YAKEEN NEET 2.0

2026

KPP-02

Discussion

Basic Maths and Calculus (Mathematical Tools)

PHYSICS | Lecture - 02

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Trigonometric Reduction Formulae:

$\sin(90° + \theta) = \cos\theta$	$\sin(180° - \theta) = \sin\theta$
$\cos(90° + \theta) = -\sin\theta$	$\cos(180° - \theta) = -\cos\theta$
$\tan(90° + \theta) = -\cot\theta$	$\tan(180° - \theta) = -\tan\theta$
$\sin(180° + \theta) = -\sin\theta$	$\sin(270° - \theta) = -\cos\theta$
$\cos(180° + \theta) = -\cos\theta$	$\cos(270° - \theta) = -\sin\theta$
$\tan(180° + \theta) = \tan\theta$	$\tan(270° - \theta) = \cot\theta$
$\sin(-\theta) = -\sin\theta$	$\sin(90° - \theta) = \cos\theta$
$\cos(-\theta) = \cos\theta$	$\cos(90° - \theta) = \sin\theta$
$\tan(-\theta) = -\tan\theta$	$\tan(90° - \theta) = \cot\theta$
$\sin(270° + \theta) = -\cos\theta$	$\sin(360° - \theta) = -\sin\theta$
$\cos(270° + \theta) = \sin\theta$	$\cos(360° - \theta) = \cos\theta$
$\tan(270° + \theta) = -\cot\theta$	$\tan(360° - \theta) = -\tan\theta$

Question - 01

As θ increases from 0° to 90°, the value of $\cos\theta$

(1) Increases

(2) Decreases

(3) Remains constant

(4) First decreases then increases

Ans : (2)

Question - 02

The greatest value of the function $8\sin\theta - 6\cos\theta$ is:

(1) 10

(2) 12

(3) 20

(4) 15

$\sqrt{8^2 + (-6)^2} = 10$

$a\sin\theta + b\cos\theta$

$\sqrt{a^2+b^2}$

Ans : (1)

Question - 03

What is the minimum value of

$$\frac{2}{4+\sin\theta+\sqrt{3}\cos\theta}$$?

(1) 0

(2) 1

(3) 1/3

(4) 1/2

$\sin\theta+\sqrt{3}\cos\theta$ → max $\sqrt{a^2+b^2}$

$=\sqrt{1^2+(\sqrt{3})^2}$

$=2$

max = 2

$\frac{2}{4+2}=\frac{2}{6}$

$y = (10)+x^2$ → max

Ans : (3)

Question - 04

Match List-I with List-II.

List-I		List-II	
(A)	$\sin\left(\frac{\pi}{2}-\theta\right)$ (iv)	(I)	$-\tan\theta$
(B)	$\sin 2\theta$ (iii)	(II)	$2\cos^2\theta-1$
(C)	$\tan(-\theta)$ (i)	(III)	$2\sin\theta\cos\theta$
(D)	$\cos 2\theta$ (ii)	(IV)	$\cos\theta$

Choose the correct answer from the options given below:

(1) A–I, B–II, C–III, D–IV

(2) A–II, B–IV, C–I, D–III

(3) A–III, B–I, C–IV, D–II

(4) A–IV, B–III, C–I, D–II

Ans : (4)

Question - 05

$\cos^2\theta$ can be equated to:

(1) $\frac{1+\cos 2\theta}{2}$ (2) $\frac{1-\cos 2\theta}{2}$

(3) $1+\sin^2\theta$ (4) $\cos(2\theta)$

$\cos 2\theta = 2\cos^2\theta - 1$

$\frac{\cos 2\theta + 1}{2} = \cos^2\theta$

Ans : (1)

Question - 06

As θ increases from $0°$ to $90°$, the value of $\cos\theta$.

(1) Increases

(2) Decreases

(3) Remains constant

(4) First decreases then increases.

