



## MATHS

### NCERT - NCERT MATHEMATICS(HINGLISH)

### TRIGONOMETRIC FUNCTIONS

#### Exercise 3 2

1. Find the value of the trigonometric function  $\tan \frac{19\pi}{3}$

A.  $\sqrt{3}$

B.  $\sqrt{4}$

C.  $\sqrt{6}$

D.  $\sqrt{2}$

**Answer: A**



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2. Find the values of the trigonometric function  $\sin\left(-\frac{11\pi}{3}\right)$

A. 0

B. 1

C.  $\sqrt{1}$

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

**Answer: D**



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3. Find the value of other five trigonometric function

$$\cos x = -\frac{1}{2}, x \text{ lies in third quadrant.}$$

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4. Find the value of other five trigonometric function  $\sin x = \frac{3}{5}$ ,  $x$  lies in second quadrant.

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5. Find the value of other five trigonometric function  $\cot x = \frac{3}{4}$ ,  $x$  lies in third quadrant.

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6. Find the value of other five trigonometric function  $\sec x = \frac{13}{5}$ ,  
 $x$  lies in fourth quadrant.

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7. Find the value of other five trigonometric function  
 $\tan x = -\frac{5}{12}$ ,  $x$  lies in second quadrant.

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8. Find the values of the trigonometric function  $\sin 765^\circ$

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

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

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

D.  $-\frac{1}{\sqrt{2}}$

**Answer: B**



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9. The value of the trigonometric function  $\operatorname{cosec}(-1410^\circ)$  is

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

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

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

D.  $-\frac{1}{2}$

**Answer: A**



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10. Find the values of the trigonometric function  $\cot\left(-\frac{15\pi}{4}\right)$

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### Exercise 3 5

1. Two trees, A and B are on the same side of a river. From a point C in the river the distance of the trees A and B is 250m and 300m, respectively. If the angle C is  $45^\circ$ , find the distance between the trees (use  $\sqrt{2} = 1.414$ ).

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2. A tree stands vertically on a hill side which makes an angle of  $15^\circ$  with the horizontal. From a point on the ground 35m down

the hill from the base of the tree, the angle of elevation of the top of the tree is  $60^\circ$ . Find the height of the

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3. Two ships leave a port at the same time. One goes 24 km per hour in the direction  $N45^\circ E$  and other travels 32 km per hour in the direction  $S75^\circ E$ . Find the distance between the ships at the end of 3 hours.

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4. For any triangle ABC, prove that

$$(b^2 c^2) \cot A + (c^2 a^2) \cot B + (a^2 b^2) \cot C = 0$$

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5. For any triangle ABC, prove that

$$\frac{b^2 - c^2}{a^2} \sin 2A + \frac{c^2 - a^2}{b^2} \sin 2B + \frac{a^2 - b^2}{c^2} \sin 2C = 0$$

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6. For any triangle ABC, prove that  $a \cos A + b \cos B + c \cos C = 2a \sin B \sin C$

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7. For any triangle ABC, prove that

$$\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2 + b^2 + c^2}{2abc}$$

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8. In any triangle ABC, if  $a = 18$ ,  $b = 24$ ,  $c = 30$ , find  $\cos A$ ,  $\cos B$ ,  $\cos C$

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9. For any triangle ABC, prove that  $\frac{a + b}{c} = \frac{\cos\left(\frac{A - B}{2}\right)}{\frac{\sin C}{2}}$

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10. In any triangle ABC, if  $a = 18$ ,  $b = 24$ ,  $c = 30$ , find  $\sin A$ ,  $\sin B$ ,  $\sin C$

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11. For any triangle ABC, prove that

$$\sin \frac{B - C}{2} = \frac{b - c}{a} \left( \cos \frac{A}{2} \right)$$

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12. For any triangle ABC, prove that  $\frac{a - b}{c} = \frac{\sin\left(\frac{A - B}{2}\right)}{\frac{\cos C}{2}}$

