# GOVERNMENT OF KARNATAKA
# DEPARTMENT OF SCHOOL EDUCATION (PRE-UNIVERSITY)

18TH CROSS, MALLESHWARAM, BENGALURU – 560 012

**CHAPTERWISE MULTIPLE CHOICE QUESTIONS FOR COMPETATIVE EXAM**

**SUBJECT: MATHEMATICS – I PUC**

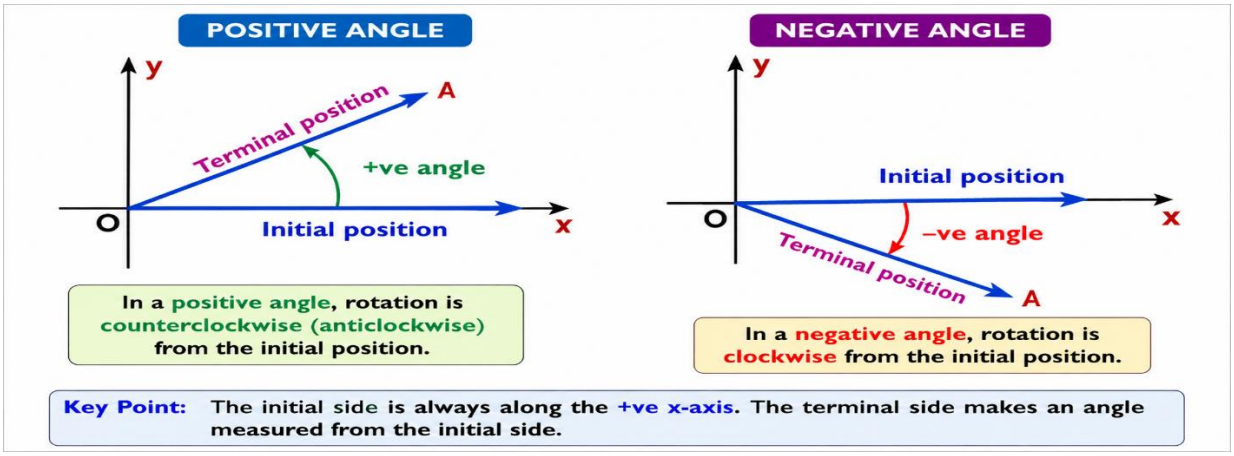
**NAME OF THE CHAPTER: TRIGONOMETRIC FUNCTIONS**

RECAP

## *ANGLES AND THEIR MEASURES*

### *Angle*

A figure traced by rotating a given ray about its end point. The measure of angle is the amount of rotation performed from the initial side to the terminal side. Angle performed by anticlockwise rotation are taken as positive whereas angles formed by clockwise rotation are considered as negative.




### *Radian or Circular Measure*

The angle subtended at the centre of a circle by an arc of the same circle whose length is equal to the radius of the circle is called 1 radian and is denoted by $1^{c}$.

When no unit is mentioned with an angle, it is always understood to be in radian.

Radian measure and real numbers are same.

The ratio of circumference and diameter of a circle is always constant and denoted by Greek letter '$\pi$'.

$\pi$ is an irrational number, $\pi = \dfrac{\text{Circumference of Circle}}{\text{Diameter of Circle}}$

**Circumference** $= 2\pi r = \pi \times$ **diameter,** $\pi = \dfrac{22}{7}$ (approx) = 3.1415.....

## Arc-angle relation

$Angle = \frac{arc}{radius}$ , $\theta = \frac{l}{r}$ Here angle is always in radian.

Angle subtended by a very small arc is approximately calculated by $\theta = \frac{\text{Chord AB}}{r}$

