UDAAN

2026

Trigonometry

MATHS LECTURE-4

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Topics *to be covered*

A More Questions on T-ratios for some specific angles

B Introduction to Trigonometric Identities

Sin↑ Cosec↓

Sin↑ Cos↓
sin↑ cos↓

T. Ratios / θ	0°	30°	45°	60°	90°
sin θ	0	1/2	$1/\sqrt{2}$	$\sqrt{3}/2$	1
cos θ	1	$\sqrt{3}/2$	$1/\sqrt{2}$	1/2	0
tan θ	0	$1/\sqrt{3}$	1	$\sqrt{3}$	Not defined
cosec θ	Not defined	2	$\sqrt{2}$	$2/\sqrt{3}$	1
sec θ	1	$2/\sqrt{3}$	$\sqrt{2}$	2	Not defined
cot θ	Not defined	$\sqrt{3}$	1	$1/\sqrt{3}$	0

0·5

0·866

#Q. Which of the following statements is true?

A $\sin 20° > \sin 70°$

B $\sin 20° > \cos 20°$

C $\cos 20° > \cos 70°$

D $\tan 20° > \tan 70°$

Visualization

(i) The value of $\sin\theta$ increases from 0 to 1 and $\cos\theta$ decreases from 1 to 0, when $0 \le \theta \le 90°$.

(ii) Division by 0 is not allowed, hence $1/0$ is an indeterminate (not defined) value.

(iii) In the case of $\tan\theta$ the value increases from 0 to ∞, where $0 < \theta \le 90°$.

(iv) In the case of $\cot\theta$, the values decreases from ∞ to 0, where $0 \le \theta \le 90°$.

(v) In the case of $\text{cosec}\,\theta$, the values decreases from ∞ to 1, where $0 \le \theta \le 90°$.

(vi) In the case of $\sec\theta$, the values increases from 1 to ∞, where $0 \le \theta \le 90°$.

#Q. If $\sin\theta - \cos\theta = 0$, then the value of $\sin^4\theta + \sin^4\theta$ is :

$\sin\theta = \cos\theta \times 1$

$\frac{\sin\theta}{\cos\theta} = 1$

$\tan\theta = 1$

$\tan\theta = \tan 45^\circ$

$\theta = 45^\circ$

$= \sin^4 45^\circ + \sin^4 45^\circ$

$= \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4$

$= \frac{1}{4} + \frac{1}{4}$

$= \frac{2}{4}$

$= \frac{1}{2}$

$\sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2}$

2×2

4

A 1

B $\frac{1}{2}$

C $\frac{1}{4}$

D $\frac{3}{4}$

#Q. In a ΔABC right angled at B, $\angle A = \angle C$.

Find the value of : $\boxed{\sin A \cos C + \cos A \sin C}$

A 0

B 1

C $\sqrt{2}$

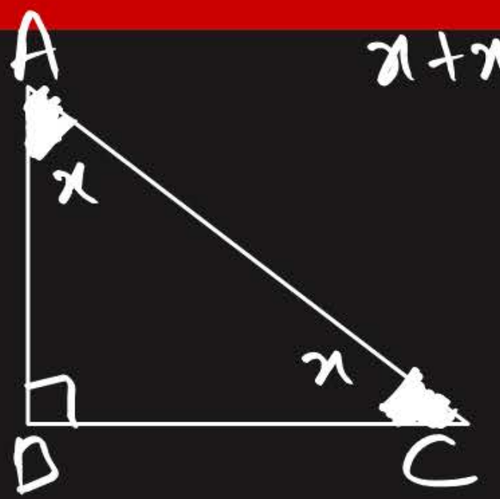
D NOTA

$= \sin 45^\circ \cos 45^\circ + \cos 45^\circ \sin 45^\circ$

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

$= \frac{1}{2} + \frac{1}{2}$

$= 1$ //



$x + x + 90^\circ = 180^\circ$

$2x = 90^\circ$

$\boxed{x = 45^\circ}$ //

#Q. If ΔABC, $\angle B = 90^\circ$. If $\tan A = \sqrt{3}$, then the value of $\sin A \cdot \cos C - \cos A \cdot \sin C$ is:

A $\frac{1}{2}$

B -1

C 1

D 0

#Q. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, find the value of $\tan^7\theta + \cot^7\theta$.

