20 Trigonometrical Tables

20.1 TRIGONOMETRICAL TABLES

The approximate values correct upto four decimal places of *sine, cosine* and *tangent* of all angles lying between 0° and 90° can be found from the tables of *natural sines, natural cosines* and *natural tangents* given at the end of the book. These tables are called **trigonometrical tables.**

Trigonometrical tables consist of three parts :

(*i*) a column on the extreme left containing degrees from 0 to 90.

(*ii*) ten columns (at the intervals of 6') headed by 0', 6', 12', 18', 24', 30', 36', 42', 48' and 54'.

(*iii*) five columns (called mean difference columns) for an increase of 1', 2', 3', 4' and 5' in the angle.

20.2 USE OF TRIGONOMETRICAL TABLES

We illustrate the method of using trigonometrical tables with the help of following examples :

ILLUSTRATIVE EXAMPLES

Example 1. *Find the value of sin 53° 34'.*

Solution. To find the value of sin 53° 34', we read the table of natural sines in the horizontal line which begins with 53° and in the vertical column headed by 30' (∵ 34' = 30' + 4'). The value that we find is 8039. Now read, in the same horizontal line, the value written in the mean difference column headed by 4'; it is found to be 7. On adding these two numbers, we get 8039 + 7 = 8046, and so sin 53° 34' = ·8046.

Thus the value of sin 53° 34' is obtained as under :

sin 53° 30' = ·8039   (From tables)

Mean difference for 4' =   7   (To be added)

∴   sin 53° 34' = ·8046.

Example 2. *Find the value of cos 49° 21′.*

Solution. We know that as θ increases, the value of cos θ decreases, therefore, the numbers in the mean difference columns are to be subtracted.

The value of cos 49° 21′ is obtained as under :

Since	cos 49° 21′ = cos (49° 18′ + 3′)	
	cos 49° 18′ = ·6521	(From tables)
	Mean difference for 3′ = 7	(To be subtracted)
∴	cos 49° 21′ = ·6514.	

Example 3. *Find the value of tan 65° 41′.*

Solution. Since tan 65° 41′ = tan (65° 36′ + 5′)

	tan 65° 36′ = 2·2045	(From tables)
	Mean difference for 5′ = 85	(To be added)
∴	tan 65° 41′ = 2·2130.	

> **Note**
>
> By using the trigonometrical tables of natural sines, natural cosines and natural tangents, we can find the angle whose sine, cosine or tangent is given. We illustrate this with the help of following examples :

Example 4. *Using trigonometric tables, find the measure of the angle θ when sin θ = 0·2826.*

Solution. In the table of natural sines, look for a value ($\le$ ·2826) which is sufficiently close to ·2826. We find that the value ·2823 occurs in the horizontal line beginning with 16° and in the column headed by 24′. Then, we look for the number 3 (= 2826 − 2823) in the same horizontal line and in the mean differences column, we find the number 3 in the column headed by 1′, so we get θ = 16° 24′ + 1′ = 16° 25′.

Thus the value of θ is obtained as under :

Given	sin θ = ·2826	
	sin 16° 24′ = ·2823	(From tables)
∴	Difference = ·0003	
	Mean difference for 1′ = ·0003	(From tables)
∴	θ = 16° 24′ + 1′ = 16° 25′.	

Example 5. *Find the acute angle θ when cos θ = ·8637.*

Solution. Given

	cos θ = ·8637	
	cos 30° 18′ = ·8634	(From tables)
∴	Difference = ·0003	
	Mean difference for 2′ = ·0003	(From tables)
∴	θ = 30° 18′ − 2′ = 30° 16′.	

($\because$ greater is the value of cos θ, smaller is θ)

Example 6. *Using tables, find the value of 2 sin θ − cos θ when tan θ = ·3726.*

Solution. Given

	tan θ = ·3726	
	tan 20° 24′ = ·3719	(From tables)
∴	Difference = ·0007	

Mean difference for 2′ = ·0007   (From tables)

∴   θ = 20° 24′ + 2′ = 20° 26′.

Thus to find the value of 2 sin θ – cos θ, we have to find the values of sin 20° 26′ and cos 20° 26′.

$$\text{sin } 20° \ 24′ = ·3486 \quad \text{(From tables)}$$

Mean difference for 2′ =   5   (To be added)

∴   sin 20° 26′ = ·3491

cos 20° 24′ = ·9373   (From tables)

Mean difference for 2′ =   2   (To be subtracted)

∴   cos 20° 26′ = ·9371

2 sin θ – cos θ = 2 sin 20° 26′ – cos 20° 26′

= 2 × ·3491 – ·9371

= ·6982 – ·9371 = – ·2389.

Exercise 20

1. Find the value of the following :

   (i) sin 35° 22′   (ii) sin 71° 31′

   (iii) sin 65° 20′   (iv) sin 23° 56′.

2. Find the value of the following :

   (i) cos 62° 27′   (ii) cos 3° 11′

   (iii) cos 86° 40′   (iv) cos 45° 58′.

3. Find the value of the following :

   (i) tan 15° 2′   (ii) tan 53° 14′

   (iii) tan 82° 18′   (iv) tan 6° 9′.

4. Use tables to find the acute angle θ, given that

   (i) sin θ = ·5789   (ii) sin θ = ·9484

   (iii) sin θ = ·2357   (iv) sin θ = ·6371.

5. Use tables to find the acute angle θ, given that

   (i) cos θ = ·4625   (ii) cos θ = ·9906

   (iii) cos θ = ·6951   (iv) cos θ = ·3412.

6. Use tables to find the acute angle θ, given that

   (i) tan θ = ·2685   (ii) tan θ = 1·7451

   (iii) tan θ = 3·1749   (iv) tan θ = ·9347.

7. Using trigonometric table, find the measure of the angle A when sin A = 0·1822.

8. Using tables, find the value of 2 sin θ – cos θ when

   (i) θ = 35°   (ii) tan θ = ·2679.

9. If sin x° = 0·67, find the value of

   (i) cos x°   (ii) cos x° + tan x°.

10. If θ is acute and cos θ = ·7258, find the value of

   (i) θ   (ii) 2 tan θ – sin θ.