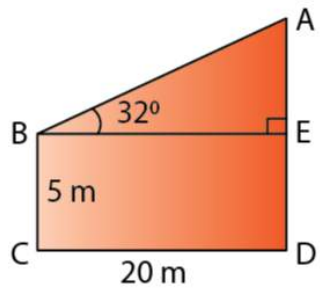
## Exercise 22(C)



**1. Find AD.**

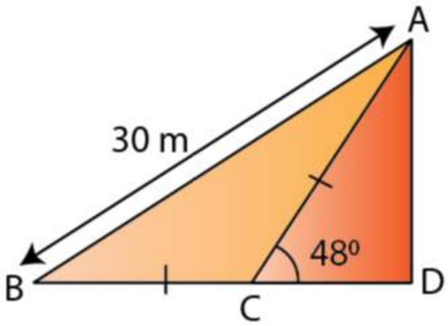
**(i)**




**Solution:**

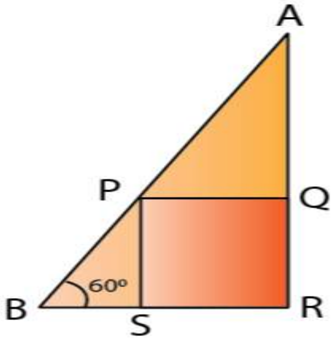
In ΔAEB,
AE/BE = tan 32°
AE = 20 x 0.6249 = 12.50 m
AD = AE + ED = 12.50 + 5 = 17.50 m

**(ii)**




**Solution:**
In ΔABC,
∠ACD = ∠ABC + ∠BAC
and ∠ABC = ∠BAC [Since, AC = BC]
∠ABC = ∠BAC = 48°/ 2 = 24°
Now,
AD/AB = sin 24°
AD = 30 x 0.4067 = 12.20 m

**2. In the following diagram, AB is a floor-board; PQRS is a cubical box with each edge = 1 m and ∠B = 60°. Calculate the length of the board AB.**

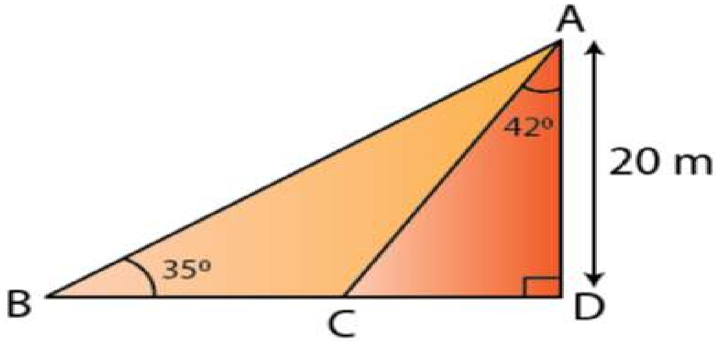



**Solution:**

In ΔPSB,
PS/PB = sin 60°
PB = 2/ √3 = 1.155 m
In ΔAPQ,

$\angle APQ = 60^o$
$PQ/AP = \cos 60^o$
$AP = 1/ (1/2) = 2$ m
Thus,
$AB = AP + PB = 2 + 1.155 = 3.155$ m

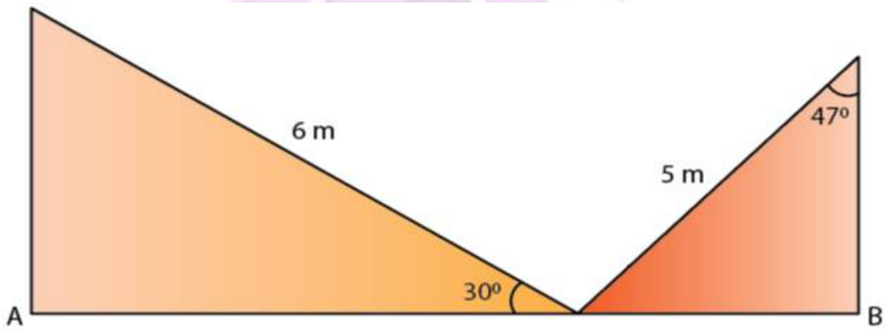
**3. Calculate BC.**




**Solution:**

In ΔADC,
$CD/AD = \tan 42^o$
$CD = 20 \times 0.9004 = 18.008$ m
In ΔADB,
$AD/BD = \tan 35^o$
$BD = AD/ \tan 35^o = 20/ 0.7002 = 28.563$ m
Thus, $BC = BD – CD = 10.55$ m

