Padasalai's

Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

- Padasalai's NEWS - Group

https://t.me/joinchat/NIfCqVRBNj9hhV4wu6_NqA

- Padasalai's Channel - Group

https://t.me/padasalaichannel

- Lesson Plan - Group

https://t.me/joinchat/NIfCqVWwo5iL-21gpzrXLw

- 12th Standard - Group

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- 11th Standard - Group

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- 9th Standard - Group

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- 6th to 8th Standard - Group

https://t.me/Padasalai_6to8

- 1st to 5th Standard - Group

https://t.me/Padasalai_1to5

- TET - Group

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- PGTRB - Group

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- TNPSC - Group

https://t.me/Padasalai_TNPSC

10th STANDARD

EASY METHOD FOR TRIGONOMETRY PROBLEMS

[NEW SYLLABUS 2019-2020]

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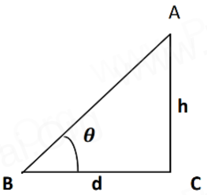
SOME USEFUL FORMULA

1..Height and Distance :



In Δ ABC , $\tan\theta = \frac{AC}{BC}$

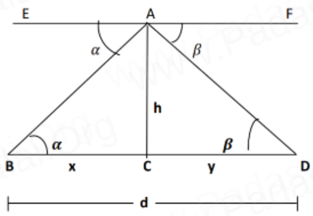
$\tan\theta = \frac{h}{d} \Rightarrow h = d\tan\theta$

$d = \frac{h}{\tan\theta} = h\cot\theta$

Height $\boldsymbol{h = d\tan\theta}$

Distance $\boldsymbol{d = h\cot\theta}$

2. Two objects are in angle of depression on opposite direction :



Δ ABC , $\tan\alpha = \frac{AC}{BC}$, ΔADC , $\tan\beta = \frac{AC}{CD}$

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

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

$x = h\cot\alpha$ .....(1) $y = h\cot\beta$.....(2)

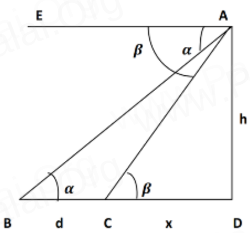
(1)+(2) $\Rightarrow$ $x + y = h\cot\alpha + h\cot\beta$

$x + y = h\,[\cot\alpha + \cot\beta\,]$

$\boldsymbol{d = h\,[\cot\alpha + \cot\beta\,]}$, $(\because d = x + y)$

[Note : α - Smaller , β - Bigger]

3. Two objects are in angle of depression on same direction :



Δ ABD , $\tan\alpha = \frac{AD}{BD}$ ΔACD , $\tan\beta = \frac{AD}{CD}$

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

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

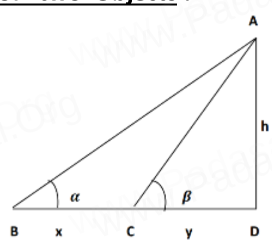
$d + x = h\cot\alpha$ ......(1) $x = h\cot\beta$ ....(2)

$(1) - (2) \Rightarrow d + x - x = h\cot\alpha - h\cot\beta$

$\boldsymbol{d = h\,[\cot\alpha - \cot\beta\,]}$

[Note : α - Smaller , β - Bigger]

4. Distance of two Objects :



ΔABD , $\tan\alpha = \frac{AD}{BD}$ ΔACD, $\tan\beta = \frac{AD}{CD}$

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

$h = (x + y)\tan\alpha$ ....(1) $h = y\tan\beta$......(2)

From (1) and (2) $(x + y)\tan\alpha = y\tan\beta$

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

$x\tan\alpha = y\tan\beta - y\tan\alpha$

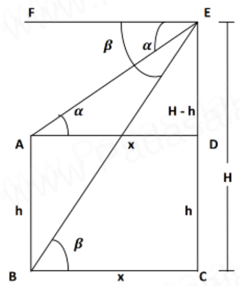
$x\tan\alpha = y\,[\tan\beta - \tan\alpha\,]$

$\boldsymbol{x = \frac{y\,[\tan\beta - \tan\alpha\,]}{\tan\alpha}}$

$\boldsymbol{y = \frac{x\tan\alpha}{\tan\beta - \tan\alpha}}$

[Note : α - Smaller , β - Bigger]

5. Height of two different objects :



Δ ADE , $\tan\alpha = \frac{DE}{AD}$ ΔBCE , $\tan\beta = \frac{CE}{BC}$

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

$x = \frac{H-h}{\tan\alpha}$ ......(1) $x = \frac{H}{\tan\beta}$ ....(2)