$\therefore$ Arc AB $\approx$ chord AB for small angle $\theta$

## Relation between degree and radian.

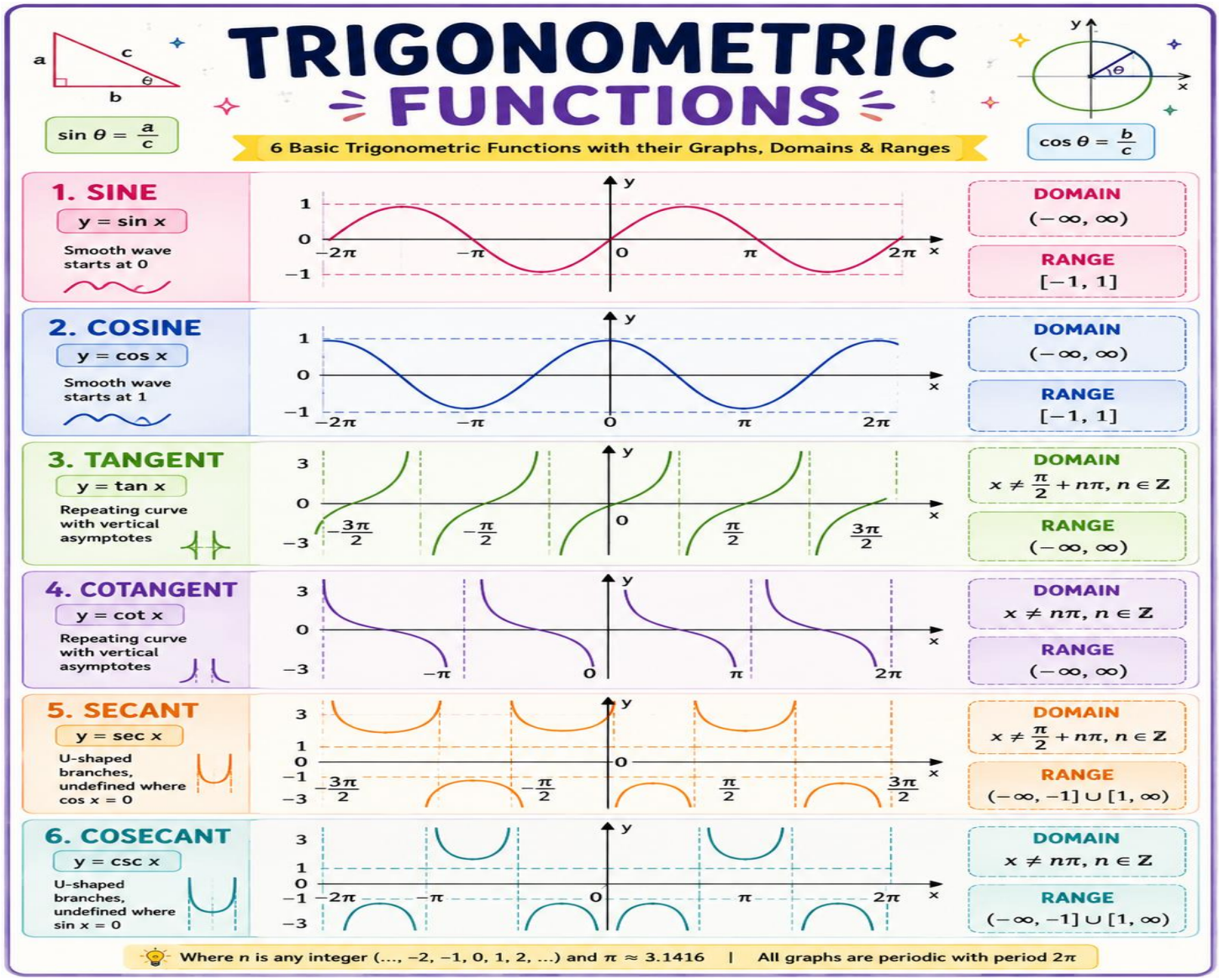
$\pi^c = 180^0$ , $1^c = \left(\frac{180}{\pi}\right)^0$ , $1^0 = \left(\frac{\pi}{180}\right)^c$

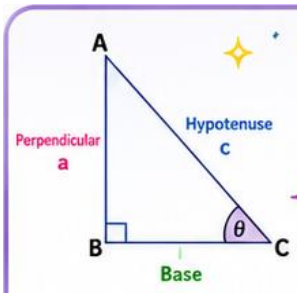
## Relation between the sides and interior angles of a polygon

(a) Sum of interior angle of polygon of $n$ sides = $(2n - 4) \times 90° = (n - 2)\pi^c$

(b) Each interior angle of a regular polygon of $n$ sides = $\frac{(2n-4)90^0}{n} = \frac{(n-2)}{n}\pi^c$

