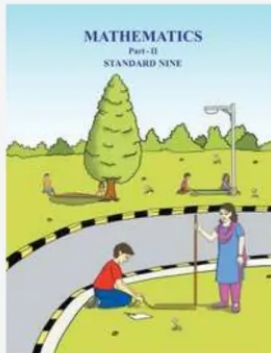


Maharashtra Board Solutions Class 9-Maths

(Part 2): Chapter 8.2- Trigonometry

BOOK SOLUTIONS
CLASS 9
MATHS (PART 2)

CHAPTER 8.2
Trigonometry



Maharashtra Board Solutions→

For any clarifications or questions you can write to info@indcareer.com

Postal Address

IndCareer.com, 52, Shilpa Nagar, Somalwada Nagpur - 440015
Maharashtra, India

WhatsApp: +91 9561 204 888, **Website:** <https://www.indcareer.com>

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Maharashtra Board Solutions Class 9-Maths

(Part 2): Chapter 8.2- Trigonometry

Class 9: Maths Chapter 8.2 solutions. Complete Class 9 Maths Chapter 8.2 Notes.

Maharashtra Board Solutions Class 9-Maths (Part 2): Chapter 8.2- Trigonometry

Maharashtra Board 9th Maths Chapter 8.2, Class 9 Maths Chapter 8.2 solutions

Question 1.

In the following table, a ratio is given in each column. Find the remaining two ratios in the column and complete the table.

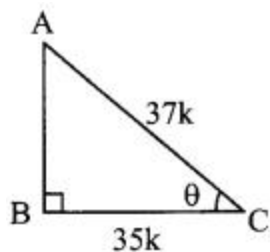
Sr. No.	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.
$\sin \theta$		$\frac{11}{61}$		$\frac{1}{2}$				$\frac{3}{5}$	
$\cos \theta$	$\frac{35}{37}$				$\frac{1}{\sqrt{3}}$				
$\tan \theta$			1			$\frac{21}{20}$	$\frac{8}{15}$		$\frac{1}{2\sqrt{2}}$

Solution:

i. $\cos \theta = \frac{35}{37}$... (i) [Given]

In right angled $\triangle ABC$,

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$\angle C = \theta$.

$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \cos \theta = \frac{BC}{AC} \quad \dots (ii)$$

$$\therefore \frac{BC}{AC} = \frac{35}{37} \quad \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore BC = 35k \text{ and } AC = 37k$$

Now, $AC^2 = AB^2 + BC^2$... [Pythagoras theorem]

$$\therefore (37k)^2 = AB^2 + (35k)^2$$

$$1369k^2 = AB^2 + 1225k^2$$

$$AB^2 = 1369k^2 - 1225k^2$$

$$= 144k^2$$

$$AB = 12k$$

$$AB = 12k \quad \dots [\text{Taking square root of both sides}]$$

$$= 12k$$

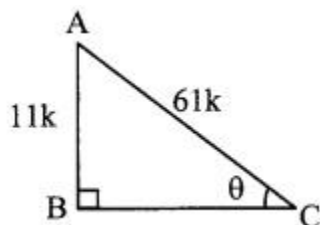
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$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{12k}{37k} = \frac{12}{37}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{AB}{BC} = \frac{12k}{35k} = \frac{12}{35}$$

ii. $\sin \theta = \frac{11}{61}$ (i) [Given]

In right angled $\triangle ABC$, $\angle C = \theta$.



$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \sin \theta = \frac{AB}{AC} \dots(ii)$$

$$\therefore \frac{AB}{AC} = \frac{11}{61} \dots[\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$AB = 11k \text{ and } AC = 61k$$

Now, $AC^2 = AB^2 + BC^2$...[Pythagoras theorem]

$$\therefore (61k)^2 = (11k)^2 + BC^2$$

$$\therefore 3721k^2 = 121k^2 + BC^2$$

$$\therefore BC^2 = 3721k^2 - 121k^2 = 3600k^2$$

$$BC = \sqrt{3600k^2} \dots[\text{Taking square root of both sides}]$$

$$= 60k$$

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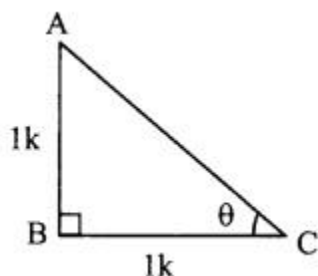
$$\therefore \cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{60k}{61k} = \frac{60}{61}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{AB}{BC} = \frac{11k}{60k} = \frac{11}{60}$$

iii. $\tan \theta = 1 = 11$..(i) [Given]

In right angled $\triangle ABC$,

$\angle C = \theta$.



