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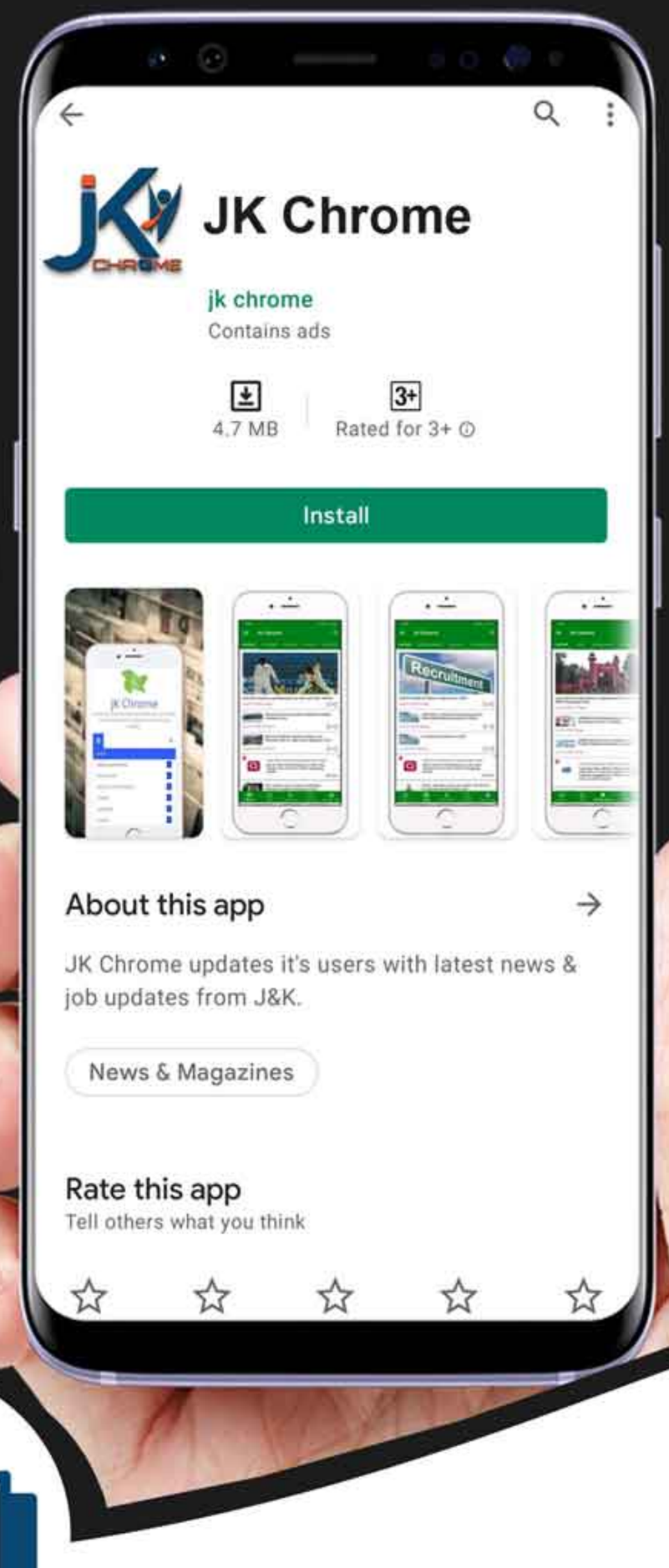

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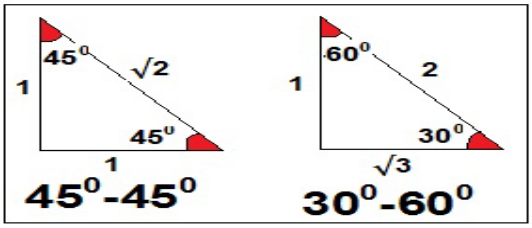
HEIGHTS & DISTANCES

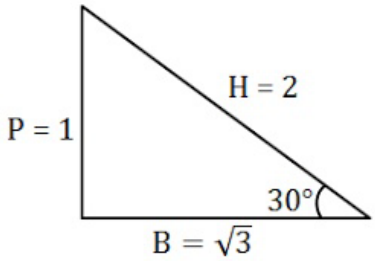
Understanding 45-45 and 30-60 triangles



Applications of 45-45 and 30-60 triangles

RULE

Rule-1: When θ=30°

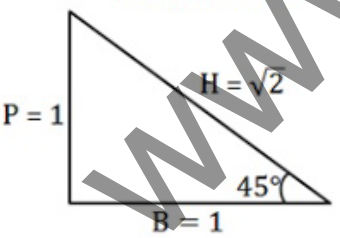


$$\tan\theta = \frac{1}{\sqrt{3}}$$

θ	P	B	H
30°	1	$\sqrt{3}$	2

RULE

Rule2: When θ=45°

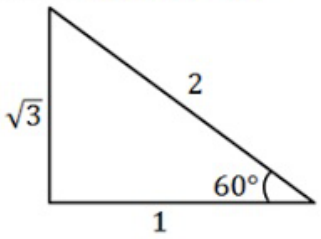


$$\tan 45° = \frac{P}{B}$$

$$1 = \frac{P}{B}$$

θ	P	B	H
45°	1	1	$\sqrt{2}$

Rule 3: When θ=60°



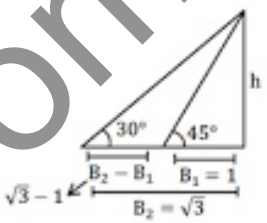
$$\tan 60° = \sqrt{3}$$

$$\frac{P}{B} = \frac{\sqrt{3}}{1}$$

θ	P	B	H
60°	$\sqrt{3}$	1	2

RULE

Rule-4: When θ=30°, 45 (Same side)



$$\tan 45° = 1$$

$$\frac{h}{B_1} = \frac{1}{1}$$

$$h : B_1 = 1 : 1$$

$$\tan 30° = \frac{1}{\sqrt{3}}$$

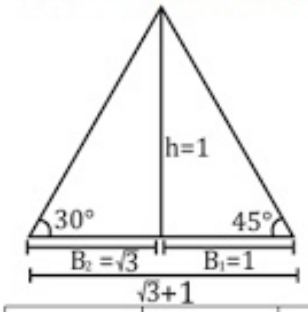
$$\frac{h}{B_2} = \frac{1}{\sqrt{3}} \Rightarrow h : B_2 = 1 : \sqrt{3}$$