**4. Calculate AB.**



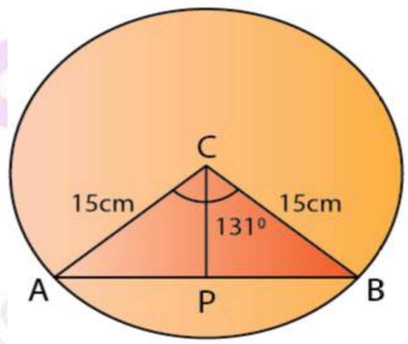

**Solution:**

In ΔAMOB,
$\cos 30^o = AO/MO$
$\sqrt{3}/2 = AO/6$
$AO = 5.20$ m
In ΔBNO,
$\sin 47^o = OB/NO$
$0.73 = OB/5$

OB = 3.65 m

So, AB = OA + OB
AB = 5.20 + 3.65
AB = 8.85 m

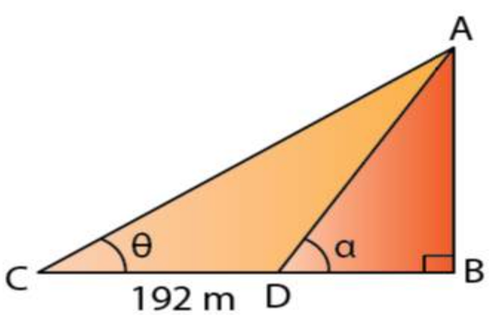
**5. The radius of a circle is given as 15 cm and chord AB subtends an angle of 131º at the centre C of the circle. Using trigonometry, calculate:**
**(i) the length of AB;**
**(ii) the distance of AB from the centre C.**
**Solution:**




Given, CA = CB = 15 cm and ∠ACB = 131º
Construct a perpendicular CP from centre C to the chord AB.
Then, CP bisects ∠ACB as well as chord AB.
So, ∠ACP = 65.5º
In ΔACP,
AP/AC = sin (65.5º)
AP = 15 x 0.91 = 13.65 cm

(i) AB = 2 AP = 2 x 13.65 = 27.30 cm
(ii) CP = AP cos (65.5º) = 15 x 0.415 = 6.22 cm

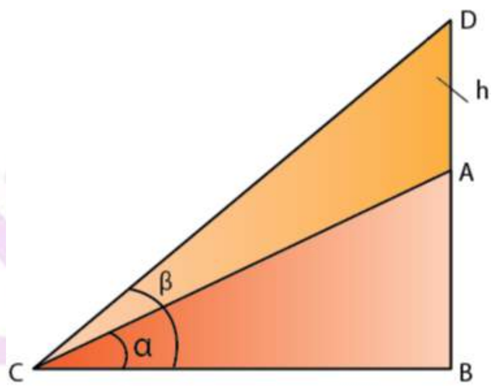
**6. At a point on level ground, the angle of elevation of a vertical tower is found to be such that its tangent is 5/12. On walking 192 meters towards the tower, the tangent of the angle is found to be 3/4. Find the height of the tower.**
**Solution:**




Let’s assume AB to be the vertical tower and C and D be the two points such that CD = 192 m.
And let ∠ACB = θ and ∠ADB = α
Given,
tan θ = 5/12
AB/BC = 5/12
AB = 5/12 BC …… (i)
Also, tan α = ¾
AB/BD = ¾
(5/12 x BC)/ BD = ¾
(192 + BD)/ BD = ¾ x 12/5

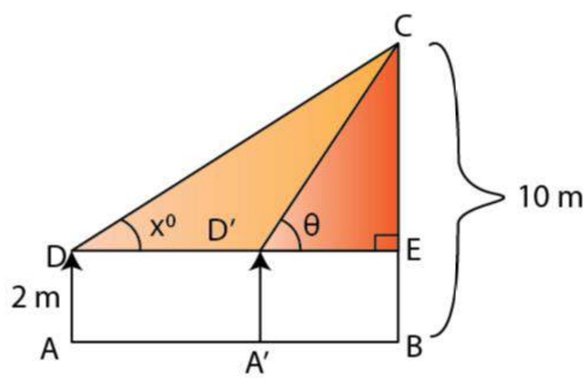
BD = 240 m
BC = (192 + 240) = 432 m
By (i), AB = 5/12 x 432 = 180 m
Therefore, the height of the tower is 180 m.