$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta}$$

$$\therefore \tan \theta = \frac{AB}{BC} \quad \dots(ii)$$

$$\therefore \frac{AB}{BC} = \frac{1}{1} \quad \dots[\text{From (i) and (ii)}]$$

Let the common multiple be k.

$\therefore AB = 1k$ and $BC = 1k$

Now, $AC^2 = AB^2 + BC^2$...[Pythagoras theorem]

$$= K^2 + K^2$$

$$= 2K^2$$

$$\therefore AC = \sqrt{2\{k\}}$$

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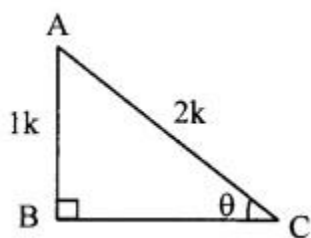
$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{1k}{\sqrt{2}k} = \frac{1}{\sqrt{2}}$$

$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{1k}{\sqrt{2}k} = \frac{1}{\sqrt{2}}$$

iv. $\sin \theta = \frac{1}{\sqrt{2}}$..(i) [Given]

In right angled $\triangle ABC$,

$\angle C = \theta$.



$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \sin \theta = \frac{AB}{AC} \quad \dots(ii)$$

$$\therefore \frac{AB}{AC} = \frac{1}{2} \quad \dots[\text{From (i) and (ii)}]$$

Let the common multiple be k.

$\therefore AB = 1k$ and $BC = 2k$

Now, $AC^2 = AB^2 + BC^2$...[Pythagoras theorem]

$$\therefore 2K^2 = K^2 + BC^2$$

$$\therefore 4K^2 = K^2 + BC^2$$

$$\therefore BC^2 = 4K^2 - K^2 = 3K^2$$

$$\therefore BC = \sqrt{3k^2} \dots \dots \dots [\text{Taking square root of both sides}]$$

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$$= \sqrt{3k}$$

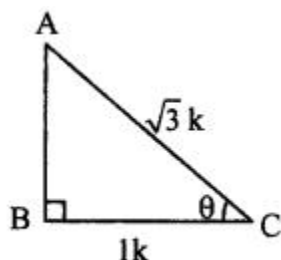
$$\therefore \cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{\sqrt{3}k}{2k} = \frac{\sqrt{3}}{2}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{AB}{BC} = \frac{1k}{\sqrt{3}k} = \frac{1}{\sqrt{3}}$$

$$\therefore \cos \theta = \frac{1}{2} \dots (i) \text{ [Given]}$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \cos \theta = \frac{BC}{AC} \dots (ii)$$

$$\therefore \frac{BC}{AC} = \frac{1}{\sqrt{3}} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore AB = 1k \text{ and } BC = \sqrt{3}k$$

Now, $AC^2 = AB^2 + BC^2 \dots [\text{Pythagoras theorem}]$

$$\therefore (\sqrt{3}k)^2 = AB^2 + k^2$$

$$\therefore 3k^2 = AB^2 + k^2 = 2k^2$$

$$\therefore AB = \sqrt{2k^2} \dots [\text{Taking square root of both sides}]$$

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$$AB = \sqrt{2}K$$

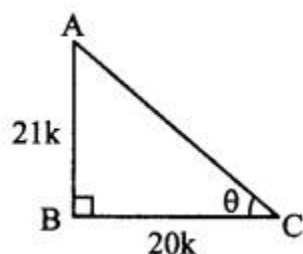
$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{\sqrt{2}k}{\sqrt{3}k} = \frac{\sqrt{2}}{\sqrt{3}}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{AB}{BC} = \frac{\sqrt{2}k}{1k} = \sqrt{2}$$

$$\text{vi. } \cos \theta = \frac{21}{20\sqrt{5}} \dots (i) \text{ [Given]}$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta}$$

$$\therefore \tan \theta = \frac{AB}{BC} \dots (ii)$$

$$\therefore \frac{AB}{BC} = \frac{21}{20} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore AB = 21k \text{ and } BC = 20k$$

