MATHS

BOOKS - SELINA MATHS (ENGLISH)

HEIGHTS AND DISTANCES

Example

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1. The length of shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the

tower. The angle of elevation of sun is 45^0 (b) 30^0 (c) 60^0 (d) 90^0

2. The angle of elevation of the of a tower at a distance of 120 m from its foot on a horizontal plane is found to be $30°$. Find the height of the tower.

3. A guard observes an enemy boat, from an observation tower at a height of 180 m above sea level, to be at an angle of depression of $29°$

Calculate, to the nearest metre, the distance of the boat from the foot of the observation tower.

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4. A guard observes an enemy boat, from an observation tower at a height of 180 m above sea level, to be at an angle of depression of $29°$

After some time, it is observed that the boat is 200 m from the foot of the observation tower. Calculate the new angle of depression.

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5. Two people standing on the same side of a tower in a straight line with it, measure the angles of elevation of the top of the tower as $25°$ and $50°$ respectively. If the height of the tower is 70 m, find the distance between the two people

6. The shadow of a vertical tower on level ground increases by 10 metres, when the

altitude of the sun changes from angle of elevatin $45^0 \rightarrow 30^0$. Find the height of the tower, correct to one place of decimal. $\left(Take\sqrt{3} = 1.73\right.$

7. An observer on the top of a cliff, 200 m above the sea-level, observes the angles of depression of the two ships to be 45° and 30° respectively. Find the distance

between the ships, if the ships are

on the same side of the cliff,

8. An observer on the top of a cliff, 200 m above the sea-level, observes the angles of depression of the two ships to be $45°$ and $30°$ respectively. Find the distance between the ships, if the ships are on the opposite sides of the cliff

9. 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.

10. The angle of elevation of a stationary cloud from a point 25 m above a lake is $30°$ and the angle of depression of its reflection in the lake is $60°$. What is the height of the cloud above that lake-level ?

11. From a point on the ground, the angle of elevation of the top of a vertical tower is found to be such that its tangent is $\frac{3}{5}$. On

walking 50 m towards the tower, the tangent of the new angle of elevation of the top of the tower is found to be $\dfrac{4}{5}$. Find the height of the tower.

12. A vertical pole and a vertical tower are on the same level ground in such a way that from the top of the pole the angle of elevation of the top of the tower is $60°$ and the angle of depression of the bottom of the tower is $30°$.

Find :

the height of the tower, it the height of the

pole is 20 m ,

Exercise 22 A

1. The height of a tree is $\sqrt{3}$ times the length

of its shadow. Find the angle of elevation of

the sun

2. The angle of elevation of the top of a tower. from a point on the ground and at a distance of 160 m from its foot, is find to be $60°$. Find the height of the tower .

    A. 277.12 m

    B. 377.12 m

    C. 477.12 m

    D. None

Answer: A

3. A ladder is placed along a wall such that its upper end is resting against a vertical wall. The foot of the ladder is 2.4 m from the wall and the ladder is making an angle of $68°$ with the ground . Find the height, upto which the ladder reaches.

4. The persons are standing on the opposite sides of a tower. They observe the angles of elevation of the top of the tower to be $30°$ and $38°$ respectively. Find the distance between them, if the height of the tower is 50 m

5. A kite is attached to a string. Find the length of the string , when the height of the kite is 60

m and the string makes an angle $30°$ with the

ground .

6. A boy, 1.6 m tall, is 20 m away from a tower

and observes the angle of elevation of the top

of the tower to be $45°$ then find the height of

tower

7. A boy, 1.6 m tall, is 20 m away from a tower and observes the angle of elevation of the top of the tower to be $60°$. Find the height of the tower in each case

8. The upper part of a tree, broken over by the wind. makes an angle of $45°$ with the ground , and the distance from the root to the point where the top of the tree touches the ground.

is 1.5 m. What was the height of the tree before it was broken ?

