MATHS

BOOKS - AGRAWAL PUBLICATION

INTRODUCTION TO TRIGNOMETRY AND ITS APPLICATIONS

Example

1. Prove that:

$$\frac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1} = \frac{1 + \cos\theta}{\sin\theta}$$

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2. Prove that:

$2\left(\sin^6\theta+\cos^6\theta\right)-3\left(\sin^4\theta+\cos^4\theta\right)+1=0$

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3. If $\sin\theta+\cos\theta=\sqrt{3}$, then prove that $\tan\theta+\cot\theta=1$.

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4. Prove that: $\left(\sin^4\theta - \cos^4\theta + 1\right)\operatorname{cosec}^2\theta = 2.$

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5. Prove that: $\dfrac{2\cos^3\theta - \cos\theta}{\sin\theta - 2\sin^3\theta} = \cot\theta$

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6. If $\tan A = \dfrac{3}{4}$, then prove that $\sin A \cos A = \dfrac{12}{25}$

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7. $\frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta} = \frac{\cos\theta+\sin\theta}{\cos\theta-\sin\theta}$

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8. If $\cos\theta+\sin\theta=\sqrt{2}\cos\theta$, then $\cos\theta-\sin\theta$ is

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9. Prove that $(\sin\theta+1+\cos\theta)(\sin\theta-1+\cos\theta).\sec\theta\cos ec\theta$

=2

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10. A ladder 15 metres long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, find the height of the wall.

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11. Prove that:

$$\sqrt{\frac{\sec\theta - 1}{\sec\theta + 1}} + \sqrt{\frac{\sec\theta + 1}{\sec\theta - 1}} = 2\text{cosec}\theta$$

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12. Prove that $(\sin\theta + \cos ec\theta)^2 + (\cos\theta + \sec\theta)^2$ = $7 + \tan^2\theta + \cot^2\theta.$

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13. Prove that: $(1 + \cot\theta - \operatorname{cosec}\theta)(1 + \tan\theta + \sec\theta) = 2$

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14. If $4\tan\theta = 3$, evaluate $\dfrac{4\sin\theta - \cos\theta + 1}{4\sin\theta + \cos\theta - 1}$

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15. A player sitting on the top of a tower of height 20 m observes the angle of depression of a ball lying on the ground as 60°. Find the distance between the foot of the tower and the ball. $\left(Take\sqrt{3} = 1.732\right)$.

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16. Using the formula $\cos 2\theta = 2\cos^2\theta - 1$, find the value of $\cos 30^\circ$, it is being given that $\cos 60^\circ = 1/2$.

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17. If $\sin\theta + \cos\theta = \sqrt{3}$, then prove $\tan\theta + \cot\theta = 1$.

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18. Prove that following identity:

$$\frac{\cos A}{1+\sin A}+\frac{1+\sin A}{\cos A} = 2\sec A$$

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19. Prove that $\sec^2\theta + \text{cosec}^2\theta = \sec^2\theta \text{cosec}^2\theta$

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20. If $2\sin^2\theta - \cos^2\theta = 2$, find the value of θ.

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21. The shadow of a tower standing on a level plane is found to be 50 m longer when the Sun's elevation is 30° than when it is 60°. The height of the tower is

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22. From a window, 15 m high above the ground, the angles of elevation and depression of the top the foot of a house on the opposite side of the street are 30° and 45°, repectively,

find the height of the opposite house.

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

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23. A moving boat is observed from the top of a 150 m high cliff moving away from the cliff. The angle of depression of the boat changes from 60° to 45° is 2 minutes. Find the speed of the boat in m/hr.

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24. An observer 1.5 m tall is $20\sqrt{3}m$ away from a chimney. The angle of elevation from the top of the chimney from his eyes is 30° and from bottom is 45°. Find the height of the chimney.

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25. Two men on either side of a tower 75 m high observe the angle of elevation of the top of the tower to be 30^o and 60^o. What is the distance between the two men ?

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26. The angles of depression of the top and bottom of a 50 m high building from the top of a tower are 45° and 60°, respectively. Find the height of the tower and the horizontal distance between the tower and the building. $(Use \sqrt{3} = 1.73)$

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27. A man standing on the deck of a ship, which is 10 m above water level, observes the angle of

elevation of the top of a hil as 60° and the angle of depression of the base of hill as 30°. Find the distance of the hill from the ship and the height of the hill.

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28. 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 45°. Find the height of the pedestal. $\left(Use\sqrt{3} = 1.73\right)$

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29. The angle of elevation of an aeroplane from a point A on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the aeroplane is flying at a constant height of $1500\sqrt{3}$ of the plane in km/hr.

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30. From the top of a 7 m building, the angle of elevation of a top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. $(Use \sqrt{3} = 1.73)$

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31. The angle of elevation of the top of a tower from a certain point is 30°. If the observer moves 20 metres towards the tower, the angle

of elevation of the top increases by 15°. Find the height of the tower.

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32. A straight highway leads to the foot of a tower. A man standing at the top of the tower observes a car at an angle of depression of 30°, which is approaching the foot of the tower with a uniform speed. After covering a distance of 50 m, the angle of derpession of the car

becomes 60°.find the height of the tower. $(Use\sqrt{3} = 1.73)$.

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33. The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of the top of a tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.

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34. If $1 + \sin^2\theta = 3\sin\theta\cos\theta$, then prove that $\tan\theta = 1$ or 1/2.

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35. From a point on the ground the angles of elevation of the bottom and the top of a tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.