From (1) and (2) $\frac{H-h}{\tan\alpha} = \frac{H}{\tan\beta}$

$H\tan\beta - h\tan\beta = H\tan\alpha$

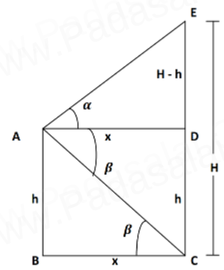
$H\,[\tan\beta - \tan\alpha] = h\tan\beta$

$\boldsymbol{H = \frac{h\tan\beta}{\tan\beta - \tan\alpha}}$

$\boldsymbol{h = \frac{H\,[\tan\beta - \tan\alpha\,]}{\tan\beta}}$

[Note : α - Smaller , β - Bigger]

6. Height of two objects are in angle of elevation and depression :



ΔADE , $\tan\alpha = \frac{DE}{AD}$ ΔADC , $\tan\beta = \frac{CD}{AD}$

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

$x = \frac{H-h}{\tan\alpha}$ ......(1) $x = \frac{h}{\tan\beta}$ ....(2)

From (1) and (2) $\frac{H-h}{\tan\alpha} = \frac{h}{\tan\beta}$

$H\tan\beta - h\tan\beta = h\tan\alpha$

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

$H\tan\beta = h[\,\tan\alpha + \tan\beta\,]$

$H = h\,[\frac{\tan\alpha}{\tan\beta} + \frac{\tan\beta}{\tan\beta}]$

$H = h\,[\,\tan\alpha\cot\beta + 1]$

$\boldsymbol{H = h\,[\,1 + \tan\alpha\cot\beta\,]}$

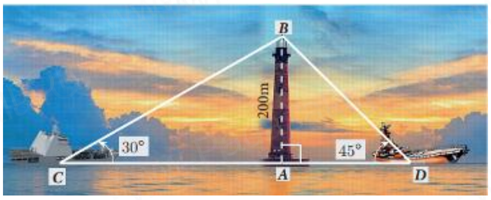
[Note : α - Angle of elevation , β – angle of depression]

1.EXAMPLE 6.21 / PAGE NO : 251

Two ships are sailing in the sea on either sides of a lighthouse. The angle of elevation of the top of the lighthouse as observed from the ships are $30°$ *and* $45°$ respectively. If the lighthouse is 200 m high, find the distance between the two ships.

$(\sqrt{3} = 1.732)$

Solution:



Height of light house AB = h = 200 m ,

$\angle BCA = \alpha = 30°$, $\angle ADB = \beta = 45°$

Distance between two ships $CD = d = h[\cot\alpha + \cot\beta]$

$= 200[\cot 30° + \cot 45°]$

$= 200[\sqrt{3} + 1]$

$= 200[1.732 + 1]$

$= 200 \times 2.732$

Distance between two ships $d = 546.4$ m

2.EXAMPLE – 6.22 / PAGE.NO :252

From a point on the ground, the angles of elevation of the bottom and top of a tower fixed at the top of a 30 m high building are $45°$ *and* $60°$ respectively. Find the height of the tower . $(\sqrt{3} = 1.732)$

Solution :

Height of building AB = y = 30 m ,

$\angle BPA = \alpha = 45°$, $\angle BPC = \beta = 60°$

Height of tower $AC = x = \frac{y[\tan\beta - \tan\alpha]}{\tan\alpha}$

$= \frac{30[\tan 60° - \tan 45°]}{\tan 45°}$

$= \frac{30[\sqrt{3}-1]}{1}$

$= 30[1.732 - 1]$

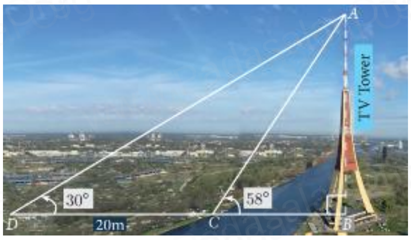
$= 30 \times 0.732$

Height of tower $x = 21.96$ m

3. EXAMPLE 6.23 / PAGE NO : 252

A TV tower stands vertically on a bank of a canal. the tower is watched from a point on the other bank directly opposite to it. The angle of elevation of the top of the tower is $58°$.From another point 20 m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the top of the tower is $30°$. Find the height of tower and the width of the canal. ($tan58° = 1.6003$)

Solution :