## Graphs of Trigonometric Functions with domain and range






# TRIGONOMETRIC RATIOS OF ALLIED ANGLES

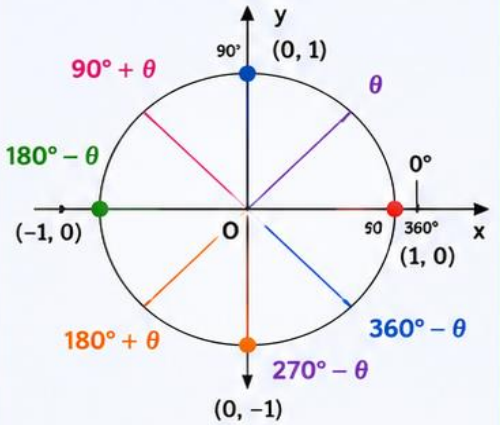
## BASIC RATIOS

$$\sin\theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{a}{c}$$

$$\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{b}{c}$$

$$\tan\theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{a}{b}$$

## ALLIED ANGLES ON UNIT CIRCLE




All angles are measured from the +x axis in anti-clockwise direction.

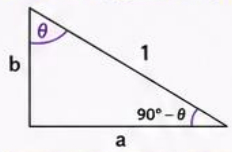
## TRIGONOMETRIC RATIOS OF ALLIED ANGLES

| Functions | $90°-\theta$ | $90°+\theta$ | $180°-\theta$ | $180°+\theta$ | $360°-\theta$ | $270°-\theta$ |
|---|---|---|---|---|---|---|
| sin | $\cos\theta$ | $\cos\theta$ | $\sin\theta$ | $-\sin\theta$ | $-\sin\theta$ | $-\cos\theta$ |
| cos | $\sin\theta$ | $-\sin\theta$ | $-\cos\theta$ | $-\cos\theta$ | $\cos\theta$ | $-\sin\theta$ |
| tan | $\cot\theta$ | $-\cot\theta$ | $-\tan\theta$ | $\tan\theta$ | $-\tan\theta$ | $\cot\theta$ |
| cot | $\tan\theta$ | $-\tan\theta$ | $-\cot\theta$ | $\cot\theta$ | $-\cot\theta$ | $\tan\theta$ |
| sec | $\operatorname{cosec}\theta$ | $-\operatorname{cosec}\theta$ | $-\sec\theta$ | $-\sec\theta$ | $\sec\theta$ | $-\operatorname{cosec}\theta$ |
| cosec | $\sec\theta$ | $\sec\theta$ | $\operatorname{cosec}\theta$ | $-\operatorname{cosec}\theta$ | $-\operatorname{cosec}\theta$ | $-\sec\theta$ |

## WHY THESE RELATIONS?

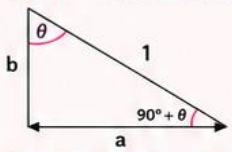
They come from the signs of ratios in different quadrants.

**1. $90° - \theta$ (Quadrant I)**



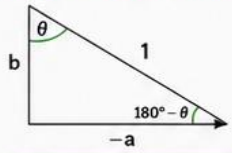

$\sin(90° - \theta) = \cos\theta$

**2. $90° + \theta$ (Quadrant II)**



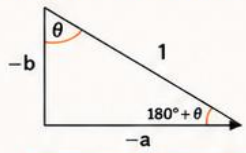

$\sin(90° + \theta) = \cos\theta$

**3. $180° - \theta$ (Quadrant II)**



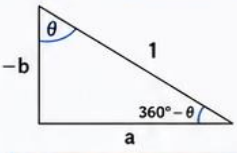

$\sin(180° - \theta) = \sin\theta$

**4. $180° + \theta$ (Quadrant III)**



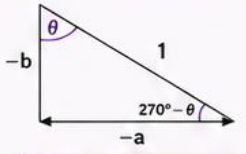

$\sin(180° + \theta) = -\sin\theta$

**5. $360° - \theta$ (Quadrant IV)**



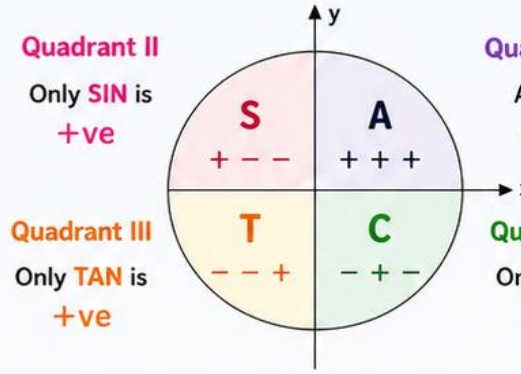

$\sin(360° - \theta) = -\sin\theta$

**6. $270° - \theta$ (Quadrant IV)**




$\sin(270° - \theta) = -\cos\theta$

## SIGNS OF TRIGONOMETRIC RATIOS




## IMPORTANT NOTES

- ★ $\theta$ can be any angle (in degrees or radians).
- ★ Use these relations to find ratios of difficult angles in terms of easy angles.
- ★ These identities are extremely useful in simplifying expressions and solving equations.

