



MATHS

BOOKS - S CHAND IIT JEE FOUNDATION

SOME APPLICATIONS OF TRIGONOMETRY

Solved Examples

1. The angle of elevation of the top of a tower from a point at a distance of 100 metres from its foot on a horizontal plane is found to be 60° . Find the height of the tower

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2. A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground . Find the height of the pole, if the angle and by the rope with ground leave is 30°



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3. A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground . If the length of the string is $40\sqrt{3}$. find the inclination of the string with the ground



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4. The angle of depression of a boat B from the top K of a cliff HK, 300 metres high is 30° . Find the distance of the boat from the foot H of the cliff.

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5. Two men on either side of a temple 126 m high observe the angle of elevation of the top of the temple to be 30° and 60° respectively. Find the distance between the two men ?

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6. A tower is 120 m high. Its shadow is s m shorter, when the sun's altitude is 60° than when it was 45° . Find x correct to

nearest metre .



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7. The angular elevation of a tower from a point is 30° . As we move 100 m nearer to the base of the tower, the angle of elevation become 60° . Find the height of the tower and the distance of the first point from the base of the tower .



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8. Two pillars of equal height and on either side of a road, which is 100m wide. The angles of elevation of the top of the pillars are 60° and 30° at a point on the road between the

pillars. Find the position of the point between the pillars and the height of each pillar.

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9. A 10 m long flagstaff is fixed on the top of a tower from a point on the ground, the angles of elevations of the top and bottom of flagstaff are 45° and 30° respectively. Find the height of the tower

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10. The angle of depression of 47 m high building from the top of a tower 137 m high is 30° . Calculate the distance between the building and the tower.



Question Bank 34

1. If the angle of elevation of sun is θ and the length of the shadow of a pole of length p is s , then

A. $p = s \cos \theta$

B. $p = s \sin \theta$

C. $p = \frac{s}{\cot \theta}$

D. $p = s \cot \theta$

Answer: C

2. The foot of a ladder leaning against a wall of length 5 metres rests on a level ground $5\sqrt{3}$ metres from the base of the wall. The angle of inclination of the ladder with the ground is

A. 60°

B. 50°

C. 40°

D. 30°

Answer: D



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3. From the top of a light house 60 metre high, with its base at the sea level, the angle of depression of a boat is 30° .

The distance of the boat from the foot of the light - house is

A. $60\sqrt{3}$ metres

B. $\frac{60}{\sqrt{3}}$ metres

C. 60 metres

D. $30\sqrt{2}$ metres

Answer: A



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4. A pole is standing erect on the ground which is horizontal.

The tip of the pole is tied tight with a rope of length $\sqrt{12}$ m

to a point on the ground. If the rope is making 30° angle with the horizontal, then the height of the pole is

A. $2\sqrt{3}m$

B. $3\sqrt{2}m$

C. $3m$

D. $\sqrt{3}m$

Answer: D



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5. Two observers are stationed due north of a tower at a distance of 20 m from each other. If the elevations of the tower observed by them are 30° and 45° respectively, then the height of the tower is

A. 10 m

B. 16. 32

C. $10(\sqrt{3} + 1)m$

D. 30 m

Answer: C



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6. Two ships are sailing in the sea on either side of a light - house . The angle of depression of the two ships are 45° each . If the height of the light-house is 300 metres, then the distance between the ships is

A. 600 m

B. $600 / \sqrt{3}m$

C. $300\sqrt{3}m$

D. 300 m

Answer: A

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7. Two posts are k metres apart. If from the middle point of the line joining their feet, an observer finds the angles of elevations of their tops to be 60° and 30° respectively, then the ratio of height of the posts respectively is

A. 3

B. $\frac{1}{3}$

C. $\sqrt{3}$

D. $\frac{1}{\sqrt{3}}$

Answer: A



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8. A person standing on the bank of a river observes that the angle subtended by a tree on the opposite of bank is 60° . When he retires 40 m. from the bank, he finds the angle to be 30° . What is the breadth of the river ?