Let CD $= x = 20\,m$, Let $BC = y$

$\angle ADC = \alpha = 30°$, $\angle ACB = \beta = 58°$

Width of canal $BC = y = \frac{x\tan\alpha}{\tan\beta - \tan\alpha}$

$= \frac{20\tan 30°}{\tan 58° - \tan 30°}$

$= \frac{20\times\frac{1}{\sqrt{3}}}{1.6003 - \frac{1}{\sqrt{3}}}$

$= \frac{\frac{20}{\sqrt{3}}}{\frac{1.6003\sqrt{3}-1}{\sqrt{3}}}$

$= \frac{20}{\sqrt{3}} \times \frac{\sqrt{3}}{1.6003\times 1.732 - 1}$

$= \frac{20}{2.7717-1}$

$= \frac{20}{1.7717}$

Width of canal $y = 11.28\,m$

Height of tower $AB = h = y\tan\beta$

$= 11.28 \times \tan 58°$

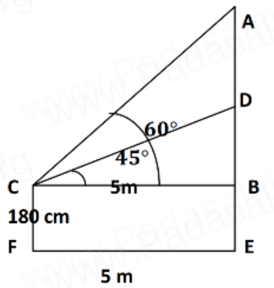
$= 11.28 \times 1.6003$

Height of tower $h = 18.05$

4. EXERCISE 6.2 – 3rd SUM / PAGE NO : 255

To a man standing outside his house , the angles of elevation of the top and bottom of a window are $60°$ and $45°$ respectively. If the height of the man is 180 cm and if he is 5 m away from the wall , what is the height of the window ? $(\sqrt{3} = 1.732)$

Solution :



Let CF is man. Let Height of window = AD =x , Let DB=y

Distance b/w man and wall EF =BC = 5 m

$\angle BCD = \alpha = 45°$, $\angle ACB = \beta = 60°$

$\tan 45° = \frac{DB}{BC}$

$1 = \frac{y}{5}$

$y = 5$

Height of window $x = \frac{y[\tan\beta - \tan\alpha]}{\tan\alpha}$

$= \frac{5[\tan 60° - \tan 45°]}{\tan 45°}$

$= \frac{5[\sqrt{3}-1]}{1}$

$= 5[1.732 - 1]$

$= 5 \times 0.732$

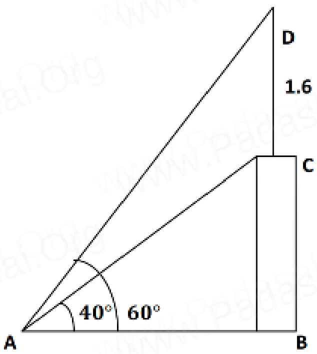
Height of window $x = 3.66\,m$

5.EXERCISE 6.2 – 4th SUM / PAGE NO : 255

A statue 1.6 m tall stands on the top of a pedestal. From a point on the ground , the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 40° . Find the height of pedestal.

$(\tan 40° = 0.8391, \sqrt{3} = 1.732)$

Solution :



Let $Height\ of\ Statue\ CD = x = 1.6\ m$

Let Height of pedestal $BC = y$

$\angle BAC = \alpha = 40°$, $\angle BAD = \beta = 60°$

Height of pedestal $y = \frac{x \tan\alpha}{\tan\beta - \tan\alpha}$

$= \frac{1.6 \times \tan 40°}{\tan 60° - \tan 40°}$

$= \frac{1.6 \times 0.8391}{\sqrt{3} - 0.8391}$

$= \frac{1.34256}{1.732 - 0.8391}$

$= \frac{1.34256}{0.8929} \times \frac{10000}{10000}$

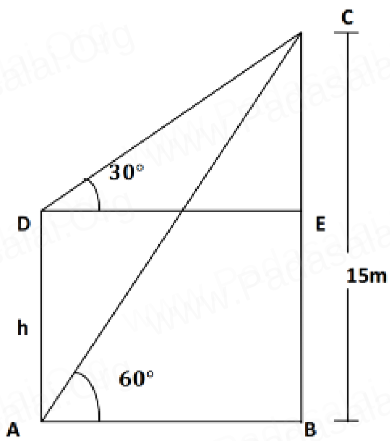
$= \frac{13425.6}{8929}$

Height of pedestal $y = 1.5035\ m$

6.EXERCISE 6.2 – 6th SUM / PAGE NO : 256

The top of 15m high tower makes an angle of elevation of 60° with the bottom of an electronic pole and angle of elevation of 30° with the top of the pole. What is the height of the electric pole ?

