11 CHAPTER

HEIGHT AND DISTANCE

EXERCISE

YEAR 2011

1. The angle of 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, then the speed of the aeroplane in km/hr. is

   (a) 600 (b) $600\left(\sqrt{3}+1\right)$

   (c) $600\sqrt{3}$ (d) $600\left(\sqrt{3}-1\right)$

2. At a point on a horizontal line through the base of a monument the angle of elevation of the top of the monument is found to be such that its tangent is $\frac{1}{5}$. On walking 138 metres towards the monument the secant of the angle of elevation is found to be $\frac{\sqrt{193}}{12}$. The height of the monument (in metre) is

   (a) 42 (b) 49
   (c) 35 (d) 56

3. The angle of elevation of the top of a building from the top and bottom of a tree are x and y respectively. If the height of the tree is h metre, then the height of the building is (in metre)

   (a) $\frac{h\cot x}{\cot x+\cot y}$ (b) $\frac{h\cot y}{\cot x+\cot y}$

   (c) $\frac{h\cot x}{\cot x-\cot y}$ (d) $\frac{h\cot y}{\cot x-\cot y}$

4. The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower is

   (a) $\sqrt{3}$ m (b) $5\sqrt{3}$ m
   (c) $10\sqrt{3}$ m (d) $20\sqrt{3}$ m

5. Two poles of equal height are standing opposite to each other on either side of a road which is 100m wide. From a point between them on road, angle of elevation of their tops are 30° and 60°. The height of each pole (in meter) is

   (a) $25\sqrt{3}$ (b) $20\sqrt{3}$
   (c) $28\sqrt{3}$ (d) $30\sqrt{3}$ m

6. The angle of elevation of the top of a chimney and roof of the building from a point on the ground are x and 45° respectively. The height of building is h metre. Then the height of the chimney (in metre) is

   (a) $h\cot x+h$ (b) $h\cot x-h$
   (c) $h\tan x-h$ (d) $h\tan x+h$

7. There are two vertical posts, one on each side of a road, just opposite to each other. One post is 108 metre high. From the top of this post the angle of depression of the top and foot of the other post are 30° and 60° respectively. The height of the other post (in metre) is

   (a) 36 (b) 72 (c) 108 (d) 110

YEAR 2012

8. The angle of elevation of the top of a tower from two points A and B lying on the horizontal through the foot of the tower are 15° and 30° respectively. If A and B are on the same side of the tower and AB = 48 meter, then the height of the tower is;

   (a) $25\sqrt{3}$ meter (b) 24 meter
   (c) $24\sqrt{2}$ meter (d) 96 meter

9. Two posts are x metres apart horizontally and the height of one is double that of the other. If from the mid-point of the line joining their feet an observer finds the angular elevations of their tops to be complementary, then the height (in metres) of the shorter post is

   (a) $\frac{x}{2\sqrt{2}}$ (b) $\frac{x}{4}$

   (c) $x\sqrt{2}$ (d) $\frac{x}{2}$

10. An aeroplane when flying at a height of 5000m from the ground passes vertically above another aeroplane at an instant, when the angles of elevation of the two aeroplanes from the same point on the ground are 60° and 45° respectively. The vertical distance between the aeroplanes at that instant is

    (a) $5000\left(\sqrt{3}-1\right)$m

    (b) $5000\left(3-\sqrt{3}\right)$m

    (c) $5000\left(1-\frac{1}{\sqrt{3}}\right)$m

    (d) 4500 m

11. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30°. The man walks some distance towards the tower and then his angle of elevation of the top of the tower is 60°. If the height of tower is 30m, then the distance he moves is

    (a) 22 m (b) $22\sqrt{3}$ m
    (c) 20 m (d) $20\sqrt{3}$ m

12. An aeroplane when flying at a height of 3125m from the ground passes vertically below another plane at an instant when the angle of elevation of the two planes from the same point on the ground an 30° and 60° respectively. The distance between the two planes at that instant is
(a) 6520 m (b) 6000 m
(c) 5000 m (d) 6250 m

13. The shadow of the tower becomes 60 meters longer when the altitude of the sun changes from 45° to 30°. Then the height of the tower is
(a) $20\left(\sqrt{3}+1\right)$ m (b) $24\left(\sqrt{3}+1\right)$ m
(c) $30\left(\sqrt{3}+1\right)$ m (d) $30\left(\sqrt{3}-1\right)$ m

14. A vertical post 15 ft. high is broken at a certain height and its upper part, not completely separated meets the ground at an angle of 30°. Find the height at which the post is broken
(a) 10 ft (b) 5 ft
(c) $15\sqrt{3}\left(2-\sqrt{3}\right)$ ft (d) $5\sqrt{3}$ ft

15. The shadow of a tower is $\sqrt{3}$ times its height . Then the angle of elevation of the top of the tower is
(a) 45° (b) 30°
(c) 60° (d) 90°

16. A man 6ft tall casts a shadow 4ft long. At the same time when a flag pole casts a shadow 50 ft long. The height of the flag pole is
(a) 80ft (b) 75ft
(c) 60ft (d) 70ft

17. The angle of elevation of an aeroplane from a point on the ground is 60°. After 15 seconds flight, the elevation changes to 30°, If the aeroplane is flying at a height of $1500\sqrt{3}$ m, find the speed of the plane.
(a) 300 m/sec (b) 200m/sec
(c) 100m/sec (d) 150m/sec

18. There are two temples, one on each bank of a river just opposite to each other. One temple is 54m high. From the top of this temple, the angles of depression of the top and the foot of the other temple are 30° and 60° respectively. The length of the other temple is;
(a) 18 m (b) 36 m
(c) $36\sqrt{3}$ m (d) $18\sqrt{3}$ m

YEAR 2013

19. The angle of elevation of the top of a tower from the point P and Q at distance of 'a' and 'b' respectively from the base of the tower and in the same straight line with it are complementary. The height of the tower is
(a) $\sqrt{ab}$ (b) $\frac{a}{b}$
(c) ab (d) a^2b^2

20. The angle of elevation of a tower from a distance 100 m from its foot is 30°. Height of the tower is
(a) $\frac{100}{\sqrt{3}}$ m (b) $50\sqrt{3}$ m
(c) $\frac{200}{\sqrt{3}}$ m (d) $100\sqrt{3}$ m

21. A pole stands vertically inside a scalene triangular park ABC. If the angle of elevation of the top of the pole from each corner of the park is same, then in ΔABC, the foot of the pole is at the
(a) centroid (b) circumcentre
(c) incentre (d) orthocentre

22. If the angle of elevation of a balloon from two consecutive kilometre-stones along a road are 30° and 60° respectively, then the height of the balloon above the ground will be
(a) $\frac{\sqrt{3}}{2}$ km (b) $\frac{1}{2}$ km
(c) $\frac{2}{\sqrt{3}}$ km (d) $3\sqrt{3}$ km

23. A vertical stick 12 cm long casts a shadow 8 cm long on the ground.At the same time, a tower casts a shadow 40 m long on the ground. The height of the tower is
(a) 72 m (b) 60 m
(c) 65 m (d) 70 m

24. A tower standing on a horizontal plane subtends a certain angle at a point 160 m apart from the foot of the tower. On advancing 100 m towards it, the tower is found to subtend and angle twice as before. The height of the tower is
(a) 80 m (b) 100 m
(c) 160 m (d) 200 m

25. The length of the shadow of a vertical tower on level ground increases by 10 metres when the altitude of the sun changes from 45° to 30°. Then the height of the tower is
(a) $5\sqrt{3}$ metre
(b) $10\left(\sqrt{3}+1\right)$ metre
(c) $5\left(\sqrt{3}+1\right)$ metre
(d) $10\sqrt{3}$ meter

26. The elevation of the top of a tower from a point on the ground is 45°. On travelling 60 m from the point towards the tower the elevation of the top becomes 60°. The height of the tower (in metres) is
(a) 30 (b) $30\left(3-\sqrt{3}\right)$
(c) $30\left(3+\sqrt{3}\right)$ (d) $30\sqrt{3}$

27. The top of two poles of height 24m and 36 m are connected by a wire. If the wire makes an angle of 60° with the horizontal, then the length of the wire is
(a) 6m (b) $8\sqrt{3}$ m
(c) 8 m (d) $6\sqrt{3}$ m

28. From the top of a hill 200 m high the angle of depression of the top and the bottom of a tower are observed to be 30° and 60°. The height of the tower is (in m) ;
(a) $\frac{400\sqrt{3}}{3}$ (b) $166\frac{2}{3}$
(c) $133\frac{1}{3}$ (d) $200\sqrt{3}$

29. From a tower 125 metres high the angle of depression of two objects, which are in horizontal line through the base of the tower are 45° and 30° and they are on the same side of the tower. The distance (in metres) between the objects is
(a) $125\sqrt{3}$ (b) $125\left(\sqrt{3}-1\right)$
(c) $125/\left(\sqrt{3}-1\right)$ (d) $125\left(\sqrt{3}+1\right)$

YEAR 2014

30. From a point P on the ground the angle of elevation of the top of a 10m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff (Take $\sqrt{3}=1.732$)
(a) $10\left(\sqrt{30}+2\right)$ m (b) $10\left(\sqrt{30}+1\right)$ m
(c) $10\sqrt{3}$ m (d) 7.32 m

31. From a point 20 m away from the foot of a tower, the angle of elevation of the top of the tower is 30°. The height of the tower is

(a) $10\sqrt{3}$ m (b) $20\sqrt{3}$ m

(c) $\frac{10}{\sqrt{3}}$ m (d) $\frac{20}{\sqrt{3}}$ m

32. The angle of elevation of ladder leaning against a house is 60° and the foot of the ladder is 6.5 metres from the house. The length of the ladder is

(a) $\frac{13}{\sqrt{3}}$ (b) 13 meters

(c) 15 meters (d) 3.25 metres

33. The angle of elevation of sun changes from 30°to 45°, the length of the shadow of a pole decreases by 4 metres, the height of the pole is (Assume $\sqrt{3}=1.732$)

(a) 1.464m (b) 9.464 m

(c) 3.648 cm (d) 5.464 m

34. A vertical pole and a vertical tower are standing on the same level ground. Height of the pole is 10 metres. From the top of the pole the angle of elevation of the top of the tower and angle of depression of the foot of the tower are 60° and 30° respectively. The height of the tower is

(a) 20 m (b) 30 m

(c) 40 m (d) 50 m

35. A 1.6 m tall observer is 45 metres away from a tower. The angle of elevation from his eye to the top of the tower is 30°, then the height of the tower in metres is

(Take $\sqrt{3}=1.732$)

(a) 25.98 (b) 26.58

(c) 27.58 (d) 27.98

36. If a pole of 12 m height castes a shadow of $4\sqrt{3}$ m long on the ground then the sun's angle of elevation at that instant is

(a) 30° (b) 60°

(c) 45° (d) 90°

37. The angle of elevation of the top of a tower from a point on the ground is 30° and moving 70 meters towards the tower it becomes 60°. The height of the tower is

(a) 10 meter (b) $\frac{10}{\sqrt{3}}$ metre

(c) $10\sqrt{3}$ metre (d) $35\sqrt{3}$ metre

38. From the top of a tower of height 180m the angles of depression of two objects on either sides of the tower are 30° and 45°. Then the distance between the objects are

(a) $180\left(3+\sqrt{3}\right)$ (b) $180\left(3-\sqrt{3}\right)$

(c) $180\left(\sqrt{3}-1\right)$ (d) $180\left(\sqrt{3}+1\right)$

39. From the peak of a hill which is 300m high , the angle of depression of two sides of a bridge lying on a ground are 45° and 30°(both ends of the bridge are on the same side of the hill). Then the length of the bridge is

(a) $300\left(\sqrt{3}-1\right)$ m (b) $300\left(\sqrt{3}+1\right)$

(c) $300\sqrt{3}$ m (d) $\frac{300}{\sqrt{3}}$ m

40. From an aeroplane just over a river, the angles of depression to the bottom of trees on the opposite bank of the river are found to be 60° and 30° respectively. If the breadth of the river is 400 metres, then the height of the aeroplane above the river at that instant is (Assume $\sqrt{3}=1.732$)

(a) 173.2 metres

(b) 346.4 metres

(c) 519.6 metres

(d) 692.8 metres

41. From the top and bottom of a straight hill, the angle of depression and elevation of the top of a pillar of 10 m. height are observed to be 60° and 30° respectively. The height(in metres) of the hill is

(a) 30 (b) 80

(c) 60 (d) 40

42. The distance between two parallel poles is $40\sqrt{3}$ m. The angle of depression of the top of the second pole when seen from the top of first pole is 30°. What will be the height of second tower if the first pole is 100m long?