$$\tan\theta + \cot\theta = 2$$

$$\frac{\tan\theta}{1} + \frac{1}{\tan\theta} = 2$$

$$\frac{(\tan\theta)^2 + 1}{\tan\theta} = 2$$

$$\tan^2\theta + 1 = 2\tan\theta$$

$$\tan^2\theta - 2\tan\theta + 1 = 0$$

$\tan\theta = x$

$$x^2 - 2x + 1 = 0$$

$P = 1, \; S = 2$

$-1, -1$

$$x^2 - 1x - 1x + 1 = 0$$

$$x(x-1) - 1(x-1) = 0$$

$$(x-1)(x-1) = 0$$

$x = 1, 1$

$1\theta = 1$

$\tan\theta = \tan 45^\circ$

$\theta = 45^\circ$

$= \tan^7\theta + \cot^7\theta$

$= \tan^7 45 + \cot^7 45$

$= (1)^7 + (1)^9$

$= 1 + 1$

$= (2)$ Ans

$\tan^{200}\theta + \cot^{200}\theta$ //

#Q. Find an acute angle θ, when

$$\frac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \frac{1-\sqrt{3}}{1+\sqrt{3}}$$

$$\frac{\frac{\cos\theta - \sin\theta}{\cos\theta}}{\frac{\cos\theta + \sin\theta}{\cos\theta}}$$

$$\frac{\frac{\cos\theta}{\cos\theta} - \frac{\sin\theta}{\cos\theta}}{\frac{\cos\theta}{\cos\theta} + \frac{\sin\theta}{\cos\theta}}$$

$$\frac{1-\tan\theta}{1+\tan\theta} = \frac{1-\sqrt{3}}{1+\sqrt{3}}$$

On comparison,

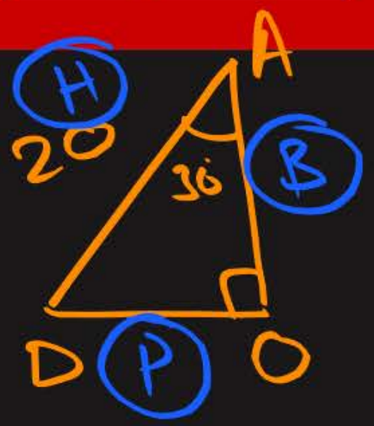
$\tan\theta = \sqrt{3}$

$\tan\theta = \tan 60^\circ$

$\theta = 60^\circ$

Ans.

#Q. A rhombus of side 20 cm has two angles of 60 each. Find the length of the diagonals.



$\cos 30 = \frac{B}{H} = \frac{AO}{AD}$

$\frac{\sqrt{3}}{2} = \frac{AO}{20}$

$10\sqrt{3}\ \text{cm} = AO$

$AC = 2\,AO$

$AC = 2 \times 10\sqrt{3}$

$= 20\sqrt{3}\ \text{cm}$

$\sin 30 = \frac{P}{H} = \frac{DO}{AD}$

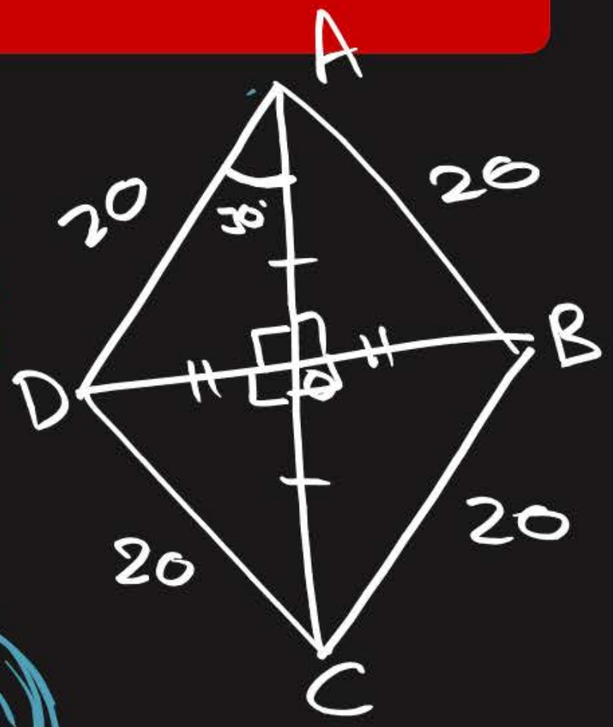
$\frac{1}{2} = \frac{DO}{20}$

$10\ \text{cm} = DO$

$DB = 2 \cdot DO$

$DB = 2 \cdot 10$

$DB = 20\text{cm}$



#Q. Statement A (Assertion) : In ΔPQR, right angled at Q, QR = 3 cm, PR = 5 cm and PQ = 4 cm. The value of $\sin^2 R + \text{cosec } R$ is 189/100.