9. The angle of elevation of the top of an unfinished tower from a point at a distance of 80 m from its base is $30°$. How much higher must the tower be raised so that its angle of elevation as the same point may be $60°$

10. At a particular time , when the sun's altitude is $30°$, the length of the shadow of a vertical tower is 45 m . Calculate :

(i) the height of the tower ,

(ii) the length of the shadow of the same tower, when the sun's altitude is :

(a) $45°$, (b) $60°$

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11. Two vertical poles are on either side of a road. A 30 m long ladder is placed between

the two poles. When the ladder rests against one pole, it makes angle $32°\,24'$ with the pole and when it is turned to rest against another pole, it makes angle $32°\,24'$ with the road . Calculate the width of the road.

12. Two climbers are at points A and B on a vertical cliff face. To an observer C, 40 m from the foot of the cliff, on the level ground . A is

at an elevation of $48°$ and B of $57°$. What is the distance between the climbers ?

13. A man stands 9 m away from a flag-pole. He observes that angle of elevation of the top of the pole is $28°$ and the angle of depression of the bottom of the pole is $13°$ .Calculate the height of the pole .

14. From the top of a cliff 92 m high. the angle of depression of a buoy is $20°$. Calculate, to the nearest metre, the distance of the buoy from the foot of the cliff
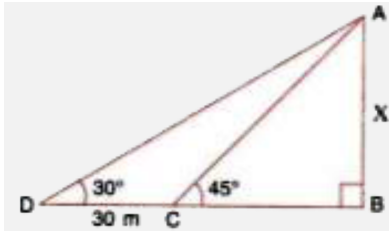
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Exercise 22 B

1. In the figure, given below, it is given that AB is perpendicular ot BD and is of length X metres. DC = 30 m,

$\angle ADB = 30°$ and $\angle ACB = 45°$. Without using tables, find X

A. 30.98 m

B. 40.98 m

C. 60.98 m

D. None

Answer: B

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2. Find the height of a tree it is found that on walking away from is 20 m, in a horizontal line through is base , the elevation of its top changes from $60° to 30°$

3. Find the height of a building, when it is found that on walking towards it 40 m in a horizontal line through its base the angular elevation of its top changes from $30° to 45°$

4. From the top of a light house 100 m high, the angles of depression of two ships are observed as $48°$ and $36°$ respectively. Find the distance between the two ships (in the nearest metre) if :

the ships are on the same side of the light house.

5. From the top of a light house 100 m high, the angles of depression of two ships are observed as $48°$ and $36°$ respectively. Find the distance between the two ships (in the nearest metre) if :

the ships are on the same side of the light house.

6. Two pillars of equal heights stand on either side of a roadway, which is 150 m wide. At a

point in the roadway between the pillars the elevations of the tops of the pillars are $60°$ and $30°$. Find the height of the pillars and the position of the point

7. From the figure, given below . calculate the length of CD
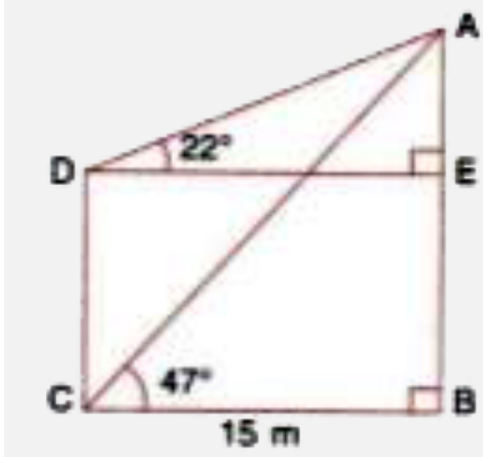
8. The angle of elevation of the top of a tower is observed to be $60°$. At a point , 30 m vertically above the first point of observation, the elevation is found to be $45°$. Find :

the height of the tower

9. The angle of elevation of the top of a tower is observed to be $60°$. At a point , 30 m vertically above the first point of observation, the elevation is found to be $45°$. Find :

its horizontal distance from the points of observation.