(a) $50\sqrt{3}$ m (b) 80 m

(c) $35\sqrt{3}$ m (d) 60m

43. An earthing wire connected to the top of an electricity pole has its other end inside the ground. The foot of the wire is 1.5 m away from the pole and the wire is making an angle of 60° with the level of the ground. Determine the height of pole.

(a) $\frac{3\sqrt{3}}{2}$ (b) 3 m

(c) $\sqrt{3}$ m (d) $\frac{\sqrt{3}}{2}$ m

44. The angle of elevation of the sun when the length of the shadow of a pole is equal to its height is:

(a) 30° (b) 45°

(c) 60° (d) 90°

45. A person observes that the angle of elevation at the top of a pole of height 5 meter is 30°. Then the distance of the person from the pole is:

(a) $5\sqrt{3}$ meter (b) $\frac{5}{\sqrt{3}}$ meter

(c) $\sqrt{3}$ meter (d) $10\sqrt{3}$ meter

46. The cliff of a mountain is 180 m high, and the angles of depression of two ships on the either side of cliff are 30° and 60°. What is the distance between the two ships?

(a) 400 m (b) $400\sqrt{3}$ m

(c) 415.68 m (d) 398.6 m

47. A ladder is placed along a wall such that its upper end is touching the top of the wall. The foot of the ladder is 10 ft away from the wall and the ladder is making an angle of 60° with the ground. When a man starts climbing on it, it slips and now ladder makes an angle of 30° with ground. How much did the ladder slip?

(a) $10(\sqrt{3}-1)$ ft

(b) $20(\sqrt{3}-1)$ ft

(c) $30(\sqrt{3}-1)$ ft

(d) $18(\sqrt{3}-1)$ ft

48. Two persons are on either side of a temple, 75 m high, observe the angle of elevation of the top of the temple to be 30° and 60° respectively. The distance between the persons is

(a) 173.2m (b) 100m
(c) 157.7m (d) 273.2m

(SSC CGL Pre Exam 2016)

49. The length of shadow of a tower is $\sqrt{3}$ times that of its length. The angle of elevation of the sun is

(a) 45° (b) 30°
(c) 60° (d) None of these

(SSC CGL Pre Exam 2016)

50. From a point on a bridge across the river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 2.5 m from the banks, then the width of the river is (take $\sqrt{3}$ =1.732)

(a) 5.83 m (b) 6.83 m
(c) 5.76 m (d) 6.87 m

(SSC CGL Pre Exam 2016)

51. A tower is 50 metres high. Its shadow is x metres shorter when the sun's altitude is 45° than when it is 30°. The value of x in metres is

(a) $50\sqrt{3}$ (b) $50\left(\sqrt{3}-1\right)$
(c) $50\left(\sqrt{3}+1\right)$ (d) 50

(SSC CGL Pre Exam 2016)

52. A boat is moving away from an observation tower. It makes an angle of depression of 60° with an observer's eye when at a distance of 50 m from the tower. After 8 sec, the angle of depression becomes 30°. By assuming that it is running in still water, the approximate speed of the boat is

(a) 33 km/h (b) 42 km/h
(c) 45 km/h (d) 50 km/h

(SSC CGL Pre Exam 2016)

53. The angles of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary. The height of the tower is

(a) 4 m (b) 7m
(c) 9 m (d) 6 m

(SSC CGL Pre Exam 2016)

54. A pilot in an aeroplane at an altitude of 200 m observes two points lying on either side of a river. If the angles of depression of the two points be 45° and 60°, then the width of the river is

(a) $\left(200+\frac{200}{\sqrt{3}}\right)$ m

(b) $\left(200-\frac{200}{\sqrt{3}}\right)$ m

(c) $400\sqrt{3}$ m

(d) $\left(\frac{400}{\sqrt{3}}\right)$ m

(SSC CGL Pre Exam 2016)

55. A telegraph post is bent at a point above the ground. Its top just touches the ground at a distance of $8\sqrt{3}$ m from its feet and makes an angle of 30° with the horizontal. The height (in metre) of the post is

(a) 12 (b) 16
(c) 18 (d) 24

(SSC CGL Pre Exam 2016)

56. Two men are on opposite sides of a tower. They measure the angles of elevation of the top of the tower as 30° and 45° respectively. If the height of the tower is 50m, the distance between the two men is (Take $\sqrt{3}$ = 1.73)

(a) 136.6 m (b) $50\sqrt{3}$ m
(c) $100\sqrt{3}$ m (d) 135.5 m

(SSC CGL Pre Exam 2016)-

57. The shadow of a tower when the angle of elevation of the sun is 45°, is found to be 10 m longer that when it was 60°. The height of the tower is

(a) $5(\sqrt{3}-1)$m (b) $5(3+\sqrt{3})$m
(c) $10(\sqrt{3}-1)$m (d) $10(\sqrt{3}+1)$m

(SSC CGL Pre Exam 2016)

58. The angles of elevation of top and bottom of flag kept on a flagpost from 30 metres distance, are 45° and 30° respectively. Height of the flag is [taking $\sqrt{3}=1.732$]

(a) $12\sqrt{3}$ m (b) 15 m
(c) 14.32 m (d) 12.68 m

(SSC CGL Pre Exam 2016)

59. A man standing on the bank of river observes that the angle subtended by a tree on the opposite bank is 60°. When he retrieves 36 m from the bank, he finds that the angle is 30°. The breadth of the river is

(a) 15 m (b) 18 m
(c) 16 m (d) 11 m

(SSC CGL Pre Exam 2016)

60. 129 meter from the foot of a cliff on level of ground, the angle of elevation of the top of cliff is 30°. The height of this cliff is

(a) $50\sqrt{3}$ metre
(b) $45\sqrt{3}$ metre
(c) $43\sqrt{3}$ metre
(d) $47\sqrt{3}$ metre

(SSC CGL Pre Exam 2016)

61. Two ships are sailing in the sea on the two sides of a light house. The angle of elevation of the top of the light house as observed from the two ships are 30° and 45° respectively. If the light house is 100 m high, the distance between the two ships is : (take $\sqrt{3}$ =1.73)

(a) 173 m (b) 200m
(c) 273m (d) 300m

(SSC CGL Pre Exam 2016)

62. A straight tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with the ground. The distance from the foot of the tree to the point, where the top touches the ground is 10m. Find the total height of the tree

(a) $10\sqrt{3}$ m (b) $\frac{10\sqrt{3}}{3}$ m
(c) $10(\sqrt{3}+1)$m (d) $10(\sqrt{3}-1)$m

(SSC CGL Pre Exam 2016)

63. An observer on the top of a mountain, 500 m above the sea level, observes the angles of depression of the two boats in his same place vision to be 45° and 30° respectively. Then the distance between the boats, if the boats are on the same side of the mountain, is

(a) 456 m (b) 584 m

(c) 366 m (d) 699 m

(SSC CGL Pre Exam 2016)

64. A helicopter, at an altitude of 1500m, finds that two ships are sailing towards it, in the same direction. The angles of depression of the ships as observed from the helicopter are 60° and 30° respectively. Distance between the two ships, in metres is

(a) $1000\sqrt{3}$ (b) $350\sqrt{3}$

(c) $500\sqrt{3}$ (d) $450\sqrt{3}$

(SSC CGL Pre Exam 2016)

65. The angles of depression of two ships from the top of a light house are 30°, 45° respectively towards east. If the ships are 200m apart, the height of the light house is (take $\sqrt{3}$ = 1.73)

(a) 273m (b) 270m

(c) 253m (d) 263m

(SSC CGL Pre Exam 2016)

66. The top of a broken tree touches the ground at a distance of 15 m from its base. If the tree is broken at a height of 8 m from the ground, then the actual height of the tree is:

(a) 17 m (b) 20 m

(c) 25 m (d) 30 m

(SSC CGL Pre Exam 2016)

67. From two points, lying on the same horizontal line, the angles of elevation of the top of the pillar are θ and ϕ ($\theta < \phi$). If the height of the pillar is 'h' m and the two points lie on the same sides of the pillar, then the distance between the two points.

(a) $h(\tan\theta - \tan\phi)$m

(b) $h(\cot\theta + \cot\phi)$m

(c) $h(\cot\theta - \cot\phi)$m

(d) $h\dfrac{\tan\theta\tan\phi}{\tan\phi - \tan\theta}$ m

(SSC CGL Pre Exam 2016)

68. A person from the top of a hill observes a vehicle moving towards him at a uniform speed. It takes 10 minutes for the angle of depression to change from 45° to 60°. After this the time required by the vehicle to reach the bottom of the hill is

(a) 12 min 20 sec

(b) 13 min

(c) 13 min 40 sec

(d) 14 min 24 sec

(SSC CGL Mains Exam 2016)

69. From the top of a cliff 100 metre high the angles of depression of the top and bottom of a tower are 45° and 60° respectively. The height of the tower is

(a) $\dfrac{100}{3}\left(3-\sqrt{3}\right)$ metre

(b) $\dfrac{100}{3}\left(\sqrt{3}-2\right)$ metre

(c) $\dfrac{100}{3}\left(2\sqrt{3}-1\right)$ metre

(d) $\dfrac{100}{3}\left(\sqrt{3}-\sqrt{2}\right)$ metre

(SSC CGL Mains Exam 2016)

70. A vertical tower stands on a horizontal plane and is sumounted by a vertical flag staff of height h. At a point on the plane the angle of elevation of the bottom of the flag staff os α and that of the top of the flag staff is a and that of the top of the flag staff is β . Then the height of the tower is

(a) $h\tan\alpha$

(b) $\dfrac{h\tan\alpha}{\tan\beta - \tan\alpha}$

(c) $\dfrac{h\tan\alpha}{\tan\alpha - \tan\beta}$

(d) None of these

(SSC CGL Mains Exam 2016)

71. A man on the of a tower , standing on the sea shore finds that a boat coming towards him takes 10 minutes for the angle of depression to change from 30° to 60° . How soon the boat reach the sea shore?