Statement R (Reason) : $\sin^2 A = (\sin A)^2$ and $\text{cosec } A = (\sec A)^{-1}$.

$\text{cosec } A = \frac{1}{\sec A}$

$\sin R = \frac{4}{5}$

$\text{Cosec } R = \frac{5}{4}$

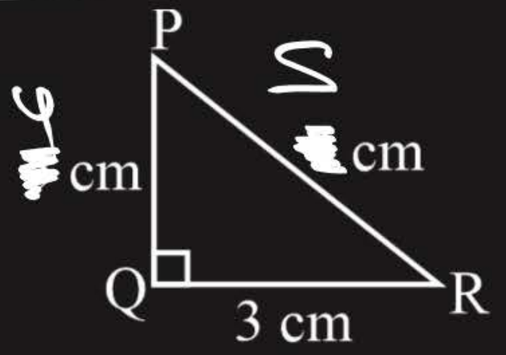
$= \sin^2 R + \text{cosec } R$

$= \left(\frac{4}{5}\right)^2 + \frac{5}{4}$

$= \frac{16}{25} + \frac{5}{4}$

$= \frac{64 + 125}{100}$

$= \boxed{\frac{189}{100}}$



ASSERTION–REASON BASED MCQs

Each of the following examples contains Assertion (A) and Reason (R) and has the following four choices (a), (b), (c) and (d), only one of which is the correct answer.

Mark the correct choice.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

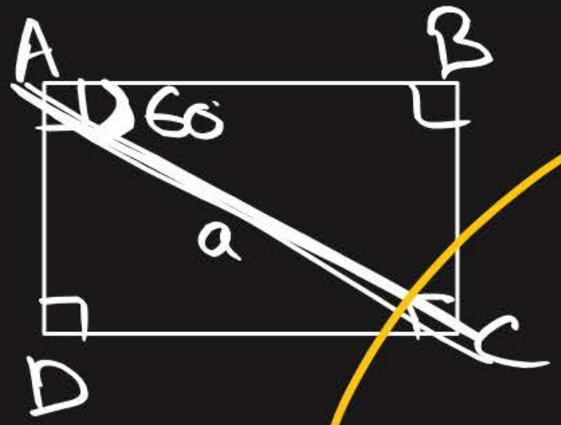
(b) Both assertion (A) and reason (R) are true and reason (R) not is the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

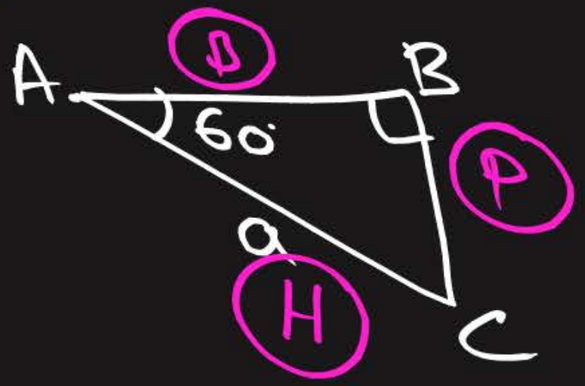
(d) Assertion (A) is false but reason (R) is true.

#Q. Statement A (Assertion) : ABCD is a rectangle such that $\angle CAB = 60°$ and AC = a units. The area of rectangle ABCD is $\sqrt{3}/2\ a^2$ sq. units.

Statement R (Reason) : The value of sin 60° is $\sqrt{3}/2$ and cos 60° is 1/2.



$A = l \times b$



$\cos 60° = \frac{AB}{AC}$

$\frac{1}{2} = \frac{AB}{a}$

$\frac{a}{2} = AB$

$A = \frac{a}{2} \times \frac{\sqrt{3}a}{2}$

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

$\sin 60° = \frac{BC}{AC}$

$\frac{\sqrt{3}}{2} = \frac{BC}{a}$

$BC = \frac{\sqrt{3}a}{2}$

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#Q. Statement A (Assertion) : If $\sin\theta = 1/2$ and θ is acute angle, then $(3\cos\theta - 4\cos^3\theta)$ is equal to 0.

