



## MATHS

### BOOKS - RS AGGARWAL MATHS (HINGLISH)

#### TRIGONOMETRIC RATIOS OF COMPLEMENTARY ANGLES

##### Solved Examples

1. Without using trigonometric tables, evaluate :

(i)  $\frac{\cos 53^\circ}{\sin 37^\circ}$

(ii)  $\frac{\tan 68^\circ}{\cot 22^\circ}$

(iii)  $\frac{\sec 49^\circ}{\csc 41^\circ}$

(iv)  $\frac{\sin 30^\circ 17'}{\cos 59^\circ 43'}$



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2. Without using trigonometric tables, evaluate :

(i)  $\cos 48^\circ - \sin 42^\circ$

(ii)  $\cos 31^\circ - \sec 59^\circ$

(iii)  $\cot 34^\circ - \tan 56^\circ$

(iv)  $\cos^2 13^\circ - \sin^2 77^\circ$



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3. Without using trigonometric tables, prove that :

(i)  $\sin 43^\circ \cos 47^\circ + \cos 43^\circ \sin 47^\circ = 1$

(ii)  $\cos 38^\circ \cos 52^\circ - \sin 52^\circ = 0$

(iii)  $\sec 50^\circ \sin 40^\circ + \cos 40^\circ \csc 50^\circ = 2$

(iv)  $\sec 70^\circ \sin 20^\circ - \cos 20^\circ - \csc 70^\circ = 0$



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4. Without using trigonometric tables, prove that :

(i)  $\tan 48^\circ \tan 23^\circ \tan 42^\circ \tan 67^\circ = 1$

$$(ii) \tan 7^\circ \tan 23^\circ \tan 60^\circ \tan 67^\circ \tan 83^\circ = \sqrt{3}$$

$$(iii) \cot 12^\circ \cot 38^\circ \cot 52^\circ \cot 60^\circ \cot 78^\circ = \frac{1}{\sqrt{3}}$$



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5.  $\tan 1^\circ \tan 2^\circ \dots \tan 89^\circ =$

A. 0

B. -1

C. 1

D. None

Answer: B



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6. Evaluate:

$$\frac{\cos 58^\circ}{\sin 32^\circ} + \frac{\sin 22^\circ}{\cos 68^\circ} - \frac{\cos 38^\circ \csc 52^\circ}{\tan 18^\circ \tan 35^\circ \tan 60^\circ \tan 72^\circ \tan 55^\circ}.$$

A.  $\frac{1}{3}(6 - \sqrt{3})$

B.  $\frac{2}{3}(6 - \sqrt{3})$

C.  $\frac{1}{3}(3 - \sqrt{6})$

D.  $\frac{2}{3}(3 - \sqrt{6})$

**Answer: A**

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7. Without using trigonometric tables, evaluate each of the following :

(i)  $\sin^2 65^\circ + \sin^2 25^\circ$

(ii)  $\cos^2 17^\circ - \sin^2 73^\circ$

(iii)  $\cos^2 67^\circ - \tan^2 23^\circ$

(iv)  $\sec^2 36^\circ - \cot^2 54^\circ$ .

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8. Evaluate : 
$$\frac{2 \sin^2 63^\circ + 1 + 2 \sin^2 27^\circ}{3 \cos^2 17^\circ - 2 + 3 \cos^2 73^\circ}$$



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9. Without using trigonometric tables, evaluate each of the following:

$$\frac{\cos^2 20^\circ + \cos^2 70^\circ}{\sec^2 50^\circ - \cot^2 40^\circ} + 2 \operatorname{cosec}^2 58^\circ - 2 \cot 58^\circ \tan 32^\circ - 4 \tan 13^\circ \tan 37^\circ \tan 47^\circ$$



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10. If  $\sin 3A = \cos(A - 10^\circ)$  where  $3A$  is an acute angle, then find the value of  $A$ .

A.  $25^\circ$

B.  $35^\circ$

C.  $45^\circ$

D. None

Answer: A



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11. If  $\tan 2A = \cot(A - 21^\circ)$  where  $2A$  is an acute angle, then find the value of  $A$ .

A.  $40^\circ$

B.  $45^\circ$

C.  $37^\circ$

D.  $35^\circ$

**Answer: C**



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12. If  $\sec 5A = \operatorname{cosec}(A - 30^\circ)$ , where  $5A$  is an acute angle then find the value of  $A$ .