(a) 5 minutes (b) 7 minutes

(c) 10 minutes (d) 15 minutes

(SSC CGL Mains Exam 2016)

72. The distance between two pillars is 120 metres. The height of one pillar is thrice of the other pillar . The angles of elevation of their tops from the midpoint of the line connecting their feet are complementary to each other. The height (in metres) of the pillar is (use: $\sqrt{3}$ = 1.732)

(a) 34.64 (b) 51.96

(c) 69.28 (d) 103.92

(SSC CGL Mains Exam 2016)

73. The angle of elevation of an aeroplane as observed from a point 30 m above the transport water-surface of lake is 30° and the angle of depression of the image of the aeroplane in the water of the lake is 60°. The height of the aeroplane from the water-surface of the lake is

(a) 60 m. (b) 45 m.

(c) 50 m. (d) 50 m.

(SSC CGL Mains Exam 2016)

74. The angles of depression of two ships from the top of a light house are 60° and 45° towards east. If the ships are 300 m apart, the height of the light house is

(a) $200\left(3+\sqrt{3}\right)$ metere

(b) $250\left(3+\sqrt{3}\right)$ metere

(c) $150\left(3+\sqrt{3}\right)$ metere

(d) $160\left(3+\sqrt{3}\right)$ metere

(SSC CGL Mains Exam 2016)

75. An aeroplane flying horizontally at a height of 3 km. Above the the ground is observed at a certain point on earth to subtend an angle of 60°. After 15 sec flight, its angle of elevation is changed to 30°. The speed of the aeroplane (taking $\sqrt{3}$ =1.732)

(a) 230.63m/sec

(b) 230.93m/sec

(c) 235.85m/sec

(d) 236.25m/sec

(SSC CGL Mains Exam 2016)

76. If the angle of elevation of the sun decreases from 45° to 30°, then the length of the shadow of a pillar increases by 60m. The height of the pillar is

(a) $60(\sqrt{3}+1)$m (b) $30(\sqrt{3}-1)$m

(c) $30(\sqrt{3}+1)$m (d) $60(\sqrt{3}-1)$m

(SSC CGL Mains Exam 2016)

77. The angle of elevation of the top of a tower, vertically erected in the middle of paddy field, from two points on a horizontal line through the foot of the tower are given to be α and β ($\alpha > \beta$). The height of the tower is h unit. A possible distance (in the same unit) between the points is

(a) $\frac{h(\cot\beta - \cot\alpha)}{\cos(\alpha+\beta)}$

(b) $h(\cot\alpha - \cot\beta)$

(c) $\frac{h(\tan\beta - \tan\alpha)}{\tan\alpha\tan\beta}$

(d) $h(\cot\alpha + \cot\beta)$

(SSC CGL Mains Exam 2016)

78. The angle of elevation of the top of an unifinished pillar at a point 150 metres from its base is 30°. The height (in metres) that the pillar must be raised so that its angle of elevation of the same point may be 45°, is (takeing $\sqrt{3}$ =1.732)

(a) 63.4 (b) 86.6

(c) 126.8 (d) 173.2

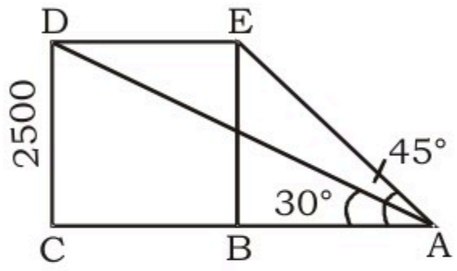
(SSC CGL Mains Exam 2016)

ANSWER KEY

1. (d)	9. (a)	17. (b)	25. (c)	33. (d)	42. (d)	51. (b)	61. (c)	70. (b)	
2. (a)	10. (c)	18. (b)	26. (c)	34. (c)	43. (a)	52. (c)	62. (a)	71. (a)	
3. (c)	11. (d)	19. (a)	27. (b)	35. (c)	44. (b)	53. (d)	63. (c)	72. (d)	
4. (c)	12. (d)	20. (a)	28. (c)	36. (b)	45. (a)	54. (a)	64. (a)	73. (a)	
5. (a)	13. (c)	21. (b)	29. (b)	37. (d)	46. (c)	55. (d)	65. (a)	74. (c)	
6. (c)	14. (b)	22. (a)	30. (d)	38. (d)	47. (a)	56. (a)	66. (c)	75. (b)	
7. (b)	15. (b)	23. (b)	31. (d)	39. (a)	48. (a)	57. (b)	67. (c)	76. (c)	
8. (b)	16. (b)	24. (a)	32. (b)	40. (a)	49. (b)	58. (d)	68. (c)	77. (d)	
				41. (d)	50. (b)	59. (b)	69. (a)	78. (a)	
						60. (c)			

EXPLANATION

1. (d)



In Δ ABE,

$$\tan 45 = \frac{2500}{AB}$$

$$AB = 2500$$

In Δ ACD,

$$\tan 30 = \frac{2500}{AC}$$

$$AC = 2500\sqrt{3}$$

Distance covered by Aeroplane in 15 sec.

$$= AC - AB = 2500\sqrt{3} - 2500$$

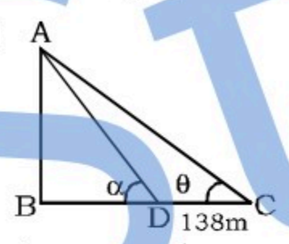
$$= 2500\,(\sqrt{3} - 1)$$

$$\text{speed} = \frac{2500(\sqrt{3}-1)}{15} \text{ m/s}$$

$$= \frac{2500(\sqrt{3}-1)}{15} \times \frac{18}{5} \text{ km/hr.}$$

$$= 600(\sqrt{3} - 1) \text{ km/hr.}$$

2. (a)



Shortcut approach

Ist Case:

$$\tan\theta = \frac{AB}{BC} = \frac{\text{Perpendicular}}{\text{Base}} = \frac{1}{5}$$

IInd Case:

$$Sec\alpha = \frac{AD}{BD} = \frac{Hypo}{Base}$$

$$= \frac{\sqrt{193}}{12}$$

In ΔABD

Hypo = $\sqrt{193}$

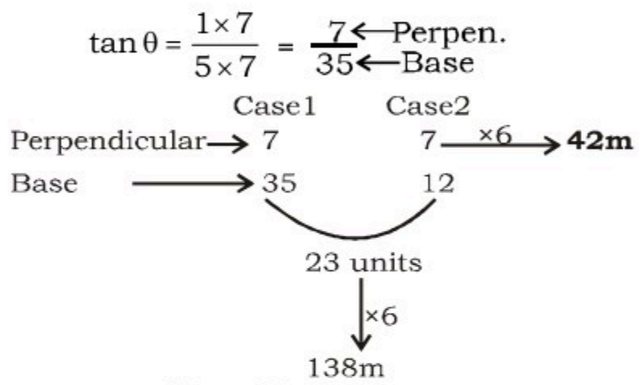
Base = 12

Then perpendicular = 7

(By pythagoras theorem)

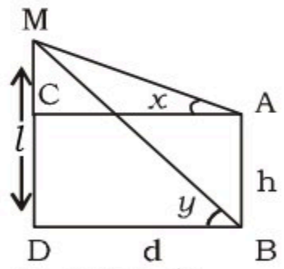
In both case perpendicular will be equal

$$\tan\theta = \frac{1\times 7}{5\times 7} = \frac{7 \leftarrow \text{Perpen.}}{35 \leftarrow \text{Base}}$$



AB = **42m**

3. (c)



AB = tree 'h'

MD = Building 'l'

DB = CA = 'd'

In ΔMCA

$$\tan x = \frac{MC}{AC} = \frac{l-h}{d}$$

$$\Rightarrow d = \frac{l-h}{\tan x} \Rightarrow d = (l - h)\cot x \ldots\ldots(i)$$

In ΔMDB

$$\tan y = \frac{MD}{DB} = \frac{l}{d}$$

$d = l \cot y$ .....*(ii)*

from equation (i) and (ii)

$(l - h)\cot x = l \cot y$

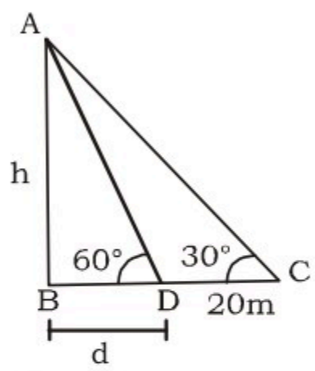
$(l - h)\cot x = l \cot y$

$l \cot x - h \cot x = l \cot y$

$h \cot x = l\,(\cot x - \cot y)$

$$l = \frac{h\cot x}{\cot x - \cot y}$$

4. (c)



AB = 'h' metre

In ΔABC

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{h}{(d+20)}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{(d+20)}$$

$$\sqrt{3}h = d + 20\ldots\ldots(i)$$

In ΔABD

$$\tan 60° = \frac{AB}{BD} = \frac{h}{d}$$

$$\sqrt{3} = \frac{h}{d}$$

$$h = \sqrt{3}d$$

$$d = \frac{h}{\sqrt{3}} \ldots\ldots\ldots\ldots(ii)$$

Put the value of d in equation (i)

$$\sqrt{3}h = \frac{h}{\sqrt{3}} + 20$$

$$\sqrt{3}h = \frac{h+20\sqrt{3}}{\sqrt{3}}$$

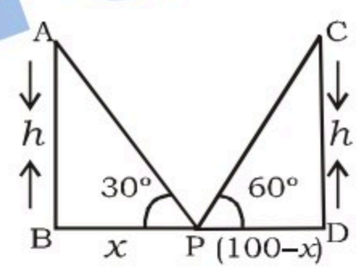
$$3h = h + 20\sqrt{3}$$

$$2h = 20\sqrt{3}$$

$$h = \frac{20\sqrt{3}}{2}$$

$$h = 10\sqrt{3} \text{ metre}$$

5. (a)



BD = 100

AB = CD = 'h' metre (Height of pole)

In ΔABP

$$\Rightarrow \tan 30° = \frac{h}{x}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x} \Rightarrow \sqrt{3}h = x \ldots\ldots(i)$$

In ΔCDP

$$\tan 60° = \frac{h}{(100-x)}$$

$$\Rightarrow \sqrt{3}\,(100 - x) = h$$

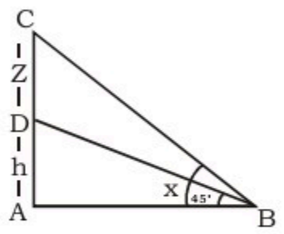
(Put the value of x from equation (i)

$$\Rightarrow \sqrt{3}\left(100 - \sqrt{3}h\right) = h$$

$$\Rightarrow 100\sqrt{3} - 3h = h \Rightarrow 4h = 100\sqrt{3}$$

$$h = 25\sqrt{3} \text{ metre}$$

6. (c) Height building, AD = h



Let height of chimney, CD = Z

In triangle ABC:

AB = AC cotx = (h + z) cotx .....(i)

In triangle ABD:

AB = AD cot 45° = h ..... (ii)

From (i) and (ii):