Statement R (Reason) : As $\sin\theta = 1/2$ and θ is acute angle, so θ must be 60°.

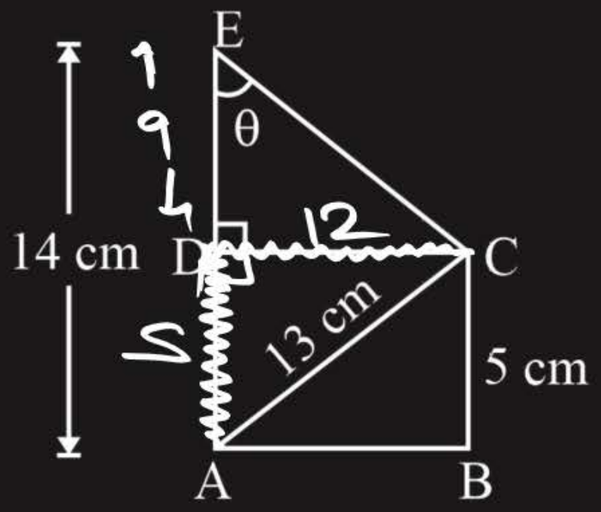
#GPH

#Q. In figure, if AE = 14 cm, AC = 13 cm, BC = 5 cm, then find the value of tan θ.

$\tan\theta = \frac{P}{B} = \frac{DC}{ED}$

$= \frac{12}{9}$

$= \frac{4}{3}$



A $\frac{1}{2}$

B $\frac{4}{3}$

C $\frac{1}{\sqrt{2}}$

D $\frac{\sqrt{3}}{2}$

#Q. In a ΔABC, right angle at B, the value of $\sin(A + C)$ is:

Sin 90°

A 0

B 1

C $\frac{1}{2}$

D $\frac{\sqrt{3}}{2}$

#Q. In a ΔABC, if $\angle B = 90°$, BC = 5 cm, AC – AB = 1 cm. Then the value of $\frac{1+\sin C}{1+\cos C}$ is:

#GPK

A $\frac{18}{25}$

B $\frac{36}{31}$

C $\frac{25}{18}$

D $\frac{31}{36}$

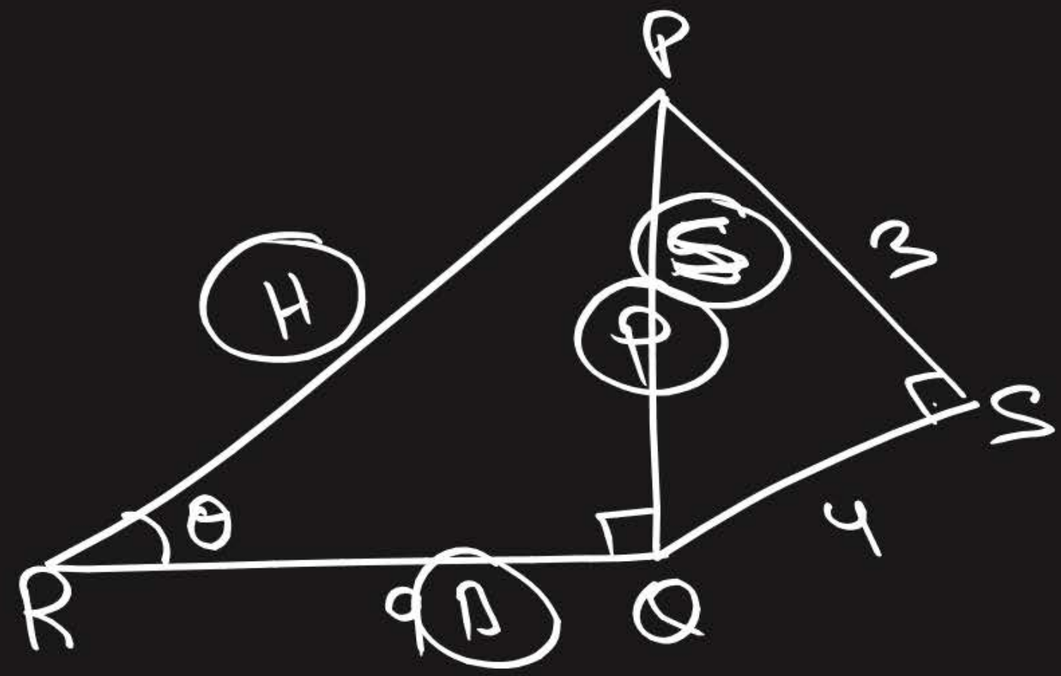
$\tan\theta = ?$

$= \frac{P}{B}$

$= \frac{PQ}{RQ}$

$= \frac{PQ}{q}$

$= \frac{s}{q}$



Q $4\cot^2 45° - \sec^2 60° + \sin^2 60° + P = \frac{3}{4}$

$4(1)^2 - (2)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + P = \frac{3}{4}$

$4 - 4 + \frac{3}{4} + P = \frac{3}{4}$

$P = \frac{3}{4} - \frac{3}{4}$

$P = 0$

(ii) $\sec\theta + \cos\theta\cot\theta$

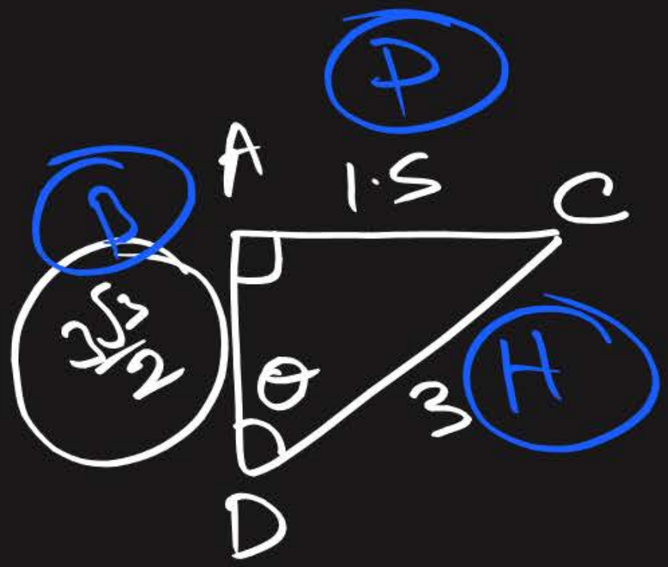
$= \frac{H}{B} + \frac{H}{P}$

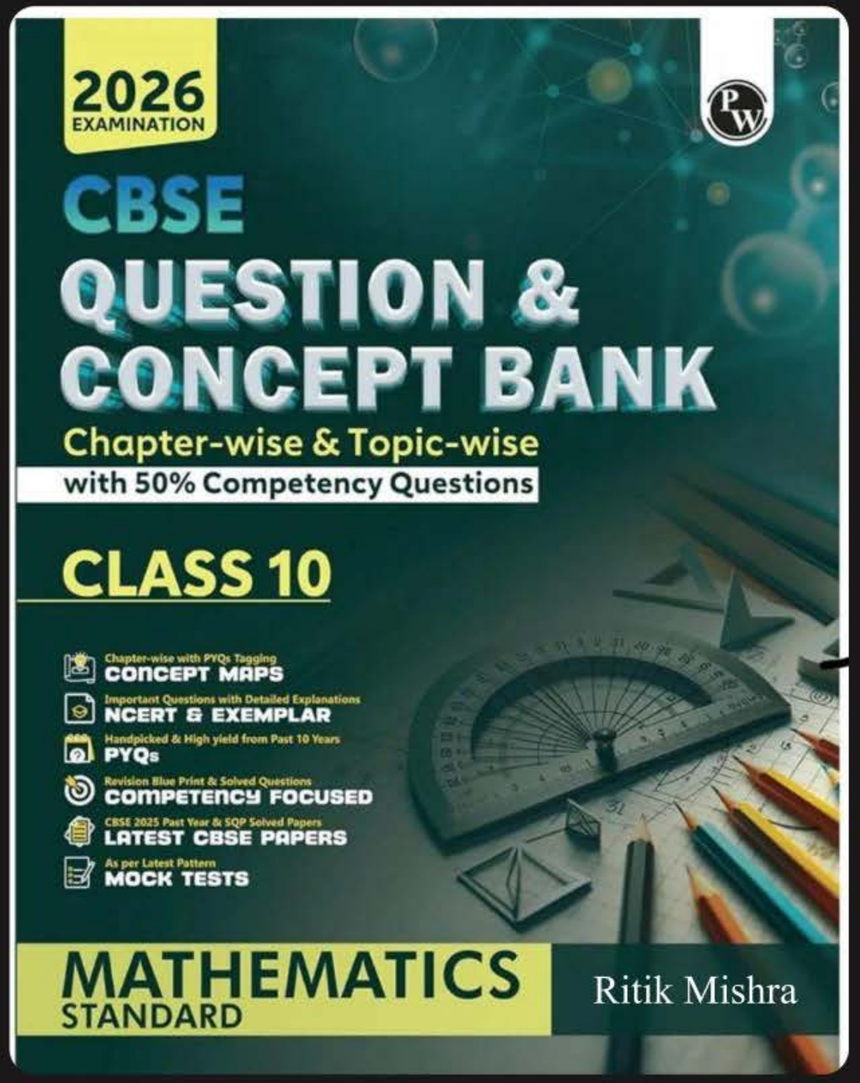
$= \frac{3/1}{3\sqrt{3}/2} + \frac{3/1}{1.5/10}$