A. 20 m

B. 24 m

C. 40 m

D. 64 m

Answer: A



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9. The horizontal distance between two trees of different heights is 60m. The angle of depression of the top of the first tree when seen from the top of the second tree is 45° . If the height of the second tree is 80m, find the height of the first tree.

A. $\frac{k}{2\sqrt{2}}$

B. $\frac{k}{4}$

C. $k\sqrt{2}$

D. $\frac{k}{\sqrt{2}}$

Answer: A



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10. Two persons are a metres apart and the height of one is double that of the other. If from the middle point of the line joining their feet, an observer finds the angular elevation of their tops to be complementary, then the height of the shorter post is $\frac{a}{4}$ (b) $\frac{a}{\sqrt{2}}$ (c) $a\sqrt{2}$ (d) $\frac{a}{2\sqrt{2}}$

A. 20 m

B. $10(1 + \sqrt{2})$ m

C. $10\sqrt{2}$ m

D. $20\sqrt{2}$ m

Answer: A



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11. A tree AC is broken over by wind from B . D is the point where the top of the broken tree touches the ground and BD makes an angle of 45° with the ground. If the distance between the base of the tree and the point $D = 10$ m. What is the height of the tree?

A. $20\sqrt{3}$ m

B. 60 m

C. $20(\sqrt{3} - 1)$ m

D. $40\sqrt{3}m$

Answer: B



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

A. 43.3 m

B. 57.66 m

C. 86.6 m

D. 100 m

Answer: C



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13. A straight highway leads to the foot of a tower of height 50 m . From the top of the tower, angles of depressions of two cars standing on the highway are 30° and 60° , What is the distance between the cars ?

A. 100 m

B. 125 m

C. $50\sqrt{3}m$

D. 150 m

Answer: B

14. The angle of elevation of the top of a hill at the foot of a tower is 60° and the angle of elevation of the top of the tower from the foot of the hill is 30° . If the tower is 50 m high, what is the height of the hill

- A. 1350 m
- B. 1268 m
- C. 1000 m
- D. 1160 m

Answer: D

15. An aeroplane when 3000 m high passes vertically above another aeroplane at an instance when their angles of elevation at the same observation point are 60° and 45° ..
How many metres higher is hits one than the other

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Self Assessment Sheet 33

1. The angle of elevation of the top of a tree of height 18 metres is 30° when measured form a point P in the plane of its base. The distance of the base of the tree from P is

A. 6 m

B. $6\sqrt{3}m$

C. 19 m

D. $18\sqrt{3}$ m

Answer: D



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2. If the shadow of a pole 3 metre high is $3\sqrt{3}$ metre long then the angle of elevation of the sun is

A. 30°

B. 45°

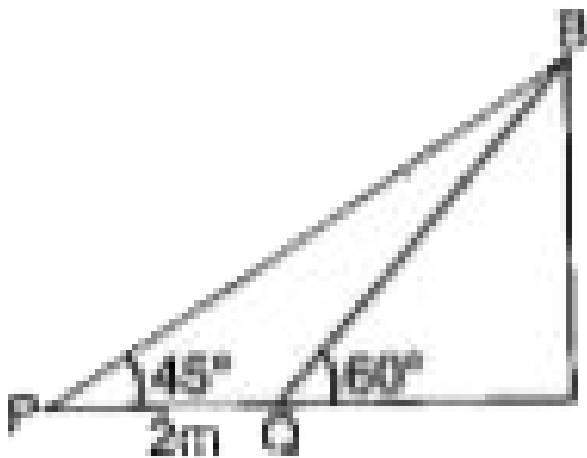
C. 60°

D. 75°

Answer: A

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3. The angle of depression of two posts P and Q at a distance of 2 metres on the same side of a road from a ballown (B) vertically over the road are observed to be 45° and 60° .
What is the height of the balloon ?