(h +z) cot x = h

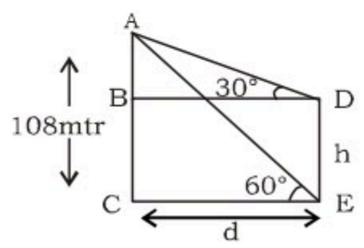
$\Rightarrow$ hcotx + zcotx = h

$$\Rightarrow z = \frac{h(1-\cot x)}{\cot x} = \frac{h\left(1-\frac{1}{\tan x}\right)}{\frac{1}{\tan x}}$$

$\Rightarrow z$ = h (tan$x$ – 1) = h tan x – h

Hence height of chimney = (h tan$x$ – h)

7. (b)



In ΔACE

$$\tan 60° = \frac{AC}{CE}$$

$$\frac{\sqrt{3}}{1} = \frac{AC}{CE} = AC : CE = \sqrt{3} : 1 \quad .....(i)$$

In ΔABD

$$\tan 30° = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD} \Rightarrow AB : BD = 1 : \sqrt{3} \quad .....(ii)$$

Since BD = CE

$\therefore$ AC : CE : AB

equation(I)$\rightarrow$ $\sqrt{3}$: 1

equation(II)$\rightarrow$ $\sqrt{3}$: 1

3 : $\sqrt{3}$: 1

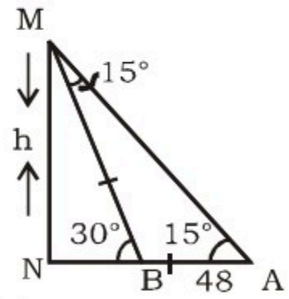
×36 ×36

acutal height $\rightarrow$ 108 36

$\Rightarrow$ DE = AC – AB = 108 – 36

= 72 metre

8. (b)



MN is tower

In ΔMNB

$\angle MBN = \angle MAB + \angle BMA$

(Triangle property)

$30° = 15° + \angle BMA$

$\angle BMA$ = 15°

So AB = BM = 48

In ΔMNB

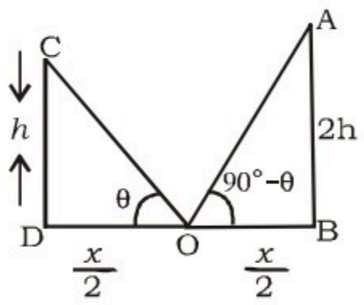
hypo : Base : height

2 : $\sqrt{3}$: 1

×24 ×24

48 **24m**

9. (a)



OB = OD = $\frac{x}{2}$

In ΔOCD

$$\tan\theta = \frac{\frac{h}{x}}{2} \Rightarrow \frac{2h}{x} \quad .....(i)$$

In ΔAOB

$$\tan(90° - \theta) = \frac{AB}{OB}$$

$$\Rightarrow \cot\theta = \frac{2h}{\frac{x}{2}} = \frac{4h}{x} \quad .....(ii)$$

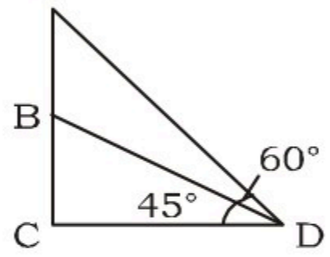
Multiplying both equations

$$\tan\theta.\cot\theta = \frac{2h}{x} \times \frac{4h}{x}$$

$\Rightarrow x^2$ = 8h²

$\Rightarrow h^2 = \frac{x^2}{8} \Rightarrow h = \frac{x}{2\sqrt{2}}$ metre

10. (c) A



AC = 5000

In ΔACD

$$\tan 60° = \frac{AC}{CD}$$

$$\sqrt{3} = \frac{AC}{CD} \Rightarrow AC:CD = \sqrt{3} : 1$$

In ΔBCD

$$\tan 45° = \frac{BC}{CD}$$

$$1 = \frac{BC}{CD} = BC : CD = 1 : 1 \quad .....(ii)$$

Now,

BC	:	CD	:	AC
1	:	1	:	
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

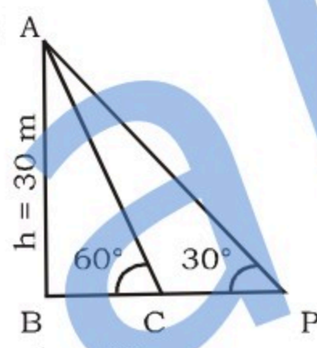
AB = AC – BC = $\left(\sqrt{3}-1\right)$ units

AC = $\sqrt{3}$ units = 5000 m

AB = $\left(\sqrt{3}-1\right)$ units = $\frac{5000}{\sqrt{3}}\left(\sqrt{3}-1\right)$

= $5000\left[1-\frac{1}{\sqrt{3}}\right]$ m

11. (d)



h = 30 m

PC = ?

In ΔABP

$$\tan 30° = \frac{AB}{BP}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BP} \Rightarrow AB : BP = 1 : \sqrt{3} \quad .....(i)$$

In ΔABC

$$\tan 60° = \frac{AB}{BC}$$

$$\frac{\sqrt{3}}{1} = \frac{AB}{BC} \Rightarrow AB : BC = \sqrt{3} : 1 \quad .....(ii)$$

BP	:	AB	:	BC
$\sqrt{3}$	:	1		
		$\sqrt{3}$	:	1
3	:	$\sqrt{3}$	:	1

Now

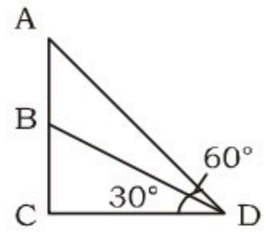
AB = $\sqrt{3}$ units = 30 metre

1 unit = $\frac{30}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 10\sqrt{3}$

PC = 3 – 1 = 2 units

= $10\sqrt{3} \times 2 = 20\sqrt{3}$ metre

12. (d) BC = 3125



In ΔACD

$$\text{Tan}60° = \frac{AC}{DC}$$

$$\frac{\sqrt{3}}{1} = \frac{AC}{DC}$$

$$AC : DC = \sqrt{3} : 1 \text{.....(i)}$$

In ΔDCB

$$\text{Tan}30° = \frac{BC}{DC}$$

$$\frac{1}{\sqrt{3}} = \frac{BC}{DC}$$

$$BC : DC = 1 : \sqrt{3} \text{ .....(ii)}$$

Now,

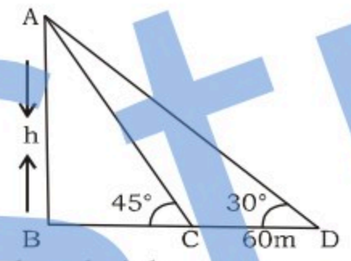
AC	:	DC	:	BC
$\sqrt{3}$	:	1		
		$\sqrt{3}$	:	1
3	:	$\sqrt{3}$	:	1
				(3125m)

AB = AC – BC

$\Rightarrow$ 3 – 1 = 2 units

= 2 × 3125 = **6250 m**

13. (c)



h = height

In ΔABC

$$\tan45° = \frac{AB}{BC}$$

$$\frac{1}{1} = \frac{AB}{BC} = AB : BC = 1 : 1 \text{ .....(i)}$$

In ΔABD

$$\tan30° = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD} \Rightarrow AB : BD = 1 : \sqrt{3} \text{ .....(ii)}$$

Now,

BD	:	AB	:	BC
		1	:	1
$\sqrt{3}$	:	1		
$\sqrt{3}$	:	1	:	1

CD = BD – BC

CD = $\sqrt{3}$ – 1

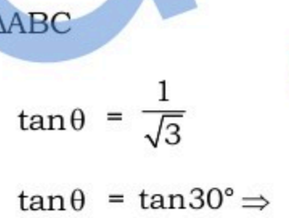
$\sqrt{3}$ – 1 units = 60

H = 1 unit = $\frac{60}{\sqrt{3}-1}$

$= \frac{60}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

h $\Rightarrow$ $30\left(\sqrt{3}+1\right)$ m

14. (b)



MAB was straight earlier

AB + AM = 15 ft

In ΔABM

$$\tan30° = \frac{AB}{BM}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BM}$$

If AB = 1

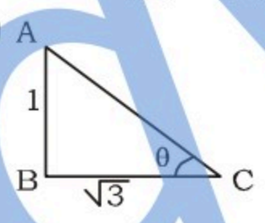
BM = $\sqrt{3}$

then AM = 2(By pythagoras theorem)

AB + AM = 2 +1 $\Rightarrow$ 3 units = 15 ft

AB = 1 unit = 5ft

15. (b)



In ΔABC

$$\tan\theta = \frac{1}{\sqrt{3}}$$

$\tan\theta = \tan30° \Rightarrow \theta = 30°$

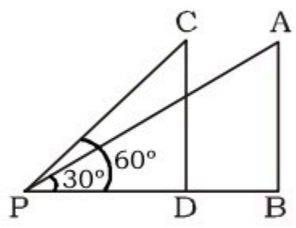
16. (b)

Height		Shadow
6ft		4ft
3	:	2

So height of pole will be in same ratio.

$= 50 \times \frac{3}{2}$ = **75ft**

17. (b)



AB = CD = $1500\sqrt{3}$

(height of aeroplane)

In ΔPDC

$$\tan60° = \frac{CD}{PD}$$

$$\sqrt{3} = \frac{CD}{PD} \Rightarrow CD:PD = \sqrt{3} : 1 \text{...(i)}$$

In ΔPBA

$$\tan30° = \frac{AB}{PB}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{PB} \Rightarrow AB : PB = 1 : \sqrt{3} \text{.....(ii)}$$

AC = BD and AB = CD

PD	:	AB	:	PB
1	:	$\sqrt{3}$		
		1	:	$\sqrt{3}$
1	:	$\sqrt{3}$	:	3

DB = PB – PD

= 3 – 1 = 2 units

AB = $\sqrt{3}$ units = $1500\sqrt{3}$ m

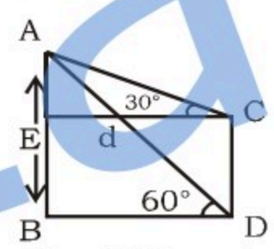
$\Rightarrow$ 1 unit = 1500 m

CA = DB $\Rightarrow$ 2 units = 3000 metre

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$= \frac{3000}{15}$ =200 m/s

18 (b)



AB and CD are temples

BD = width of river

AB = 54 m

In ΔAEC

$$\tan30° = \frac{AE}{EC} = \frac{1}{\sqrt{3}} \Rightarrow AE : EC = 1 : \sqrt{3}$$

In ΔABD

$$\tan60° = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{AB}{BD} \Rightarrow AB : BD = \sqrt{3} : 1 \text{.....(ii)}$$

EB = CD and EC = BD

Now,

AB	:	BD	:	AE
		$\sqrt{3}$	:	1
$\sqrt{3}$	:	1		
3	:	$\sqrt{3}$	:	1

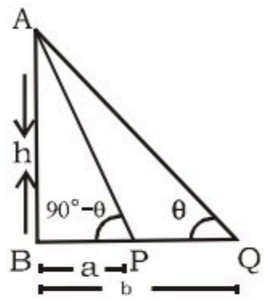
CD = AB – AE

= 3 – 1 = 2 units

AB = 3 units × 18 = 54 m

CD =2 units × 18 = 36 m

19. (a)



AB is tower

$\therefore \quad \angle AQB = \theta \ \therefore \angle APB = 90° - \theta$

PB = a, BQ = b

In ΔAQB

$$\tan\theta = \frac{AB}{BQ}$$

$$\tan\theta = \frac{h}{b} \ldots\ldots\ldots (i)$$

In ΔAPB

$$\tan(90° - \theta) = \frac{h}{PB}$$

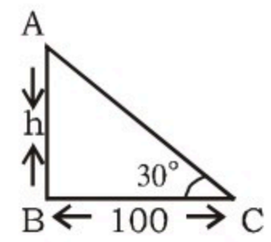
$$\Rightarrow \quad Cot\theta = \frac{h}{a} \ldots\ldots\ldots (ii)$$

By multiplying both equation

$$\tan\theta . \cot\theta = \frac{h}{b} \times \frac{h}{a}$$

$$h^2 = ab \Rightarrow h = \sqrt{ab}$$

20. (a)



In ΔABC

$$\tan 30° = \frac{AB}{BC}$$

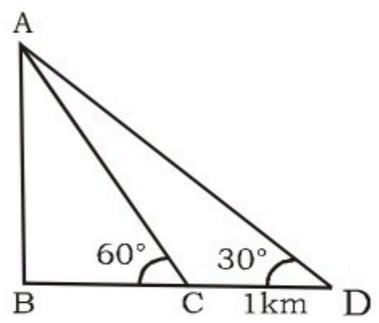
$$\frac{1}{\sqrt{3}} = \frac{AB}{BC}$$

$\Rightarrow$ AB : BC = 1 : $\sqrt{3}$

$\frac{100}{\sqrt{3}}$ 100m

21. (b) It should be on circumcentre.