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13. For any triangle ABC, prove that

$$a(\cos C - \cos B) = 2(b - c) \frac{\cos^2 A}{2}$$

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14. For any triangle ABC, prove that

$$a(b \cos C - c \cos B) = b^2 - c^2$$

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15. For any triangle ABC, prove that

$$(b + c) \cos \left( \frac{B + C}{2} \right) = a \cos \left( \frac{B - C}{2} \right)$$

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16. For any triangle ABC, prove that  $\frac{\sin(B - C)}{\sin(B + C)} = \frac{b^2 - c^2}{a^2}$

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Solved Examples

1. Find the solution of  $\sin x = -\frac{\sqrt{3}}{2}$ .

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2. Solve  $\cos x = \frac{1}{2}$ .

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3. Solve  $\tan 2x = -\cot\left(x + \frac{\pi}{3}\right)$ .

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4. Solve  $\sin 2x - \sin 4x + \sin 6x = 0$ .

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5.  $2 \cos^2 x + 3 \sin x = 0$

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6. If  $\sin x = \frac{3}{5}$ ,  $\cos y = -\frac{12}{13}$ , where  $x$  and  $y$  both lie in second quadrant, find the value of  $\sin(x + y)$ .

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7. Find the value of  $\tan \frac{\pi}{8}$ .

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8. If  $\tan x = \frac{3}{4}$ ,  $\pi < x < \frac{3\pi}{2}$ , find the value of  $\sin\left(\frac{x}{2}\right)$ ,  $\cos\left(\frac{x}{2}\right)$ ,  $\tan\left(\frac{x}{2}\right)$ .

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9. Prove that  $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$ .

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10. Prove that  $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$ .

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11. Find the value of  $\sin \frac{31\pi}{3}$ .

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

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

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

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

Answer:  $\frac{\sqrt{3}}{2}$

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12. Find the value of  $\cos(-1710^\circ)$

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13. If  $\cos x = -\frac{3}{5}$ ,  $x$  lies in the third quadrant, find the values of other five trigonometric functions.

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14. If  $\cot x = -\frac{5}{12}$ ,  $x$  lies in second quadrant, find the values of other five trigonometric functions.



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15. The minute hand of a watch is 1.5 cm long. How far does its tip move in 40 minutes? (Use  $\pi = 3.14$ ).

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16. If the arcs of the same lengths in two circles subtend angles  $65^\circ$  and  $110^\circ$  at the centre, find the ratio of their radii.

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17. Convert 6 radians into degree measure.

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18. Find the radius of the circle in which a central angle of  $60^\circ$  intercepts an arc of length 37.4 cm (use  $\pi = \frac{22}{7}$ ).

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19. Convert  $40^\circ 20'$  into radian measure.

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20. Find the principal solution of the equation  $\tan x = -\frac{1}{\sqrt{3}}$ .

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21. Find the principal solution of the equation  $\sin x = \frac{\sqrt{3}}{2}$ .

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22. Find the value of  $\sin 15^\circ$ .

A.  $\frac{\sqrt{3} - 1}{2\sqrt{2}}$

B.  $\frac{\sqrt{3} + 1}{2\sqrt{2}}$

C.  $\frac{1 - \sqrt{3}}{2\sqrt{2}}$

D.  $-\frac{\sqrt{3} + 1}{2\sqrt{2}}$

**Answer: A**

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23. Prove that  $3 \sin \frac{\pi}{6} \sec \frac{\pi}{3} - 4 \sin \frac{5\pi}{6} \cot \frac{\pi}{4} = 1$

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24. Prove that  $\frac{\sin(x + y)}{\sin(x - y)} = \frac{\tan x + \tan y}{\tan x - \tan y}$

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25. Find the value of  $\tan \frac{13\pi}{12}$ .

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26. Prove that  $\cos\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right) = \sqrt{2} \cos x$ .

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27. Show that  $\tan 3x \tan 2x \tan x = \tan 3x - \tan 2x - \tan x$ .

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28. Prove that  $\frac{\sin 5x - 2 \sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$

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29. Prove that  $\frac{\cos 7x + \cos 5x}{\sin 7x - \sin 5x} = \cot x$ .