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13. If  $\sin(\theta + 34^\circ) = \cos \theta$  and  $(\theta + 34^\circ)$  is acute then  $\theta = ? ?$ .

A.  $28^\circ$

B.  $38^\circ$

C.  $36^\circ$

D. None

**Answer: A**



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**14.** Express each of the following in terms of trigonometric ratios of angle between  $0^\circ$  and  $45^\circ$ .

(i)  $\sin 75^\circ + \operatorname{cosec} 75^\circ$ .

(ii)  $\tan 65^\circ + \cot 49^\circ$

(iii)  $\sec 67^\circ + \operatorname{cosec} 58^\circ$

(iv)  $\cos 83^\circ - \sec 76^\circ$ .



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15. If  $A$  and  $B$  are acute angles such that  $\sin A = \cos B$ , prove that  $(A + B) = 90^\circ$ .

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16. If  $A$ ,  $B$  and  $C$  are interior angles of a triangle  $ABC$ , then show that  $\sin\left(\frac{B + C}{2}\right) = \frac{\cos A}{2}$ .

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## Exercise 12

1. Without using trigonometric tables, evaluate :

(i)  $\frac{\sin 16^\circ}{\cos 74^\circ}$

(ii)  $\frac{\sec 11^\circ}{\cos 79^\circ}$

(iii)  $\frac{\tan 27^\circ}{\cot 63^\circ}$

(iv)  $\frac{\cos 35^\circ}{\sin 55^\circ}$



$$(v) \frac{\cos 42^\circ}{\sec 48^\circ}$$

$$(vi) \frac{\cot 38^\circ}{\tan 52^\circ}$$



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2. Without using trigonometric tables, prove that :

$$(i) \cos 81^\circ - \sin 9^\circ = 0$$

$$(ii) \tan 71^\circ - \cot 19^\circ = 0$$

$$(iii) \cos 80^\circ - \sec 10^\circ = 0$$

$$(iv) \cos^2 72^\circ - \tan^2 18^\circ = 1$$

$$(v) \cos^2 75^\circ + \cos^2 15^\circ = 0$$

$$(vi) \tan^2 66^\circ - \cot^2 24^\circ = 0$$

$$(vii) \sin^2 48^\circ + \sin^2 42^\circ = 1$$

$$(viii) \cos^2 57^\circ - \sin^2 33^\circ = 0$$

$$(ix) (\sin 65^\circ + \cos 25^\circ)(\sin 65^\circ - \cos 25^\circ) = 0$$



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3. Without using trigonometric tables, prove that :

$$(i) \sin 53^\circ \cos 37^\circ + \cos 53^\circ \sin 37^\circ = 1$$

$$(ii) \cos 54^\circ \cos 36^\circ - \sin 54^\circ \sin 36^\circ = 0$$

$$(iii) \sec 70^\circ \sin 20^\circ + \cos 20^\circ \csc 70^\circ = 2$$

$$(iv) \sin 35^\circ \sin 55^\circ - \cos 35^\circ \cos 55^\circ = 0$$

$$(v) (\sin 72^\circ + \cos 18^\circ)(\sin 72^\circ - \cos 18^\circ) = 0$$

$$(vi) \tan 48^\circ \tan 23^\circ \tan 42^\circ \tan 67^\circ = 1$$



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4. Prove that :

$$(i) \frac{\sin 70^\circ}{\cos 20^\circ} + \frac{\csc 20^\circ}{\sec 70^\circ} - 2\cos 70^\circ \csc 20^\circ = 0$$

$$(ii) \frac{\cos 80^\circ}{\sin 10^\circ} + \cos 59^\circ \csc 31^\circ = 2$$

$$(iii) \frac{2\sin 68^\circ}{\cos 22^\circ} - \frac{2\cot 15^\circ}{5\tan 75^\circ} - \frac{3\tan 45^\circ \tan 20^\circ \tan 40^\circ \tan 50^\circ \tan 70^\circ}{5} = 1$$

$$(iv) \frac{\sin 18^\circ}{\cos 72^\circ} + \sqrt{3}(\tan 10^\circ \tan 30^\circ \tan 40^\circ \tan 50^\circ \tan 80^\circ) = 2$$

$$(v) \frac{7\cos 55^\circ}{3\sin 35^\circ} - \frac{4(\cos 70^\circ \csc 20^\circ)}{3(\tan 5^\circ \tan 25^\circ \tan 45^\circ \tan 65^\circ \tan 85^\circ)} = 1$$



