MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

TRIGONOMETRY

Execrise 5 1

1. Prove that following identities

$\cot\theta + \tan\theta = \sec\theta \operatorname{cosec}\theta$

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2. Prove that following identities

$$\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$$

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3. Prove that following identities

$$\frac{1-\tan^2\theta}{\cot^2\theta - 1} = \tan^2\theta$$

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4. Prove that following identities

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

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5. Prove that following identities

$$\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$$

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6. Prove that following identities

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

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7. Prove that following identities

$$\sec^6\theta = \tan^4\theta + 3\tan^2\theta\sec^2\theta + 1$$

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8. Prove that following identities

$$(\sin\theta + \sec\theta)^2 + (\cos\theta + \cos ec\theta)^2 = 1 + (\sec\theta + \cos ec\theta)^2$$

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9. Prove that following identities

$$\sec^4\theta(1 - \sin^4\theta) - 2\tan^2\theta = 1$$

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10. Prove that following identities

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

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11. Prove that following identities

$$\frac{\sin A - \sin B}{\cos A + \cos B} + \frac{\cos A - \cos B}{\sin A + \sin B} = 0$$

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12. Prove that following identities

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

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

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14. If $\sqrt{3}\sin\theta - \cos\theta = 0$, then show that $\tan 3\theta = \dfrac{3\tan\theta - \tan^3\theta}{1 - 3\tan^3\theta}$

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15. If $\dfrac{\cos\alpha}{\cos\beta} = m$ and $\dfrac{\cos\alpha}{\sin\beta} = n$ then prove that $\left(m^2 + n^2\right)\cos^2\beta = n^2.$

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16. If $\cot\theta + \tan\theta = x$ and $\sec\theta - \cos\theta = y$ then prove that $\left(x^2y\right)^{\frac{2}{3}} - \left(xy^2\right)^{\frac{2}{3}} = 1$

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

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18. If $\sin\theta\left(1 + \sin^2\theta\right) = \cos^2\theta$, then prove that $\cos^6\theta - 4\cos^2\theta + 8\cos^2\theta = 4$

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19. If $\frac{\cos\theta}{1 + \sin\theta} = \frac{1}{a}$ then prove that $\frac{a^2 - 1}{a^2 + 1} = \sin\theta.$

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Execrise 5 2

1. Find the angle of elevation of the top of a tower from a point on the ground, which is 30 m away the foot of a tower of height $10\sqrt{3}$m.

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2. A road is flanked on either side by continuous rows of house of height $4\sqrt{3}$ m with no space in between them. A pedestrain is standing on the median of the road facing a row house. The angle of elevationn from the pedestrain to the top of the house is 30°.Find the width of the road.

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3. 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 5m away from the wall. What is the height of the window? $\left(\sqrt{3} = 1.732\right)$.

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4. 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 angle of elevation of the top of the pedestal is 40°. Find the height of the pedestal. $\left(\tan 40^\circ = 0.8931, \sqrt{3} = 1.732\right)$

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5. A flog pole 'h' metres is on the top of the hemispherical dome of radius 'r' metres. A man is standing 7m away form the dome. Seeing the top of the pole at an angle 45° and moving 5 m away from the dome and seeing the bottom of the pole at angle 30°. Find

the height of the pole

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6. A flog pole 'h' metres is on the top of the hemispherical dome of radius 'r' metres. A man is standing 7m away form the dome. Seeing the top of the pole at an angle45° and

moving 5 m away from the dome and seeing the bottom of the pole at angle 30°. Find

radius of the dome.

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7. The top of a 15m high tower make 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?

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8. A vertical pole fixed to the ground is divided in the ratio 1:9 by a mark on it with lower part shorter than the upper

part. If the two parts subtend equal angles at a place on the ground, 25 m away from the base of the pole, what is the height of the pole?

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9. A traveler approaches a mountain on highway. He measures the angle of elevation to the peak at each milestone. At two consecutive milestones the angles measured are 4° and 8°. What is the height of the peak if the distance between consecutive milestones is 1 mile. $(\tan 4^\circ = 0.0699, \tan 8^\circ = 0.14405)$

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Execrise 5 3

1. From the top of a rock $50sqr(3)$ m high, the angle of depression of car on the ground is observed to be 30°. Find the distance of the car from the rock.

