MATHS

NCERT - NCERT MATHEMATICS (ENGLISH)

TRIGONOMETRIC FUNCTIONS

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 $\tan 2x = -\cot(x+pi/3)$

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

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

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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 tanx=3/4, $\pi < x < \frac{3\pi}{2}$, find the value of sin(x/2) , cos(x/2), tan(x/2)

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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 $\cos 2x \cos\left(\frac{x}{2}\right) - \cos 3x \cos\left(\frac{9x}{2}\right) = \sin 5x \sin\left(\frac{5x}{2}\right)$.

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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 m the third quadrant, find the values of other five trigonometric functions.

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14. If $\cot x = -\frac{5}{12}$, 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 m two circles subtend angles $65o$and $110o$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° intercepts an arc of length 37.4 cm (use $\pi = \frac{22}{7}$).

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19. Convert $40^o 20'$ 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 $\sin 15o$.

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: $2\frac{\sin\pi}{6}sec\frac{\pi}{3}-4\frac{\sin(5\pi)}{6}\frac{\cos\pi}{4}=1$

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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 45^0 and from a point B, the angle of elevation is 60^0, where B is point at a distance d from the point A measured along the line AB which makes an angle 30^0 with AQ. Prove that $d=\left(\sqrt{3}-1\right)h$.

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32. If any triangle ABC, find the value of $a\sin(B-C)+b\sin(C-A)+c\sin(A-B)$.

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33. In triangle ABC, prove that 'tan((B-C)/2)=(b-c)/(b+c)cotA/2tan(C-A)/2=(c-a)/(c+a)cotB/2tan(A-B)/2=(a-b)/(a+b)cotC/2`

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Exercise 3 4

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

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2. Find the principal and general solution of $\operatorname{cosec} x = 2$

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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: $\sin 2x + 2\sin 4x + \sin 6x = 4\cos^2 x \sin 4$

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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. $\cot^2\frac{\pi}{6} + \cos ec\frac{5\pi}{6} + 3\tan^2\frac{\pi}{6} = 6$

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

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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. 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) $\sin 75^o$ (ii) $\tan 15^o$

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

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

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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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Exercise 3 2

1. Find the values 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 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°

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. Find the values of the trigonometric function $cosec(-1410^\circ)$.

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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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: $\sin 3x + \sin 2x - \sin x = 4\sin x \cos\frac{x}{2}\cos\frac{3x}{2}$

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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 3 x +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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Exercise 3 1

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° and 75° 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^o (ii) $-47^o30'$ (iii) 240^o (iv) 520^o

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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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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 trees A and B are 25 m and 300 m respectively. If the angle C is 45^0 , find the distance between the trees $\left(use\ \sqrt{2} = 1.\ 44\right)$

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2. A tree stands vertically on a hill side which makes an angle of 15^0 with the horizontal. From a point on the ground 35 m down the hill from the base of three, the angle of elevation of the top of the tree is 60^0 . Find the height of the tree.

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3. Two ships leave port at the same time. One goes 24 km per hour in the direction $N\ 45^0 E$ and other travels 32 km per hour in the direction $S75^0 E$. Find the distance between the ships at the end of 3 hours.

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4. For any triangle ABC, prove that

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

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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 $a=18, b=24, c=30$, findcosA, cosB, cosC

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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 $a = 18, b = 24, c = 30$, findsinA, sinB, sinC

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

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

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13. For any triangle ABC, prove that

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

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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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