22. (a)



AB = height of balloon

In ΔABC

$$\tan 60° = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{AB}{BC} \Rightarrow AB : BC = \sqrt{3} : 1$$

In ΔABD

$$\tan 30° = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD} = AB : BD = 1 : \sqrt{3} \quad \ldots\ldots (ii)$$

In ΔABD

$$\tan 30° = \frac{AB}{BD} = \frac{1}{\sqrt{3}} \Rightarrow AB : BD = 1 : \sqrt{3}$$

Now,

BC	:	AB	:	BD
1	:	$\sqrt{3}$		
		1	:	$\sqrt{3}$
1	:	$\sqrt{3}$	:	3

CD = BD – BC

= 3 – 1 = 2 units

2 units = 1 km

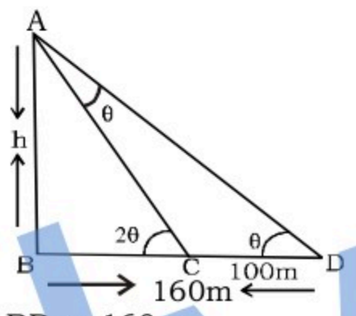
1 unit = $\frac{1}{2}$

AB = $\sqrt{3}$ unit = $\frac{1}{2} \times \sqrt{3} = \frac{\sqrt{3}}{2}$ km

23. (b)

	Height	:	Shadow
Stick →	12	:	8
Tower →	3	:	2
	×20		×20
	60m		40m

24. (a)



BD = 160m

In ΔACD

exter. $\angle ACB = \angle CAD + \angle ADC$

$2\theta = \angle CAD + \theta$

$\angle CAD = \theta$

$\therefore$ AC = CD

AC = 100 m

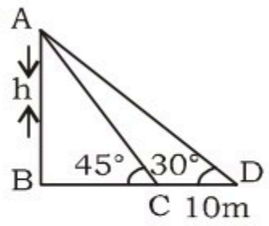
In ΔABC

AC = 100 m

BC = 160 – 100 = 60 m

Then AB = 80 m (By pythagoras theorem)

25. (c)



AB = tower = h

In ΔABC

$$\tan 45° = \frac{AB}{BC} = 1$$

AB : BC = 1 : 1 .....(i)

In ΔABD

$$\tan 30° = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD} = AB : BD = 1 : \sqrt{3} \quad \ldots\ldots (ii)$$

Now,

BC	:	AB	:	BD
1	:	1		
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

CD = BD – BC

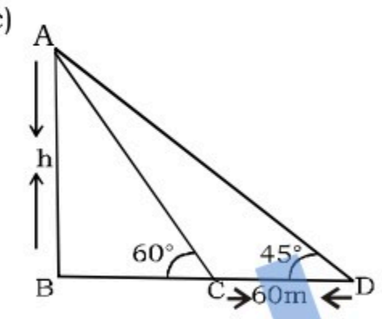
$= \sqrt{3} - 1$

$(\sqrt{3} - 1)$ units = 10 m

(AB) = 1 unit = $\frac{10}{\sqrt{3} - 1}$

$= 5(\sqrt{3} + 1)$ metre

26. (c)



AB height of tower

In ΔABC

$$\tan 60° = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{AB}{BC} \Rightarrow AB : BC = \sqrt{3} : 1 \ldots.(i)$$

In ΔABD

$$\tan 45° = \frac{AB}{BD}$$

$$1 = \frac{AB}{BD} \Rightarrow AB : BD = 1 : 1 \ldots\ldots\ldots (ii)$$

Now

BD	:	AB	:	BC
1	:	1		
		$\sqrt{3}$	:	1
$\sqrt{3}$	:	$\sqrt{3}$	:	1

CD = BD – BC

$= (\sqrt{3} - 1)$

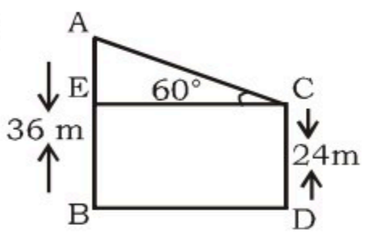
$(\sqrt{3} - 1)$ = 60 metre

1 unit = $\frac{60}{\sqrt{3} - 1}$

AB = $\sqrt{3}$ units = $\frac{60}{\sqrt{3} - 1} \times \sqrt{3}$

$= 30(3 + \sqrt{3})$ m

27. (b)



AC = wire

AB and CD are two poles

In ΔAEC

$$\sin 60° = \frac{AE}{AC}$$

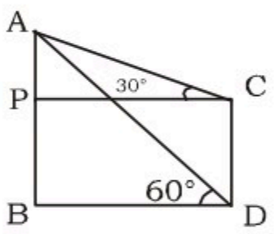
$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{12}{AC}$$

(AE = AB – CD = 36 – 24 = 12 m)

$$AC = \frac{24}{\sqrt{3}}$$

$$= 8\sqrt{3} \text{ m}$$

28. (c)



AB = hill =200 metre

CD = tower

In ΔAPC

$$\tan 30° = \frac{AP}{PC}$$

$$\frac{1}{\sqrt{3}} = \frac{AP}{PC} \Rightarrow AP : PC = 1 : \sqrt{3} \quad \text{.....(i)}$$

In ΔABD

$$\tan 60° = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{AB}{BD} = AB : BD = \sqrt{3} : 1 \text{.....(ii)}$$

PB = CD and PC = BD

Now

AB	:	BD	:	AP
$\sqrt{3}$	:	1		
		$\sqrt{3}$	:	1
3	:	$\sqrt{3}$	:	1

CD = PB $\Rightarrow$ AB – AP

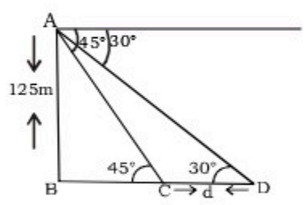
CD = 3 – 1 = 2 units

AB = 3 units = 200 metre

$$CD = 2 \text{ units} = \frac{200}{3} \times 2$$

$$= 133\frac{1}{3} \text{ metre}$$

29. (b)



AB = Tower

In ΔABC $\tan 45° = \frac{AB}{BC}$

$$1 = \frac{AB}{BC} = AB : BC = 1 : 1 \text{ ....(i)}$$

In $\Delta ABD = \tan 30° = \frac{AB}{BD}$

$$= AB : BD = 1 : \sqrt{3} \text{ .(ii)}$$

Now,

BC	:	AB	:	BD
1	:	1		
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

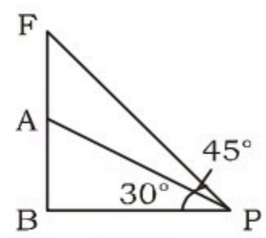
CD = BD – BC

$$= \left(\sqrt{3} - 1\right) \text{units}$$

AB =1unit = 125 metre

CD $= \left(\sqrt{3} - 1\right)$ units $= 125\left(\sqrt{3} - 1\right)$ metre

30. (d)



AB - bulding = 10 m

In ΔABP

$$\tan 30° = \frac{AB}{BP}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BP} = AB : BP = 1 : \sqrt{3} \text{.....(i)}$$

In ΔFBP

$$\tan 45° = \frac{FB}{BP}$$

$$1 = \frac{FB}{BP} = FB : BP = 1 : 1 \text{.....(ii)}$$

now,

AB	:	BP	:	FB
1	:	$\sqrt{3}$		
		1	:	1
1	:	$\sqrt{3}$	:	$\sqrt{3}$
×10 ↓				×10 ↓
10m				$10\sqrt{3}$

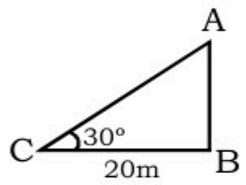
FB =17.32 m

FA = FB – AB

= 17.32 – 10

= 7.32 metre

31. (b)



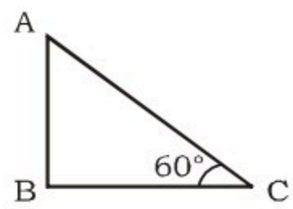
AB = Tower

In ΔABC

$$\tan 30° = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{20} \Rightarrow AB = \frac{20}{\sqrt{3}}$$

32. (b)



AC = Ladder

BC = 6.5 metres

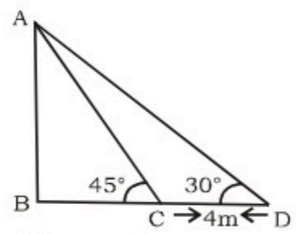
In ΔABC

$$\cos 60° = \frac{BC}{AC}$$

$$\frac{1}{2} = \frac{6.5}{AC} \text{ m}$$

AC = 13 m

33. (d)



AB = pole

In ΔABC

$$\tan 45° = \frac{AB}{BC}$$

$$1 = \frac{AB}{BC} = AB : BC = 1 : 1 \text{ .....(i)}$$

In ΔABD

$$\tan 30° = \frac{AB}{BD} = AB : BD = 1 : \sqrt{3} \text{ ....(ii)}$$

BC	:	AB	:	BD
1	:	1		
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

CD = BD – BC

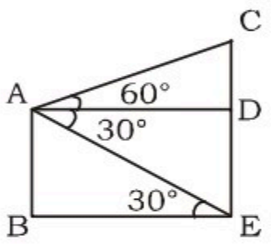
$$= \sqrt{3} - 1$$

$$= \sqrt{3} - 1 \text{ units} = 4 \text{ m}$$

$$AB = 1\text{unit} = \frac{4}{\sqrt{3} - 1}$$

$$= 2\left(\sqrt{3} + 1\right) = 5.464 \text{ m}$$

34. (c)



AB = pole CE = tower

AB = 10 metre

In ΔABE

$$\tan 30° = \frac{AB}{BE}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BE} = AB : BE = 1 : \sqrt{3} \text{ .....(i)}$$