$$B_2 : h : B_1 = \sqrt{3} : 1 : 1$$

θ	B_1	B_2	$B_2 - B_1$	P
30°, 45°	1	$\sqrt{3}$	$\sqrt{3} - 1$	1

RULE

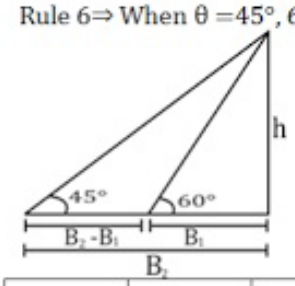
Rule 5⇒ When $\theta = 30°, 45°$



θ	B_1	B_2	$B_1 + B_2$	h
30°, 45°	1	$\sqrt{3}$	$\sqrt{3}+1$	1

RULE

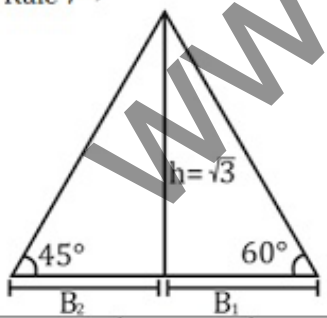
Rule 6⇒ When θ =45°, 60°



θ	B_1	B_2	$B_2 - B_1$	h
45°, 60°	1	$\sqrt{3}$	$\sqrt{3}-1$	$\sqrt{3}$

RULE

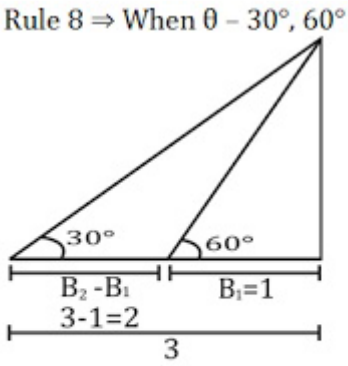
Rule 7⇒



θ	B_1	B_2	$B_2 + B_1$	h
45°, 60°	1	$\sqrt{3}$	$\sqrt{3}+1$	$\sqrt{3}$

RULE

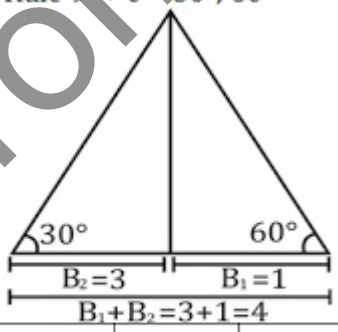
Rule 8 ⇒ When θ – 30°, 60°



θ	B_1	B_2	$B_2 - B_1$	h
30°, 60°	1	3	2	$\sqrt{3}$

RULE

Rule 9 ⇒ θ = 30°, 60°



θ	B_1	B_2	$B_1 + B_2$	h
30°, 60°	1	3	4	$\sqrt{3}$

RULE

Previous year questions

1. If the angle of elevation of the Sun changes from 30° to 45°, the length of the shadow of a pillar decreases by 20 meters, The height of the pillar is:
(a) 20(√3-1)m (b) 20 (√3+1)m
(c) 10(√3-1)m (d)10(√3+1)m

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 1/5 On walking 138 meters towards the monument the secant of the angle of elevation is √193/12 the height of monument (in meter) is
(a) 42 (b) 49
(c) 35 (d) 56

3. The distance between two pillar of length 16 meters and 9 meters is x meters. If two angles of elation of their respective top from t bottom of the other are complementary to each other then the value of x (in meters) is

(a)15 (b) 16

(c)12 (d) 9

4. 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 (in metre the height of the building

(a) h cot x /cot x +cot y (b) h cot y / cot +cot y

(c) h cot x / cot x –cot y (d) h cot y /cot x –cot y

5. 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 meters towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower is

(a) √3 m (b) 5 √3 m

(c) 10 √3m (d) 20√3 m

6. Two poles of equal height are standing opposite to each other on another 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√3 (b) 20 √3

(c) 28 √3 (d)30 √3

7. The angle of elevation of the top of a chimney and roof of the building for a point on the ground are x and 45° respectively. The height of building is h meter. Then the height of the chimney, (in meter) is

(a) h cot x + h, (b) h cot x - h

(c) h tan x - h (d) h tan x + h

8. There are two vertical posts, one on each side of a road, just opposite to each other. One post is 108 meter 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 meter) is

(a) 36 (b) 72

(c) 08 (d) 110

9. One files a kite with a thread 150 meter long. If the thread of the kite makes an angle of 60° with the horizontal line, then the height of the kite from the ground (assuming the thread to be in a straight line) is

(a) 50 m (b) 75√3 m

(c)25√3 m (d)80 m

10. 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 respectively 15° and 30°. 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√3 m (b) 24 meter

(c) 24√2 m (d) 96 m

11. Two post are x meters apart 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 meters) of the shorter post is

(a) x/2√2 (b) x/4

(c) x√2 (d)x/2

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

(a) 5000(√3-1)m (b) (5000(3-√3)m

(c) 5000 (1- (1√3) (d) 4500 m

13. 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 sole distance towards the tower and then his angle of elevation of the top of the tower is 60°. If the height of tower is 3Orn,then the distance he moves is

(a) 22 m (b) 22√3m

(c) 20 m (d) 20√3 m

14. An aero plane when flying at a height of 3125m from the ground passé 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

15. 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(√3+ 1)m (b) 24(√3 + 1)m

(c) 30(√3 + 1)m (d) 30(√3-1)m

16. 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) 10ft (b) 5ft

(c) 15√3(2-√3) ft (d) 5√3 ft

17. The shadow of a tower is √3 times its height. Then the angle of elevation of the top of the tower is

(a) 45° (b) 30°

(c) 60° (d) 90°

18. A man 6 ft tall casts a shadow 4 ft long. At the same time when a flag pole casts of shadow 50 ft long. The height of the flag pole is

(a) 80ft (b) 75ft

(c) 60ft (d) 70ft

19. The angle of elevation of an aero plane from a point on the ground is 60°. After 15 seconds flight the elevation changes to 30°, If the aero plane is flying at a height of1500√3 m, find the speed of the plane

(a) 300 m/sec (b)200 m/sec

(c) 100m/sec (d) 150m/sec

20. There are two temples, one on each bank of a river just opposite to each other. One temple is 54 m high. From the top of this temple, the angles of depression of the top and the foot of the other temple are 30° and 60° respectively, The length of the temple is;

(a) 18 m (b) 36 m

(c) 36√3 (d) 18√3 m

21. 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) a/b
(c) ab (d) a^2b^2

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

23. 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

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

25. 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

26. 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

27. The angle of elevation of a tower from a distance 50 m from its foot is 30°. The height of the tower is
(a) $50\sqrt{3}$ m (b) $50/\sqrt{3}$m
(c) $75\sqrt{3}$ m (d) $75/\sqrt{3}$m

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

29. 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 meters) is
(a) 30 (b) 30 $(3-\sqrt{3})$
(c) 30 $(3+\sqrt{3})$ (d) $30\sqrt{3}$

30. From two points on the ground lying on a straight line, through the foot of a pillar, the two angles of elevation of the top of the pillar are complementary to each other. If the distance of the two points from the foot of the pillar are 9 meters and 16 meters and the two points lie on the same side of the pillar. Then the height of the pillar is
(a) 5m (b) 10m
(c) 9m (d) 12m

31. 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

32. In 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° height of the tower is (in m)
(a)$(400\sqrt{3})/3$ (b)500/3
(c) 400/3 (d) $200\sqrt{3}$

33. From a tower 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 meters)between the objects is
(a) $125\sqrt{3}$ (b) $125(\sqrt{3}-1)$
(c) $125/(\sqrt{3}-1)$ (d) $125(\sqrt{3}+1)$

34. From a point P on the ground the angle of elevation of the top of a 10 m tall building is 30 degree . 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) $10(\sqrt{30}+2)$ m (b) $10(\sqrt{30}+1)$m
(c) $10\sqrt{3}$ m (d) 7.32 m

35. The angle of elevation of the top of a vertical tower situated perpendicularly on a plane is observed as 60° from a point P on the same plane .From another point Q ,10m vertically above the point P, the angle of depression of the foot of the tower is 30 m height of the tower is
(a)15m (b) 30 m
(c) 20 m (d) 25 m