Now, $AC^2 = AB^2 + BC^2 \dots [\text{Pythagoras theorem}]$

$$= (21)K^2 + (20K)^2$$

$$= 441K^2 - 400^2$$

$$= 841K^2$$

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$\therefore AB = 841k^2 \dots \sqrt{\dots}$ [Taking square root of both sides]

$= 29K$

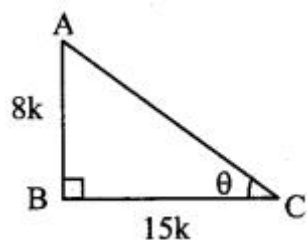
$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{21k}{29k} = \frac{21}{29}$$

$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{20k}{29k} = \frac{20}{29}$$

vii. $\tan \theta = \frac{8}{15}$..(i) [Given]

In right angled $\triangle ABC$,

$\angle C = \theta$.



$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta}$$

$$\therefore \tan \theta = \frac{AB}{BC} \dots (ii)$$

$$\therefore \frac{AB}{BC} = \frac{8}{15} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$\therefore AB = 8k$ and $BC = 15k$

Now, $AC^2 = AB^2 + BC^2 \dots$ [Pythagoras theorem]

$$= (8K)^2 + (15K)^2$$

$$= 64K^2 + 225K^2$$

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$$= 289K^2$$

$$\therefore AC = \sqrt{289K^2} \dots \text{[Taking square root of both sides]}$$

$$= 17K$$

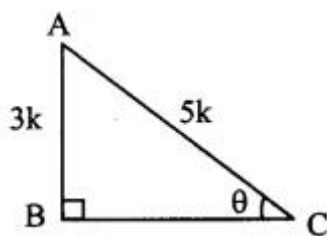
$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{8k}{17k} = \frac{8}{17}$$

$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{15k}{17k} = \frac{15}{17}$$

$$\text{viii. } \sin \theta = \frac{3}{5} \dots (i) \text{ [Given]}$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \sin \theta = \frac{AB}{AC} \dots (ii)$$

$$\therefore \frac{AB}{AC} = \frac{3}{5} \dots \text{[From (i) and (ii)]}$$

Let the common multiple be k.

$$\therefore AB = 3k \text{ and } AC = 5k$$

$$\text{Now, } AC^2 = AB^2 + BC^2 \dots \text{[Pythagoras theorem]}$$

$$\therefore (5K)^2 = (3K)^2 + BC^2$$

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$$\therefore 25K^2 = 9K^2 - 225^2$$

$$\therefore BC^2 = 25K^2 - 9K^2$$

$$\therefore BC = 16k^2 - \dots \sqrt{\dots} \dots \text{[Taking square root of both sides]}$$

$$= 4K$$

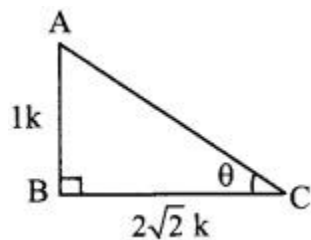
$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{4k}{5k} = \frac{4}{5}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{AB}{BC} = \frac{3k}{4k} = \frac{3}{4}$$

$$\text{ix. } \tan \theta = 122 \sqrt{\dots} \dots \text{[Given]}$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta}$$

$$\therefore \tan \theta = \frac{AB}{BC} \dots \text{(ii)}$$

$$\therefore \frac{AB}{BC} = \frac{1}{2\sqrt{2}} \dots \text{[From (i) and (ii)]}$$

Let the common multiple be k.