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30. In triangle ABC, prove that  $\frac{\tan(B - C)}{2} = \left[ \frac{b - c}{b + c} \right] \frac{\cot A}{2}$ ,  
 $\frac{\tan(C - A)}{2} = \left[ \frac{c - a}{c + a} \right] \frac{\cot B}{2}$ ,  $\frac{\tan(A - B)}{2} = \left[ \frac{a - b}{a + b} \right] \frac{\cot c}{2}$

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31. The angle of elevation of to be top point  $P$  of the vertical tower PQ of height  $h$  from poin A is  $45^\circ$  and from a point B, the

angle of elevation is  $60^\circ$ , where B is point at a distance  $d$  from the point A measured along the line  $AB$  which makes an angle  $30^\circ$  with  $AQ$ . Prove that  $d = (\sqrt{3} - 1)h$ .

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32. Prove that  $a \sin(B - C) + b \sin(C - A) + c \sin(A - B) = 0$

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33. In triangle ABC, prove that  $\frac{\tan(B - C)}{2} = \frac{b - c}{b + c} \frac{\cot A}{2}$   
 $\frac{\tan(C - A)}{2} = \frac{c - a}{c + a} \frac{\cot B}{2} \frac{\tan(A - B)}{2} = \frac{a - b}{a + b} \frac{\cot C}{2}$

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1. Find the general solution :  $\sec^2 2x = 1 - \tan 2x$

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2. Find the principal and general solution of  $\cos ecx = 2$

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3. Find the general solution :  $\cos 4x = \cos 2x$

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4. Find the principal and general solution of  $\sec x = 2$ .

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5. Find the principal and general solution of  $\cot x = -\sqrt{3}$

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6. Find the principal and general solution of  $\tan x = \sqrt{3}$ .

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7. Find the general solution :  $\sin x + \sin 3x + \sin 5x = 0$

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8. Find the general solution :  $\cos 3x + \cos x - \cos 2x = 0$

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9. Find the general solution :  $\sin 2x + \cos x = 0$

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### Exercise 3 3

1. Prove that:

$$\sin(n+1)x \sin(n+2)x + \cos(n+1)x \cos(n+2)x = \cos x$$

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2. Prove that:  $\cos\left(\frac{3\pi}{4} + x\right) - \cos\left(\frac{3\pi}{4} - x\right) = -\sqrt{2} \sin x$

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3. Prove that:  $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$





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4. Prove that:  $\cos^2 2x - \cos^2 6x = \sin 4x \sin 8x$



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5. Prove that:  $\sin 2x + 2 \sin 4x + \sin 6x = 4 \cos^2 x \sin 4x$



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6. Prove that:  $\cot 4x (\sin 5x + \sin 3x) = \cot x (\sin 5x \sin 3x)$



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7. Prove that:  $\frac{\cos 9x - \cos 5x}{\sin 17x - \sin 3x} = -\frac{\sin 2x}{\cos 10x}$

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8. Prove that: 
$$\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x} = \tan 4x$$

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9. Prove that: 
$$\frac{\sin x - \sin y}{\cos x + \cos y} = \tan \frac{x - y}{2}$$

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10. Prove that: 
$$\frac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$$

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11. 
$$\cot^2 \frac{\pi}{6} + \operatorname{cosec} \frac{5\pi}{6} + 3 \tan^2 \frac{\pi}{6} = 6$$



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$$12. 2 \sin^2\left(\frac{\pi}{6}\right) + \operatorname{cosec}^2\left(\frac{7\pi}{6}\right) \cos^2\left(\frac{\pi}{3}\right) = \frac{3}{2}$$

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$$13. \sin^2\frac{\pi}{6} + \cos^2\frac{\pi}{3} - \tan^2\frac{\pi}{4} = -\frac{1}{2}$$

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$$14. \text{ Prove that: } \frac{\tan\left(\frac{\pi}{4} + x\right)}{\tan\left(\frac{\pi}{4} - x\right)} = \left(\frac{1 + \tan x}{1 - \tan x}\right)^2$$