36. 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) $10/\sqrt{3}$m (d) $20/\sqrt{3}$m

37. The angle of elevation of ladder leaning against a house is 60° and the foot of the ladder is 6.5 meters from the house. The length of the ladder is
(a)$13/\sqrt{3}$ (b) 13 meters
(c) 15 meters (d) 3.25 meters

38. The angle of elevation of sun changes for 30°to 45°, the length of the shadow of a pole decreases by 4 meters, the height of the poleis (Assume $\sqrt{3}$ =1.732)
(a) 1.464m (b) 9.464 m
(c) 3.648 m (d) 5.464 m

39. A vertical pole and a vertical tower are standing on the same level ground. Height of the pole is 10 meters. 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

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

41. If a pole of 12 m height caste as 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°

42. 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) $10/\sqrt{3}$ meter
(c) $10\sqrt{3}$ meter (d) $35\sqrt{3}$ meter

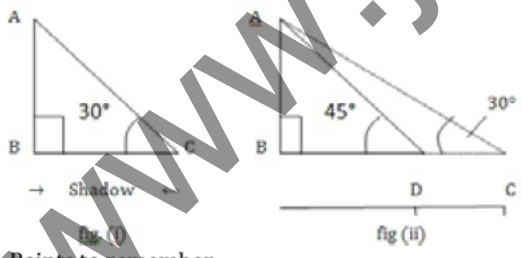
43. From the top of a tower of height 180m the angles of depression of two objects on either sides of the tower are 30° and 45°. Then the distance between the objects are
(a) $180(3+\sqrt{3})$ (b) $180(3-\sqrt{3}$
(c) $180(\sqrt{3}-1)$ (d) $180(\sqrt{3}+1)$

44. 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 degree and 30 degree (both ends of the bridge are on the same side of the hill) then the length of the bridge is
(a) $300(\sqrt{3}-1)$ m (b) $300(\sqrt{3}-1)$
(c) $300\sqrt{3}$m (d) $300/\sqrt{3}$ m

45. From an aero plane just over a river, trees on the opposite bank of the river are found to be 60° and 30° respectively. If the breadth of the river is 400 meters, then the height of the aero plane above the river at that instant is Assume $\sqrt{3} = 1.732$
(a) 173.2 meters (b) 346.4 meters
(c)519.6 meters (d) 692.8 meters

46. 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 meters) of the hill is
(a) 30 (b) 80
(c) 60 (d) 40

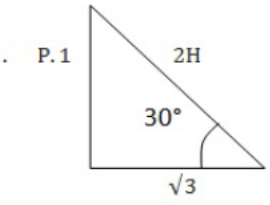
1. (d)



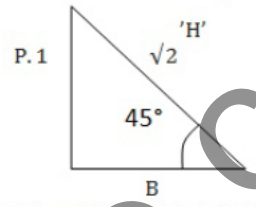
→ Points to remember
it $\theta = 30° \rightarrow$ tna30° = perpendicular (P)/Base (B)

→H = 2
P = 1
B = $\sqrt{3}$

$1/\sqrt{3}$ = D/B

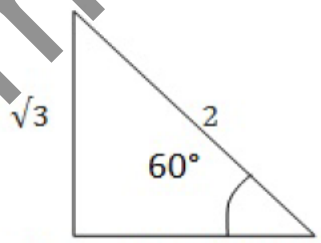


If $\theta = 45 \rightarrow \tan 45° = P/B \rightarrow 1/1$



H = √2
P = 1
B = 1

If $\theta = 60° \rightarrow \tan 61° = P/B \rightarrow$
$\sqrt{3}/1 = P/B$



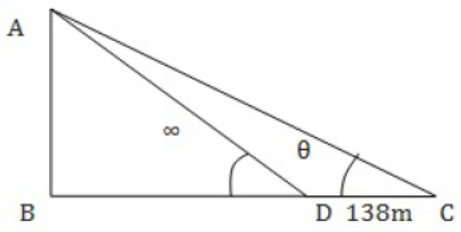
H = 2
P = √3
B = 1

Now $\theta = 30°$ then AB = 1 & BC = $\sqrt{3}$
When $\theta = 45°$ then AB = 1 & = 1
DC = BC − BD
DC = $(\sqrt{3} - 1)$

AB : DC
1 : $(\sqrt{3} - 1)$

$0(\sqrt{3} - 1)$: 20
By rationalizing

2. (d)



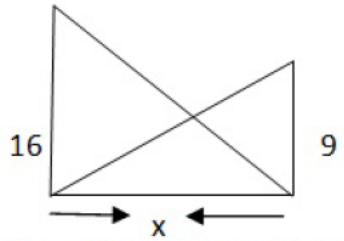
Shortcut approach
1st. Case:

Tanθ = AB/BC = Perpendicular/Base = 1/5
2nd. Case:
Sec. ∞ = AD/BD = Hypo/ Base
= √193/12
In Δ ABD Hypo = √193
Base = 12
Then Perpendicular = 7
(By pythagores theorem)
In case I Perpendicular is 1.
So equal this
tanθ = 1× 7/5×7 = 7/35 (7← Perpen, 35 ← Base)

Perpendicular → 7 7 ×6 → 42 m
Base 35 12
23 units
↓
138m

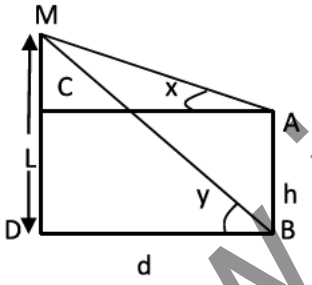
AB = 42m

3. (c)



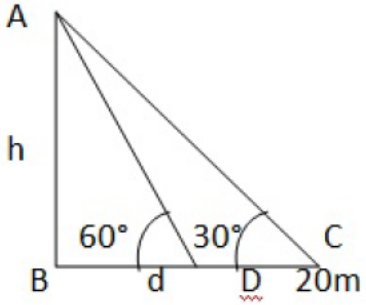
if $\theta_1 + \theta_2 = 90$ then $x = \sqrt{(h_1 \times h_2)}$
(h = height of towers)
$x = \sqrt{(16 \times 9)} = \sqrt{144} = 12$mtr

4. (c)



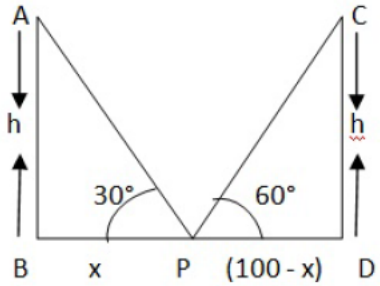
AB = Tree 'h'
MD = Building '1'
DB = CA = 'd'
In ΔMCA
tanx = MC/AC = 1-h/d
→ d= (l-h)/tan x → d = (l - h) cot x …….. (i)
In ΔMDB
tan y = 1/d = MD/DB
d = l cot y ……(ii)
from equitation (i) and (ii)
(l - h) cot x = l cot y
(l - h) cot x = l cot y
l cot x - h cot x = l cot y
h cot x = 1 (cot x – cot y)
l = (h cot x)/ cot x – cot y

5. (c)