Ans : (2)

Question - 07

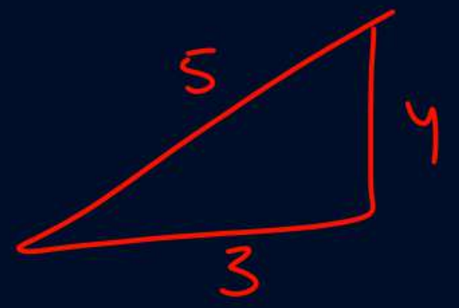
The greatest value of the function $-5\sin\theta + 12\cos\theta$ is:

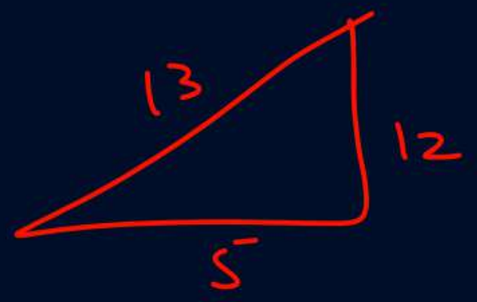
(1) 12 (2) 13

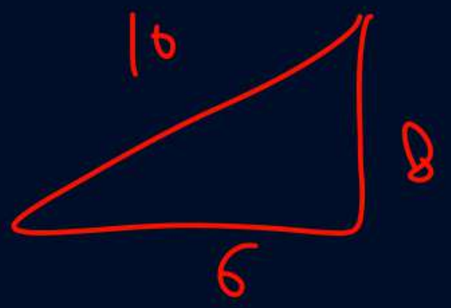
(3) 7 (4) 17

$-5\sin\theta + 12\cos\theta$

$\sqrt{5^2+(12)^2} \equiv 13$







Ans : (2)

Question - 08

Find the value of $\sin(90 + \theta)$ $= +\cos\theta$

(1) $\sin\theta$

(2) $-\sin\theta$

(3) $\cos\theta$

(4) $-\cos\theta$

Ans : (3)

Question - 09

Minimum value of $\cos\theta$ for $-\pi \le \theta \le \pi$

(1) -1 (2) $+1$

(3) 0 (4) $\frac{1}{2}$

$-180 \le \theta \le 180$

$\cos(-180)$

$= \cos 180 = -1$

$\cos 180^\circ = -1$

Ans : (1)

Question - 10

If $y = \sin 2\theta$ then find 'θ' where y will be maximum

(1) $90°$ (2) $60°$

(3) $45°$ (4) $32°$

$2\theta = 90°$

$\theta = 45°$

Ans : (3)

Question - 11

Find maximum value of 'y' where $y = 2\sin\theta + \sqrt{5}\cos\theta$.

(1) 3

(2) $2 + \sqrt{5}$

(3) $2\sqrt{5}$

(4) $\sqrt{5}$

$(\sqrt{5})^2 = \sqrt{5} \times \sqrt{5} = 5$

$y = 2\sin\theta + \sqrt{5}\cos\theta$

$\sqrt{4+5}$

Ans : (1)

Question - 12

Friction force acting on an object is given as function of angle 'θ' $f_r = \dfrac{\mu mg}{\sin\theta + \mu\cos\theta}$ then find min value of friction.