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15. Prove that:

$$\cos\left(\frac{\pi}{4} - x\right)\cos\left(\frac{\pi}{4} - y\right) - \sin\left(\frac{\pi}{4} - x\right)\sin\left(\frac{\pi}{4} - y\right) = \sin(x + y)$$

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16. Find the value of : (i)  $\sin 75^\circ$  (ii)  $\tan 15^\circ$

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17. Proved that  $2\sin^2\frac{3\pi}{4} + 2\cos^2\frac{\pi}{4} + 2\sec^2\frac{\pi}{3} = 10$

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18. Prove that:

$$\cos\left(\frac{3\pi}{2} + x\right)\cos(2\pi + x)\left[\cot\left(\frac{3\pi}{2} - x\right) + \cot(2\pi + x)\right] = 1$$



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19. Prove that: 
$$\frac{\cos(\pi + x)\cos(-x)}{\sin(\pi - x)\cos\left(\frac{\pi}{2} + x\right)} = \cot^2 x$$

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20. Prove that: 
$$\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$$

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21. Prove that: 
$$\frac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x} = 2 \sin x$$

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22. Prove that: 
$$\tan 4x = \frac{4 \tan x (1 - \tan^2 x)}{1 - 6 \tan^2 x + \tan^4 x}$$



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23. Prove that:  $\cot x \cot 2x \cot 2x \cot 3x \cot 3x \cot x = 1$



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24. Prove that:  $\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$



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25. Prove that :  $\cos 4x = 1 - 8 \sin^2 x \cos^2 x$ .



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Miscellaneous Exercise

1. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  of the following :  $\sin x = \frac{1}{4}$ ,  $x$  in quadrant II.

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2. Prove that:

$$\sin 3x + \sin 2x + \sin x = 4 \sin x \cos\left(\frac{x}{2}\right) \cos\left(\frac{3x}{2}\right)$$

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3. Prove that:  $\frac{(\sin 7x + \sin 5x) + (\sin 9x + \sin 3x)}{(\cos 7x + \cos 5x) + (\cos 9x + \cos 3x)} = \tan 6x$

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4. Prove that

$$\sin x + \sin 3x + \sin 5x + \sin 7x = 4 \cos x \cos 2x \sin 4x$$

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5. Prove that:  $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4 \sin^2 \frac{x - y}{2}$

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6. Prove that:  $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4 \cos^2 \frac{x + y}{2}$

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7. Prove that:  $(\sin 3x + \sin x)\sin x + (\cos 3x - \cos x)\cos x = 0$

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8. Prove that:  $2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$

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9. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  of the following :  $\cot x = -\frac{1}{3}$ ,  $x$   
in quadrant III

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10. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  of the following :  $\tan x = -\frac{4}{3}$ ,  $x$   
in quadrant II`

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1. In a circle of diameter 40 cm. The length of a chord is 20 cm.

Find the length of minor arc of the chord.



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2. Find the degree measure of the angle subtended at the centre of a circle of radius 100 cm by an arc of length 22 cm (use

$$\pi = \frac{22}{7}).$$



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3. Find the angle in radian through which a pendulum swings if its length is 75 cm and the tip describes an arc of length

(i) 10 cm

(ii) 15 cm

(iii) 21 cm



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4. If in two circles, arcs of the same length subtend angles  $60^\circ$  and  $75^\circ$  at the centre, find the ratio of their radii.



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5. Find the radian measures corresponding to the following degree measures: (i)  $25^\circ$  (ii)  $-47^\circ 30'$  (iii)  $240^\circ$  (iv)  $520^\circ$



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6. A wheel makes 360 revolutions in one minute. Through how many radians does it turn in one second?



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7. Find the degree measures corresponding to the following radian measures (use  $\pi = \frac{22}{7}$ ). (i)  $\frac{11}{16}$  (ii) 4 (iii)  $\frac{5\pi}{3}$  (iv)  $\frac{7\pi}{6}$

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