

EXERCISE 19

1. Find the value of the following:

(i) $\sin 35^\circ 22'$

Solution:-

To find the value of $\sin 35^\circ 22'$,

We read the table of natural sines in the horizontal line which begins with 35°

In the vertical column headed by $22'$ i.e. $22' - 18' = 4'$ in the difference column, the value of $4'$ in mean difference column is 10.

Then, value that we find in vertical column is 0.5779

Now adding the value of $18'$ and $4' = 0.5779 + 10$
 $= 0.5789$

Therefore, the value of $\sin 35^\circ 22'$ is obtained as under,

$\sin 35^\circ 22' = 0.5779$... [from table]

Mean difference for $4' = 10$... [to be added]

Then, $\sin 35^\circ 22' = 0.5789$

(ii) $\sin 71^\circ 31'$

Solution:-

To find the value of $\sin 71^\circ 31'$,

We read the table of natural sines in the horizontal line which begins with 71°

In the vertical column headed by $31'$ i.e. $31' - 30' = 1'$ in the difference column, the value of $1'$ in mean difference column is 1.

Then, value that we find in vertical column is 0.9483

Now adding the value of $30'$ and $1' = 0.9483 + 1$
 $= 0.9484$

Therefore, the value of $\sin 71^\circ 31'$ is obtained as under,

$\sin 71^\circ 31' = 0.9483$... [from table]

Mean difference for $1' = 1$... [to be added]

Then, $\sin 71^\circ 31' = 0.9484$

(iii) $\sin 65^\circ 20'$

Solution:-

To find the value of $\sin 65^\circ 20'$,

We read the table of natural sines in the horizontal line which begins with 65°

In the vertical column headed by $20'$ i.e. $20' - 18' = 2'$ in the difference column, the value of $2'$ in mean difference column is 2.

Then, value that we find in vertical column is 0.9085

$$\begin{aligned}\text{Now adding the value of } 18' \text{ and } 2' &= 0.9085 + 2 \\ &= 0.9087\end{aligned}$$

Therefore, the value of $\sin 65^\circ 20'$ is obtained as under,

$$\begin{aligned}\sin 65^\circ 20' &= 0.9085 && \dots \text{ [from table]} \\ \text{Mean difference for } 2' &= 2 && \dots \text{ [to be added]}\end{aligned}$$

$$\text{Then, } \sin 65^\circ 20' = 0.9087$$

(iv) $\sin 23^\circ 56'$

Solution:-

To find the value of $\sin 23^\circ 56'$,

We read the table of natural sines in the horizontal line which begins with 23°

In the vertical column headed by $56'$ i.e. $56' - 54' = 2'$ in the difference column, the value of $2'$ in mean difference column is 5.

Then, value that we find in vertical column is 0.4051

$$\begin{aligned}\text{Now adding the value of } 54' \text{ and } 4' &= 0.4051 + 5 \\ &= 0.4056\end{aligned}$$

Therefore, the value of $\sin 23^\circ 56'$ is obtained as under,

$$\begin{aligned}\sin 23^\circ 56' &= 0.4051 && \dots \text{ [from table]} \\ \text{Mean difference for } 2' &= 5 && \dots \text{ [to be added]}\end{aligned}$$

$$\text{Then, } \sin 23^\circ 56' = 0.4056$$

2. Find the value of the following:

(i) $\cos 62^\circ 27'$

Solution:-

We know that as θ increase, the value of $\cos \theta$ decreases, therefore, the numbers in the mean difference columns are to be subtracted.

To find the value of $\cos 62^\circ 27'$,

We read the table of natural sines in the horizontal line which begins with 62°

In the vertical column headed by $27'$ i.e. $27' - 24' = 3'$ in the difference column, the value of $3'$ in mean difference column is 8.

Then, value that we find in vertical column is 0.4633

$$\begin{aligned}\text{Now adding the value of } 24' \text{ and } 3' &= 0.4633 - 8 \\ &= 0.4625\end{aligned}$$

Therefore, $\cos 62^\circ 27'$ is 0.4625.

(ii) $\cos 3^\circ 11'$

Solution:-

We know that as θ increase, the value of $\cos \theta$ decreases, therefore, the numbers in the mean difference columns are to be subtracted.