10. 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 $30o$ and $60o$. Find the height of the tower.

11. A man on a cliff observes a boat, at an angle of depression $30°$, which is sailing towards the shore to the point immediately beneath him. Three minutes later, the angle of

depression of the boat is found to be $60°$.

Assuming that the boat sails at a uniform speed, determine.

how much more time it will take to reach the shore ?

12. A man on a cliff observes a boat, at an angle of depression $30°$, which is sailing towards the shore to the point immediately beneath him. Three minutes later, the angle of

depression of the boat is found to be $60°$.

Assuming that the boat sails at a uniform speed, determine.

the speed of the boat in metre per second if the height of the cliff is 500 m

13. A man in a boat rowing away from a lighthouse 150 m high, takes2 minutes to change the angle of elevation of the top of the

lighthouse from $60°$ to $45°$. Find the speed of the boat .

14. 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 move 40 metres away from the bank, he finds the angle of elevation to be 30^0. Find the height of the tree and the width of the river.

15. 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 move 40 metres away from the bank, he finds the angle of elevation to be 30^0. Find the height of the tree and the width of the river.

16. The horizontal distance between two towers is 75 m and the angular depression of the top of the first tower as see from the top of the second, which is 160 m high, is $45°$. Find the height of the first tower.

A. 80 m

B. 81 m

C. 85 m

D. None

Answer: C

17. The length of the shadow of a tower standing of level plane is found to be 2y metres longer when the sun's altitude is $30°$ then when it was $45°$. Prove that the height of the tower is $y\left(\sqrt{3}+1\right)$ metres

18. An aeroplane flying horizontally 1 km above the ground is observed at an elevation of $60o$. After 10 seconds, its elevation is observed to be $30o$. Find the speed of the aeroplane in km/hr.

19. From the top of a hill, the angles of depression of two consecutive kilometre stones, due east, are found to be

$30°$ and $45°$ respectively. Find the distance of the two from the foot of the hill

Exercise 22 C

1. Find AD
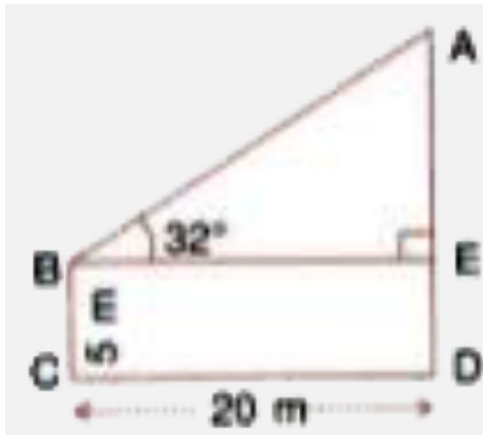
2. Find AD
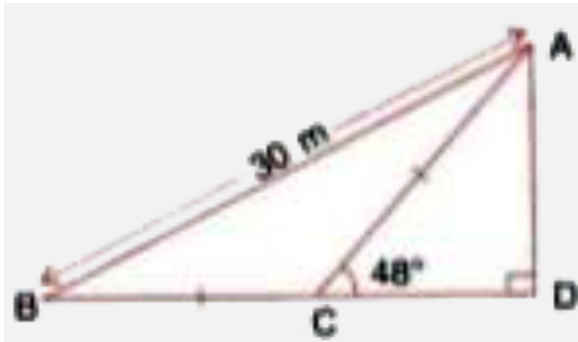
3. In the following diagram, AB is a floor-board,

PQRS is a cubical box with each edge = 1 m and
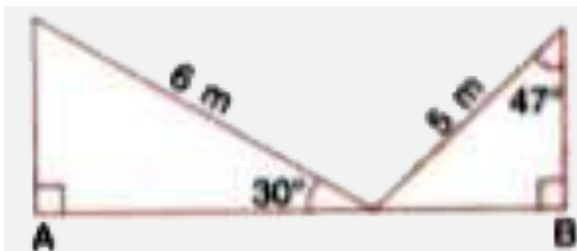
$\angle B = 60°$. Calculate the length of the board