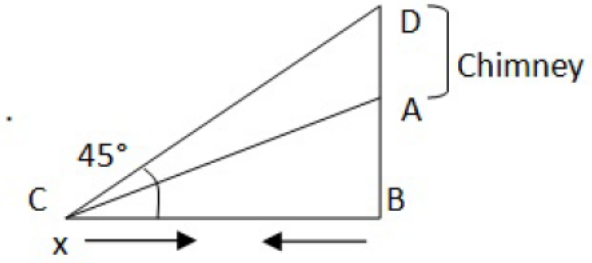
AB = 'h' metre
In ΔABC
tan30° = AB/BC
→ h/(d + 20)
→ 1/√3 = h/(d + 20)
√3h = d + 20 ……. (i)
In ΔABD
tan 60° = AB = BD = h/d
√3 = h/d
h= √3d
d = h/√3 …….. (ii)
Put the value of d in equation (i)
√3h = h/√3 + 20
√3h = h/√3 + 20
√3h = (h + 20√3)/√3
3h = h + 20√3
2h = 20√3
h = 20√3/2
h = 10√3 meter

6. (a)



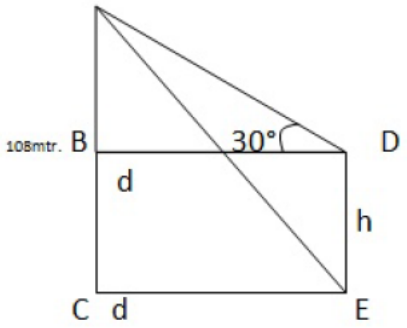
BD = 100
AB = CD = 'h' meter (Height of pole in Δ)
→ tan 30° = h/x
→ 1/√3 = h/x → √3h = x …….. (i)
In ΔCDP
tan 60° = h / (100 - x)
→ √3(100 - x) = 4
→ √3(100 - √3h) = 4
(Put the value of x from equation (i)
→ 100√3 – 3h = h → 4h = 100√3
h = 25√3 meter

7. (b) AB = Building = h meter



AD = chimney 'y' meter
In Δ DCB
tan45° = DB/BC → 1 = (h + y)/BC
→ BC = h + y ..... (i)
In ΔACB
tanx° = AB/BC → tan x = h/BC → BC
= h cot x ..... (ii)
From equation (i) and (ii)
→ h + y = h cot x
→ y = (hcot x – h) meter

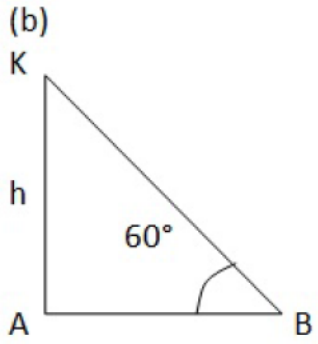
8. (b) A



In ΔACE
tan60° = AC /CE
√3/1 = AC/CE = AC : CE = √3 : 1 ..... (i)
In ΔABD
tan30° = AB/BD
MN is tower
In ΔMNB
∠MBN = ∠MAB + ∠BMA
(Triangle property)
∠30° = 15° + ∠BMA
∠BMA = 15°
So AB = BM = 48
In ΔMNB

hypo	:	Base	:	Height
2	:	√3	:	1
×24				×24
48				24m

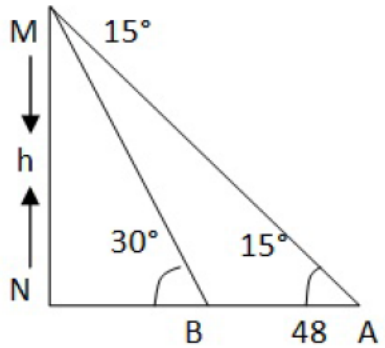
9. (b)



K = Kit
KB = thread = 150 meter
KA = height of kit from ground
In ΔKAB
tan60° = KA/AB
√3/1 = KA/AB
If h = √3
AB = 1
then KB = 2 (By Pythagoras theorem

KB	:	AB	:	h(KA)
2	:	1	:	√3
↓				↓
150mtr.				75√3 m

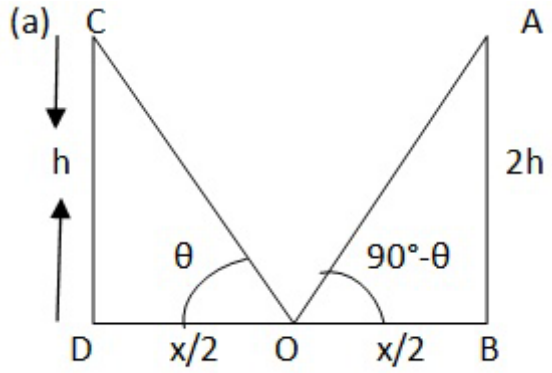
10. (b)



MN is tower
In ΔMNB
∠MBN = ∠ MAB + ∠BMA
(Triangle property)
∠30° = 15° + ∠BMA
So AB = BM = 48
In ΔMNB

Hypo	:	Base	:	Height
2		√3		1
×24 ↓				×24 ↓
48				24m

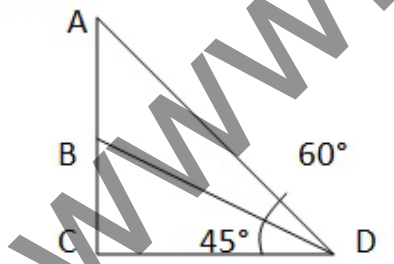
11.



OB = OD = x/2
In Δ OCD

tanθ = (h/x)/2 → 2h/2 ..... (i)
In ΔAOB
tan(90° - θ) = AB/30
cotθ = 2h/(x/2) = 4h/x ..... (ii)
Multiplying both equations
tanθ. cotθ = 2h/x × 4h/x
→ x^2 - $8h^2$ = h = x/2√2 meter

12. (c)

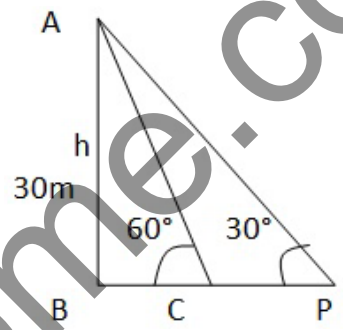


AC = 5000
In Δ ACD
tan 60° = AC/CD
√3 = AC/CD → AC : CD = √3 : 1
In ΔBCD
tan45° = BC/CD
1 = BC/CD = BC: CD = 1 : 1 ..... (ii)

Now, BC	:	CD	:	AC
1	:	1	:	
		1	:	√3
1	:	1	:	√3

AB = AC - BC
= (√3 - 1) units
AC = √3 units = 5000 m
AB = (√3 - 1)units = 5000/√3 (√3 - 1)
= 5000 [1 – 1/√3] m

13. (d)

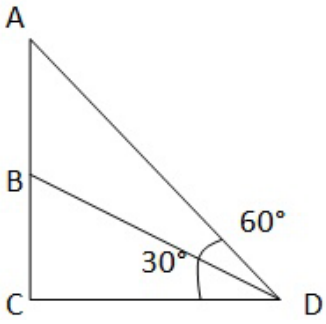


h = 30° m
PC = ?
In Δ ABP
tan30° = AB/BP
1/√3 = AB/BP → AB: BP = 1 : √3 ..... (i)
In Δ ABC
tan 60° = AB/BC
√3/1 = AB/BC → AB : BC = √3 : 1 ..... (ii)