Solution :



Let Height of tower BC= H = 15 m

Let Height of electronic pole $AD = h$

$\angle CDE = \alpha = 30°$, $\angle BAC = \beta = 60°$

Height of electric pole $h = \frac{H[\tan\beta - \tan\alpha]}{\tan\beta}$

$= \frac{15 \times [\tan 60° - \tan 30°]}{\tan 60°}$

$= \frac{15 \times [\sqrt{3} - \frac{1}{\sqrt{3}}]}{\sqrt{3}}$

$= \frac{15 \times [3-1]}{3}$

$= 5 \times 2$

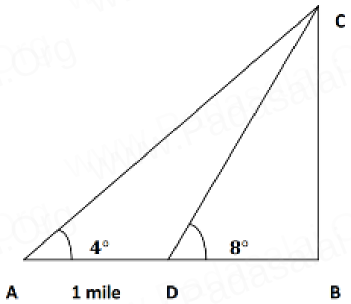
Height of electric pole $h = 10\ m$

7. EXERCISE 6.2 – 8th SUM / PAGE NO : 256

A traveler approaches a mountain on highway. He measures the angle of elevation to the peak at each milestone . At two consecutive milestone the angles measured are 4° and 8°.What is the height of the peak if the distance between consecutive milestone is 1 mile.

$(\tan 4° = 0.0699, \tan 8° = 0.1405)$

Solution :



Let A , D are milestone .Let Height of peak BC = h

Distance b/w two milestone $AD = x = 1$, Let DB = y

$\angle CAB = \alpha = 4°$, $\angle CDB = \beta = 8°$

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

$= \frac{1 \times \tan 4°}{\tan 8° - \tan 4°}$

$= \frac{0.0699}{0.1405 - 0.0699}$

$= \frac{0.0699}{0.0706} \times \frac{10000}{10000}$

$= \frac{699}{706}$

$y = 0.99$

Height of peak $h = y \times \tan\beta = 0.99 \times \tan 8°$

$= 0.99 \times 0.1405$

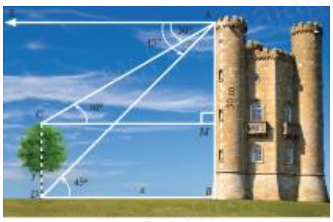
$= 0.139095$

Height of peak $h = 0.14\ miles$

8. **EXAMPLE 6.28 / PAGE NO : 257**

From the top of a tower 50 m high , the angles of depression of the top and bottom of a tree are observed to be 30° and 45° respectively. Find the height of the tree. $(\sqrt{3} = 1.732)$

Solution :



Height of tower AB= H = 50 m , Let Height of tree = CD = h

$\angle ACM = \alpha = 30°$, $\angle ADB = \beta = 45°$

Height of tree $h = \frac{H[\tan\beta - \tan\alpha]}{\tan\beta}$

$= \frac{50[\tan 45° - \tan 30°]}{\tan 45°}$

$= \frac{50[1 - \frac{1}{\sqrt{3}}]}{1}$

$= 50\,[\,1 - \frac{1}{\sqrt{3}}\,]$

$= 50 - \frac{50}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= 50 - \frac{50\sqrt{3}}{3}$

$= 50 - \frac{50 \times 1.732}{3}$

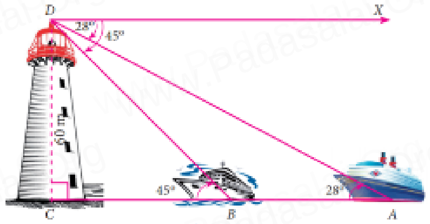
$= 50 - 28.85$

Height of tree $h = 21.15\ m$

9. **EXAMPLE - 6.29 / PAGE NO : 258**

As observed from the top of a 60 m high lighthouse from the sea level, the angles of depression of two ships are $28°$ and $45°$, If one ship is exactly behind the other on the same side of the lighthouse, find the distance between two ships. ($\tan 28° = 0.5317$)

Solution :



Height of lighthouse $CD = h = 60$,

$\angle DAC = \alpha = 28°$, $\angle DBC = \beta = 45°$

Distance b/w two ships AB $= d = h\,[\,\cot\alpha - \cot\beta\,]$

$= h[\frac{1}{\tan\alpha} - \frac{1}{\tan\beta}]$

$= h\,[\frac{\tan\beta - \tan\alpha}{\tan\alpha\tan\beta}]$

$= 60\,[\frac{\tan 45° - \tan 28°}{\tan 28° \tan 45°}]$

$= 60\,[\frac{1 - 0.5317}{0.5317 \times 1}]$

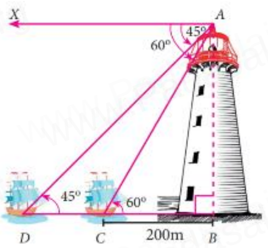
$= 60\,[\frac{0.4683}{0.5317}]$

Distance b/w two ships d $= 52.85\ m$

10. **EXAMPLE – 6.30 / PAGE NO : 6.30**

A man is watching a boat speeding away from the top of a tower. The boat makes an angle of depression of $60°$ with the man's eye when at a distance of 200 m from the tower. After 10 seconds, the angle of depression becomes $45°$. What is the approximate speed of the boat (in km / hr), assuming that it is sailing in still water. ($\sqrt{3} = 1.732$)