**7. A vertical tower stands on a horizontal plane and is surmounted by a vertical flagstaff of height h meter. At a point on the plane, the angle of elevation of the bottom of the flagstaff is α and at the top of the flagstaff is β. Prove that the height of the tower is h tan α/ (tan β - tan α).**
**Solution:**




Let AB be the tower of height x metre, surmounted by a vertical flagstaff AD. Let C be a point on the plane such that ∠ACB = α, ∠ACB = β and AD = h.
In ΔABC,
AB/BC = tan α
BC = x/ tan α ……. (i)
In ΔDBC,
BD/BC = tan β
BD = (x/tan α) x tan β …… [From (i)]
(h + x) tan α = x tan β
x tan β – x tan α = h tan α
Therefore, height of the tower is h tan α/ (tan β - tan α)

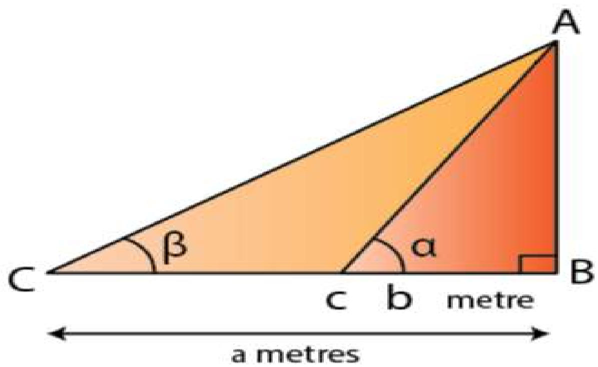
**8. With reference to the given figure, a man stands on the ground at point A, which is on the same horizontal plane as B, the foot of the vertical pole BC. The height of the pole is 10 m. The man's eye s 2 m above the ground. He observes the angle of elevation of C, the top of the pole, as $x^o$, where tan $x^o$ = 2/5. Calculate:**
**(i) the distance AB in metres;**
**(ii) angle of elevation of the top of the pole when he is standing 15 metres from the pole. Give your answer to the nearest degree.**
**Solution:**




Let take AD to be the height of the man, AD = 2 m.
So, CE = (10 - 2) = 8 m
(i) In ΔCED,
CE/DE = tan x = 2/5
8/DE = 2/5
⇒ DE = 20 m
And, as AB = DE we get
AB = 20 m

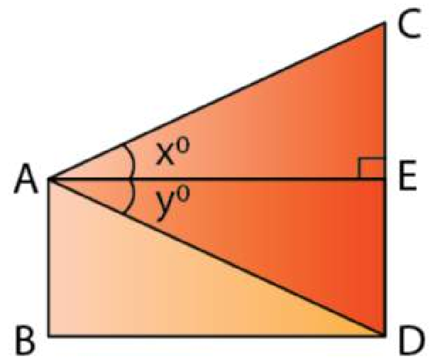
(ii) Let A'D' be the new position of the man and θ be the angle of elevation of the top of the tower.
So, D'E = 15 m
In ΔCED,
tan θ = CE/ D'E = 8/15 = 0.533
θ = 28°

**9. The angles of elevation of the top of a tower from two points on the ground at distances *a* and *b* meters from the base of the tower and in the same line are complementary. Prove that the height of the tower is √ab meter.**
**Solution:**




Let's assume AB to be the tower of height h meters.
And, let C and D be two points on the level ground such that BC = b meters, BD = a meters, ∠ACB = α, ∠ADB = β.
Given, $\alpha + \beta = 90^o$
In ΔABC,
AB/BC = tan α
h/b = tan α ….. (i)
In ΔABD,
AB/BD = tan β
h/a = tan $(90^o - \alpha)$ = cot α ….. (ii)
Now, multiplying (i) by (ii), we get
(h/a) x (h/b) = 1
$h^2 = ab$
So, h = √ab meter
Therefore, height of the tower is √ab meter.

**10. From a window A, 10 m above the ground the angle of elevation of the top C of a tower is $x^o$, where tan $x^o$ = 5/2 and the angle of depression of the foot D of the tower is $y^o$, where tan $y^o$ = 1/4. Calculate the height CD of the tower in metres.**
**Solution:**




We have, AB = DE = 10 m
So, in ΔABC
DE/AE = tan y = ¼
AE = 4 DE = 4 x 10 = 40 m
In ΔABC,
CE/AE = tan x = 5/2
CE = 40 x 5/2 = 100 m
So, CD = DE + EC = 10 + 100 = 110 m
Therefore, the height of the tower CD is 110 m.