$$\therefore AB = 1k \text{ and } AC = 2\sqrt{2} k$$

$$\text{Now, } AC^2 = AB^2 + BC^2 \dots \text{[Pythagoras theorem]}$$

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$$= K^2 + (2\sqrt{2} k)^2$$

$$= K^2 - 225^2$$

$$= 25K^2 + 8K^2$$

$$= 9K^2$$

$$\therefore AC = 9k^2 \dots \sqrt{\dots} \dots [\text{Taking square root of both sides}]$$

$$= 3K$$

$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{1k}{3k} = \frac{1}{3}$$

$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{2\sqrt{2}k}{3k} = \frac{2\sqrt{2}}{3}$$

Sr. No.	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.
$\sin \theta$	$\frac{12}{37}$	$\frac{11}{61}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	$\frac{\sqrt{2}}{\sqrt{3}}$	$\frac{21}{29}$	$\frac{8}{17}$	$\frac{3}{5}$	$\frac{1}{3}$
$\cos \theta$	$\frac{35}{37}$	$\frac{60}{61}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\frac{20}{29}$	$\frac{15}{17}$	$\frac{4}{5}$	$\frac{2\sqrt{2}}{3}$
$\tan \theta$	$\frac{12}{35}$	$\frac{11}{60}$	1	$\frac{1}{\sqrt{3}}$	$\sqrt{2}$	$\frac{21}{20}$	$\frac{8}{15}$	$\frac{3}{4}$	$\frac{1}{2\sqrt{2}}$

Question 2.

Find the values of:

i. $5 \sin 30^\circ + 3 \tan 45^\circ$

ii. $45 \tan^2 60^\circ + 3 \sin^2 60^\circ$

iii. $2 \sin 30^\circ + \cos 0^\circ + 3 \sin 90^\circ$

iv. $\tan 60^\circ \sin 60^\circ + \cos 60^\circ$

v. $\cos^2 45^\circ + \sin^2 30^\circ$

vi. $\cos 60^\circ \times \cos 30^\circ + \sin 60^\circ \times \sin 30^\circ$

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Solution:

i. $\sin 30^\circ = \frac{1}{2}$ and $\tan 45^\circ = 1$

$$\begin{aligned}5 \sin 30^\circ + 3 \tan 45^\circ &= 5 \left(\frac{1}{2} \right) + 3(1) \\&= \frac{5}{2} + 3 \\&= \frac{5+6}{2}\end{aligned}$$

$$\therefore 5 \sin 30^\circ + 3 \tan 45^\circ = \frac{11}{2}$$

ii. $4 \tan^2 60^\circ + 3 \sin^2 60^\circ$

$$\begin{aligned}&\frac{4}{5} \tan^2 60^\circ + 3 \sin^2 60^\circ \\&= \frac{4}{5} (\tan 60^\circ)^2 + 3 (\sin 60^\circ)^2 \\&= \frac{4}{5} (\sqrt{3})^2 + 3 \left(\frac{\sqrt{3}}{2} \right)^2 \\&= \frac{4}{5} \times 3 + 3 \times \frac{3}{4} \\&= \frac{12}{5} + \frac{9}{4} \\&= \frac{48+45}{20} \\&= \frac{93}{20}\end{aligned}$$

$$\therefore \frac{4}{5} \tan^2 60^\circ + 3 \sin^2 60^\circ = \frac{93}{20}$$

iii. $2 \sin 30^\circ + \cos 0^\circ + 3 \sin 90^\circ$

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$$2 \sin 30^\circ + \cos 0^\circ + 3 \sin 90^\circ = 2(1/2) + 1 + 3(1)$$

$$= 1 + 1 + 3$$

$$\therefore 2 \sin 30^\circ + \cos 0^\circ + 3 \sin 90^\circ = 5$$

iv. $\tan 60^\circ \sin 60^\circ + \cos 60^\circ$

$$\begin{aligned}\frac{\tan 60^\circ}{\sin 60^\circ + \cos 60^\circ} &= \frac{\sqrt{3}}{\frac{\sqrt{3}}{2} + \frac{1}{2}} \\ &= \frac{\sqrt{3}}{\frac{\sqrt{3} + 1}{2}} \\ &= \sqrt{3} \times \frac{2}{\sqrt{3} + 1}\end{aligned}$$