Solution :



Let AB –Tower, C,D –position of boat, BC$= y = 200\ m$

$\angle ADB = \alpha = 45°$, $ACB = \beta = 60°$

CD $= x = \frac{y[\tan\beta - \tan\alpha]}{\tan\alpha}$

$= 200\,[\frac{\tan 60° - \tan 45°}{\tan 45°}]$

$= 200\,[\frac{\sqrt{3} - 1}{1}]$

$= 200\,[\,\sqrt{3} - 1\,]$

$= 200\,[\,1.732 - 1\,]$

$= 200 \times 0.732$

$x = 146.4\ m$

The distance of 146.4 m is covered in 10 seconds.

Speed of the boat $= \frac{distance}{time}$

$= \frac{146.4}{10} = 14.64$ m/s

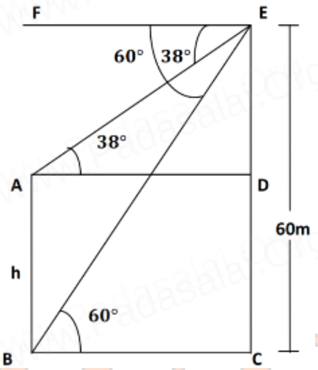
$= 14.64 \times \frac{3600}{1000}$

Speed of the boat $= 52.704$ km / hr

11. **EXERCISE 6.3 – 3rd SUM / PAGE NO : 259**

From the top of the tower 60 m high the angle of depression of the top and bottom of a vertical lamp post are observed to be $38°$ and $60°$ respectively. Find the height of the lamp post.($\tan 38° = 0.7813$, $\sqrt{3} = 1.732$)

Solution:



Height of tower $CE = H = 60\ m$

$\angle EAD = \alpha = 38°$, $\angle EBC = \beta = 60°$

Height of lamp post AB $= h = \frac{H\,[\tan\beta - \tan\alpha]}{\tan\beta}$

$= \frac{60\,[\,\tan 60° - \tan 38°\,]}{\tan 60°}$

$= \frac{60\,[\,\sqrt{3} - 0.7813\,]}{\sqrt{3}}$

$= \frac{60\,[\,1.732 - 0.7813\,]}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{60 \times 0.9507 \times \sqrt{3}}{3}$

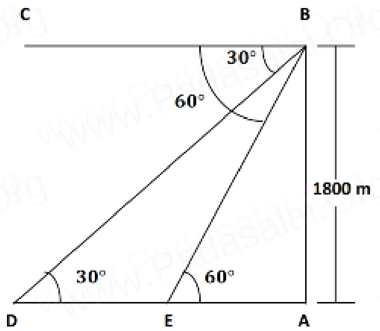
$= 20 \times 0.9507 \times 1.732$

Height of lamp post $h = 32.93\ m$

12. EXERCISE 6.3 – 4th SUM / PAGE NO : 259

An aeroplane at an altitude of 1800 m finds that two boats are sailing towards it in the same direction. The angle of depression of the boats as observed from the aeroplane are $60°$ and $30°$ respectively. Find the distance between the two boats. ($\sqrt{3} = 1.732$)

Solution :



Height of aeroplane AB = h = 1800 m ,

D , E are position of two boats

$\angle BDA = \alpha = 30°$, $\angle BEA = \beta = 60°$

Distance b/w two boats DE = $d = h\,[\cot\alpha - \cot\beta\,]$

$= 1800\,[\cot 30° - \cot 60°]$

$= 1800\,[\,\sqrt{3} - \frac{1}{\sqrt{3}}\,]$

$= 1800\,[\frac{3-1}{\sqrt{3}}\,] \times \frac{\sqrt{3}}{\sqrt{3}}$

$= 1800 \times \frac{2}{3} \times \sqrt{3}$

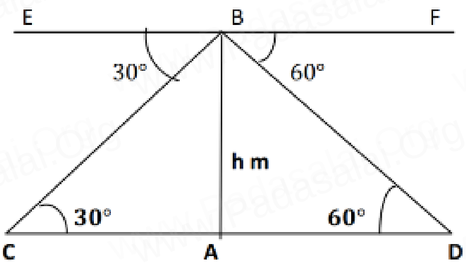
$= 600 \times 2 \times 1.732$

Distance b/w two boats $d = 2078.4\ m$

13. **EXERCISE 6.3 – 5th SUM /PAGE NO : 259**

From the top of a lighthouse , the angle of depression of two ships on the opposite sides of it are observed to be $30°$ and $60°$ .If the height of the lighthouse is h meters and the line joining the ships passes through the foot of the lighthouse , show that the distance between the ships is $\frac{4h}{\sqrt{3}}$ m.