Now, BP	:	AB	:	BC
√3	:	1	:	
		√3	:	1
3	:	√3	:	1

Now
AB = √3 units = 30 meter
1 unit = 30/√3 × √3/√3 = 10√3
PC = 3 – 1 = 2 units
= 10√3 × 2 = 20√3 meter

14. (d) BC = 3125

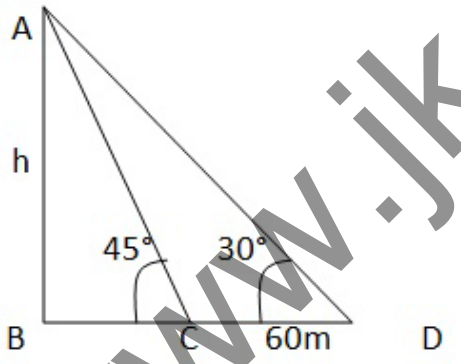


In ΔACD
tan 60° = AC/DC
√3/1 = AC/DC
AC : DC = √3 : 1 ..... (i)
In Δ DCB
Tan30° = BC/DC
1/√3 = BC/DC
BC : DC = 1 : √3 ..... (ii)

Now,	AC	:	DC	:	BC
	√3		1		
			√3		1
	3	:	√3	:	1
					(3125 m)

AB = AC - BC
→ 3 - 1 = 2 units
= 2 × 3125 = 6250 m

15. (c)



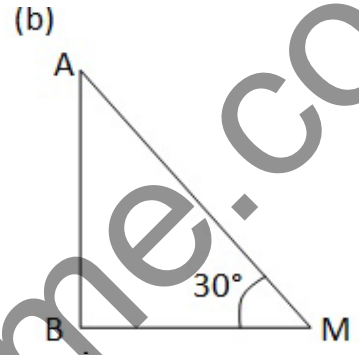
h = height
In ΔABC
tan45° = AB/BC
1/1 = AB/BC = AB : BC = 1 : 1 ..... (i)
In Δ ABD
tan 30° = AB/BD
1/√3 = AB/BD → AB : BD = 1 : √3 ..... (ii)

Now,

BD	:	AB	:	BC
		1	:	1
√3	:	1		
√3	:	1	:	1

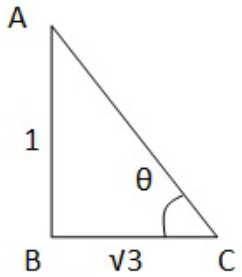
CD = BD - BC
CD = √3 - 1
√3 - 1 units = 60
H = 1 unit = 60/(√3 - 1)
= 60/(√3 - 1) × (√3 + 1)/(√3 + 1)
h = 30 (√3 + 1)m

16. (b)



MAB was straight earlier = AB + AM = 15ft
In ΔABM
tan 30° = AB/BM
1/√3 = AB/BM
If AB = 1
BM = √3
then AM = 2 (By phytagores theorem)
AB + AM = 2 + 1 → 3 units = 15ft.
AB = 1 unit = 5 ft.

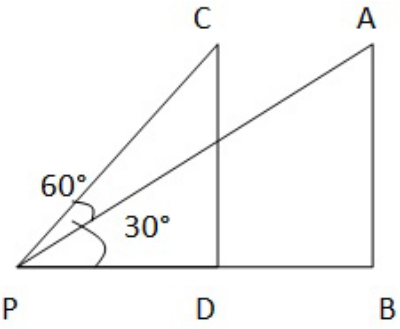
17. (b)



In ΔABC
tanθ = 1/√3
tanθ = tan30° → θ = 30°

18. (b) Height Shadow
6 ft. 4 ft.
3 : 2
So height of pole will be in same ratio.
= 50 × 3/2 = 75 ft.

19. (b)



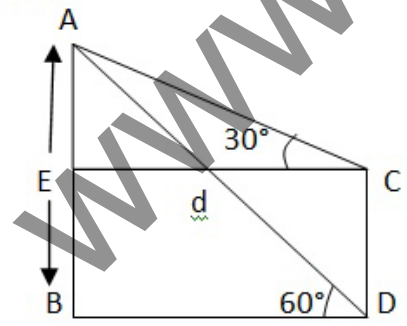
AB = CD = 1500√3 (height of areoplane)
In Δ PDC
tan 60° = CD/PD
$\sqrt{3} = CD/PD \rightarrow CD : PD = \sqrt{3} : 1$ ..... (i)
In Δ PBA
tan30° = AB/PB
$1/\sqrt{3} = AB/PB \rightarrow AB : PB = 1 : \sqrt{3}$ ..... (ii)
AC = BD and AB = CD
Now,

PD	:	AB	:	PB
1	:	√3		
		1	:	√3
1	:	√3	:	3

DB = PB - PD
= 3 - 1 = 2 units
AB = 3 units = 1500√3 m
→ 1 units = 1500 m
CA = DB → 2units = 3000 meter
Speed = Distance/ Time = 3000/15 = 200 m/s

20.

(b)

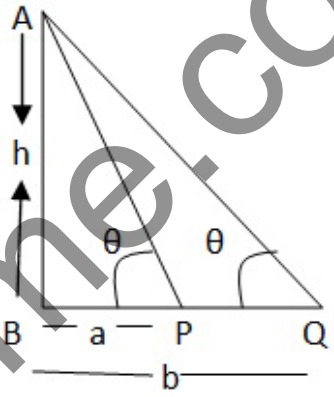


AB and CD are temples
BD = width of river
AB = 54 m
In ΔAEC
tan30° = AE/EC = 1/√3 → AE : EC = 1 : √3
In Δ ABD
tan60° = AB/BD
√3 = AB/BD → AB : BD = √3 : 1 ..... (ii)
EB = CD and EC = BD
Now,

AB	:	BD	:	AE
		√3	:	1
√3	:	1	:	1

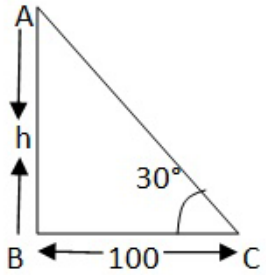
CD = AB - AE
= 3 - 1 = 2 units
AB = 3 units × 18 = 54 m
CD = 2 units × 18 = 36m

21. (a)



AB is tower
$\angle AQB = \theta$ Thus, $\angle APB = 90° - \theta$
PB = a, BQ = b
In ΔAQB
tanθ = AB/BQ
tanθ = h/b ..... (i)
In ΔAPB
tan (90° - θ) = h/PB
→ Cotθ = h/a ..... (ii)
By multiplying both equaltion
tanθ.cotθ = h/b× h/a
$h^2 = ab \rightarrow h = \sqrt{ab}$

22. (a)

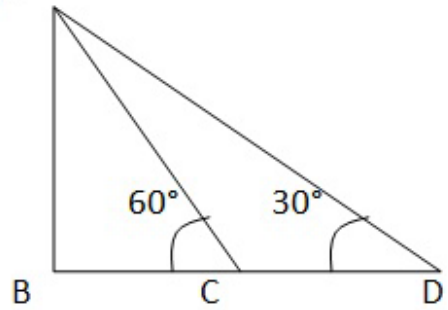


In ΔABC
tan 30° = AB/BC
1/√3 = AB/BC
→AB : BC = 1 : √3
100/√3 100m

23. (b) It should be on circumcentre.

24.