$$\therefore \frac{\tan 60^\circ}{\sin 60^\circ + \cos 60^\circ} = \frac{2\sqrt{3}}{\sqrt{3} + 1}$$

v. $\cos^2 45^\circ + \sin^2 30^\circ$

$$\begin{aligned}\cos 45^\circ &= \frac{1}{\sqrt{2}} \text{ and } \sin 30^\circ = \frac{1}{2} \\ \cos^2 45^\circ + \sin^2 30^\circ &= (\cos 45^\circ)^2 + (\sin 30^\circ)^2 \\ &= \left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{2}\right)^2 \\ &= \frac{1}{2} + \frac{1}{4} \\ &= \frac{2+1}{4}\end{aligned}$$

$$\therefore \cos^2 45^\circ + \sin^2 30^\circ = \frac{3}{4}$$

vi. $\cos 60^\circ \times \cos 30^\circ + \sin 60^\circ \times \sin 30^\circ$

$$\cos 60^\circ = \frac{1}{2}, \cos 30^\circ = \frac{\sqrt{3}}{2}, \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\text{and } \sin 30^\circ = \frac{1}{2}$$

$$\cos 60^\circ \times \cos 30^\circ + \sin 60^\circ \times \sin 30^\circ$$

$$= \frac{1}{2} \times \frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} \times \frac{1}{2}$$

$$= \frac{\sqrt{3}}{4} + \frac{\sqrt{3}}{4}$$

$$= \frac{\sqrt{3} + \sqrt{3}}{4}$$

$$= \frac{2\sqrt{3}}{4} = \frac{\sqrt{3}}{2}$$

$$\therefore \cos 60^\circ \times \cos 30^\circ + \sin 60^\circ \times \sin 30^\circ = \frac{\sqrt{3}}{2}$$

Question 3.

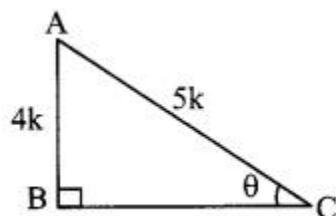
If $\sin \theta = \frac{4}{5}$, then find $\cos \theta$.

Solution:

$$\sin \theta = \frac{4}{5} \dots (i) [\text{Given}]$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \sin \theta = \frac{AB}{AC} \dots (ii)$$

$$\therefore \frac{AB}{AC} = \frac{4}{5} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore AB = 4k \text{ and } AC = 5k$$

Now, $AC^2 = AB^2 + BC^2 \dots$ [Pythagoras theorem]

$$\therefore (5k)^2 = (4k)^2 + BC^2$$

$$\therefore 25k^2 = 16k^2 + BC^2$$

$$\therefore BC^2 = 25k^2 - 16k^2 = 9k^2$$

$$\therefore BC = \sqrt{9k^2} \dots [\text{Taking square root of both sides}]$$

$$= 3k$$

$$\therefore \cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{3k}{5k} = \frac{3}{5}$$

Question 4.

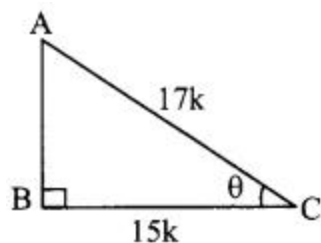
If $\cos \theta = \frac{15}{17}$, then find $\sin \theta$.

Solution:

$$\cos \theta = \frac{15}{17} \dots (i) [\text{Given}]$$

In right angled $\triangle ABC$,

$$\angle C = \theta.$$



$$\cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \cos \theta = \frac{BC}{AC} \dots (ii)$$

$$\therefore \frac{BC}{AC} = \frac{15}{17} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore BC = 15k \text{ and } AC = 17k$$

Now, $AC^2 = AB^2 + BC^2 \dots$ [Pythagoras theorem]

$$\therefore (17k)^2 = AB^2 + (15k)^2$$

$$\therefore 289k^2 = AB^2 + 225k^2$$

$$\therefore AB^2 = 289k^2 - 225k^2$$

$$= 64k^2$$

$$\therefore AB = \sqrt{64k^2} \dots [\text{Taking square root of both sides}]$$

$$= 8k$$

$$\therefore \sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{8k}{17k} = \frac{8}{17}$$

Question 1.