Solution :



Let C , D - Position of two ships .

Let height of lighthouse is AB = h

$\angle BCA = \alpha = 30°$, $\angle BDA = \beta = 60°$

Distance b/w two ships $d = h\,[\cot\alpha + \cot\beta\,]$

$= h\,[\cot 30° + \cot 60°\,]$

$= h\,[\,\sqrt{3} + \frac{1}{\sqrt{3}}\,]$

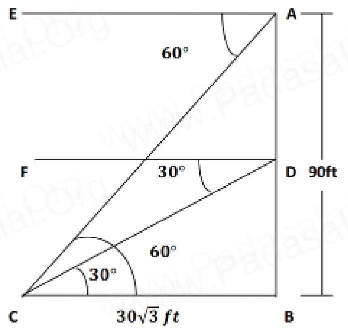
$= h\,[\frac{3+1}{\sqrt{3}}]$

Distance b/w two ships $d = \frac{4h}{\sqrt{3}}$ m

14. EXERCISE 6.3 – 6th SUM / 259

A lift in a building of height 90 feet with transparent glass walls is descending from the top of the building. At the top of the building ,the angle of depression to a fountain in the garden is $60°$.Two minutes later, the angle of depression reduces to $30°$. If the fountain is $30\sqrt{3}$ feet from the entrance to the lift, find the speed of the lift which is descending .

Solution :



Let Height of building AB = 90 ft , Let AD = d

Let C-Garden. Let BC = $h = 30\sqrt{3}\ feet$,

$\angle DCB = \alpha = 30°$, $\angle ACB = \beta = 60°$

$d = h\,[\cot\alpha - \cot\beta\,]$

$= 30\sqrt{3}\,[\cot 30° - \cot 60°\,]$

$= 30\sqrt{3}\,[\,\sqrt{3} - \frac{1}{\sqrt{3}}\,]$

$= 30\sqrt{3}\left[\frac{3-1}{\sqrt{3}}\right]$

$= 30 \times 2$

$d = 60\ feet$

Speed of the lift $= \frac{Distance}{time}$

$= \frac{60}{2}$

$=$ 30 ft / min

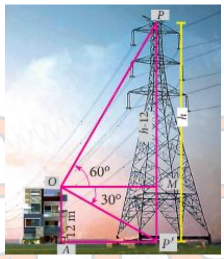
$= 30 \times \frac{1}{60}$

Speed of the lift $= 0.5$ ft / s

15. **EXAMPLE 6.31 /PAGE NO : 260**

From the top of a 12 m high building , the angle of elevation of the top of a cable tower is $60°$ and the angle of depression of its foot is $30°$. Determine the height of the tower .

Solution :



Height of building AO = h = 12 m

Angle of elevation $\angle POM = \alpha = 60°$

Angle of depression $\angle P^{I}OM\ \beta = 30°$

Height of tower PP^{I} $H = h\,[\,1 + \tan\alpha\cot\beta\,]$

$= 12\,[\,1 + \tan 60° \cot 30°\,]$

$= 12\,[\,1 + \sqrt{3} \times \sqrt{3}\,]$

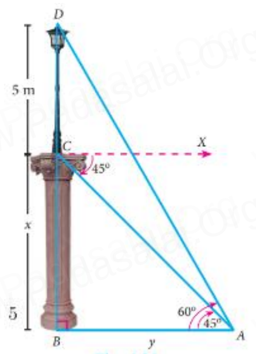
$= 12\,[\,1 + 3\,]$

Height of tower H = 48 m

16. EXAMPLE 6.32 / PAGE NO : 261

A pole 5 m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point 'A' on the ground is $60°$ and the angle of depression to the point 'A' from the top of the tower is $45°$. Find the height of tower. ($\sqrt{3} = 1.732$)

Solution :



Height of pole CD = x = 5 m ,

Height of tower BC = y

$\angle CAB = \alpha = 45°$, $\angle DAB = \beta = 60°$

Height of tower $y = \frac{x \tan\alpha}{\tan\beta - \tan\alpha}$

$= \frac{5 \times \tan 45°}{\tan 60° - \tan 45°}$

$= \frac{5 \times 1}{\sqrt{3}-1}$

$= \frac{5}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \frac{5\,(\sqrt{3}+1)}{3-1}$