AB
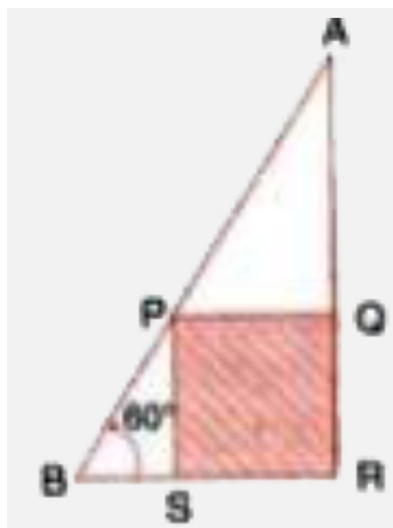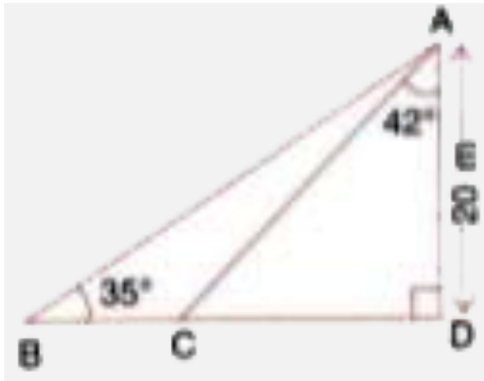
4. Calculate BC

5. Calculate AB

6. The radius of a circle is given as 15 cm and chord AB subtends an angle of $131°$ at the centre C of the circle . Using trigonometry. calculate :

the length of AB,

7. The radius of a circle is given as 15 cm and chord AB subtends an angle of $131°$ at the

centre C of the circle . Using trigonometry. calculate :

the length of AB,

8. 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.
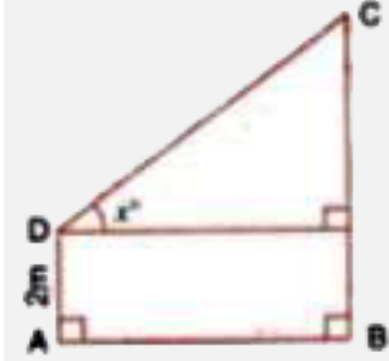
9. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag staff of height h. At a point on the plane, the angles of Elevation of the bottom and the top of the flag staff are α and β respectively. Prove that the height of the tower is $\dfrac{h\tan\alpha}{\tan\beta - \tan\alpha}$

10. With reference to the given figure, a man stands on the ground at point A, Which is on the same horizontal plane as B, the foot of the vertical pole BC. The height of the pole is 10 m . The man's eye is 2 m above the ground. He observes the angle of elevation of C, the top of the pole, as $x°$, where $\tan x° = \dfrac{2}{5}$. Calculate :

the distance AB in metres ,

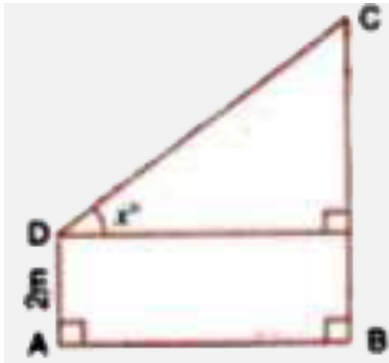Watch Video Solution

11. With reference to the given figure, a man

stands on the ground at point A, Which is on

the same horizontal plane as B, the foot of the

vertical pole BC. The height of the pole is 10 m

. The man's eye is 2 m above the ground. He

observes the angle of elevation of C, the top of the pole, as $x°$, where $\tan x° = \dfrac{2}{5}$. Calculate