## QUICK RECAP

Since $135° = 180° - 45°$,

$\sin 135° = \sin(180° - 45°) = \frac{\sqrt{2}}{2}$

Remember the formulas, understand the signs, and you can find any allied angle ratio easily!

## T-ratios of $\left(\frac{\pi}{2}\pm\theta\right)$ in terms of $\theta$ for all values of $\theta$ :

- $\sin\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\sin\theta, if\ n\ is\ even\\ \pm\cos\theta, if\ n\ is\ odd\end{cases}$
- $\cos\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\cos\theta, if\ n\ is\ even\\ \pm\sin\theta, if\ n\ is\ odd\end{cases}$
- $\tan\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\tan\theta, if\ n\ is\ even\\ \pm\cot\theta, if\ n\ is\ odd\end{cases}$
- $\cot\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\cot\theta, if\ n\ is\ even\\ \pm\tan\theta, if\ n\ is\ odd\end{cases}$
- $\sec\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\sec\theta, if\ n\ is\ even\\ \pm\cos ec\theta, if\ n\ is\ odd\end{cases}$
- $\cos ec\left(n.\frac{\pi}{2}\pm\theta\right)=\begin{cases}\pm\cos ec\theta, if\ n\ is\ even\\ \pm\sec\theta, if\ n\ is\ odd\end{cases}$

## Points to remember

- The angle b/n hour hand and minute hand when the time is A hour B minutes is given by $\left|\mathbf{30A-\frac{11}{2}B}\right|^{o}$

## Formulae for the trigonometric ratios of sum and differences of two angles

- ✓ $\sin(A+B)=\sin A.\cos B+\cos A.\sin B$
- ✓ $\sin(A-B)=\sin A\cos B-\cos A\sin B$
- ✓ $\cos(A+B)=\cos A\cos B-\sin A\sin B$
- ✓ $\cos(A-B)=\cos A\cos B+\sin A\sin B$
- ✓ $\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$
- ✓ $\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$
- ✓ $\cot(A+B)=\frac{\cot A\cot B-1}{\cot A+\cot B}$
- ✓ $\cot(A-B)=\frac{\cot A\cot B+1}{\cot B-\cot A}$
- ✓ $\sin(A+B)\sin(A-B)=\sin^2 A-\sin^2 B=\cos^2 B-\cos^2 A$
- ✓ $\cos(A+B)\cos(A-B)=\cos^2 A-\sin^2 B=\cos^2 B-\sin^2 A$
- ✓ $\tan A+\tan B+\tan(A+B)\tan A\tan B=\tan(A+B)$
- ✓ $\tan\left(45^0+\theta\right)=\frac{1+\tan\theta}{1-\tan\theta}$; $\tan\left(45^0-\theta\right)=\frac{1-\tan\theta}{1+\tan\theta}$

## Trigonometric ratios of multiple angle 2A :-

- $\sin 2A = 2\sin A\cos A = \dfrac{2\tan A}{1+\tan^2 A}$
- $\cos 2A = 2\cos^2 A - 1 = 1 - 2\sin^2 A = \cos^2 A - \sin^2 A = \dfrac{1-\tan^2 A}{1+\tan^2 A}$ ; where $A \neq (2n+1)\dfrac{\pi}{4}$.
- $\tan 2A = \dfrac{2\tan A}{1-\tan^2 A}$

## Trigonometric ratios of multiple angle 3A :-

- $\sin 3A = 3\sin A - 4\sin^3 A$
- $\cos 3A = 4\cos^3 A - 3\cos A$
- $\tan 3A = \dfrac{3\tan A - \tan^3 A}{1-3\tan^2 A}$, where $A \neq n\pi + \pi/6$ $A \neq n\pi + \pi/6$

## Complimentary angles

- A & B are said to be complimentary if $A + B = \frac{\pi}{2}$
- $\sin A = \cos B$, $\tan A = \cot B$, $\operatorname{cosec} A = \sec B$ Where A & B are complimentary angles
- If A and B are complementary angles, $\cos^2 A + \cos^2 B = 1$ and $\sin^2 A + \sin^2 B = 1$
- $\sin^2 x + \sin^2\left(\frac{\pi}{2} - x\right) = \sin^2 x + \cos^2 x = 1$