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2. The horizontal distance between two building is 70m. The angle of depression of the top of the first building when seen from the top of the second building is 45°. If the height of the second building is 120 m, find the height of the first building.

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3. From the top of the tower 60 m high the angles 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. $\left(\tan 38^\circ = 0.7813, \sqrt{3} = 1.732\right)$

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4. An aeroplane at an altitude of 1800m finds that two boats are selling towards it in the same direction. The angles of depressionn of the boats as obversed from the aeroplane are 60° and 30° respectively. Find the distance between the two boats. $\left(\sqrt{3} = 1.732\right)$.

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5. From the top of a lighhouse, the angles 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 thhe line joining the ships passes through the foot of the lighthouse. show that the distance between the ships is $\frac{4h}{\sqrt{3}}$ m.

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6. 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 angles 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 entrace of the lift, find the speed of the lift, and the speed of the lift which is descending.

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Execrise 5 4

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

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2. A man is standing on the deck of a ship, which is 40m above water level. He observes the angle of elevation of the top of a hill as 60° and the angle depression of the base of the hill as 30°. Calculate the distance of the hill from the ship and the height of the hill, $\left(\sqrt{3} = 1.732\right)$.

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3. If the angle of elevation of a cloud from a point 'h' meterss above a take is θ_1 and the angle of depression of its reflection in the take is θ_2. Prove that the height that the cloud is located from the ground is $\frac{h(\tan\theta(1) + \tan\theta_2)}{\tan\theta_2 - \tan\theta_2}$.

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4. The angle of elevation of the top of cell phone tower from the foot of a high apartment is 60° and the angle of depression of the foot of the tower from the top of the apartment is 30°. If the height of the apartment is $50m$, find the height of the cell tower. According to radiations control norms, the minimum height of the cell phone tower should be 120m. State if the height of the above mentioned cell phone tower meets the radiation norms.

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5. The angles of elevation and depression of the top and bottom of a lamp post from the top of a 66m high

apartment are 60° and 30° respectively, find

The height of the lamp post.

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

The difference between height of the lamp post and the apartment.

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7. The angles of elevation and depression of the top and bottom of a lamp post from the top of a 66m high

apartment are 60° and 30° respectively, find

The distance between the lamp post and the apartment $\left(\sqrt{3} = 1.773\right)$.

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8. Three villagers A, B and C can see each other across a valley. The horizontal distance between A and B is 8 km and the horizontal distance between B and C is 12 km. The angle of depression of B from A is 20° and the angle of elevation of C from B is 30°. Calculate:

the vertical between A and B.

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9. Three villagers A, B and C can see each other across a valley. The horizontal distance between A and B is 8 km and the horizontal distance between B and C is 12 km. The angle of depression of B from A is 20° and the angle of elevation of C from B is 30°. Calculate:

The vertical height between B and C. $(\tan 20^\circ = 0.3640, \sqrt{3} = 1.732)$.

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Execrise 5 5

1. The value of $\sin^2\theta + \dfrac{1}{1+\tan^2\theta}$ is equal to

A. $\tan^2\theta$

B. 1

C. $\cot^2\theta$

D. 0

Answer: B

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2. $\tan\theta\cos ec^2\theta - \tan\theta$ is equal to

A. $\sec\theta$

B. $\cot^2\theta$

C. $\sin\theta$

D. $\cot\theta$

Answer: D

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3. Prove the following identities:

$$(\sin\alpha + \cos ec\alpha)^2 + (\cos\alpha + \sec\alpha)^2 = \tan^2\alpha + \cot^2\alpha + 7$$

A. 9

B. 7

C. 5

D. 3

Answer: B

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4. If $\sin\theta + \cos\theta = a$ and $\sec\theta + \operatorname{cosec}\theta = b$, then the value of $b\left(a^2 - 1\right)$ is equal to

A. $2a$

B. $3a$

C. 0

D. $2ab$

Answer: B

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5. If $5x = \sec\theta$ and $\frac{5}{x} = \tan\theta$, then $x^2 - \frac{1}{x^2}$ is equal to