To find the value of $\cos 3^\circ 11'$,

We read the table of natural sines in the horizontal line which begins with 3°

In the vertical column headed by $27'$ i.e. $11' - 6' = 5'$ in the difference column, the value of $5'$ in mean difference column is 1.

Then, value that we find in vertical column is 0.9985

Now adding the value of $6'$ and $5' = 0.9985 - 1$
 $= 0.9984$

Therefore, $\cos 3^\circ 11'$ is 0.9984.

(iii) $\cos 86^\circ 40'$

Solution:-

We know that as θ increase, the value of $\cos \theta$ decreases, therefore, the numbers in the mean difference columns are to be subtracted.

To find the value of $\cos 86^\circ 40'$,

We read the table of natural sines in the horizontal line which begins with 86°

In the vertical column headed by $40'$ i.e. $40' - 36' = 4'$ in the difference column, the value of $4'$ in mean difference column is 12.

Then, value that we find in vertical column is 0.0593

Now adding the value of $36'$ and $4' = 0.0593 - 12$
 $= 0.0581$

Therefore, $\cos 86^\circ 40'$ is 0.0581.

(iv) $\cos 45^\circ 58'$

Solution:-

We know that as θ increase, the value of $\cos \theta$ decreases, therefore, the numbers in the mean difference columns are to be subtracted.

To find the value of $\cos 45^\circ 58'$,

We read the table of natural sines in the horizontal line which begins with 45°

In the vertical column headed by $58'$ i.e. $58' - 54' = 4'$ in the difference column, the value of $4'$ in mean difference column is 8.

Then, value that we find in vertical column is 0.6959

Now adding the value of $54'$ and $4' = 0.6959 - 8$
 $= 0.6951$

Therefore, $\cos 45^\circ 58'$ is 0.6951.

3. Find the value of the following :

(i) $\tan 15^\circ 2'$

Solution:-

To find the value of $\tan 15^\circ 2'$,

We read the table of natural sines in the horizontal line which begins with 15°

In the vertical column headed by $2'$, the value of $2'$ in mean difference column is 6.

Then, value that we find in vertical column is 0.2679

$$\begin{aligned}\text{Now adding the values} &= 0.2685 + 6 \\ &= 0.2685\end{aligned}$$

Therefore, $\tan 15^\circ 2'$ is 0.2685.

(ii) $\tan 53^\circ 14'$

Solution:-

To find the value of $\tan 53^\circ 14'$,

We read the table of natural sines in the horizontal line which begins with 53°

In the vertical column headed by $14'$ i.e. $14' - 12' = 2'$ in the difference column, the value of $2'$ in mean difference column is 16.

Then, value that we find in vertical column is 1.3367

$$\begin{aligned}\text{Now adding the value of } 12' \text{ and } 2' &= 1.3367 + 16 \\ &= 1.3383\end{aligned}$$

Therefore, $\tan 53^\circ 14'$ is 1.3383.

(iii) $\tan 82^\circ 18'$

Solution:-

To find the value of $\tan 82^\circ 18'$,

We read the table of natural sines in the horizontal line which begins with 82°

Then, value that we find in vertical column is 7.3962

Therefore, $\tan 82^\circ 18'$ is 7.3962

(iv) $\tan 6^\circ 9'$

Solution:-

To find the value of $\tan 6^\circ 9'$,

We read the table of natural sines in the horizontal line which begins with 6°

In the vertical column headed by $9'$ i.e. $9' - 6' = 3'$ in the difference column, the value of $3'$ in mean difference column is 9.

Then, value that we find in vertical column is 0.1069

$$\begin{aligned}\text{Now adding the value of } 6' \text{ and } 3' &= 0.1069 + 9 \\ &= 0.1078\end{aligned}$$

Therefore, $\tan 6^\circ 9'$ is 0.1078.