In ΔACD

$\tan 60° = \frac{CD}{AD}$

$\frac{\sqrt{3}}{1} = \frac{CD}{AD}$ = CD : AD = $\sqrt{3}$: 1....(ii)

AD = BE and AB = DE

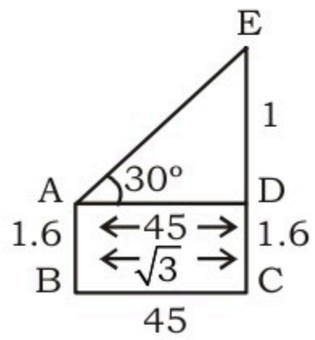
Now,

AB	:	BE	:	CD
1	:	$\sqrt{3}$		
		1	:	$\sqrt{3}$
1	:	$\sqrt{3}$	:	3
×10				×10
10 metre				30 metre

CE = CD + DE

= 30 + 10 = 40 metre

35. (c)



Let height of observer = AB

$\sqrt{3}$ unit = 45 m

1 unit = $\frac{45}{\sqrt{3}}$ = 25.98 m

So,

ED = 25.98 m

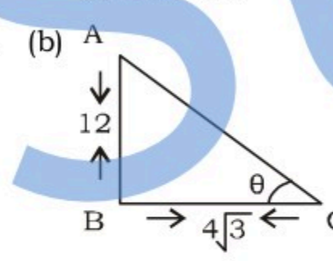
So,

Height of tower = ED+CD

= 25.98 + 1.6

= 27.58 m

36. (b)



In ΔABC

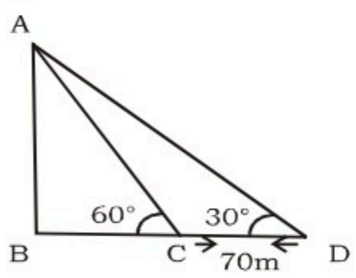
$\tan\theta = \frac{AB}{BC} = \frac{12}{4\sqrt{3}}$

$\tan\theta = \frac{3}{\sqrt{3}}$

$\tan\theta = \sqrt{3} = \tan 60°$

$\theta = 60°$

37 (d)



In ΔACD

$\angle ACB = \angle CAD + \angle ADC$

$60° = \angle CAD + 30°$

$\angle CAD = 30°$

So,

AC = CD

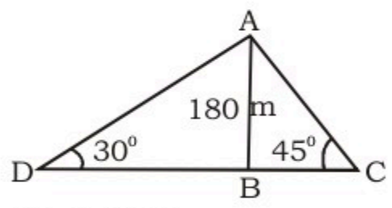
AC = 70m

$\text{cosec } 60° = \frac{AC}{AB}$

$\frac{2}{\sqrt{3}} = \frac{70}{AB}$

AB = $35\sqrt{3}$ m

38. (d)



AB = 180m

In ΔABC

$\tan 45^0 = \frac{AB}{BC}$

$1 = \frac{AB}{BC} \Rightarrow$ AB : BC = 1:1 .....(1)

In ΔABD

$\tan 30^0 = \frac{AB}{BD}$

$\frac{1}{\sqrt{3}} = \frac{AB}{BD}$

AB : BD = $1:\sqrt{3}$ .....(ii)

BC	:	AB	:	BD
1	:	1		
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

CD = BD + BC

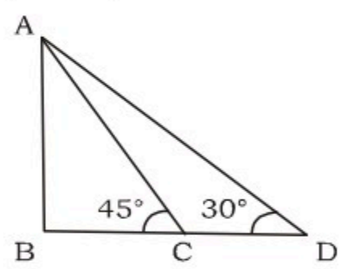
$= \left(\sqrt{3}+1\right)$ units

AB = 1 unit = 180 m

CD = $\left(\sqrt{3}+1\right)$ units =

$180\left(\sqrt{3}+1\right)$ m

39 (a)



AB = height of peak = 300 m

CD = length of Bridge

In ΔABC

$\tan 45° = \frac{AB}{BC}$

$1 = \frac{AB}{BC} \Rightarrow$ AB : BC = 1 : 1

In ΔABD

$\tan 30° = \frac{AB}{BD}$

$\frac{1}{\sqrt{3}} = \frac{AB}{BD} \Rightarrow$ AB : BD = 1 : $\sqrt{3}$

Now,

BC	:	AB	:	BD
1	:	1		
		1	:	$\sqrt{3}$
1	:	1	:	$\sqrt{3}$

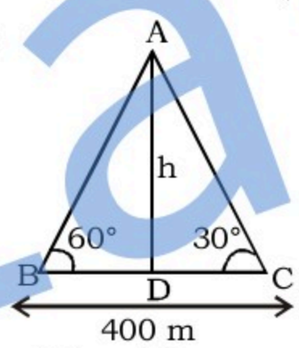
CD = BD – BC

CD $\Rightarrow \sqrt{3} - 1$

AB = 1 unit = 300 metre

$\left(\sqrt{3}-1\right)$ units = $300\left(\sqrt{3}-1\right)$ metre

40. (a)



BC = 400 metres

In ΔABD

$\tan 60° = \frac{AD}{BD}$

$\frac{\sqrt{3}}{1} = \frac{AD}{BD} \Rightarrow$ AD : BD = $\sqrt{3}$: 1....(i)

In ΔADC

$\tan 30° = \frac{AD}{DC}$

$\frac{1}{\sqrt{3}} = \frac{AD}{DC} \Rightarrow$ AD : DC = 1 : $\sqrt{3}$ .....(ii)

Now,

BD	:	AD	:	DC
1	:	$\sqrt{3}$		
		1	:	$\sqrt{3}$
1	:	$\sqrt{3}$	:	3

BC = BD + DC

= 1 + 3 = 4 units.

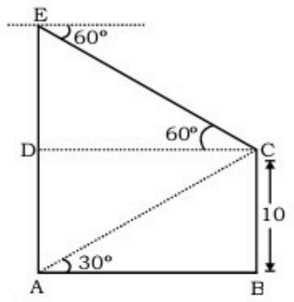
4 units = 400m

1 unit = 100m

AD = $\sqrt{3}$ unit

= $100\sqrt{3}$ = 100 × 1.732 = 173.2m

41.(d) According to the question.



From figure, AB = CD
height of pillar BC = AD = 10 m
In triangle ABC,
AB = BC cot 30°

$AB = 10\sqrt{3}$

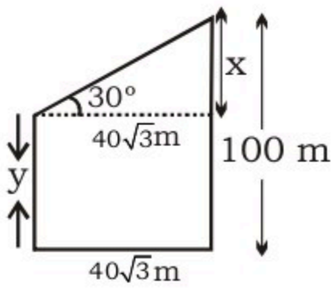
also AB = CD = $10\sqrt{3}$ m

In triangle CDE,
DE = DC tan60°

$DE = 10\sqrt{3}\ \sqrt{3} = 30$

Height of the hill = AD + DE = 10 + 30 = 40m

42. (d)



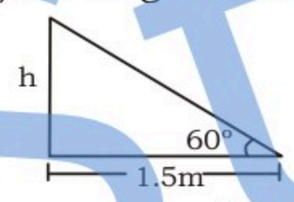
$$\tan 30° = \frac{x}{40\sqrt{3}}$$

$$\frac{1}{\sqrt{3}} = \frac{x}{40\sqrt{3}}$$

x = 40

So, y = 100 – 40 = 60

43. (a) Let height of Pole = h mtr.

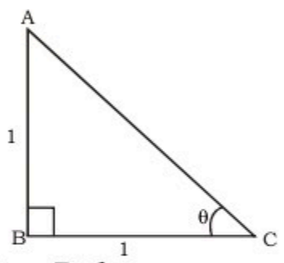


$$\tan 60° = \frac{h}{1.5}$$

$h = 1.5 \times \tan 60°$

$= 1.5 \times \sqrt{3} = \frac{3\sqrt{3}}{2} mtr$

44. (b)



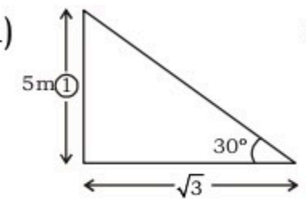
AB = Pole
BC = Shadow

$$\tan\theta = \frac{AB}{BC} = \frac{1}{1}$$

$\tan\theta = \tan 45°$

$\theta = 45°$

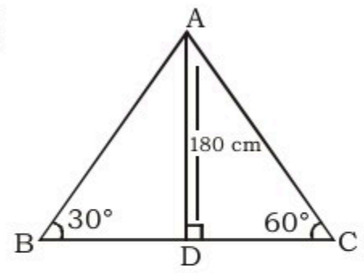
45. (a)

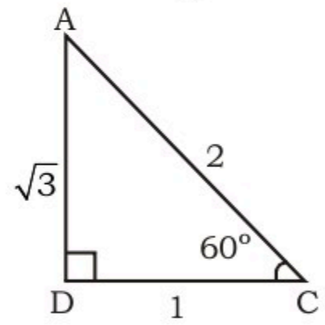


1 unit = 5m

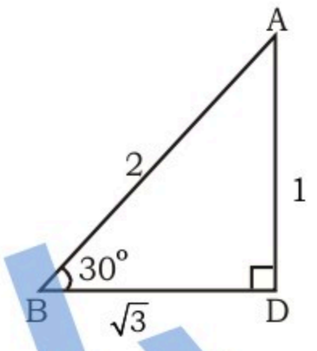
$\sqrt{3}$ unit = $\mathbf{5\sqrt{3}\ m}$

46. (c)





AD : CD = $\sqrt{3}$: 1 ...(i)



AD : BD = 1 : $\sqrt{3}$ ...(ii)

From Eq. (i) & (ii) to make equal ratio

CD : AD : BD = 1 : $\sqrt{3}$: 3

AD is equal in both triangle
BC = DC + BD
BC = 1 + 3 = 4 units

$\sqrt{3}$ units —— 180m

1 unit ——— $\frac{180}{\sqrt{3}}$

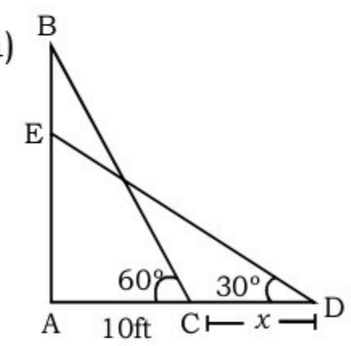
Now, Distance between the two ships

4 units —— $\frac{180}{\sqrt{3}} \times 4$

$= \frac{180 \times 4 \times \sqrt{3}}{3} = 240\sqrt{3}$ m

$= 415.58$ m

47. (a)



AB =10 tan60° = $10\sqrt{3}$

BC = 10 sec60° = 20

Since, length of ladder will remain same, hence BC = DE = 20

In triangle ADE, DE = 20 ft

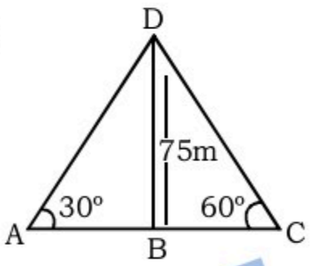
$$\Rightarrow \frac{AD}{DE} = \cos 30°$$

$$\Rightarrow AD = 20 \times \frac{\sqrt{3}}{2} = 10\sqrt{3}$$

$\Rightarrow x = AD - AC = 10\sqrt{3} - 10$

$\Rightarrow x = 10\ (\sqrt{3} - 1)$ft

48. (a)