:

angle of elevation of the top of the pole when he is standing 15 metres from the pole. Give your answer to the nearest degree.
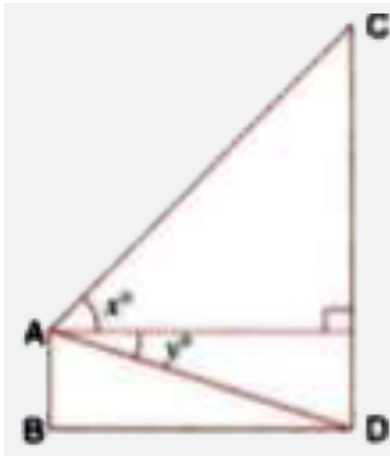
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12. The angles of elevation of the top of a tower from two points at a distances a meter and b metres from the base of the tower and in the same straight line with it are complementary. Prove that the height of the tower is $\sqrt{ab}$ metres.

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13. From a window A , 10 m above the ground the angle of elevation of the top C of a tower

is $x°$, where $\tan x° = \dfrac{5}{2}$ and the angle of depression of the foot D of the tower is $y°$ of the where $\tan y° = \dfrac{1}{4}$. (See the given figure) .Calculate the height CD of the tower is metres

.

14. A vertical tower is 20 m high. A man standing at some distance from the tower knows that the cosine of the angle of elevation of the top of the tower is 0.53. How far is he standing from the foot of the tower ?

15. A man standing on the bank of a river observes that the angle of elevation of a tree on the opposite bank is $60°$. When he moves

50 m away from the bank, he finds the angle of elevation to be $30°$. Calculate :

the width of the river and

16. A man standing on the bank of a river observes that the angle of elevation of a tree on the opposite bank is $60°$. When he moves 50 m away from the bank, he finds the angle of elevation to be $30°$. Calculate :

the height of the tree.

17. A 20 m high vertical pole and a vertical tower are on the same level ground in such a way that the angle of elevation of the top of the tower, as seen from the foot of the pole, is $60°$ and the angle of elevation of the top of the pole as seen from the foot of the tower is $30°$. Find :

the height of the tower.

18. A 20 m high vertical pole and a vertical tower are on the same level ground in such a way that the angle of elevation of the top of the tower, as seen from the foot of the pole, is $60°$ and the angle of elevation of the top of the pole as seen from the foot of the tower is $30°$. Find :

the horizontal distance between the pole and the tower.

19. A vertical pole and a vertical tower are on the same level ground in such a way that from the top of the pole the angle of elevation of the top of the tower is $60°$ and the angle of depression of the bottom of the tower is $30°$.

Find :

the height of the tower, it the height of the pole is 20 m ,

20. A vertical pole and a vertical tower are on the same level ground in such a way that from the top of the pole the angle of elevation of the top of the tower is $60°$ and the angle of depression of the bottom of the tower is $30°$.

Find :

the height of the pole, if the height of the tower is 75 m

21. From a point 36 m above the surface of a lake , the angle of elevation of a bird is observed to be $30°$ and angle of depression of its image in the water of the lake is observed to be $60°$. Find the actual of the bird above the surface of the lake .

22. A man observes the angle of elevation of the top of a building to be $30°$. He walks

towards it in a horizontal line through its base. On covering 60 m the angle of elevation changes to $60°$. Find the height of the building correct to the nearest metre.

23. As observed from the top of a 80 m tall lighthouse, the angle of depression of two ships, on the same side of the light house in horizontal line with its base, are $30°$ and $40°$ respectively . Find the distance between the