In right angled $\triangle PQR$, $\angle Q = 90^\circ$. Therefore $\angle P$ and $\angle R$ are complementary angles of each other. Verify the following ratios.

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i. $\sin \theta = \cos (90 - \theta)$

ii. $\cos \theta = \sin (90 - \theta)$

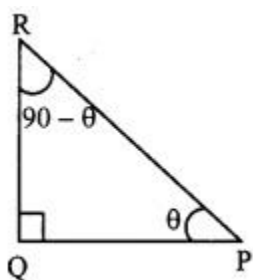
iii. $\sin 30^\circ = \cos (90^\circ - 30^\circ) = \cos 60^\circ$

iv. $\cos 30^\circ = \sin (90^\circ - 30^\circ) = \sin 60^\circ$ (Textbook pg. no. 107)

Solution:

In $\triangle PQR$, $\angle Q = 90^\circ$, $\angle P = \theta$

$\therefore \angle R = 90 - \theta$



i. $\sin \theta = \cos (90 - \theta)$

$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$= \frac{QR}{PR} \quad \dots(i)$$

$$\cos (90 - \theta) = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}}$$

$$= \frac{QR}{PR} \quad \dots(ii)$$

$\therefore \sin \theta = \cos (90 - \theta) \quad \dots[\text{From (i) and (ii)}]$

ii. $\cos \theta = \sin (90 - \theta)$

$$\begin{aligned}\cos \theta &= \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} \\ &= \frac{PQ}{PR} \quad \dots(i)\end{aligned}$$

$$\begin{aligned}\sin (90 - \theta) &= \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}} \\ &= \frac{PQ}{PR} \quad \dots(ii)\end{aligned}$$

$$\therefore \cos \theta = \sin (90 - \theta) \quad \dots[\text{From (i) and (ii)}]$$

iii. Let $\angle P = \theta = 30^\circ$

$$\therefore \angle R = 90^\circ - 30^\circ$$

$$\begin{aligned}\sin 30^\circ &= \frac{\text{Opposite side of } 30^\circ}{\text{Hypotenuse}} \\ &= \frac{QR}{PR} \quad \dots(i)\end{aligned}$$

$$\begin{aligned}\cos (90^\circ - 30^\circ) &= \frac{\text{Adjacent side of } (90^\circ - 30^\circ)}{\text{Hypotenuse}} \\ &= \frac{QR}{PR} \quad \dots(ii)\end{aligned}$$

$$\sin 30^\circ = \cos (90^\circ - 30^\circ) \quad \dots [\text{From (i) and (ii)}]$$

$$\sin 30^\circ = \cos 60^\circ$$

$$\text{iv. } \cos 30^\circ = \sin (90^\circ - 30^\circ) = \sin 60^\circ$$

$$\cos 30^\circ = \frac{\text{Adjacent side of } 30^\circ}{\text{Hypotenuse}} \dots [\because \theta = 30^\circ]$$

$$= \frac{PQ}{PR} \dots (i)$$

$$\sin (90^\circ - 30^\circ) = \frac{\text{Opposite side of } (90^\circ - 30^\circ)}{\text{Hypotenuse}}$$

$$= \frac{PQ}{PR} \dots (ii)$$

$$\therefore \cos 30^\circ = \sin (90^\circ - 30^\circ) \dots [\text{From (i) and (ii)}]$$

$$\therefore \cos 30^\circ = \sin 60^\circ$$

Question 2.

In right angled $\triangle PQR$, $\angle Q = 90^\circ$, $\angle R = \theta$ and if $\sin \theta = \frac{5}{13}$, then find $\cos \theta$ and $\tan \theta$.
(Textbook pg. no. 110)

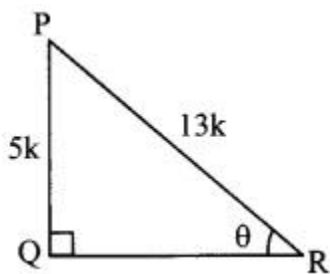
Solution:

i. Take the given trigonometric ratio as $\frac{5}{13}$ equation (i).

$$\sin \theta = \frac{5}{13} \dots (i) [\text{Given}]$$

By using the definition write the trigonometric ratio of $\sin \theta$ and take it as equation (ii).