(a) A



AB = height of balloon
In ΔABC
tan60° = AB/BC → AB: BC = √3 : 1
In Δ ABD
tan30° = AB/BD → AB : BD = 1 : √3
Now,

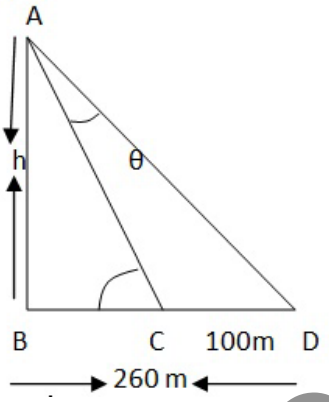
PD	:	AB	:	PB
1	:	√3		
		1	:	√3
1	:	√3	:	3

CD = BD – BC
= 3 - 1 = 2 units
2 units = 1 km
1 unit = ½
AB = √3 unit = ½ × √3
= √3/2 km

25. (b)

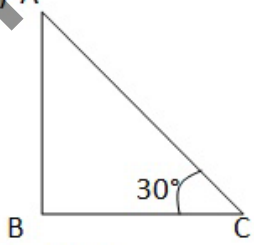
	Height	:	Shadow
Stick →	12	:	8
Tower →	3	:	2
	60 m		40 m

26. (a)



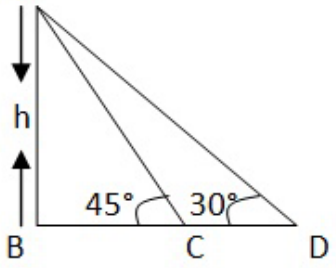
BD = 160m
In ΔACD
exter, $\angle ACB = \angle CAD + \angle ADC$
$2\theta = \angle CAD + \theta$
Thus, $AC = CD$
$AC = 100$
In ΔABC
$AC = 100m$
$BC = 160 - 100 = 60m$
Then, AB = 80 m (By phytagores theorem)

27. (b) A



AB = Tower
BC = 50
In Δ ABC
tanθ = AB/BC
tan 30° = AB/50
AB = 50/√3m

28. (c) A

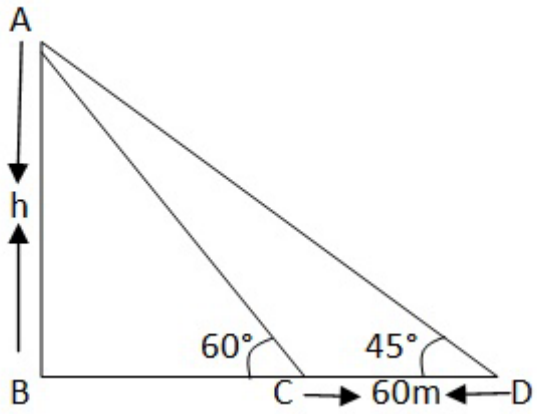


AB = Tower = h
In ΔABC
tan45° = AB/BC = 1
AB : BC = 1 : 1 ..... (i)
In Δ ABD
tan30° = AB/BD
1/√3 = AB/BD = AB : BD = 1 : √3 .....(ii)

BC	:	AB	:	BD
1	:	1		
		1	:	√3
1	:	1	:	√3

CD = BD - BC
= √3 - 1
(√3 - 1) units = 10m
(AB) = 1 unit = 10/(√3 - 1)
= 5 (√3 + 1) meter

29. (c)

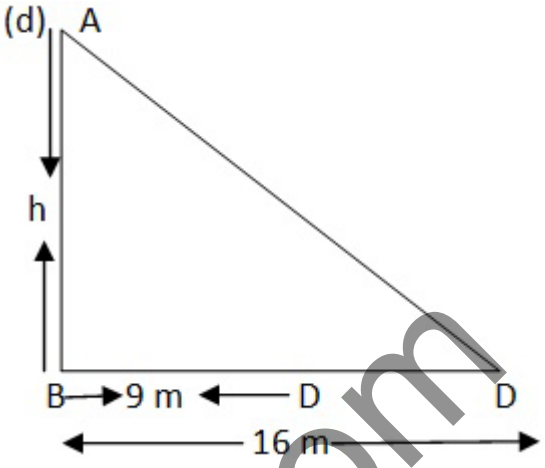


AB height of tower
In ΔABC
tan60° = AB/BC
√3 = AB/BC → AB : BD = √3 : 1 ..... (i)
In ΔABC
tan 45° = AB/BD1 = AB/BD → AB : BD = 1 : 1 ..... (ii)

Now, BD	:	AB	:	BC
1		1		
		√3	:	1
√3	:	√3	:	1

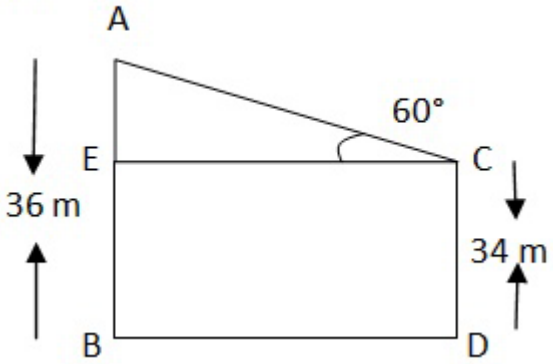
CD = BD - BC
(√3 - 1)
(√3 - 1) = 60 meter
1 unit = 60/(√3 - 1) × √3
= 30 (3 + √3) m

30. (d)



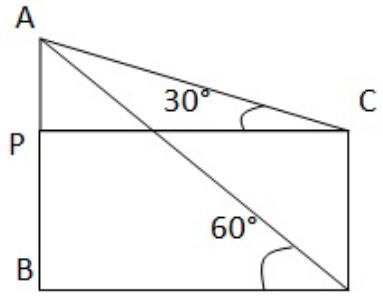
AB = Phillar
BC = 9 meter
BD = 16 meter
∠ ADB=Q
In Δ ABC
$\tan(90 - \theta) = AB/BC$
$\cot\theta = AB/BC = h/9$ ..... (i)
In Δ ABD
$\tan\theta = h/16$ ..... (ii)
By multiplying equation (i) and (ii)
$\tan\theta \cdot \cot\theta = h/9 \times h/16$
$\rightarrow h^2/144 = 1$
$\rightarrow h^2 = 144$
$h = \sqrt{144}$
$h = 12$ meter

31. (b)



AC = wire
AB and CD are two poles
In ΔAEC
sin 60° = AE/AC
→ √3/2 = 12/AC
(AE = AB – CD = 36 – 24 = 12 m)
AC = 24/√3
= 8√3 m

32. (c)

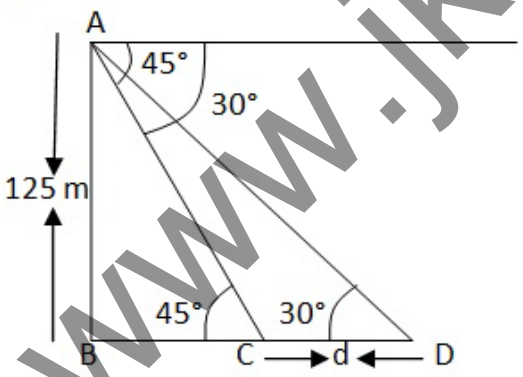


AB = hill = 200 meter
CD = tower
In Δ APC
tan30° = AP/PC
1/√3 = AP/PC = AP : PC = √3 : 1 ..... (i)
In Δ ABD
tan60° = AB/BD
√3 = AB/BD = AB : BD = √3 : 1 ..... (ii)
PB = CD and PC = BD
Now,