## Trigonometric ratios of half angles:-

- $\sin\theta = 2\sin\left(\dfrac{\theta}{2}\right).\cos\left(\dfrac{\theta}{2}\right) = \dfrac{2\tan\left(\frac{\theta}{2}\right)}{1+\tan^2\left(\frac{\theta}{2}\right)}$
- $\tan\theta = \dfrac{2\tan\left(\frac{\theta}{2}\right)}{1-\tan^2\left(\frac{\theta}{2}\right)}$
- $\cos\theta = \cos^2\left(\dfrac{\theta}{2}\right) - \sin^2\left(\dfrac{\theta}{2}\right) = 2\cos^2\left(\dfrac{\theta}{2}\right) - 1 = 1 - 2\sin^2\left(\dfrac{\theta}{2}\right) = \dfrac{1-\tan^2\left(\frac{\theta}{2}\right)}{1+\tan^2\left(\frac{\theta}{2}\right)}$

## Some Important Formulae

- $\dfrac{1-\cos A}{\sin A} = \tan\left(\dfrac{A}{2}\right)$
- $\dfrac{1+\cos A}{\sin A} = \cot\left(\dfrac{A}{2}\right)$
- $\frac{1+\cos 2A}{2} = \cos^2 A$
- $\frac{1-\cos 2A}{2} = \sin^2 A$
- $\sqrt{1+\cos 2A} = \sqrt{2}\cos A$
- $\sqrt{1-\cos 2A} = \sqrt{2}\sin A$
- $\sqrt{1+\sin 2A} = \cos A + \sin A$
- $\sqrt{1-\sin 2A} = \cos A - \sin A$

## ❖ *Transformation formulae:-*

- $2\sin A\cos B = \sin(A+B)+\sin(A-B)$
- $2\cos A\sin B = \sin(A+B)-\sin(A-B)$
- $2\cos A\cos B = \cos(A+B)+\cos(A-B)$
- $2\sin A\sin B = \cos(A-B)-\cos(A+B)$
- $\sin C+\sin D = 2\sin\frac{C+D}{2}\cos\frac{C-D}{2}$
- $\sin C-\sin D = 2\cos\frac{C+D}{2}\sin\frac{C-D}{2}$
- $\cos C+\cos D = 2\cos\frac{C+D}{2}\cos\frac{C-D}{2}$
- $\cos C-\cos D = 2\sin\frac{C+D}{2}\sin\frac{D-C}{2} = -2\sin\frac{C+D}{2}\sin\frac{C-D}{2}$.

❖ If $A+B+C = 180^o$ then

- $\tan A+\tan B+\tan C = \tan A\cdot\tan B\cdot\tan C$
- $\cot A\cdot\cot B+\cot B\cdot\cot C+\cot C\cdot\cot A = 1$
- $\sin 2A+\sin 2B+\sin 2C = 4\sin A\cdot\sin B\cdot\sin C$
- $\cos 2A+\cos 2B+\cos 2C = -1-4\cos A\cdot\cos B\cdot\cos C$

## ❖ *Important results:-*

* If $a\cos\theta+b\sin\theta = \sqrt{a^2+b^2}$ then $a\cos\theta-b\sin\theta = \frac{a^2-b^2}{\sqrt{a^2+b^2}}$

* $\sin A+\sin B = a,\ \cos A+\cos B = b$ then $\cos(A+B) = \frac{b^2-a^2}{a^2+b^2}$

* $\tan 1^0\cdot\tan 2^0\cdot\tan 3^0 \ldots\ldots\ldots\ldots\ldots\ldots\tan 89^0 = 1$

* $\cos 1^0\cdot\cos 2^0\cdot\cos 3^0 \ldots\ldots\ldots\ldots\ldots\ldots\cos 179^0 = 0$

* $\cos 1^0+\cos 2^0+\cos 3^0+\ldots\ldots\ldots\ldots\ldots+\cos 179^0 = 0$

* $\sin^2 1^0\cdot\sin^2 2^0\cdot\sin^2 3^0 \ldots\ldots\ldots\ldots\ldots\ldots\sin^2 360^0 = 0$

