and 45° . Calculate the height of three-storied building [Let $\tan 50^\circ = 1.192$]



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11. The Heights of two tower are 180 metres and 60 metres respectively. If the angle of elevation of the top of the first tower from the

foot of the second tower is 60° . Calculate the angle of elevation of the top of the second tower from the foot of the first.



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12. The length of shadow of a tower standing on the ground is found to be 60 metres more when the sun's angle of elevation changes from 30° to 45° . Find the height of the tower.



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13. Form a point on the same plane along the horizontal line passes through the foot of a chimney, the angle of elevation of the top of the chimney is 30° and the angle of elevation of the top of the chimney is 60° at a point on the same straight line proceeding 50 metres nearer to the chimney. Calculate the height of the chimney.



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14. A vertical post of 126 dcm height was bent at some point above the ground and it just touched the ground making an angle of 30° with the ground. Calculate at what height was the post bent and at what distance did it meet the ground from the foot of the post.



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15. Monu standing in the midst of a field, observes a flying bird in his north at an angle

of elevation of 30° and after 2 minutes he observer the bird in his south at an angle of elevation of 60° . If the bird flies in a straight line all along at a height of $50\sqrt{3}$ metres, find its speed in kilometre per hour.



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16. Laxmidevi standing on a railway overbridge of $5\sqrt{3}$ metres height observed the engine of the train from one side of the bridge of depression of 30° . But just after 2 seconds,

she observed the engine at an angle of depression of 45° from the other side of the bridge. Find the speed of the train in metres per second.



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17. A bridge is situated at right-angle to the bank of a river. If one moves away a certain distance from the bridge along this side of the river, the other end of the bridge is seen at an angle of 45° and if someone moves a further

distance of 400 metres in the same direction, the other end is seen at an angle of 30° . Find the length of the bridge.



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18. A house of 15 metres height, stands on one side of a park and from a point on the roof of the house the angle of depression of the foot of chimney of brick kiln of the other side is 30° and the angle of elevation of the top of the chimney of brick kiln is 60° . Find the

height of the chimney and the distance between the brick kiln and the house.



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19. If the angle of depression of two consecutive mile stones on a road from an aeroplane are 60° and 30° respectively. Find the height of the aeroplane, (i) when the two mile stones stand on opposite sides of the aeroplane, (ii) when the two stones stand on the same side of the aeroplane.



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Exercise Multiple Choice Question Mcq

1. A tower stands vertically on the ground. From a point on the ground, which is 30 m away from the foot of the tower, the angle of elevation of the top of the tower is found to be 45° . Then the height of the tower is

A. 20 m

B. 30 m

C. 40 m

D. 50 m

Answer: B



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2. The angle of elevation of the sun when the shadow of a pole of height 9 metres is $3\sqrt{3}$ metres long is

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C



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3. At an instant, the length of the shadow of a pole is $\sqrt{3}$ times the height of the pole. Then the angle of elevation of the sun is

A. 30°

B. 45°

C. 60°

D. 72°

Answer: A



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4. The shadow of a tower is 15 m when the sun's elevation is 30° . The length of the shadow when the sun's elevation is 60° will be

A. 3 m

B. 4 m

C. 6 m

D. 5 m

Answer: D



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Exercise Write True Or Fals

1. The line of sight is the straight line drawn from the eye of an observer to the point where the object is viewed by the observer.



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2. The angle of depression of the point viewed is the angle formed by the line of sight with the horizontal when the point being viewed is above the horizontal level.



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Exercise Fill In The Banks

1. When the line of sight is below the horizontal level, the angle so formed by the line of sight with the horizontal is called the angle of _____



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2. The instrument by which the height and distance of inaccessible object are measured

applying trigonometric ratio. Is known as _____ and _____.



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3. The angle of elevation of the top of a chimney at a distance of 200 m is 60° . Then the height of the chimney is _____.



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Short Answer Type Question Sa

1. The shadow of a pole is 9 m long when the angle of elevation of the sun is 30° . Find the length of shadow when the angle of elevation of the sun is 60° .



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2. A vertical pillar of height h cm stands on the plane ground. At a fixed point on the plane ground the height of the top of the pillar and that of a point x cm below the top subtend

angles 60° and 30° respectively. Prove that

$$x = \frac{2h}{3}.$$



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3. A vertical post 15 m high is broken at a certain height and its upper part, not completely separated, metres the ground at an angle of 30° . Find the height at which the post is broken.



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4. From the top of a light house 60 m high with its base at the sea-level the angle of depression of a boat is 15° . Find the distance of the boat from the foot of light house.



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Long Answer Type Question La

1. A flag staff 20 m long standing on a wall 10 m high subtends an angle whose tangent is 0.5 at a point on the ground. If θ is the angle

subtended by the wall at this point, then find the value of $\tan \theta$.



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2. A ladder rests against a wall making an angle α with the horizontal. The foot of the ladder is pulled away from the wall through a distance x , so that it slides a distance y down the wall making an angle β with the horizontal. Then prove that

$$x = y \tan\left(\frac{\alpha + \beta}{2}\right).$$



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3. At a distance $2h$ m from the foot of a tower of height h m the top of the tower and a pole at the top of the tower subtend equal angles.

Prove that the height of the pole should be

$$\frac{5h}{3} \text{ m.}$$



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4. From the bottom of a pole of height h the angle of elevation of the top of a tower is α

and the pole subtends an angle β at the top of the tower . Prove that the height of the tower is

$$\frac{h \cot(\alpha - \beta)}{\cot(\alpha - \beta) - \cot \alpha}.$$



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5. The top of a hill observed from the top and bottom of a building h is at angles of elevation p and q respectively. Prove that the height of the hill is

$$\frac{h \cot p}{\cot p - \cot q}.$$



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6. From the top of a cliff of height a , the angle of depression of the foot of a certain tower is found to be double the angle of elevation of the top of the tower of height h . If θ be the angle of elevation, then prove that

$$\tan \theta = \sqrt{3 - \frac{2h}{a}}.$$



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7. A tower subtends an angle α at a point A in the plane of its base and angle of depression of the foot of the tower at a point l metres just above A is β . Prove that the height of the tower is $l \tan \alpha \cot \beta$.



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8. From a point a metres above a lake the angle of elevation of a cloud is α and the angle of depression of its reflection is β . Prove

tha the height of the cloud is

$$\frac{a \sin(\alpha + \beta)}{\sin(\beta - \alpha)} \text{ metres.}$$



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9. From the tower 60 m high angles of depression of the top and bottom of a house are α and β respectively. If the height of the house be h . then prove that

$$h = \frac{60 \sin(\beta - \alpha)}{\cos \alpha \sin \beta}$$



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10. A spherical balloon of radius r subtends an angle α at the eye of an observer. If the angle of elevation of the centre of the balloon be β , then prove that the height of the balloon is $r \cos \frac{\alpha}{2} \sin \beta$.



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11. The angle of elevation of the top of a tower from a point A due South of the tower is α and from a point B due east of the tower is β .

If $AB = d$, then prove that the height of the tower is

$$\frac{d}{\sqrt{\cot^2 \alpha + \cot^2 \beta}}$$



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