two ships. Given your answer correct to the nearest metre

24. In the given figure, A 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 $30°$ and $60°$ respectively. Find :
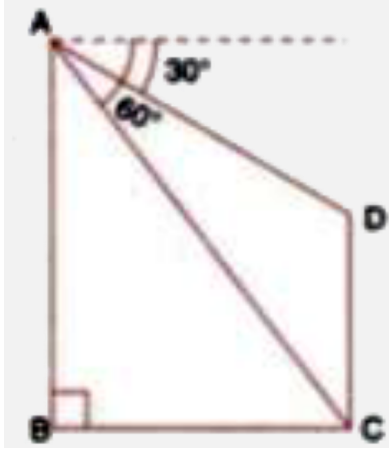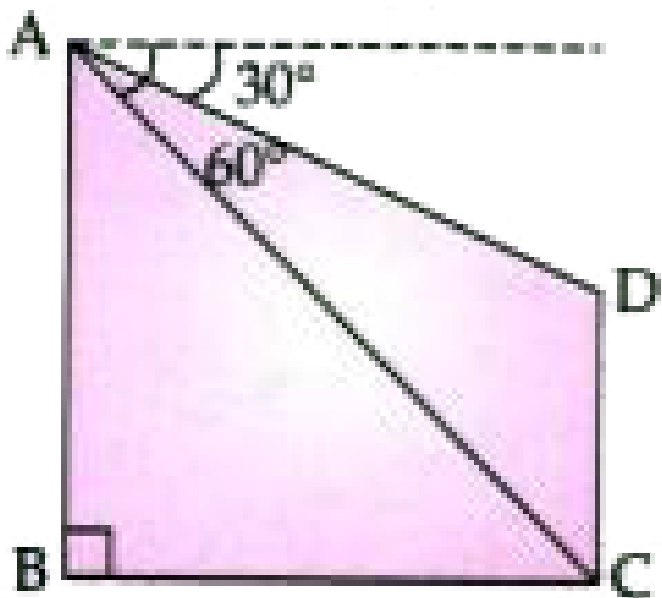
the horizontal distance between AB and CD

25. In the figure given, 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

$30°$ and $60°$ respectively. Find :

(ii) the height of the lamp post.

26. An aeroplane at an altitude of 250 m observes the angle of depression of two boats

on the opposite banks of a river to be

$45°$ and $60°$ respectively. Find the width of

the river. Write the answer correct to the

nearest whole number.

27. The horizontal distance between two tower

is 120 m. The angle of elevation of the top and

angle of depression of the bottom of the first

tower as observed from the second tower is

$30°$ and $24°$ respectively.
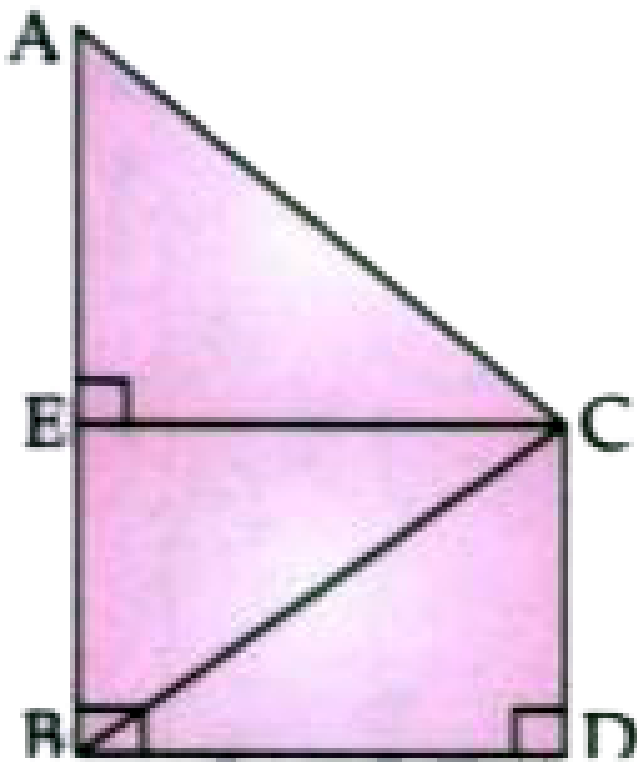
Find the height of the two towers. Give youe answer correct to 3 significant figures.

28. The angles of depression of two ships a A and B as observed from the top of a light house 60 m high are $60°$ and $45°$ respectively. If the two ships are on the opposite sides of the light house, find the distance between the two ships. Give your answer correct to the nearest whole number.