* If $A+B = C$, then $\tan C-\tan B-\tan A = \tan C\cdot\tan B\cdot\tan A$

***Multiple choice questions:***

1. **If in two circles, arcs of the same length subtend angles 30° and 78° at the centre, then the ratio of their radii is** ***Easy (KCET 2024)***

   1) $\frac{5}{13}$ 2) $\frac{13}{5}$ 3) $\frac{13}{4}$ 4) $\frac{4}{13}$

2. **The angle between hour hand and minute hand of a clock when the time is 5 hours 20 minutes** ***Difficult***

   1) $10^0$ 2) $40^0$ 3) $50^0$ 4) $30^0$

3. **The degree measure of $\frac{\pi}{32}$ is equal to** ***Average (KCET 2022)***

   1) 5°30′20” 2) 5°37’30” 3) 5°37’20” 4) 4°30’30”

4. **If for real values of x, $\cos\theta = x + \frac{1}{x}$, then** ***Easy***

   1) θ is an acute angle 2) θ is right angle
   3) θ is an obtuse angle 4) No value of θ is possible

5. **In triangle ABC angle $A = 90^0$ then $\cos^2 B + \cos^2 C =$** ***Easy***

   1) $-1$ 2) 2 3) 0 4) 1

6. **The minimum value of 1 – sin x is** ***Average (KCET 2025)***

   1) 2 2) 0 3) – 1 4) 1

7. **If ΔABC is right angled at C, then the value of tan A + tan B is** ***Difficult (KCET 2024)***

   1) a + b 2) $\frac{a^2}{bc}$ 3) $\frac{c^2}{ab}$ 4) $\frac{c^2}{ac}$

8. **Which of the following is not correct?** ***Easy***

   1) $\sin\theta = -\frac{1}{5}$ 2) $\cos\theta = 1$ 3) $\sec\theta = \frac{1}{2}$ 4) $\tan\theta = 20$

9. **Which of the following is correct?** ***Average***

   1) $\sin 1^0 > sin1$ 2) $\sin 1^0 < sin1$ 3) $\sin 1^0 = \sin 1$ 4) $\sin 1^0 = \frac{\pi}{18^0}\sin 1$

10. **If $\tan\theta + \cot\theta = 2$, then what is the value of $\tan^{100}\theta + \cot^{100}\theta$** ***Average***

    1) 2 2) $2^{100}$ 3) 1 4) 0

11. **If $\sin x + \sin^2 x + \sin^3 x = 1$, then $\cos^6 x - 4\cos^4 x + 8\cos^2 x =$** ***Difficult***

    1) 3 2) 4 3) 2 4) 1

12. **If A lies in the second quadrant and $3\tan A + 4 = 0$ then the value of $2\cot A - 5\cos A + \sin A$ is equal to** ***Average***

    1) $-\frac{53}{10}$ 2) $\frac{23}{10}$ 3) $\frac{37}{10}$ 4) $\frac{7}{10}$

13. **If $\tan\theta = -\frac{4}{3}$, then $\sin\theta$ is** ***Easy***

    1) $-\frac{4}{5}$ but not $\frac{4}{5}$ 2) $-\frac{4}{5}$ or $\frac{4}{5}$ 3) $\frac{4}{5}$ but not $-\frac{4}{5}$ 4) None of these

**14.** If $\sin\theta = -\frac{4}{5}$ and $\theta$ lies in third quadrant then the value of $\cos\frac{\theta}{2}$ is — *Difficult*

1) $\frac{1}{5}$ 2) $-\frac{1}{\sqrt{10}}$ 3) $-\frac{1}{\sqrt{5}}$ 4) $\frac{1}{\sqrt{10}}$