In right angled $\triangle PQR$, $\angle R = \theta$



$$\sin \theta = \frac{\text{Opposite side of } \theta}{\text{Hypotenuse}}$$

$$\therefore \sin \theta = \frac{PQ}{PR} \dots (ii)$$

$$\therefore \frac{PQ}{PR} = \frac{5}{13} \dots [\text{From (i) and (ii)}]$$

Let the common multiple be k.

$$\therefore PQ = 5k \text{ and } PR = 13k$$

Find QR by using Pythagoras theorem.

$$PR^2 = PQ^2 + QR^2 \dots [\text{Pythagoras theorem}]$$

$$\therefore (13k)^2 = (5k)^2 + QR^2$$

$$\therefore 169k^2 = 25k^2 + QR^2$$

$$\therefore QR^2 = 169k^2 - 25k^2$$

$$= 144k^2$$

$$\therefore QR = 144k^2 \text{-----} \sqrt{\dots} \dots [\text{Taking square root of both sides}]$$

$$= 12k$$

$$\therefore \cos \theta = \frac{\text{Adjacent side of } \theta}{\text{Hypotenuse}} = \frac{QR}{PR} = \frac{12k}{13k} = \frac{12}{13}$$

$$\tan \theta = \frac{\text{Opposite side of } \theta}{\text{Adjacent side of } \theta} = \frac{PQ}{QR} = \frac{5k}{12k} = \frac{5}{12}$$

Question 3.

While solving the above Illustrative example, why the lengths of PQ and PR are taken 5k and 13k? (Textbook pg. no. 111)

Solution:

$$PQPR = 513 \dots [\text{Given}]$$

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Here, the ratio of the lengths of sides PQ and PR is 5 : 13.

The actual lengths of the sides can be any multiple of the ratio. Hence, we consider the multiple k while solving.

Question 4.

While solving the above illustrative example, can we take the lengths of PQ and PR as 5 and 13? If so, then what changes are needed in the writing of the solution. (Textbook pg. no. 111)

Solution:

Yes, we can take lengths of PQ and PR as 5 and 13.

In that case, we will have to take $k = 1$ and solve the problem accordingly.

Question 5.

Verify that the equation ' $\sin^2 \theta + \cos^2 \theta = 1$ ' is true when $\theta = 0^\circ$ or $\theta = 90^\circ$.

(Textbook pg. no. 112)

Solution:

$$\sin^2 \theta + \cos^2 \theta = 1$$

i. If $\theta = 0^\circ$,

$$\text{L.H.S.} = \sin^2 \theta + \cos^2 \theta$$

$$= \sin^2 0^\circ + \cos^2 0^\circ$$

$$= 0 + 1 \dots [\because \sin 0^\circ = 0, \cos 0^\circ = 1]$$

$$= \text{R.H.S.}$$

$$\therefore \sin^2 \theta + \cos^2 \theta = 1$$

ii. If $\theta = 90^\circ$,

$$\text{L.H.S.} = \sin^2 \theta + \cos^2 \theta$$

$$= \sin^2 90^\circ + \cos^2 90^\circ$$

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$$= 1 + 0 \dots [\because \sin 90^\circ = 1, \cos 90^\circ = 0]$$

$$= 1$$

$$= \text{R.H.S.}$$

$$\therefore \sin^2 \theta + \cos^2 \theta = 1$$



Maharashtra Board Solutions

Class 9 Maths

Part 2

- Chapter 1.1- Basic Concepts in Geometry
- Chapter 1.2- Basic Concepts in Geometry
- Chapter 1.3- Basic Concepts in Geometry
- Chapter 2.1- Parallel Lines
- Chapter 2.2- Parallel Lines
- Chapter 3.1- Triangles
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- Chapter 5.1- Quadrilaterals
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The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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FAQs

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Postal Address

IndCareer.com
52, Shilpa Nagar,
Somalwada
Nagpur - 440015
Maharashtra, India

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