AB = 75 cot30° = $75\sqrt{3}$

BC = 75 cot60° = $\frac{75}{\sqrt{3}}$

distance between them = AB + BC

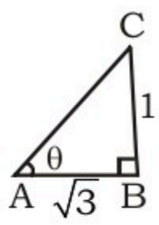
$= 75\sqrt{3} + \frac{75}{\sqrt{3}}$

$= \frac{225+75}{\sqrt{3}} = \frac{300}{\sqrt{3}} = 173.2$m

49. (b) Let angle = θ

Let length = BC = 1

so shadow = AB = $\sqrt{3}$



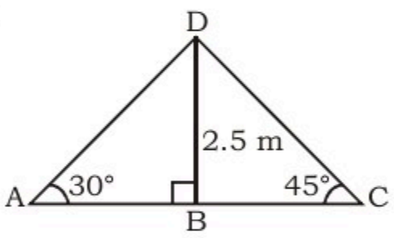
$$\tan\theta = \frac{BC}{AB}$$

$$\tan\theta = \frac{1}{\sqrt{3}}$$

$\tan\theta = \tan 30°$

$\theta = 30°$

50. (b)



In Δ ABD,

$$\tan 30° = \frac{2.5}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{2.5}{AB}$$

$AB = 2.5 \times \sqrt{3} = 2.5 \times 1.732$

$= 4.33$

In $\triangle$ BDC

$$\tan 45 = \frac{2.5}{BC}$$

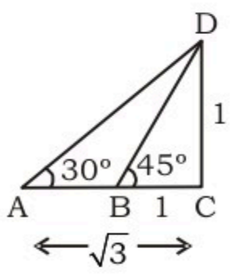
$$\boxed{BC = 2.5}$$

Width of river = AB + BC

= 4.33 + 2.5 = 6.83 metre

51. (b) Let length of tower = CD = 1 unit

difference b/w shadow's length = AC – BC =

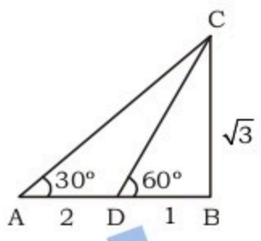


$\sqrt{3} - 1$ unit

$\because$ 1 unit = 50 m

so $\sqrt{3} - 1 = 50\ (\sqrt{3} - 1)$

52. (c)



CB = 50 tan 60 = $50\sqrt{3}$

$$AB = \frac{50\sqrt{3}}{\tan 30^\circ} = 50 \times 3 = 150$$

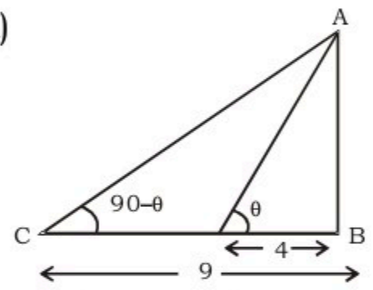
AD = AB – BD = 150–50

= 100

$$\text{speed of boat} = \frac{100}{8} = \frac{25}{2} \text{ m/s}$$

$$= \frac{25}{2} \times \frac{18}{5} = 45 \text{ km/hr}$$

53. (d)

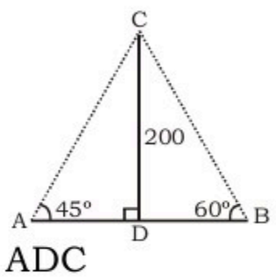


In such type of question when angle are complementary

height of tower AB = $\sqrt{4 \times 9}$

= $\sqrt{36}$ = 6 m

54. (a)



In ADC

$$\tan 45 = \frac{CD}{AD}$$

CD = AD = 200

In CDB

$$\tan 60 = \frac{CD}{BD}$$

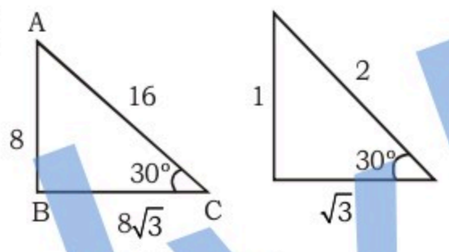
$$\sqrt{3} = \frac{200}{BD}$$

$$BD = \frac{200}{\sqrt{3}}$$

Then width of river

$$= \left(200 + \frac{200}{\sqrt{3}}\right) mt$$

55. (d)



$$\tan 30^\circ = \frac{AB}{8\sqrt{3}} \qquad \frac{1}{\sqrt{3}} = 8\sqrt{3}$$

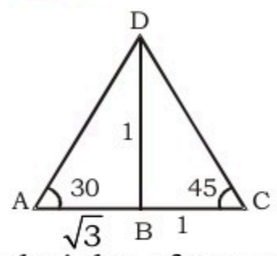
$$\frac{1}{\sqrt{3}} = \frac{AB}{8\sqrt{3}} \qquad 1 = 8$$

AB = 8 $\qquad$ 2 = 16

Length of post = AB + AC

= 8 + 16 = 24 meter.

56. (a)



Let height of tower = BD

Distance b/w both person = AC

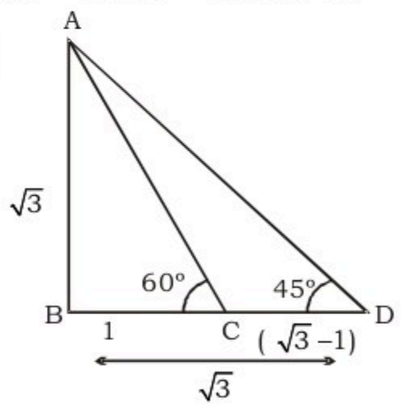
1 unit = 50 m

AC = $(1 + \sqrt{3})$ unit = $50\ (1 + \sqrt{3})$

= $50 + 50\sqrt{3}$ = 50 + 50 × 1.732

= 50 + 86.6 = 136.6 m

57. (b)



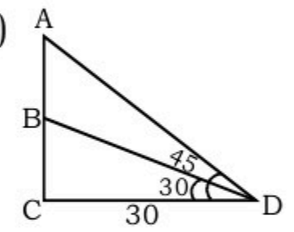
According to questions

$\because$ $\sqrt{3} - 1 = 10$

$$\therefore\ 1 = \frac{10}{\sqrt{3} - 1}$$

$$\therefore\ \sqrt{3} = \frac{10}{\sqrt{3} - 1} \times \sqrt{3} = 5(3 + \sqrt{3})$$

58. (d)



$\tan 30^\circ = \frac{BC}{30}$ and $\tan 45^\circ = \frac{AC}{CD}$

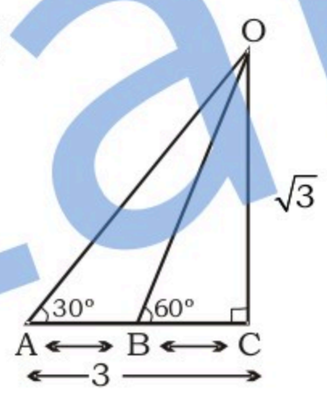
$BC = 10\sqrt{3}$ $\qquad$ CD = AC = 30

Height of flag AB = AC – BC

= $30 - 10\sqrt{3}$ = 30 – 17.32

= 12.68 m

59. (b)



Let breadth of the river = BC and height of tree = CD

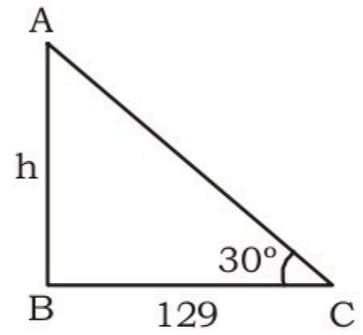
AB = AC – BC = 3 – 1 = 2 units

BC = 1 unit

2 unit = 36 m

breadth = 1 unit = 18 m

60. (c)



$$\tan\theta = \frac{h}{129}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{129}$$

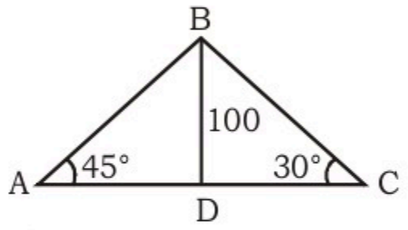
$$h = \frac{129 \times \sqrt{3}}{3} = 43\sqrt{3}$$

61. (c) $\tan 30° = \frac{100}{DC}$

$DC = 100\sqrt{3}$

$\tan 45° = \frac{BD}{AD}$

$AD = 100$



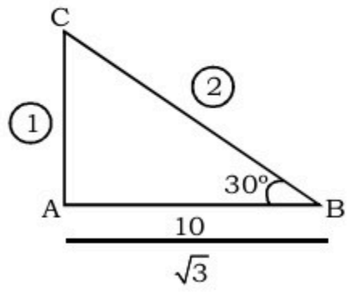
Then Distance = AC

$= 100\sqrt{3} + 100 = 100(\sqrt{3}+1)$

$= 100\,(1.73 + 1) = 2.73 \times 100$

$= 273$

62. (a)



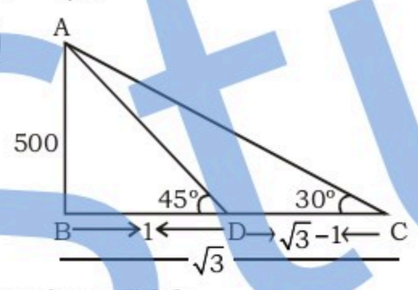
$\sqrt{3}$ unit = 10

1 unit = $\frac{10}{\sqrt{3}}$

(1 + 2) = 3 unit = $\frac{30}{\sqrt{3}}$

$\frac{30}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 10\sqrt{3}$

63. (c)



1 unit = 500

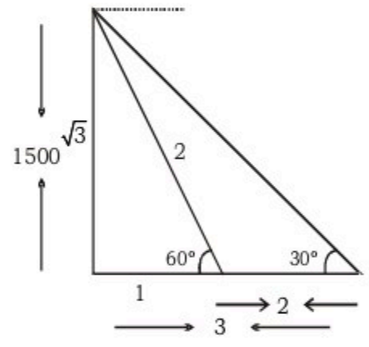
$\sqrt{3}-1$ unit = $500(\sqrt{3}-1)$

$500(1.732 - 1)$

500×0.732

CD = 366 m

64. (a)



$\sqrt{3}$ units $\rightarrow$ 1500

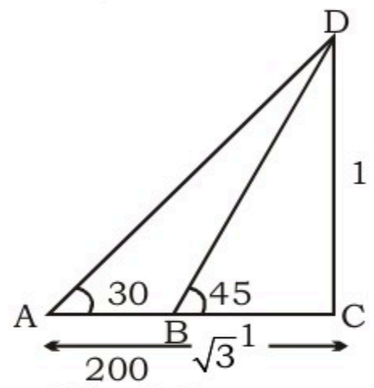
1 unit $\rightarrow \frac{1500}{\sqrt{3}}$