AB	:	BD	:	AP
√3	:	1		
		√3	:	1
3	:	√3	:	1

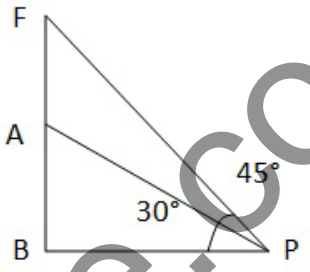
CD = PB → AB - AP
CD = 3 - 1 = 2 units
AB = 3 units = 200 meter
CD = 2 units = 200/3 × 2
= 400/3

33. (b)



AB = Tower
In ΔABC tan45° = AB/BC
1 = AB/ BC = AB : BC = 1 : 1 ..... (i)
In ΔABD = tan30° = AB/BD
= AB : BD = 1 : √3 ..... (ii)
Now, BC : AB : BD
1 : 1
1 : √3
CD = BD - BC
= (√3 - 1) units
AB = 1 unit = 125 meter
CD = (√3 - 1) units = 125 (√3 – 1) meter

34. (d)

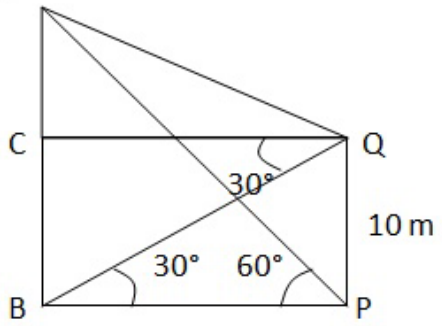


AB – building = 10 m
In Δ ABP
tan30° = AB/BP
1/√3 = AB/BP = AB : BP = 1 : √3 ..... (i)
In Δ FBP
tan45° = FB/BP
1 = FB/BP = FB : BP = 1 : 1 ..... (ii)
Now,

AB	:	BP	:	FB
1	:	√3		
		1	:	1
1	:	√3	:	√3
× 10				× 10
10m				10√3

FB = 17.32 m
FA = FB - AB
= 17.32 – 10
= 7.32 meter

35. (b) A

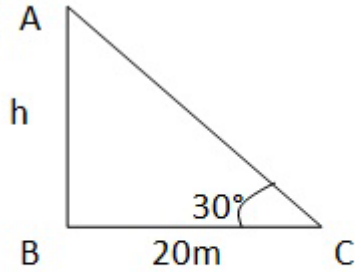


AB = Tower
QP = 10 meter
In ΔQBP

tan30° = QP/PB
1/√3 = QP/PB → QP : PB = 1 : √3 ..... (i)
In Δ ABP
tan60° = AB/BP
√3 = AB/BP → AB:BP = √3 : 1 ..... (ii)
CB = QP and CQ = BP

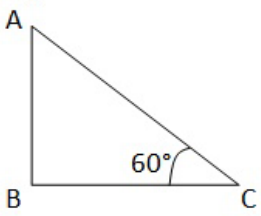
Now, AB : BP : CB
√3 : 1
√3 : 1
3 : √3 : 1
× 10 × 10
30 meter 10 meter

36. (d)



In Δ ABC
AB/BC = tan30° → h/20 = 1/√3
→ h = 20/√3 m

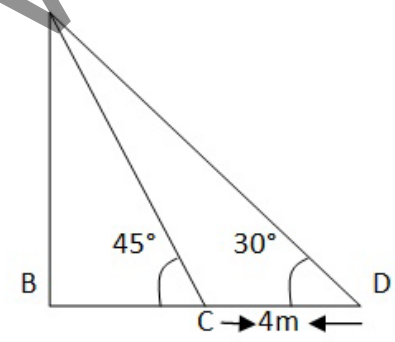
37. (b)



AC = Ladder
BC = 6.5 meters
In ΔABC
Cos60° = BC/Ac
½ = 6.5/AC (m)
AC = 13m

38. (d)

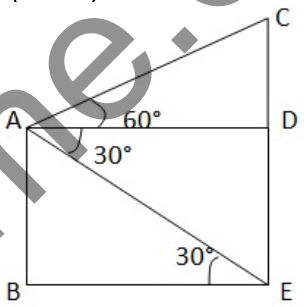
(d) A



AB = pole
In Δ ABC
tan 45° = AB/BC
1 = AB/BC = AB : BC = 1 : 1 ..... (i)
In Δ ABD
tan30° = AB/BD = AB : BD 1 : √3 .....(ii)

BC : AB : BD
1 : 1
1 : √3
1 : 1 : √3
CD = BD - BC
= √3 - 1
= √3 - 1 units = 4m
AB = 1 unit = 4/(√3 - 1)
= 2 (√3 + 1) = 5.464m

39. (c)

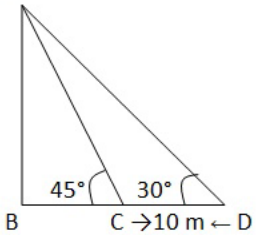


AB = pole CE = tower
AB = 10 meter
In ΔABE
tan 30° = CD/AD
1/√3 = AB/BE = AB : BE = 1 : √3 ..... (i)
In ΔACD
tan60° = CD/BE
√3/1 = CD/AD = CD : AD = √3 : 1 ..... (ii)
AD = BE and AB = DE

Now, AB : BE : CD
1 : √3
1 : √3
1 √3 3
× 10 × 10
10 meter 30 meter

CE = CD + DE
= 30 + 10 = 40 meter

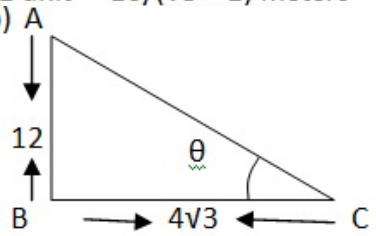
40. (a)



AB = height of tower

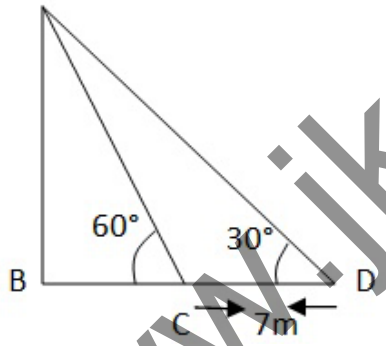
In Δ ABC
tan45° = AB/BC
1 = AB/BC = AB : BC = 1 : 1 ..... (i)
In ΔABD
Tan30° = AB/BD = 1 : √3
1/√3 = AB/BD → AB : BD = 1 : √3 ..... (ii)
Now, BC : AB : BD
1 : 1
1 : √3
CD = BD - BC
= (√3 - 1) units = 10m
= 1 unit = 10/(√3 + 1) meters

41. (b)



In ΔABC
tanθ = AB/BC = 12/4√3
tan θ = 3/√3
tanθ = √3 = tan60°
θ = 60°

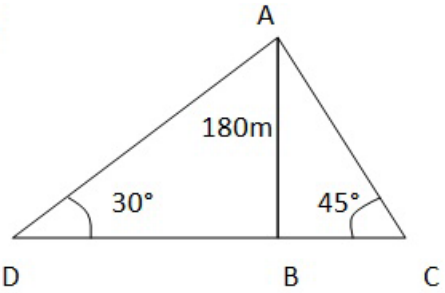
42. (d)