(1) μmg

(2) $\dfrac{\mu mg}{1+\mu}$

(3) $\dfrac{\mu mg}{\sqrt{1+\mu^2}}$

(4) Zero

$$f_{min} = \frac{\mu mg}{\sqrt{1+\mu^2}}$$

$1\cdot\sin\theta + \mu\cos\theta \rightarrow$ max

$\sqrt{1^2+\mu^2} \equiv$

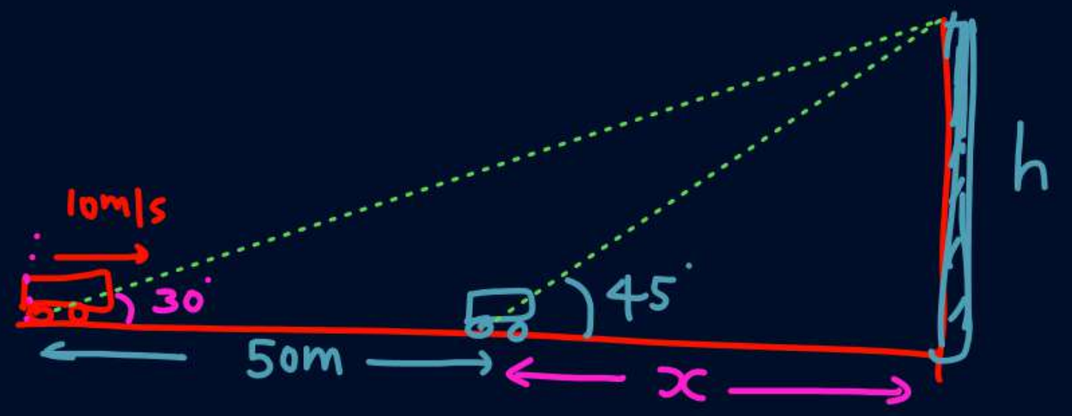
Ans : (3)

Question - 13

A car is moving towards a building with speed 10 m/s. At any instant the angle of elevation of the building is 30°. After 5 sec. the angle of elevation of the building becomes 45°, then height of building is

(1) $h = \frac{50}{\sqrt{3}+1}$ (2) $h = \frac{20}{\sqrt{3}+1}$

(3) $h = \frac{20}{\sqrt{3}-1}$ (4) $h = \frac{50}{\sqrt{3}-1}$



$\tan 45^\circ = \frac{h}{x}$

$1 = \frac{h}{x}$

$x = h$

$\tan 30^\circ = \frac{h}{50+x}$

$\frac{1}{\sqrt{3}} = \frac{h}{50+h}$

$50+h = h\sqrt{3}$

$50 = h\sqrt{3} - h = h(\sqrt{3}-1)$

$h = \frac{50}{\sqrt{3}-1}$

Ans : (4)

Question - 14

Find value of different trigonometric function

(i) $\sin(135°)$ (ii) $\tan(120°)$

(iii) $\cos(150°)$ (iv) $\tan(45°)$

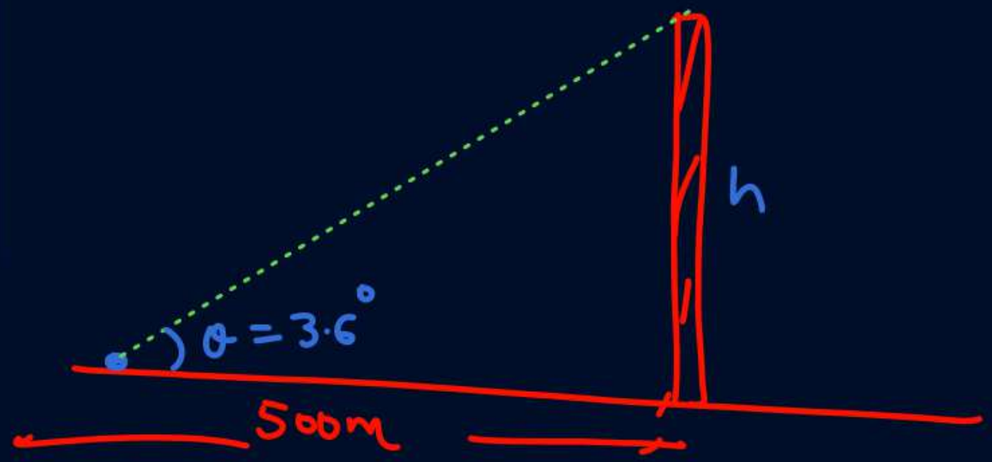
(v) $\tan 37°$ (vi) $\cos 53°$

(vii) $\cos(-60°) = \cos 60 = \frac{1}{2}$

Ans : (i) $\frac{1}{\sqrt{2}}$; (ii) $-\sqrt{3}$; (iii) $-\frac{\sqrt{3}}{2}$; (iv) 1; (v) $\frac{3}{4}$; (vi) $\frac{3}{5}$; (vii) $\frac{1}{2}$

Question - 15

A man is standing at a distance of 500 m from a building. He notes that angle of elevation of the top of the building is 3.6°. Find the height of the building. Neglect the height of the man and take $\pi = 3.14$.



