



## MATHS

### NCERT - NCERT MATHEMATICS (GUJRATI)

### TRIGONOMETRIC FUNCTIONS

#### Example

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

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2. Convert 6 radians into degree measure.

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3. 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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4. The minute hand of a watch is 1.5cm long. How far does it tip move in 40 minute?

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

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

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

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

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

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10. 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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11. Find the value of  $\sin 15^\circ$ .

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

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

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14. Show that

$$\tan 3x \tan 2x \tan x = \tan 3x - \tan 2x - \tan x$$

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15. Prove that,

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

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

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

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

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

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

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

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

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

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

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25. 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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26. Prove that,

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

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

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





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29. 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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### Exercise 3 1

1. Find the radian measure corresponding to the following degree measures.

$25^\circ$



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2. Find the degree measures corresponding to the following radian measures. (Use  $\pi = \frac{22}{7}$ )

−4

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

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4. Find the degree measure of the angle subtended at the centre of a circle of radius 100 cm by an arc of length 22cm. (Use  $\pi = \frac{22}{7}$ )

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5. In a circle of diameter  $40\text{cm}$ , the length of a chord is  $20\text{cm}$ . Find the length of minor arc of the chord.

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6. 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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7. Find the angle in radian through which a pendulum swings if its length is  $75\text{ cm}$  and the tip describes an arc of length (i)  $10\text{ cm}$  (ii)  $15\text{ cm}$  (iii)  $21\text{cm}$ .

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## Exercise 3 2

1. Find the values of other five trigonometric functions

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



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2. Find the values of other five trigonometric functions

$$\sin x = \frac{3}{5}, x \text{ lies in second quadrant.}$$



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3. Find the values of other five trigonometric functions

$$\cot x = \frac{3}{4}, x \text{ lies in third quadrant.}$$



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4. Find the values of other five trigonometric functions

$$\sec x = \frac{13}{5}, x \text{ lies in fourth quadrant.}$$

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5. Find the values of other five trigonometric functions

$$\tan x = -\frac{5}{12}, x \text{ lies in second quadrant.}$$

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6.  $\sin 765^\circ$

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7. Find the values of the trigonometric functions

$$\operatorname{cosec}(-1410^\circ)$$

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8.  $\tan \frac{19\pi}{3}$  find value.

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9. Find the values of the trigonometric functions

$$\sin\left(-\frac{11\pi}{3}\right)$$

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10. Find the values of the trigonometric functions

$$\cot\left(-\frac{15\pi}{4}\right)$$

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### Exercise 3 3

1. Prove that :

$$\sin^2\left(\frac{\pi}{6}\right) + \cos^2\left(\frac{\pi}{3}\right) - \tan^2\left(\frac{\pi}{4}\right) = -\frac{1}{2}$$

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2. Prove that :

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

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3. Prove that :

$$\cot^2\left(\frac{\pi}{6}\right) + \operatorname{cosec}\left(\frac{5\pi}{6}\right) + 3 \tan^2\left(\frac{\pi}{6}\right) = 6$$

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4. Prove that :

$$2 \sin^2\left(\frac{3\pi}{4}\right) + 2 \cos^2\left(\frac{\pi}{4}\right) + 2 \sec^2\left(\frac{\pi}{3}\right) = 10$$

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5. Find the value of :

$$\sin(75^\circ)$$

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6. 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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$$7. \frac{\tan\left(\frac{\pi}{4} + x\right)}{\tan\left(\frac{\pi}{4} - x\right)} = \left(\frac{1 + \tan x}{1 - \tan x}\right)^2$$

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$$8. \frac{\cos(\pi + x)\cos(-x)}{\sin(\pi - x)\cos\left(\frac{\pi}{2} + x\right)} = \cot^2 x$$

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9. Prove that

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



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10. Prove that

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



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11. Prove that,

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



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12. Prove that

$$\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$$



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$$13. \cos^2 2x - \cos^2 6x = \sin 4x \sin 8x$$

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14. Prove that

$$\sin(2x) + 2 \sin(4x) + \sin(6x) = 4 \cos^2 x \sin 4x$$

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$$15. \cot 4x(\sin 5x + \sin 3x) = \cot x(\sin 5x - \sin 3x)$$

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16. Prove that

$$\frac{\cos(9x) - \cos(5x)}{\sin(17x) - \sin(3x)} = - \frac{\sin(2x)}{\cos(10x)}$$

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$$17. \frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x} = \tan 4x$$

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$$18. \frac{\sin x - \sin y}{\cos x + \cos y} = \tan \frac{x - y}{2}$$

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$$19. \frac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$$

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20. Prove that

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



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21. Prove that

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



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22.  $\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x = 1$



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



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$$24. \cos 4x = 1 - 8 \sin^2 x \cos^2 x$$



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$$25. \cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$$



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### Exercise 3 4

$$1. \tan x = \sqrt{3}$$



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2.  $\sec x = 2$

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3.  $\cot x = -\sqrt{3}$

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4.  $\cos ecx = -2$

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5.  $\cos 4x = \cos 2x$

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6.  $\cos 3x + \cos x - 2 \cos x = 0$

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7.  $\sin 2x + \cos x = 0$

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8. Find the general solution of the following equations :

$$\sec^2 2x = 1 - \tan 2x$$

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9.  $\sin x + \sin 3x + \sin 5x = 0$

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## Miscellaneous Examples

1. 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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2. Prove that :

$$[\sin(3x) + \sin x] \sin x + [\cos(3x) - \cos x] \cos x = 0$$



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$$3. (\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4 \cos^2 \frac{x+y}{2}$$



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

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5. Prove that :

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

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6. 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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7. 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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8. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  in each of the following.

$$\tan x = -\frac{4}{3}, x \text{ in quadrant } II^{nd}.$$

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9. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  in each of the following.

$$\cos x = -\frac{1}{3}, x \text{ in quadrant III.}$$

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10. Find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$  in each of the following.

$\sin x = \frac{1}{4}$ ,  $x$  in quadrant II.



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