$= \frac{2}{\cancel{6}\sqrt{3}} + \frac{\cancel{30}^{2}}{\cancel{15}}$

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

$= \frac{2+2\sqrt{3}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}+6}{3}$

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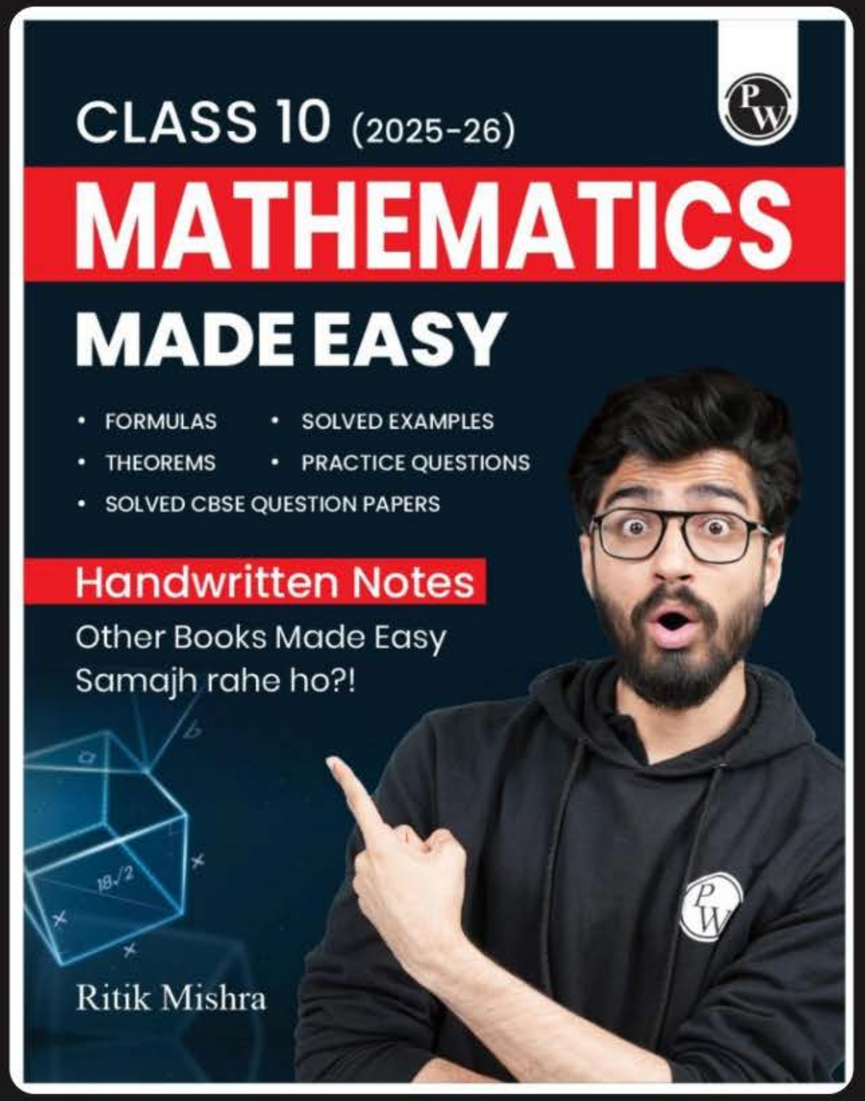
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