A. $3 - \sqrt{3}$

B. $\sqrt{3} - 1$

C. $3 + \sqrt{3}$

D. $\sqrt{3} + 1$

Answer: C



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4. The height of a tower is h and the angle of elevation of the top of the tower is α . On moving a distance $h/2$ towards the tower, the angle of elevation becomes β . What is the value of $\cot \alpha - \cot \beta$

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

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

C. 1

D. 2

Answer: A



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5. Two houses are collinear with the base of a tower and are at distance 3 m and 12 m (on the same side) from the base of the tower. The angles of elevation from these two houses of the top of the tower are complementary. What is the height of the tower ?

A. 4 m

B. 6 m

C. 7.5 m

D. 36 m

Answer: B



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6. The shadow of a flagstaff is three times as long as the shadow of the flagstaff when the sun rays meet the ground at 60° . Find the angle between the sun rays and the ground at the time of longer shadow

A. 45°

B. 30°

C. 15°

D. 90°

Answer: B



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7. From a point A on the ground , the angles of elevation of the top of a 10 m tall building and a helicopter hovering at some height of the building are 30° and 60° respectively.

Find the height of the helicopter above the building

A. $10\sqrt{3}$

B. $20(3 + \sqrt{3})$ m

C. 20 m

D. 30 m

Answer: C



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8. From two points A and B on the same side of a building the angles of elevation of the top of the building are 30° and 60° respectively. if the height of the building is 10 m find the distances between A and B correct to two decimal places

A. 10 . 66 m

B. 13 . 43 m

C. 11 . 55 m

D. 12 . 26 m

Answer: C



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9. A man stands on the ground at a point A, which is on the same horizontal plane as B, the foot of a vertical pole BC. The height of the pole is 10 m . The man's eye is 2 m above the ground . He observes the angle of elevation at C, The top of the pole as x° where $\tan x^\circ = \frac{2}{5}$. the distance AB (in metres) is

A. 15 m

B. 18 m

C. 20 m

D. 16 m

Answer: C



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10. The angle of elevation of the top of an unfinished pillar at a point 150 m from its base is 30° . If the angle of elevation at the same point is to be 45° , then the pillar has to be raised to a height of how many metres?

A. 59 . 4 m

B. 61 . 4 m

C. 62 . 4 m

D. 63 . 4 m

Answer: D



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Unit Test 6

1. If $\tan x = \frac{3}{4}$, $0 < x < 90^\circ$, then what is value of $\sin x \cos x$?

A. $\frac{3}{5}$

B. $\frac{4}{5}$

C. $\frac{12}{25}$

D. $\frac{13}{25}$

Answer: C

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2. What is the expression $\frac{\tan x}{1 + \sec x} - \frac{\tan x}{1 - \sec x}$ equal to ?

- A. cosec x
- B. 2 cosec x
- C. 2 sin x
- D. 2 cos x

Answer: B

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3. If $\tan \theta = 1$ and $\sin \phi = \frac{1}{\sqrt{2}}$, and $\theta, \phi \in \left[0, \frac{\pi}{2}\right]$, then the value of $\cos(\theta + \phi)$ is

A. -1

B. 0

C. 1

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

Answer: B



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4. If $\cos \theta = \frac{3}{5}$, then the value of $\frac{\sin \theta - \tan \theta + 1}{2 \tan^2 \theta}$ is

A. $\frac{13}{15}$

B. $\frac{91}{160}$

C. $\frac{14}{15}$

D. $\frac{92}{160}$

Answer: C



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5. Given $x \cos \theta + y \sin \theta = 2$ and $x \cos \theta - y \sin \theta = 0$,
then which of the following is correct

A. $x^2 + y^2 = 1$

B. $\frac{1}{x^2} + \frac{1}{y^2} = 1$

C. $xy = 1$

D. $x^2 - y^2 = 1$

Answer: B



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6. Which of the following is /are the value (s) of the the expression ?

$$\sin A (1 + \tan A) + \cos A (1 + \cot A)$$

1. $\sec A + \operatorname{cosec} A$

2. $2 \operatorname{cosec} A (\sin a + \cos A)$

3. $\tan A + \cot A$

Select the correct answer using the code given below :

A. 1 only

B. 1 and 2 only

C. 2 only

D. 1 and 3 only

Answer: A



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7. If $\sin A = \frac{2mn}{m^2 + n^2}$, What is the value of $\tan A$?