Distance b/w the two boats (3–1) = 2 units $\rightarrow \frac{3000}{\sqrt{3}}$

$\Rightarrow 1000\sqrt{3}$

65. (a) Let height of light house = CD

By Figure



AB = AC – BC

$= \sqrt{3} - 1$

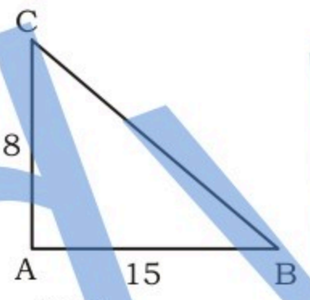
$(\sqrt{3}-1)$ units = 200 cm

(1.732 –1) units = 200 cm

.732 units = 200 cm

So, CD = 1 unit = 273 cm

66. (c) Let total height of tree = AC+BC



in Δ ABC

$BC^2 = AC^2 + AB^2$

$= 8^2 + 15^2$

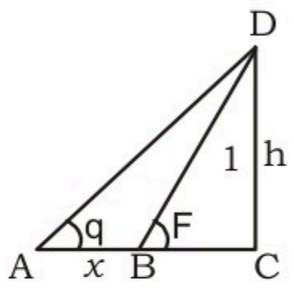
$= 64 + 225$

$BC = \sqrt{289} = 17$

total height = 17+8

= 25 m

67. (c) Let distance b/w points = x



in Δ BCD

$\tan\phi = \frac{h}{BC}$

$BC = h\cot\phi$ .....(i)

In Δ ACD

$\tan\theta = \frac{h}{BC+x}$

$BC + x = h\cot\theta$

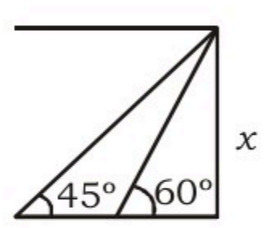
$BC = h\cot\theta - x$ . . . .(ii)

from eq (i) & (ii)

$h\cot\phi = h\cot\theta - x$

$x = h(\cot\theta - \cot\phi)$

68. (c)



$x - \frac{x}{\frac{\sqrt{3}}{x}}$

$\frac{\sqrt{3}x - x}{\sqrt{3}}$ = 10 min

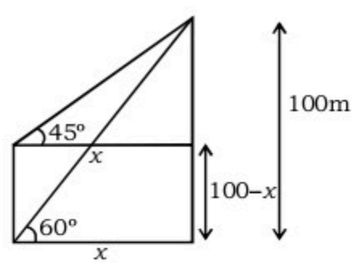
1 $\frac{\frac{10}{\sqrt{3}x - x}}{3} \times x$

$x \rightarrow \frac{10\sqrt{3}\ x}{x(\sqrt{3}-1)} = \frac{10\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \frac{10(3+\sqrt{3})}{2} = 5(3 + 1.732)$

$= 13.66 \cong 13$ min 40 sec

69. (a)



$\tan 60° = \frac{100}{x}$

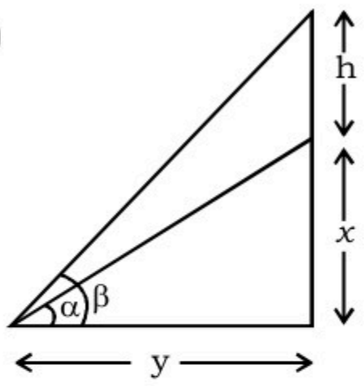
$\sqrt{3} = \frac{100}{x}$

$x = \frac{100}{\sqrt{3}}$

height of tower = $100 - \frac{100}{\sqrt{3}}$

$= \frac{100(\sqrt{3}-1)}{\sqrt{3}}$ mtr.

70. (b)



$$\tan\alpha = \frac{x}{y}$$

$$\tan\beta = \frac{h+x}{y}$$

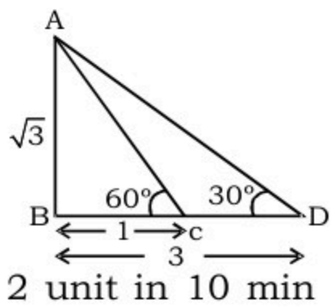
$$\frac{\tan\alpha}{\tan\beta} = \frac{x}{h+x}$$

$$x\tan\beta = h\tan\alpha + x\tan\alpha$$

$$x(\tan\beta - \tan\alpha) = h\tan\alpha$$

$$x = \frac{h\tan\alpha}{\tan\beta - \tan\alpha}$$

71. (a)

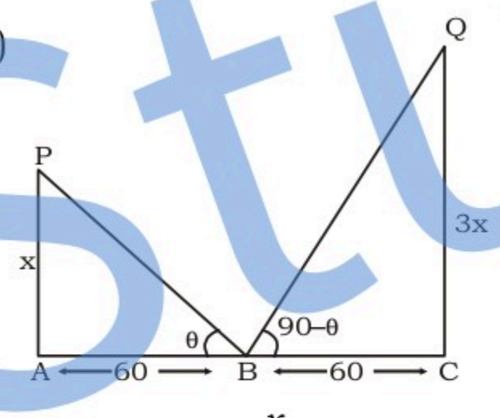


$\because$ 2 unit in 10 min

So, BC = 1 unit will travel

$$= \frac{10}{2} = 5 \text{ min}$$

72. (d)



Δ ABP $\tan\theta = \frac{x}{60}$ ..... (i)

Δ BCQ $\tan(90-\theta) = \frac{3x}{60}$

$\cot\theta = \frac{3x}{60}$ ..... (ii)

$\tan\theta \cdot \cot\theta = \frac{x}{60} \cdot \frac{3x}{60}$

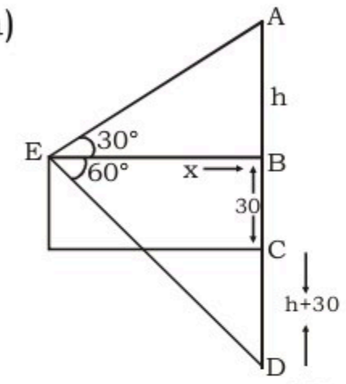
$1 = \frac{x^2}{60 \times 20}$

$x = 20\sqrt{3} = 20 \times 1.732 = 39.64$

hight of big piller = 3x

$= 3 \times 34.69 = 103.92$

73. (a)



Δ ABE $\tan 30° = \frac{AB}{EB}$

$\frac{1}{\sqrt{3}} = \frac{h}{x} \Rightarrow x = \sqrt{3} \times h$ ... (i)

Δ EBD

$\tan 60° = \frac{BD}{EB}$

$\sqrt{3} = \frac{h+30+30}{x}$

$\sqrt{3} = \frac{h+60}{\sqrt{3}h}$

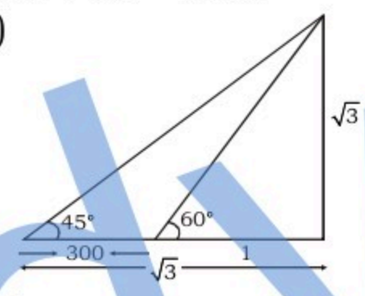
$3h = h + 60$

$2h = 60 \Rightarrow h = 30m$

height from water surface

$= 30 + 30 = 60m$

74. (c)



$\sqrt{3} - 1 = 300$ m

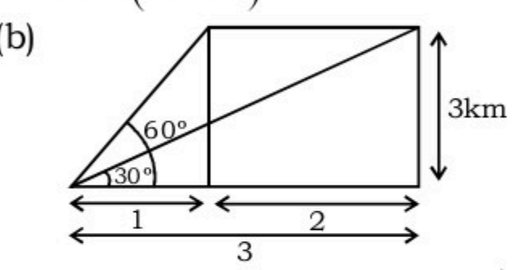
$1 = \frac{300}{\sqrt{3}-1}$

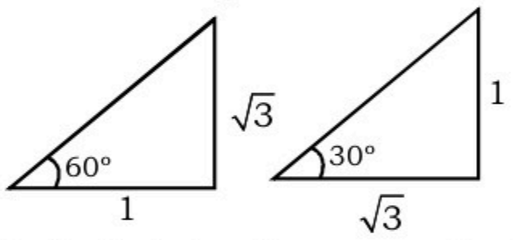
height $\sqrt{3} = \frac{300}{\sqrt{3}-1}\sqrt{3}$

$= \frac{300}{2}\left(\sqrt{3}+1\right)\sqrt{3}$

$= 150\left(3+\sqrt{3}\right)$

75.(b)





In both triangle perpendicular is same.

So make perpendicular equal.

$60° = \frac{\sqrt{3}}{1}$

$30° = \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{1}$

Now perpendicular is same.

$\sqrt{3} \rightarrow 3$

$1 \rightarrow \frac{3}{\sqrt{3}}$

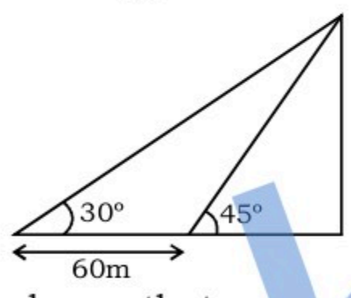
$1 \rightarrow \sqrt{3}$ km

$2 \rightarrow 2\sqrt{3}$ km

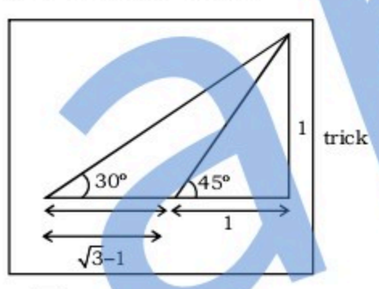
Speed $= \frac{2\sqrt{3} \times 1000}{15}$

$= \frac{2 \times 1.732 \times 1000}{15} = 230.93$m/s

76.(c)



we know that



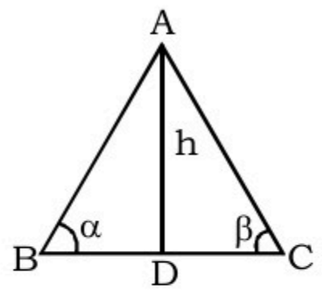
$\sqrt{3} - 1 \rightarrow 60$

$1 \rightarrow \frac{60}{\sqrt{3}-1}$

$1 \rightarrow \frac{60}{2}(\sqrt{3}+1)$

$= 30(\sqrt{3}+1)$

77.(d)



In Δ ABD

$\tan\alpha = \frac{h}{BD}$

$BD = h\cot\alpha$ .....(i)

in Δ ACD

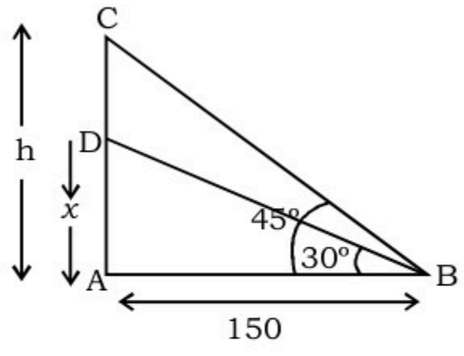
$\tan\beta = \frac{h}{CD}$

$CD = h\cot\beta$ .....(ii)

$BC = BD + CD$

$= h(\cot\alpha + \cot\beta)$

78. (a)



In Δ ABD

$$\tan 30^\circ = \frac{x}{150}$$

$$\frac{1}{\sqrt{3}} = \frac{x}{150}$$

$$x = \frac{150 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$$

$x = 50\sqrt{3} = 50 \times 1.732$

$= 86.6025$

In Δ ABC

$$\tan 45^\circ = \frac{h}{150}$$

$h = 150$

piller most be raised = CD = h – x = 150 – 86.6025 = 63.4 m