$= \frac{5\,(1.732 + 1)}{2}$

$= \frac{5 \times 2.732}{2}$

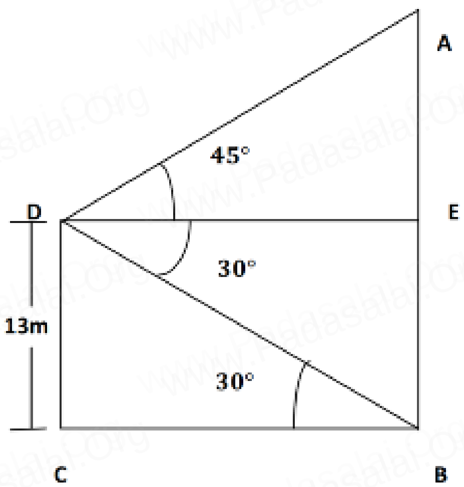
$= 5 \times 1.366$

Height of tower $y = 6.83\ m$

17. EXERCISE 6.4 - 1ST SUM / PAGE NO : 262

From the top of a tree of height 13 m the angle of elevation and depression of the top and bottom of another tree are $45°$ and $30°$ respectively. Find the height of second tree. ($\sqrt{3} = 1.732$)

Solution :



Height of first tree CD = $h = 13\ m$

Angle of elevation $\angle ADE = \alpha = 45°$

Angle of depression $\angle EDB = \beta = 30°$

Height of second tree AB = $H = h\,[\,1 + \tan\alpha \cot\beta\,]$

$= 13\,[\,1 + \tan 45° \cot 30°\,]$

$= 13\,[\,1 + 1 \times \sqrt{3}\,]$

$= 13\,[\,1 + \sqrt{3}\,]$

$= 13\,[\,1 + 1.732\,]$

$= 13 \times 2.732$

Height of second tree $H = 35.52\ m$

18. EXERCISE 6.4 – 2ND SUM / PAGE NO : 263

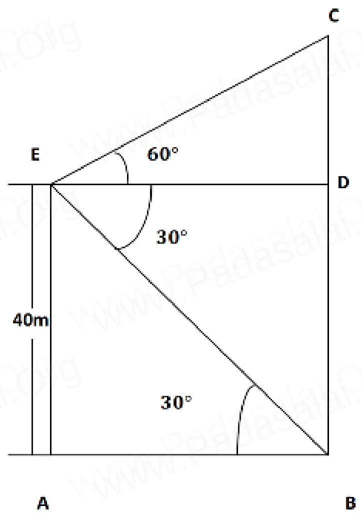
A man is standing on the deck of a ship, which is 40 m above water level. He observes the angle of elevation of the top of a hill as $60°$ and the angle of depression of the base of the hill as $30°$. Calculate the distance of the hill from the ship and the height of hill.

($\sqrt{3} = 1.732$)

Solution :

Height b/w deck of ship and water level AE = h = 40 m

Height of hill BC = H, Distance of the hill from ship AB = d



Angle of elevation $\angle CED = \alpha = 60°$

Angle of depression $\angle DEB = \beta = 30°$

Height of hill $H = h\,[\,1 + \tan\alpha \cot\beta\,]$

$= 40\,[\,1 + \tan 60° \cot 30°\,]$

$= 40\,[\,1 + \sqrt{3} \times \sqrt{3}\,]$

$= 40\,[\,1 + 3\,]$

Height of hill $H = 160\ m$

Distance of the hill from ship $d = h \cot\beta$

$= 40 \times \cot 30°$

$= 40 \times \sqrt{3}$

$= 40 \times 1.732$

Distance of the hill from ship $d = 69.28\ m$

19. **EXERCISE 6.4 – 5TH SUM / PAGE NO : 263**

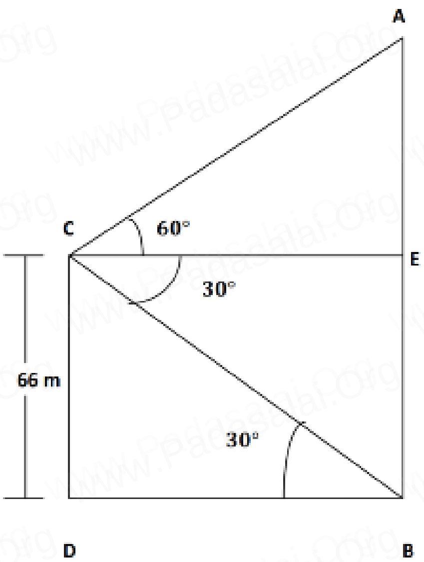
The angles of elevation and depression of the top and bottom of a lamp post from the top of a 66 m high apartment are $60°$ and $30°$ respectively. Find

(i). The height of the lamp post

(ii). The difference between height of the lamp post and the apartment.