A. 25

B. $\frac{1}{25}$

C. 5

D. 1

Answer: B

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6. If $\sin\theta = \cos\theta$ then $2\tan\theta + \cos^2\theta =$

A. $\frac{-3}{2}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $\frac{-2}{3}$

Answer: B

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7. If $x = a\tan\theta$ and $y = b\sec\theta$ then

A. $\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$

B. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

C. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

D. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$

Answer: A

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8. $(1+\tan\theta+\sec\theta)(1+\cot\theta-\cos ec\theta)$ is equal to

A. 0

B. 1

C. 2

D. -1

Answer: C

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9. $a\cot\theta + b\cos ec\theta = p$ and $b\cot\theta + a\cos ec\theta = q$ then $p^2 - q^2$ is equal to

A. $a^2 - b^2$

B. $b^2 - a^2$

C. $a^2 + b^2$

D. $b - a$

Answer: B

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10. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3}:1$, then the angle of elevation of the sum had measure.

A. 45°

B. 30°

C. 90°

D. 60°

Answer: D

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11. The electric pole subtends an angle of 30° at a point on the same level as its foot. At a second point 'b' metres above the first, the depression of the foot of the tower is 60°. The height of the tower (in towers) is equal to

A. $\sqrt{6}b$

B. $\frac{b}{3}$

C. $\frac{b}{2}$

D.

Answer: B

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12. A tower is 60 m height. Its show is x metres shorter when the sun's altitude is 45° than when it has been 30°, then x is equal to

A. 41.92 m

B. 43.92 m

C. 43 m

D. 45.6 m

Answer: B

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13. The angle of depression of the top and bottom of 20 m tall building from the top of a multistorised building are 30° and 60° respectively. The height of the multistoried building and the distances between two building (in metres) is

A. $20, 10\sqrt{2}$

B. $30, 50\sqrt{3}$

C. $20, 10$

D. $30, 10\sqrt{3}$

Answer: D

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14. Two persons are standing 'x' metres apart from each other and the height of the first person is double that of the other. If from the middle points of the linejoining their their feet an observe finds the angular elevations of their tops to be complementary, then the height of the shorter person (in metres) is

A. $\sqrt{2}x$

B. $\frac{x}{2\sqrt{2}}$

C. $\frac{x}{\sqrt{2}}$

D. $2x$

Answer: B

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15. The angle of elevation of a cloud from a point h metres above a lake is β. The angle of depression of its reflection in the lake is 45°. The height of location of the cloud from the lake is

A. $\frac{h(1+\tan\beta)}{1-\tan\beta}$

B. $\frac{h(1-\tan\beta)}{1+\tan\beta}$

C. $h\tan(45^\circ-\beta)$

D. None of these

Answer: A

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Unit Exercise 6

1. Prove that

$$\cot^2 A((\sec A - 1)/(1 + \sin A)) + \sec^2 A\left(\frac{\sin A - 1}{1 + \sec A}\right) = 0$$

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2. Prove that

$$\frac{\tan^2\theta - 1}{\tan^2\theta + 1} = 1 - 2\cos^2\theta$$

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3. Prove that $\left(\frac{1 + \sin\theta - \cos\theta}{1 + \sin\theta + \cos\theta}\right)^2 = \frac{1 - \cos\theta}{1 + \cos\theta}$

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4. If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta = y\cos\theta$, then prove that $x^2 + y^2 = 1$.

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5. If a cos θ - b sinθ = c, show that a sin θ + b cos $\theta = \pm\sqrt{a^2 + b^2 - c^2}$

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6. 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 horizontallly in such away that it remained at a constant height from the ground. After 2 seconds, the angle

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7. An aeroplane is flying parallel to the Earth's surface at a speed of 175 m/sec and at a height of 600m. The anlge elevation of the aeroplane from a point on the Earth's surface is 37° at a given point. After what period of time does the angle of elevation increase to 53°? $(\tan 53^\circ = 1.3270, \tan 37^\circ = 0.7536)$.