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5. Prove that :

$$(i) \sin \theta \cos(90^\circ - \theta) + \sin(90^\circ - \theta) \cos \theta = 1$$

$$(ii) \sec \theta \operatorname{cosec}(90^\circ - \theta) - \tan \theta \cot(90^\circ - \theta) = 1$$

$$(iii) \frac{\sin \theta \cdot \sec(90^\circ - \theta) \cot(90^\circ - \theta)}{\operatorname{cosec}(90^\circ - \theta) \cdot \cos \theta \cdot \tan \theta} - \frac{\tan(90^\circ - \theta)}{\cot \theta} = 0$$

$$(iv) \frac{1 + \sin(90^\circ - \theta)}{\cos(90^\circ - \theta)} + \frac{\cos(90^\circ - \theta)}{1 + \sin(90^\circ - \theta)} = 2 \operatorname{cosec} \theta$$



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6. Prove that :

$$(i) \tan 5^\circ \tan 25^\circ \tan 30^\circ \tan 65^\circ \tan 85^\circ = \frac{1}{\sqrt{3}}$$

$$(ii) \cot 12^\circ \cot 38^\circ \cot 52^\circ \cot 60^\circ \cot 78^\circ = \frac{1}{\sqrt{3}}$$

$$(iii) \cos 15^\circ \cos 35^\circ \operatorname{cosec} 55^\circ \cos 60^\circ \operatorname{cosec} 75^\circ = \frac{1}{2}$$

$$(iv) \cos 1^\circ \cos 2^\circ \cos 3^\circ \dots \cos 180^\circ = 0$$

$$(v) \left( \frac{\sin 49^\circ}{\cos 41^\circ} \right)^2 + \left( \frac{\cos 41^\circ}{\sin 49^\circ} \right)^2 = 2$$



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7. Prove that:

$$(i) \sin(70^\circ + \theta) - \cos(20^\circ - \theta) = 0$$

$$(ii) \tan(55^\circ - \theta) - \cot(35^\circ - \theta) = 0$$

$$(iii) \operatorname{cosec}(67^\circ + \theta) - \sec(23^\circ - \theta) = 0$$

$$(iv) \operatorname{cosec}(65^\circ + \theta) - \sec(25^\circ - \theta) - \tan(55^\circ - \theta) + \cot(35^\circ + \theta) = 0$$

$$(v) \sin(50^\circ + \theta) - \cos(40^\circ - \theta) + \tan 1^\circ \tan 10^\circ \tan 80^\circ \tan 89^\circ = 1$$



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8. Express each of the following in terms of T-ratios of angles lying between  $0^\circ$  and  $45^\circ$ .

$$(i) \sin 67^\circ + \cos 75^\circ$$

$$(ii) \cot 65^\circ + \tan 49^\circ$$

$$(iii) \sec 78^\circ + \operatorname{cosec} 56^\circ$$

$$(iv) \operatorname{cosec} 54^\circ + \sin 72^\circ.$$



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9. If  $A, B, C$  are the angles of a  $\triangle ABC$ , prove that

$$\tan\left(\frac{C + A}{2}\right) = \frac{\cot(B)}{2}.$$

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10. If  $\cos 2\theta = \sin 4\theta$ , where  $2\theta$  and  $4\theta$  are acute angles, find the value of  $\theta$ .

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11. If  $\sec 2A = \operatorname{cosec}(A - 42^\circ)$ , where  $2A$  is an acute angle, find the value of  $A$ .

A.  $A = 44^\circ$

B.  $A = 54^\circ$

C.  $A = 64^\circ$

D.  $A = 74^\circ$

**Answer: A**

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12. If  $\sin 3A = \cos(A - 26^\circ)$ , where  $3A$  is an acute angle, find the value of  $A$ .

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

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14. If  $\sec 4A = \csc(A - 15^\circ)$ , where  $4A$  is an acute angle, find the value of  $A$ .

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15. Prove that :

$$\frac{2}{3} \operatorname{cosec}^2 58^\circ - \frac{2}{3} \cot 58^\circ \tan 32^\circ - \frac{5}{3} \tan 13^\circ \tan 37^\circ \tan 45^\circ \tan 53^\circ \tan 77^\circ$$



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