(iii). The distance between the lamp post and the apartment.

Solution :



Height of apartment CD = h = 66 m

Angle of elevation $\angle ACE = \alpha = 60°$

Angle of depression $\angle BCE = \beta = 30°$

i).Height of the lamp post AB = $H = h\,[\,1 + \tan\alpha \cot\beta\,]$

$= 66\,[\,1 + \tan 60° \cot 30°]$

$= 66\,[\,1 + \sqrt{3} \times \sqrt{3}\,]$

$= 66\,[\,1 + 3\,]$

Height of the lamp post $H = 264\ m$

ii). Difference b/w lamp post and apartment $= H - h$

$= 264 - 66$

Difference b/w lamp post and apartment $= 198\ m$

iii). Distance b/w lamp post and apartment $d = h \cot\beta$

$= 66 \times \cot 30°$

$= 66 \times \sqrt{3}$

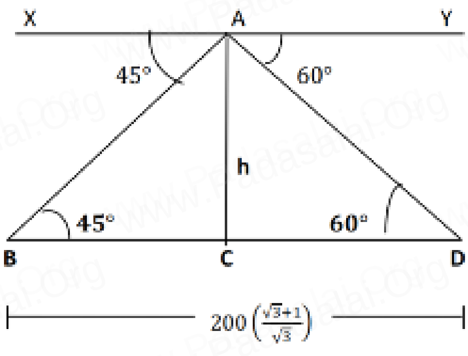
$= 66 \times 1.732$

Distance b/w lamp post and apartment $d = 114.312\ m$

20. UNIT EXERCISE 6 - 8TH SUM / PAGE NO : 265

Two ships are sailing in the sea on either side of the lighthouse . The angles of depression two ships as observed from the top the lighthouse are $60°$ and $45°$ respectively. If the distance between the ships is $200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$ meters, find the height of lighthouse.

Solution :



Let B,D- Ships . Height of lighthouse AC = h

Distance b/w ships BD = $d = 200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$

$\angle ABC = \alpha = 45°$, $\angle ADC = \beta = 60°$

Height of lighthouse $h = \frac{d}{\cot\alpha + \cot\beta}$

$= \frac{200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)}{\cot 45° + \cot 60°}$

$= \frac{200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)}{1 + \frac{1}{\sqrt{3}}}$

$= \frac{200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)}{\frac{\sqrt{3}+1}{\sqrt{3}}}$

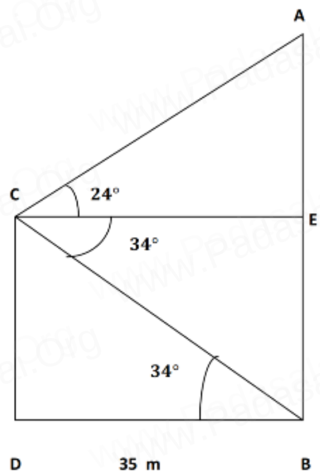
$= 200 \times \frac{\sqrt{3}+1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}+1}$

Height of lighthouse $h = 200\ m$

21. UNIT EXERCISE 6 - 9TH SUM / PAGE NO : 265

A building and a statue are in opposite side of a street from each other 35 m apart. From a point on the roof of building the angle of elevation of the top of statue is 24° and the angle of depression of base of the statue is 34°. Find the height of the statue.
($\tan 24° = 0.4452$, $\tan 34° = 0.6745$)

Solution :



Let AB – Statue , CD - Building

Distance b/w building and statue $d = 35\ m$

Height of building CD = $h = d\ \tan\beta$

$= 35 \times \tan 34°$

$= 35 \times 0.6745$

Height of building $h = 23.61\ m$

Height of statue AB = $H = h\,[\,1 + \tan\alpha \cot\beta\,]$

$= 23.61[\,1 + \tan 24° \cot 34°]$

$= 23.61\,[\,1 + 0.4452 \times \frac{1}{\tan 34}]$

$= 23.61\,[1 + \frac{0.4452}{0.6745}]$

$= 23.61\,[\,1 + 0.66\,]$

$= 23.61 \times 1.66$

Height of statue H = $39.19\ m$

Dear Teachers ,

Please give your valuable comments / feedback on this method through my whatsApp number 9360202013.

M. Mohamed Raffick.