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8. A bird is flying from A towards B at an angle of 35°, a point 30 km away from A. At B it charges its course of flight and heads towards C on a bearing of 48° and distance 32 km away.

How far is B to the North of A?

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9. A bird is flying from A towards B at an angle of 35°, a point 30 km away from A. At B it charges its course of flight and heads towards C on a bearing of 48° and distance 32 km away.

How far is B tp the West of A?

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10. A bird is flying from A towards B at an angle of 35°, a point 30 km away from A. At B it charges its course of flight and heads towards C on a bearing of 48° and distance 32 km away.

How far is C to the North of B?

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11. A bird is flying from A towards B at an angle of 35°, a point 30 km away from A. At B it charges its course of flight and heads towards C on a bearing of 48° and distance 32 km away.

How far is C to the East of B?

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12. Two ships are sailing in the sea on either side of the lighthouse. The angles of depression of two ships as observed from the top of the lighthouse are $60^\circ \text{ and } 45^\circ$

respectively. If the distance between the ship is $200\frac{\left(\sqrt{3}+1\right)}{\sqrt{3}}$ metres, find the height of the lighthouse.

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13. A building and a statue are in opposite side of a street from each other 35m apart. From a point on the roof of building the angle of elevationof the top of statue is 24° and the angle of depression of base of base of the statue is 34°. Find the height of the statue.

$(\tan 24^\circ = 0.4452, \tan 34^\circ = 0.6745)$.

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Government Exam Questions

1. $\cos 60^\circ \sin 30^\circ + \cos 30^\circ \sin 60^\circ =$

A. 90°

B. $\frac{1}{2}$

C. $\frac{\sqrt{3}}{2}$

D. 1

Answer: D

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2. Prove that : $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \cos ec\theta + \cot\theta.$

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

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Additional Question Answers

1. Prove that $\sec A(1 - \sin A)(\sec A + \tan A) = 1$.

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2. Given tan $A = \frac{4}{3}$, find the other trigonometric ratios of the angles A.

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3. Prove that $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$. using the identity $\sec^2\theta = 1 + \tan^2\theta$.

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4. In a right triangle ABC, right angled at B, if tan A=1, then verify that `2sinAcosA=1.

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5. From a point on a bridge across a river. The angles of depression of the banks on opposite sides at the river are 30° and $45(\circ)$ respectively. If the bridger is at a height at 3 m from the banks, find the width at the river.

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Unit Test

1. $\tan\theta \cos ec^2\theta - \tan\theta$ is equal to

A. $\sec\theta$

B. $\cot^2\theta$

C. $\sin\theta$

D. $\cot\theta$

Answer: D

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2. If $\sin\theta + \cos\theta = a$ and $\sec\theta + \operatorname{cosec}\theta = b$, then the value of $b\left(a^2 - 1\right)$ is equal to

A. $2a$

B. $3a$

C. 0

D. $2ab$

Answer: A

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3. Two persons are standing 'x' metres apart from each other and the height of the first person is double that of the other. If from the middle points of the linejoining their their feet an observe finds the angular elevations of their tops to be complementary, then the height of the shorter person (in metres) is

A. $\sqrt{2}x$

B. $\frac{x}{2\sqrt{2}}$

C. $\frac{x}{\sqrt{2}}$

D. $2x$

Answer: B

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4. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3}:1$, then the angle of elevation of the sum had measure.

A. 45°

B. 30°

C. 90°

D. 60°

Answer: D

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5. The angle of elevation of a cloud from a point h metres above a lake is β. The angle of depression of its reflection in the lake is 45°. The height of location of the cloud from the lake is

A. $\frac{h(1+\tan\beta)}{1-\tan\beta}$

B. $\frac{h(1-\tan\beta)}{1+\tan\beta}$

C. $h\tan(45^\circ-\beta)$

D. None of these

Answer: A

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$\sec^6\theta - \tan^6\theta - 3\tan^2\theta\sec^2\theta = 1$

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bottom of the pole at angle 30°. Find

the height of the pole

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radius of the dome.

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$$\frac{1-\tan^2\theta}{\cot^2\theta-1}=\tan^2\theta$$

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