In ∠ACD
$\angle ACB = \angle CAD + \angle ADC$
$60° = \angle CAD + 30°$

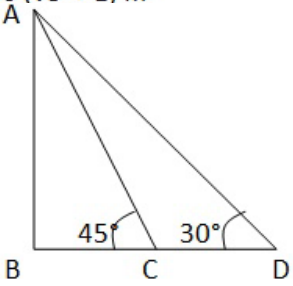
$\angle CAD = 30°$
So, $AC = CD$
$AC = 70m$
$\text{cosec}\, 60° = AC/AB$
$2/\sqrt{3} = 70/AB$
$AB = 35\sqrt{3}$ m

43. (d)



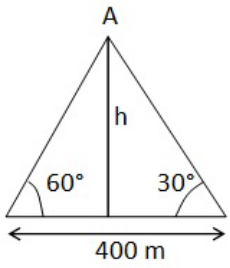
AB = 180m
CD = 1
In ΔABC
tan45° = AB/BC
1 = AB/BC → AB:BC = 1 : 1 ..... (i)
In Δ ABD
tan 30° = AB/BD
1/√3 = AB/BD
AB : BD = 1 : √3 ..... (ii)
AB : BC : BD
1 : 1
1 : √3
1 : 1 : √3
CD = BD + BC
= (√3 + 1) units
AB = 1 unit = 180m
CD = (√3 + 1) units
= 180 (√3 + 1) m

44. (a)



AB= height of peak
300 m
CD = length of Bridge
In ΔABC
tan45° = AB/BC
1 = AB/BC = AB : BC = 1 : √3
Now, BC : AB : BD
1 : 1
1 : √3
CD = BD - BC
CD → √3 - 1
AB = 1 unit = 300 meter
(√3 - 1)units = 300 (√3 - 1) meter

45. (a)



BC = 400 meters

In Δ ABD

tan60° = AD/BD

√3/1 = AD/BD → AD : BD = √3 : 1 ..... (i)

In Δ ADC

tan 30° = AD/DC

1/√3 = AD/DC → AD : DC = 1 : √3 ..... (ii)

Now, BD : AD : DC

1 : √3

1 : √3

1 : √3 : 3

BC = BD + DC

= 1 + 3 = 4 units

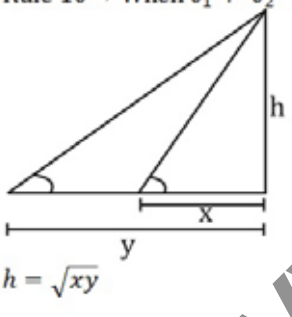
4 units = 400m

1 units = 100 m

AD = √3 unit

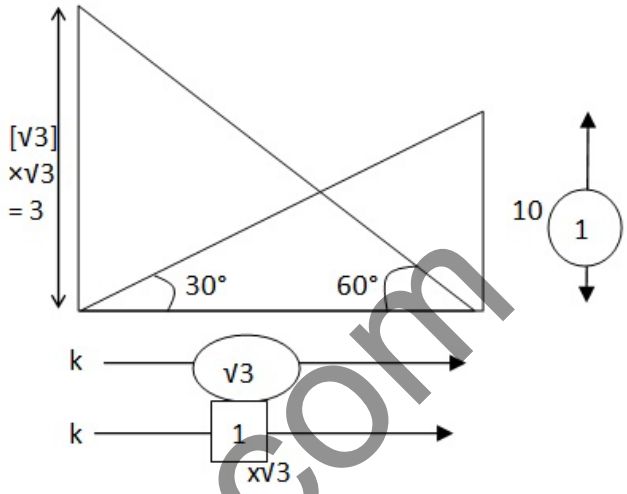
= 100√3 = 100 × 1.732 = 173.2m

Rule 10 ⇒ When $\theta_1 + \theta_2 = 90$



$h = \sqrt{xy}$

46. (a) According to the question.



1 units → 10

3 units → 10 × 3 = 30

Thus, Height of hill = 30m

JK Chrome

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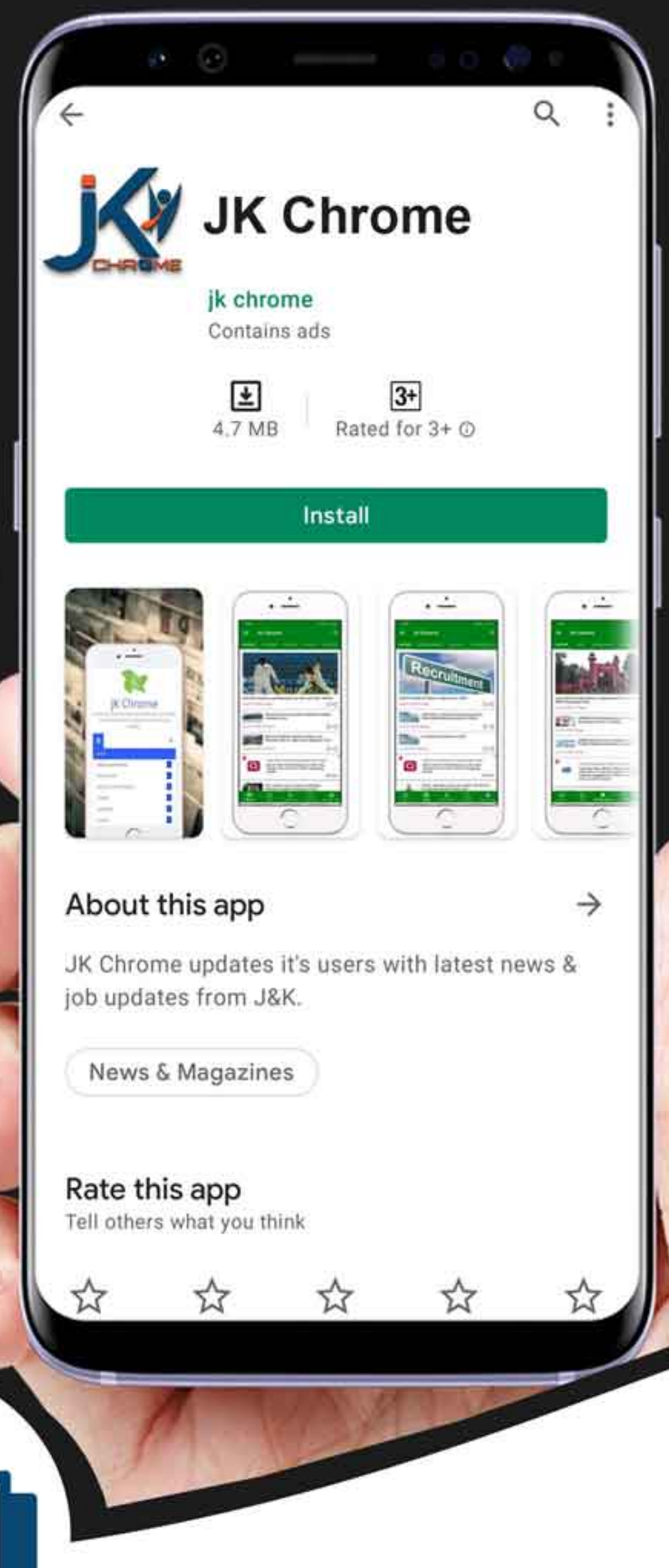

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