**15.** The maximum value of $\sin(x + \pi/6) + \cos(x + \pi/6)$ is attained at x = — *Average (KCET 2026)*

1) $\pi/2$ 2) $\pi/4$ 3) $\pi/6$ 4) $\pi/12$

**16.** The value of $\tan1^0 \cdot \tan2^0 \cdot \tan3^0 \ldots\ldots \tan89^0$ is — *Easy (KCET 2021)*

1) 0 2) 1 3) $\frac{1}{2}$ 4) Not defined

**17.** $\log\tan1^0 + \log\tan 2^0 + \log\tan 3^0 + \ldots\ldots\ldots\ldots\ldots + \log\tan 89^0 =$ — *Average*

1) 1 2) 0 3) $-1$ 4) none of these

**18.** The value of $\sin1^0 + \sin2^0 + \sin3^0 \cdots\cdots + \sin359^0$ is equal to — *Easy*

1) 1 2) 180 3) 0 4) -1

**19.** $e^{\log(\cot1^0 \cdot \cot2^2 \ldots\ldots\ldots\ldots\ldots\ldots \cot89^0)} =$ — *Average*

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

**20.** Which of the following is not correct? — *Average (KCET 2025)*

1) $\tan45° = \tan(-315°)$ 2) $\cos5\pi = \cos4\pi$

3) $\sin2\pi = \sin(-2\pi)$ 4) $\sin4\pi = \sin6\pi$

**21.** The value of $\cos1200° + \tan1485°$ is — *Difficult (KCET 2021)*

1) $\frac{1}{2}$ 2) $\frac{3}{2}$ 3) $-\frac{3}{2}$ 4) $-\frac{1}{2}$

**22.** The value of $\tan15^0 + \cot15^0 =$ — *Average*

1) 1 2) $\sqrt{3}$ 3) 4 4) $2\sqrt{3}$

**23.** $\frac{\cot72°}{\tan18°} + \frac{\tan18°}{\cot72°} =$ — *Average*

1) 1 2) 0 3) 2 4) 3

**24.** The value of $\tan(1^\circ) + \tan(89^\circ)$ is : — *Difficult*

1) $\frac{1}{\sin(1^\circ)}$ 2) $\frac{2}{\sin(2^\circ)}$ 3) $\frac{2}{\sin(1^\circ)}$ 4) $\frac{1}{\sin(2^\circ)}$

**25.** The value of $\sin^25^0 + \sin^210^0 + \sin^215^0 + \ldots\ldots\ldots\ldots\ldots + \sin^290^0 =$ — *Difficult*

1) 8 2) 9 3) 7 4) 9 ½

**26.** The value of $\cot\left(\frac{\pi}{4} + \theta\right)\cot\left(\frac{\pi}{4} - \theta\right)$ is — *Average*

1) $-1$ 2) 0 3)1 4) Not defined

**27.** The value of $\sum_{k=1}^{45} \sin^2\left(2k^0\right)$ is — *Difficult*

1) 23.5 2) 23 3) 45 4) 0

**28.** The value of $\sin(45^0+\theta)-\cos(45^0-\theta)$ is *Average*

1) $2\cos\theta$ 2) $2\sin\theta$ 3) 1 4) 0

**29.** $\cos 2\theta\cos 2\emptyset+\sin^2(\theta-\emptyset)-\sin^2(\theta+\emptyset)$ is equal to *Difficult*

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

**30.** What will be the value of $\sec^4\theta - \tan^4\theta$, if $\sec^2\theta+\tan^2\theta=\pi$. *Average*

1) $-\pi$ 2) 0 3) 1 4) $\pi$

**31.** If $\sin\theta+\operatorname{cosec}\theta=2$, then $\sin^2\theta+\operatorname{cosec}^2\theta$ is equal to *Average*