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36. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag-staff is height 6 m. At a point on the plane, the angle of elevation of the bottom and top of the flag-staff are 30° and 45° respectively. Find the height of the tower. $\left(take\sqrt{3} = 1.73\right)$

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37. From a point on the ground, the angles of elevation of the bottom and the top of a

transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.$\left(Use\sqrt{3}=1.73\right)$

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38. A boy standing on a horizontal plane find that angle of elevation of a bird 100 meter away from him at 30°. A girl standing at a house 20 meter above the plane find that elevation of the bird is 45°. If boy and girl are

in the opposite direction find the distance between the bird and the girl.

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39. If $\sin\theta + \cos\theta$ = p and $\sec\theta + \cos ec\theta$ = q, then prove that $q\left(p^2 - 1\right)$ = 2p.

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40. The angle of elevation of an aeroplane from a point A on the ground is 60°. After a flight of

30 seconds, the angle of elevation changes to 30°. If the aeroplane is flying at a constant height of $3600\sqrt{3} metres$ find the speed of the aeroplane.

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41. Prove that:

$$\frac{(1+\cot\theta+\tan\theta)(\sin\theta-\cos\theta)}{\sec^3\theta-\cos ec^3\theta} =$$

$$\sin^2\theta\cos^2\theta.$$

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42. If $\sec\theta + \tan\theta$ = m, show that $\frac{m^2 - 1}{m^2 + 1} = \sin\theta$.

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43. A moving boat is observed from the top of a 150 m high cliff moving away from it. The angle of depressioin of the boat changes from 60° to 45° in 2 minutes. Find the speed of the boat in 'm' min.

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44. A ladder rests against a vertical wall at an inclination α to the horizontal, its foot is pulled away from the wall through a distance p so that its upper end slides a distance q down the wall and then the ladder makes an $\angle\beta$ to the horizontal. show that $\frac{p}{q} = \frac{\cos\beta - \cos\alpha}{\sin\alpha - \sin\beta}$

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45. There are two poles, one each on either bank of a river just opposite to each other. One pole is 60 m high. From the top of this pole,

the angles of depression at the top and foot of the other pole are 30° and 60° respectively. Find the width of the river and the height of the other pole.

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46. Amit, standing on a horizontal plane, finds a bird flying at a distance of 200 m from him at an elevation of 30°. Deepak standing on the roof of a 50m high building, finds the angle of elevation of the same bird to be 45°. Amit and

Deepak are on the opposite sides of the bird.

Find the distance of the bird from Deepak.

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47. Prove that:

$$\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\cos ec\theta$$

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48. The lower window of a house is at a height of 2 m above the ground and its upper window

is 4 m vertically above the lower window. At certain distance the angles of elevation of a balloon from these window are observed to be 60° and 30°, respectively. Find the height of the balloon above the ground.

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49. Prove that:

$$\frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} = 2 + \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$$

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50. Prove that $\frac{\sin A - \cos A + 1}{\sin A + \cos A - 1} = \frac{1}{\sec A - \tan A}$

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51. A man in a boat rowing away form a light house 100 m hight takes 2 minutes to change the angle of elevation of the top of the light house from 60° to 30°. Find the speed of the boat in metres per minute.$\left(Use\sqrt{3} = 1.732\right)$

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52. Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30°, respectively. Find the height of the poles and the distances of the point from the poles.

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53. The shadow of a tower at a time is three times as long as its shadow when the angle of

elevation of the sun is 60°. Find the angle of elevation of the sun of the longer shadow.

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54. Prove that:

$$\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$$

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55. A straight highway leads to the foot of a tower. A man standing on its top observes a car

at an angle of depression of 30°, which is approaching the foot of the tower with a unifrom speed. 6 seconds later, the angle of depression of the car becomes 60°. Find the time taken by the car to reach the foot of the tower from this point.

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56. The angle of elevation of a cloud from a point 60 m above the surface of the water of a lake is 30° and the angle of depression of its

shadow in water of lake is 60°. Find the height of the cloud from the surface of water.

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57. From a point P on the ground, the angles of elevation of the top of a 10 m tall building and a helicopter, at some height vertically over the top the building are 30° and 60° respectively. Find the height of the helicopter above the ground.

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58. A 1.6 m tall boy is standing at some distance from a 40 m tall building. The angle of elevation from his eyes to the top of the building increases from 30° to 60° as the walks towards the building. Find the distance he walked towards the building.

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59. From the top of a 120 m high tower,a man observes two cars on the opposite sides of the

tower and in straight line with the base of tower the angles of pression as 60° and 45°. Find the distance between two cars.

A.

B.

C.

D.

Answer:

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60. A vertical tower stands on a horizontal plane and its surmounted by a flagstaff of height 5 m. From a point on the ground the angles of elevation of the top and bottom of the flagstaff are 60° and 30° respectivley. Find the height of the tower and the distance of the point from the water. $\left(take\sqrt{3} = 1.732\right)$

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61. At a point A, 20 metres above the level of water in a lake, the angle of elevation of a

cloud is 30°. The angle of depression of the reflection of the cloud in the lake, at A is 60°. Find the distance of the cloud from A.

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62. A bird is sitting on the top of a 80 m high tree. From a point on the ground, the angle of elevation of the bird is 45°. The bird flies away horizontally in such a way that it remained at a constant height from the ground. After 2 seconds, the angle of elevation of the bird from

the same point is 30°. Find the speed of the height of the bird.$\left(Take\sqrt{3}=1.732\right)$

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63. From the top of a lighthouse. 100 m high, the angle of depression of two ships are 30^o and 45^o, if both ships are on same side find the distance between the ships ?

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