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

(i) $\sin \theta = .5789$

Solution:-

In the table of natural sines, look for a value ($\leq .5789$) which is sufficiently close to .5789. We find the value .5779 occurs in the horizontal line beginning with 35° and in the column headed by $18'$ and in the mean difference, we see $.5789 - .5779 = .0010$ in the column of $4'$.

$$\text{So we get, } \theta = 35^\circ 18' + 4' = 35^\circ 22'.$$

(ii) $\sin \theta = .9484$

Solution:-

In the table of natural sines, look for a value ($\leq .9484$) which is sufficiently close to .9484. We find the value .9483 occurs in the horizontal line beginning with 71° and in the column headed by $30'$ and in the mean difference, we see $.9484 - .9483 = .0001$ in the column of $1'$.

$$\text{So we get, } \theta = 71^\circ 30' + 1' = 71^\circ 31'.$$

(iii) $\sin \theta = .2357$

Solution:-

In the table of natural sines, look for a value ($\leq .2357$) which is sufficiently close to .2357. We find the value .2351 occurs in the horizontal line beginning with 13° and in the column headed by $36'$ and in the mean difference, we see $.2357 - .2351 = .0006$ in the column of $2'$.

$$\text{So we get, } \theta = 13^\circ 36' + 2' = 13^\circ 38'.$$

(iv) $\sin \theta = .6371$.

Solution:-

In the table of natural sines, look for a value ($\leq .6371$) which is sufficiently close to .6371. We find the value .6361 occurs in the horizontal line beginning with 39° and in the column headed by $30'$ and in the mean difference, we see $.6371 - .6361 = .0010$ in the column of $4'$.

$$\text{So we get, } \theta = 39^\circ 30' + 4' = 39^\circ 34'.$$

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

(i) $\cos \theta = .4625$

Solution:-

In the table of cosines, look for a value ($\leq .4625$) which is sufficiently close to .4625. We find the value .4617 occurs in the horizontal line beginning with 62° and in the column headed by $30'$ and in the mean difference, we see $.4625 - .4617 = .0008$ in the column of $3'$.

So we get, $\theta = 62^\circ 30' - 3' = 62^\circ 27'$.

(ii) $\cos \theta = .9906$

Solution:-

In the table of cosines, look for a value ($\leq .9906$) which is sufficiently close to .9906. We find the value .9905 occurs in the horizontal line beginning with 7° and in the column headed by $54'$ and in the mean difference, we see $.9906 - .9905 = .0001$ in the column of $3'$.

So we get, $\theta = 70^\circ 54' - 3' = 70^\circ 51'$.

(iii) $\cos \theta = .6951$

Solution:-

In the table of cosines, look for a value ($\leq .6951$) which is sufficiently close to .6951. We find the value .6947 occurs in the horizontal line beginning with 46° and in the mean difference, we see $.6951 - .6947 = .0004$ in the column of $2'$.

So we get, $\theta = 46^\circ - 2' = 45^\circ 58'$.

(iv) $\cos \theta = .3412$.

Solution:-

In the table of cosines, look for a value ($\leq .3412$) which is sufficiently close to .3412. We find the value .3404 occurs in the horizontal line beginning with 70° and in the column headed by $6'$ and in the mean difference, we see $.3412 - .3404 = .0008$ in the column of $3'$.

So we get, $\theta = 70^\circ 6' - 3' = 70^\circ 3'$.

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

(i) $\tan \theta = .2685$

Solution:-

In the table of natural tangent, look for a value ($\leq .2685$) which is sufficiently close to

.2685.

We find the value .2679 occurs in the horizontal line beginning with 15° and in the mean difference, we see $.2685 - .2679 = .0006$ in the column of $2'$.

So we get, $\theta = 15^\circ + 2' = 15^\circ 2'$.

(ii) $\tan \theta = 1.7451$

Solution:-

In the table of natural tangent, look for a value (≤ 1.7451) which is sufficiently close to 1.7451.

We find the value 1.7391 occurs in the horizontal line beginning with 60° and in the column headed by $6'$ and in the mean difference, we see $1.7451 - 1.7391 = .0060$ in the column of $5'$.

So we get, $\theta = 60^\circ 6' + 5' = 60^\circ 11'$.

(iii) $\tan \theta = 3.1749$

Solution:-

In the table of natural tangent, look for a value (≤ 3.1749) which is sufficiently close to 3.1749.