$$\tan\theta = \frac{h}{500} = \frac{3.6\,\pi}{180}$$

$$\frac{36}{10} \times \frac{\pi}{180} = \frac{h}{500}$$

$$10\pi = h$$

$$h = 10 \times 3.14 = 31.4$$

Ans : 31.40 m

Question - 16

Find the value of:

(i) $\tan 135°$

(ii) $\sin(-30°)$

(iii) $\cos(-60°)$

(iv) $\tan(-45°)$

$= -\sin 30° = -\frac{1}{2}$

$= \cos 60 = \frac{1}{2}$

$= -\tan 45° = -\frac{1}{\sqrt{2}}$

Ans : (i) -1; (ii) $-\frac{1}{2}$; (iii) $\frac{1}{2}$; (iv) -1

Question - 17

Find maximum and minimum values of function y:

(i) $y = 2\sin x \Rightarrow [-2, +2]$

(ii) $y = 4 - \cos x$

(iii) $y = 3\sin x + 4\cos x = (-5, +5)$

$y = 4 - \cos x$

max

max

$y_{max} = 4 - (-1) = 5$

$y_{min} = 4 - (+1) = 3$

$y = 4 - x$

$y = 4 - (1) = 3$

$y = 4 - (2) = 2$

$y = 4 - (3) = 1$

Ans : (i) 2, –2; (ii) 5, 3; (iii) 5, –5

Question - 18

What is the value of x for which y is maximum $y = k \sin 2x$.

max

$2x = 90$

$x = 45$

Ans : $\frac{\pi}{4}$ rad

Question - 19

The maximum value of the function $f(x) = \sqrt{3} \sin x + \cos x$, is:

$\sqrt{(\sqrt{3})^2 + 1^2} = 2$

Ans : (2)

Question - 20

$\sin 2\theta = 2\sin\theta\cos\theta$

Find the value of

(i) $\sin 74^\circ = \sin(2\times 37^\circ) = 2\sin 37\cos 37 = 2\times\frac{3}{5}\times\frac{4}{5} = \frac{24}{25}$

(ii) $\cos 106^\circ$

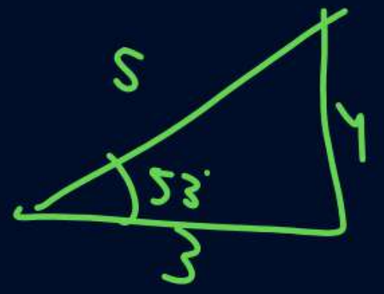
(iii) $\sin 15^\circ = \sin(45-30) = \frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}\frac{1}{2} = \frac{\sqrt{3}-1}{2\sqrt{2}}$

$\cos 106^\circ = \cos(2\times 53^\circ) = \cos^2 53 - \sin^2 53 = \left(\frac{3}{5}\right)^2 - \left(\frac{4}{5}\right)^2$

$= \frac{9}{25} - \frac{16}{25}$

$= \frac{-7}{25}$

$\cos 2\theta = \cos^2\theta - \sin^2\theta$



Ans : (i) $\frac{24}{25}$; (ii) $-\frac{7}{25}$; (iii) $\sin 30^\circ = \frac{\sqrt{3}-1}{2\sqrt{2}}$

Question - 21

Find maximum and minimum value of

(i) $8 - 6\cos x = y$

(ii) $3\sin x - 4\cos x \equiv (5)$ $(-5, -5)$

(iii) $5\sin(x) + 12\cos x + 4$

$\pm a\sin\theta \pm b\cos\theta = y$

$y_{max} = \sqrt{a^2+b^2}$

$y_{min} = -\sqrt{a^2+b^2}$

max $\Rightarrow 13+4 = 17$

Min $\Rightarrow -13+4 = -9$

① $y = 8 - 6\cos x$

$y_{max} = 8-6(-1) = 8+6 = 14$

$y_{min} = 8-6(+1) = 2$

Ans : (i) 14, 2; (ii) 5, –5; (iii) 17, –9

Question - 22

Evaluate:

(i) $2 \sin 15^\circ \cos 15^\circ$

(ii) $\sin 22.5^\circ . \cos 22.5^\circ$

(iii) $\tan 75^\circ$

(iv) $\sin^2 22.5^\circ$

(i) $\sin 2\theta = \sin(2 \times 15^\circ) = \sin 30^\circ = \frac{1}{2}$

(ii) $\frac{2}{2} \sin(22.5) \times \cos(22.5) = \frac{2 \sin\theta \cos\theta}{2}$

$= \frac{\sin(2 \times 22.5)}{2} = \frac{\sin 45^\circ}{2} = \frac{1}{2\sqrt{2}}$

(iii) $\tan 75^\circ = \tan(45 + 30)$

$= \frac{\tan 45^\circ + \tan 30}{1 - \tan 45 \tan 30^\circ}$

$= \frac{\left(1 + \frac{1}{\sqrt{3}}\right)}{\left(1 - 1 \times \frac{1}{\sqrt{3}}\right)} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$

Ans : (i) $\frac{1}{2}$; (ii) $\frac{1}{2\sqrt{2}}$; (iii) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$; (iv) $\frac{\sqrt{2}-1}{2\sqrt{2}}$

④ $\sin^2(22.5) = \frac{1-\cos 45^\circ}{2}$

$\theta = 22.5$

$2\theta = 45^\circ$

$= \frac{1-\frac{1}{\sqrt{2}}}{2}$

$= \frac{\frac{\sqrt{2}-1}{2}}{2}$

$= \frac{\sqrt{2}-1}{2\sqrt{2}}$

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

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

$\sin^2\theta = \frac{1-\cos 2\theta}{2}$

Question - 23

Evaluate:

(i) $\cos 15^\circ = \cos(45-30)$ (ii) $\cos 53^\circ$

(iii) $\tan 37^\circ$ (iv) $\sin 53^\circ - \cos 37^\circ$

Ans : (i) $\frac{\sqrt{3}+1}{2\sqrt{2}}$; (ii) $\frac{3}{5}$; (iii) $\frac{3}{4}$; (iv) 0

Question - 24

Evaluate:

(i) $\dfrac{\sin 135^\circ}{\cos 120^\circ} = \dfrac{+\frac{1}{\sqrt{2}}}{-\frac{1}{2}} = -\dfrac{2}{\sqrt{2}} = -\sqrt{2}$

(ii) $\dfrac{\sin 120^\circ}{\cos 15^\circ} = \dfrac{\sqrt{3}/2}{\cos(45-30)} = \dfrac{\sqrt{3}}{2\left(\frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}\frac{1}{2}\right)} = \dfrac{\sqrt{3}}{2\left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)} = \dfrac{\sqrt{3} \times 2\sqrt{2}}{2 \times (\sqrt{3}+1)} = \dfrac{\sqrt{6}}{\sqrt{3}+1}$

(iii) $\sin 105^\circ$ = next page

(iv) $\sin 300^\circ = -\sqrt{3}/2$

(v) $\cos 240^\circ$

(vi) $\sin^2(20^\circ) + \sin^2(70^\circ)$

$\Downarrow$

$\cos^2(70) + \sin^2 70 = 1$

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

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

$\sin 20^\circ = \sin(90-70) = \cos 70^\circ$

Ans : (i) $-\sqrt{2}$; (ii) $\dfrac{\sqrt{6}}{\sqrt{3}+1}$; (iii) $\dfrac{\sqrt{3}+1}{2\sqrt{2}}$; (iv) $\dfrac{-\sqrt{3}}{2}$; (v) $\dfrac{-1}{2}$; (vi) 1

$\sin 105^\circ = \sin(60+45) = \sin 60 \cos 45 + \cos 60 \sin 45 = \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}} + \frac{1}{2} \times \frac{1}{\sqrt{2}}$

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

$\sin(180-75) = +\sin 75 = \sin(30+45)$

$= \sin 30 \cos 45 + \cos 30 \sin 45$

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

THANK YOU