A. $\frac{2mn}{m^2 + n^2}$

B. $\frac{2mn}{m^2 - n^2}$

C. $\frac{m^2 - n^2}{2mn}$

D. $\frac{m^2 + n^2}{m^2 - n^2}$

Answer: B



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8. If $\sec^2 \theta + \tan^2 \theta = \frac{5}{3}$ and $0 \leq \theta \leq \frac{\pi}{2}$ then the value of

θ is equal to

A. 15°

B. 30°

C. 45°

D. 60°

Answer: B



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9. Evaluate :
$$\frac{5 \sin^2 30^\circ + \cos^2 45^\circ + 4 \tan^2 60^\circ}{2 \sin 30^\circ \cos 60^\circ + \tan 45^\circ}$$

A. 1

B. $9\frac{1}{6}$

C. $7\frac{3}{7}$

D. $\frac{47}{12}$

Answer: B



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10. Evaluate :
$$\frac{5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$$

A. $2\frac{5}{16}$

B. $\frac{67}{12}$

C. 0

D. 1

Answer: B



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11. The value of

$$\sin^2 1^\circ + \sin^2 2^\circ + \sin^2 3^\circ + \dots + \sin^2 89^\circ + \sin^2 90^\circ$$

is

A. 1

B. 0

C. 45.5

D. 44

Answer: C



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12. If $\tan 2A = \cot(A - 60^\circ)$, where $2A$ is an acute angle then the value of A is

A. 30°

B. 60°

C. 50°

D. 24°

Answer: C



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13. Evaluate : $\frac{2\cos 53^\circ \operatorname{cosec} 37^\circ}{(\cos^2 29^\circ + \cos^2 61^\circ)} - 3 \tan^2 45^\circ$

A. 1

B. 3

C. 6

D. -1

Answer: D



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14. Evaluate _____ :

$$\sin \theta \cos \theta - \frac{\sin \theta \cos(90^\circ - \theta) \cos \theta}{\sec(90^\circ - \theta)} - \frac{\cos \theta \sin(90^\circ - \theta) \sin \theta}{\operatorname{cosec}(90^\circ - \theta)}$$

A. -1

B. 2

C. 0

D. 1

Answer: C



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15. Using trigonometric identities $5 \sec^2 \theta - 5 \cot^2 \theta$ expressed as an integer is

A. 5

B. 3

C. 2

D. 0

Answer: C



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16. The angle of elevation of the top of a tower at a horizontal distance equal to the height of the tower from the base of the tower is

A. 30°

B. 45°

C. 60°

D. any acute angle

Answer: B



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17. a person aims at a bird on top of a 5 metre high pole with an elevation of 30° . If the bullet is fired, it will travel k metre

before reaching the bird. The value of k (in meters) is

A. $5\sqrt{3}/2$

B. 10

C. $5\sqrt{3}$

D. $10\sqrt{3}$

Answer: B



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18. Horizontal distance between two pillars of different heights is 60 m . It was observed that the angular elevation from the top of the shorter pillar is 45° . If the height of taller pillar is 130 m, the height of the shorter pillar is

A. 45 m

B. 70 m

C. 80 m

D. 60 m

Answer: B



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19. The angles of elevation of the top of a tower h metre tall from two different points on the same horizontal line are x and y ($x > y$). What is the distance between the points

A. $h (\tan x - \tan y)$

B. $\frac{h}{\tan x \tan y}$

C. $\frac{h(\tan x - \tan y)}{\tan x \tan y}$

D. $\frac{h(\tan x \tan y)}{\tan x - \tan y}$

Answer: C



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20. A radio transmitter antenna of height 100 m stands at the top of a tall building. At a point on the ground, the angle of elevation of the bottom of the antenna is 45° and that of the the top of the antenna is 60° . What is the height of the building ?

A. 100 m

B. 50 m

C. $50(\sqrt{3} + 1)m$

D. $50(\sqrt{3} - 1)m$

Answer: D



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