We find the value 3.1716 occurs in the horizontal line beginning with 72° and in the column headed by $30'$ and in the mean difference, we see $3.1749 - 3.1716 = .0033$ in the column of $1'$.

So we get, $\theta = 72^\circ 30' + 1' = 72^\circ 31'$.

(iv) $\tan \theta = .9347$

Solution:-

In the table of natural tangent, look for a value ($\leq .9347$) which is sufficiently close to .9347.

We find the value .9325 occurs in the horizontal line beginning with 43° and in the mean difference, we see $.9347 - .9325 = .0022$ in the column of $4'$.

So we get, $\theta = 43^\circ + 4' = 43^\circ 4'$.

7. Using trigonometric table, find the measure of the angle A when $\sin A = 0.1822$.

Solution:-

In the table of natural sines, look for a value (≤ 0.1822) which is sufficiently close to 0.1822.

We find the value 0.1822 occurs in the horizontal line beginning with 10° and in the column headed by $30'$.

So we get, $A = 10^\circ 30'$.

8. Using tables, find the value of $2 \sin \theta - \cos \theta$ when (i) $\theta = 35^\circ$ (ii) $\tan \theta = .2679$.

Solution:-

(i) We have to find the value of $2 \sin \theta - \cos \theta$

From the question it is given that, value of $\theta = 35^\circ$

So, substitute the value of θ ,

$$= 2 \sin 35^\circ - \cos 35^\circ$$

From the table value of $\sin 35^\circ = .5736$ and $\cos 35^\circ = .8192$

$$= (2 \times .5736) - .8192$$

$$= 0.3280$$

(ii) from the question it is given that, $\tan \theta = .2679$

In the table of natural sines, look for a value ($\leq .2679$) which is sufficiently close to .2679.

We find the value column headed by 15° .

So we get, $\theta = 15^\circ$

So, substitute the value of θ ,

$$= 2 \sin 15^\circ - \cos 15^\circ$$

From the table value of $\sin 15^\circ = .2588$ and $\cos 15^\circ = .9659$

$$= (2 \times .2588) - .9659$$

$$= -0.4483$$

9. If $\sin x^\circ = 0.67$, find the value of (i) $\cos x^\circ$ (ii) $\cos x^\circ + \tan x^\circ$.

Solution:-

From the question it is given that, $\sin x^\circ = 0.67$.

In the table of natural sines, look for a value (≤ 0.67) which is sufficiently close to 0.67.

We find the value 0.6691 occurs in the horizontal line beginning with 42° and in the mean difference, we see $0.6700 - 0.6691 = .0009$ in the column of $4'$.

So we get, $\theta = 42^\circ + 4' = 42^\circ 4'$.

Then,

$$(i) \cos x^\circ = \cos 42^\circ 4'$$

From the table

$$= .7431 - .0008$$

$$= 0.7423$$

$$(ii) \cos x^\circ + \tan x^\circ = \cos 42^\circ 4' + \tan 42^\circ 4'$$

$$= 0.7423 + .9025$$

$$= 1.6448$$

10. If θ is acute and $\cos \theta = .7258$, find the value of (i) θ (ii) $2 \tan \theta - \sin \theta$.

Solution:-

From the question, $\cos \theta = .7258$

In the table of cosines, look for a value ($\leq .7258$) which is sufficiently close to $.7258$.

We find the value $.7254$ occurs in the horizontal line beginning with 43° and in the column headed by $30'$ and in the mean difference, we see $.7258 - .7254 = .0004$ in the column of $2'$.

So we get, $\theta = 43^\circ 30' - 2' = 43^\circ 28'$.

$$\begin{aligned} \text{(i) } \theta &= 43^\circ 30' - 2' \\ &= 43^\circ 28' \end{aligned}$$

(ii) $2 \tan \theta - \sin \theta$

$$\begin{aligned} \text{Substitute the value } \theta, \\ &= 2 \tan 43^\circ 28' - \sin 43^\circ 28' \\ &= 2 (.9479) - .6879 \\ &= 1.8958 - .6879 \\ &= 1.2079 \end{aligned}$$

Therefore, the value of $2 \tan \theta - \sin \theta$ is 1.2079



