Trigonometric Ratios & Identities

Question1

Which of the following is not correct?

KCET 2025

Options:

A. $\cos 5\pi = \cos 4\pi$

B. $\sin 2\pi = \sin(-2\pi)$

C. $\sin 4\pi = \sin 6\pi$

D. $\tan 45^\circ = \tan\left(-315^\circ\right)$

Answer: A

Solution:

Let's check each identity:

Option A:

$$\cos 5\pi = \cos(\pi + 4\pi) = -1, \quad \cos 4\pi = 1$$

These are not equal, so A is false.

Option B:

$$\sin 2\pi = 0, \quad \sin(-2\pi) = -\sin 2\pi = 0$$

Option C:

$$\sin 4\pi = 0, \quad \sin 6\pi = 0$$

Option D:

$$\tan 45^\circ = 1, \quad \tan(-315^\circ) = \tan(45^\circ) = 1$$

Only Option A fails, so the incorrect statement is Option A.

Question2

The minimum value of $1 - \sin x$ is

KCET 2025

Options:

A. 0

B. -1

C. 1

D. 2

Answer: A

Solution:

To find the minimum value of the expression $f(x) = 1 - \sin x$, we start by considering the range of the sine function. Since $-1 \leq \sin x \leq 1$, this means the minimum value of $\sin x$ is -1.

Now, compute $f(x)$ when $\sin x = -1$:

$f(x) = 1 - (-1) = 1 + 1 = 2$

Check if $\sin x = 1$:

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

Thus, the minimum value of $f(x) = 1 - \sin x$ occurs when $\sin x = 1$, making the minimum value:

$f_{\text{min}} = 0$

Question3

The degree measure of $\frac{\pi}{32}$ is equal to

KCET 2022

Options:

A. $5^{\circ}30'20''$

B. $5^{\circ}37'20''$

C. $5^{\circ}37'30''$

D. $4^{\circ}30'30''$

Answer: C

Solution:

Given, angle in radian $= \frac{\pi}{32}$

$$\text{Degree measure} = \frac{180}{\pi} \times \text{radian measure}$$

$$= \frac{180}{\pi} \times \frac{\pi}{32} = \left(\frac{45}{8}\right)^{\circ} = \left(5\frac{5}{8}\right)^{\circ}$$
$$= 5^{\circ}\left(\frac{5}{8} \times 60\right)' = 5^{\circ}\left(\frac{75}{2}\right)'$$
$$= 5^{\circ}37'\left(\frac{1}{2} \times 60\right)'' = 5^{\circ}37'30''$$

Question4

The value of $\sin\frac{5\pi}{12}\sin\frac{\pi}{12}$ is

KCET 2022

Options:

A. 0

B. 1

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

D. $\frac{1}{4}$

Answer: D

Solution:

Given, expression is $\sin \frac{5\pi}{12} \sin \frac{\pi}{12}$.

We know that,

$2 \sin A \sin B = \cos(A - B) - \cos(A + B)$

Therefore, $\sin \frac{5\pi}{12} \sin \frac{\pi}{12}$

$$= \frac{1}{2}\left[\cos\left(\frac{5\pi}{12} - \frac{\pi}{12}\right) - \cos\left(\frac{5\pi}{12} + \frac{\pi}{12}\right)\right]$$
$$= \frac{1}{2}\left[\cos\left(\frac{4\pi}{12}\right) - \cos\left(\frac{6\pi}{12}\right)\right]$$
$$= \frac{1}{2}\left[\cos\left(\frac{\pi}{3}\right) - \cos\left(\frac{\pi}{2}\right)\right] = \frac{1}{2}\left[\frac{1}{2} - 0\right] = \frac{1}{4}$$

Question5

$$\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}} =$$

KCET 2022

Options:

A. $\sin 2\theta$

B. $2\cos\theta$

C. $2\sin\theta$

D. $2\cos\frac{\theta}{2}$

Answer: B

Solution:

Let $y = \sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$

We know, $1 + \cos 2A = 2\cos^2 A$

Therefore, $y=\sqrt{2+\sqrt{2+\sqrt{2\cdot(1+\cos 8\theta)}}}$

$$=\sqrt{2+\sqrt{2+\sqrt{2\cdot 2\cos^2 4\theta}}}$$
$$=\sqrt{2+\sqrt{2+2\cos 4\theta}}=\sqrt{2+\sqrt{2\cdot 2\cos^2 2\theta}}$$
$$=\sqrt{2+2\cos 2\theta}=\sqrt{2\cdot 2\cos^2\theta}=2\cos\theta$$

Question6

The value of $\cos 1200^\circ+\tan 1485^\circ$ is

KCET 2021

Options:

A. $\frac{1}{2}$

B. $\frac{3}{2}$

C. $-\frac{3}{2}$

D. $-\frac{1}{2}$

Answer: A

Solution:

$$\begin{aligned}
&\text{Given, } \cos 1200^\circ+\tan 1485^\circ\\
&=\cos 1200^\circ+\tan 1485^\circ\\
&=\cos(3\times 360^\circ+120^\circ)+\tan(4\times 360^\circ+45^\circ)\\
&=\cos(120^\circ)+\tan(45^\circ)\\
&=\cos(180^\circ-60^\circ)+1\\
&=-\cos 60^\circ+1\\
&=-\frac{1}{2}+1=\frac{1}{2}
\end{aligned}$$

Question7

The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan 89^\circ$ is

KCET 2021

Options:

A. 0

B. 1

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

D. -1

Answer: B

Solution:

Given, $\tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan 89^\circ$

$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan 87^\circ \tan 88^\circ \tan 89^\circ$
$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan (90 - 3^\circ)$
$\tan(90 - 2)^\circ \tan(90 - 1)^\circ$

$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \cot 3^\circ \cot 2^\circ \cot 1^\circ$
$= \tan 1^\circ \cot 1^\circ \tan 2^\circ \cot 2^\circ \tan 3^\circ \cot 3^\circ \ldots \tan 45^\circ$
$= (1)\,(l)\,(l)\,\ldots\,(l)$
$= 1$

Question8

The value of $\sin^2 51^\circ + \sin^2 39^\circ$ is

KCET 2020

Options:

A. 1

B. 0

C. $\sin 12^\circ$

D. $\cos 12^\circ$

Answer: A

Solution:

We have,

$$\sin^2 51^\circ + \sin^2 39^\circ$$
$$\sin^2 51^\circ + \sin^2 (90^\circ - 51^\circ)$$
$$\sin^2 51^\circ + \cos^2 51^\circ = 1$$

Question9

If $\tan A + \cot A = 2$, then the value of $\tan^4 A + \cot^4 A =$

KCET 2020

Options:

A. 2

B. 1

C. 4

D. 5

Answer: A

Solution:

We have, $\tan A + \cot A = 2$

$$(\tan A + \cot A)^2 = (2)^2$$
$$\tan^2 A + \cot^2 + 2 = 4$$
$$\tan^2 A + \cot^2 A = 2$$
$$\left(\tan^2 A + \cot^2 A\right)^2 = (2)^2$$
$$\tan^4 A + \cot^4 A + 2 = 4$$
$$\tan^4 A + \cot^4 A = 2$$

Question10

$\sqrt{3}\,\text{cosec}\,20^\circ - \sec 20^\circ =$

KCET 2019

Options:

A. 4

B. 2

C. 1

D. 3

Answer: A

Solution:

$$\sqrt{3}\,\text{cosec}\,20^\circ - \sec 20^\circ$$

$$= \sqrt{3}\frac{1}{\sin 20^\circ} - \frac{1}{\cos 20^\circ} = \frac{\cot 30^\circ}{\sin 20^\circ} - \frac{1}{\cos 20^\circ}$$

$$= \frac{\cos 30^\circ}{\sin 30^\circ \sin 20^\circ} - \frac{1}{\cos 20^\circ}$$

$$= \frac{\cos 30^\circ \cos 20^\circ - \sin 30^\circ \sin 20^\circ}{\sin 30^\circ \sin 20^\circ \cos 20^\circ}$$

$$= \frac{\cos(30^\circ + 20^\circ)}{\frac{1}{2}\cdot\frac{2\sin 20^\circ \cos 20^\circ}{2}} = \frac{\cos 50^\circ}{\frac{1}{4}\sin 40^\circ} = \frac{4\cos(90^\circ - 40^\circ}{\sin 40^\circ}$$

$$= 4\frac{\sin 40^\circ}{\sin 40^\circ} = 4$$

Question11

The value of $\cos^2 45^\circ - \sin^2 15^\circ$ **is**

KCET 2017

Options:

A. $\frac{\sqrt{2}+1}{2\sqrt{2}}$

B. $\frac{\sqrt{3}-1}{2\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$

D. $\frac{\sqrt{3}}{4}$

Answer: D

Solution:

To find the value of $\cos^2 45^\circ - \sin^2 15^\circ$, we can use a trigonometric identity:

$\cos^2 A - \sin^2 B = \cos(A+B)\cos(A-B)$

Applying this identity with $A = 45^\circ$ and $B = 15^\circ$, we get:

$\cos^2 45^\circ - \sin^2 15^\circ = \cos(45^\circ + 15^\circ)\cos(45^\circ - 15^\circ)$

Calculating each expression, we find:

$\cos(45^\circ + 15^\circ) = \cos 60^\circ$

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

Now, substituting the known cosine values:

$\cos 60^\circ = \frac{1}{2} \quad \text{and} \quad \cos 30^\circ = \frac{\sqrt{3}}{2}$

Thus, we have:

$\cos^2 45^\circ - \sin^2 15^\circ = \frac{1}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}$

Therefore, the value is $\frac{\sqrt{3}}{4}$.