1) 1 2) 4 3) 2 4) None of these

**32.** If $\cos x + cos^2 x = 1$, then the value of $sin^2 x + sin^4 x$ is *Easy (KCET 2025)*

1) 2 2) –1 3) 1 4) 0

**33.** If $0<x<\frac{\pi}{2}$, what is the largest angle of a triangle whose sides are 1, sinx, cosx ? *Average*

1) $\frac{\pi}{3}$ 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$

**34.** If $f(x)=\cos^2 x+\sec^2 x$, then *Average*

1) $f(x)<1$ 2) $f(x)=1$ 3) $1<f(x)<2$ 4) $f(x)\geq 2$

**35.** The value of $3(\sin A-\cos A)^4+6(\sin A+\cos A)^2+4(\sin^6 A+\cos^6 A)$ is *Difficult*

1) 12 2) 13 3) 14 4) 15

**36.** $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}}=$ *Average (KCET 2022)*

1) $\sin 2\theta$ 2) $2\sin\theta$ 3) $2\cos\theta$ 4) $2\cos\frac{\theta}{2}$

**37.** If $\tan\theta=\frac{1}{2}$ and $\tan\emptyset=\frac{1}{3}$, then the value of $(\theta+\emptyset)$ is *Easy*

1) $\frac{\pi}{6}$ 2) $\pi$ 3) 0 4) $\frac{\pi}{4}$

**38.** If $\alpha+\beta=\frac{\pi}{4}$, then the value of $(1+\tan\alpha)(1+\tan\beta)$ is *Average*

1) 1 2) 2 3) $-2$ 4) Not defined

**39.** If $\tan\theta=\frac{a}{b}$, then $b\cdot\cos 2\theta+a\cdot\sin 2\theta$ is equal to *Difficult*

1) a 2) b 3) $\frac{a}{b}$ 4) None of these

**40.** If $\tan\alpha=\frac{1}{7}$, $\tan\beta=\frac{1}{3}$, then $\cos 2\alpha$ is equal to *Difficult*

1) $\sin 2\beta$ 2) $\sin 4\beta$ 3) $\sin 3\beta$ 4) $\cos 2\beta$

**41.** $\frac{\sin x}{\sin\left(\frac{x}{8}\right)}=$ *Average*

1) $8\cos\frac{x}{8}\sin\frac{x}{4}\cos\frac{x}{2}$ 2) $8\cos\frac{x}{8}\cos\frac{x}{4}\sin\frac{x}{2}$ 3) $8\cos\frac{x}{8}\cos\frac{x}{4}\cos\frac{x}{2}$ 4) $8\sin\frac{x}{8}\sin\frac{x}{4}\sin\frac{x}{2}$

**42.** The value of $sin\frac{5\pi}{12} \cdot sin\frac{\pi}{12}$ is *Difficult (KCET 2022)*

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

**43.** The value of $tan3A - tan2A - tanA$ is equal to *Easy*

1) $\tan3A \cdot \tan2A \cdot \tan A$ 2) $-\tan3A \cdot \tan2A \cdot \tan A$

3) $\tan A \tan 2A - \tan 2A \tan 3A - \tan 3A \tan A$ 4) None of these

**44.** $\tan A + \tan 2A + \tan 3A \tan 2A \tan A =$ *Average*

1) $2\tan 2A$ 2) $3\tan A$ 3) $\tan 3A$ 4) $\tan 5A$

**45.** If $(1 + \tan A)(1 + \tan B) = 2$ then $A + B =$ *Average*

1) $30^0$ 2) $45^0$ 3) $90^0$ 4) $0^0$

**46.** The value of $\tan 20^0 + \tan 40^0 + \sqrt{3}\tan 20^0 \cdot \tan 40^0 =$ *Average*

1) $\sqrt{3}$ 2) $\frac{\sqrt{3}}{2}$ 3) $\frac{\sqrt{3}}{4}$ 4) none of these

**47.** $\sqrt{3}\,\mathrm{cosec}\,20^0 - \sec 20^0 =$ *Difficult*

1) 4 2) 2 3) 1 4) 3

**48.** The value of $\frac{1-\tan^2 15^0}{1+\tan^2 15^0}$ is *Easy*

1) 1 2) $\sqrt{3}$ 3) $\frac{\sqrt{3}}{2}$ 4) 2

**49.** What is the value of $(2\tan 15^0) / (1 + \tan^2 15^0)$ *Easy*

1) $\frac{\sqrt{3}}{2}$ 2) 2 3) $\frac{1}{2}$ 4) 1

**50.** If $1 + \sin\theta + \sin^2\theta + \cdots \text{upto} \infty = 2\sqrt{3} + 4$ then $\theta$ is *Difficult*

1) $\frac{\pi}{4}$ 2) $\frac{3\pi}{4}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{3}$

**51.** If $1 + \tan x + \tan^2 x + \cdots\cdots\infty = \frac{\sqrt{3}}{\sqrt{3}-1}$, then the least positive value of $x$ is *Difficult*

1) $\frac{\pi}{4}$ 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{8}$ 4) $\frac{\pi}{12}$

**52.** $f(x) = \frac{\sin 6x}{\sin 2x}, x \neq \frac{n\pi}{2}$ then the range of the function $f(x)$ is *Difficult*

1) [-1,1] 2) [-1 , 3) 3) [-1,3] 4) (-1,3)

**53.** The value of $\tan\frac{\pi}{8}$ is equal to *Difficult*

1) $\sqrt{2}+1$ 2) $1-\sqrt{2}$ 3) $\frac{1}{2}$ 4) $\frac{1}{\sqrt{2}+1}$

Hint: Use the formula $\tan^2 x = \frac{1-\cos 2x}{1+\cos 2x}$

**54.** The value of $\sin 20^0 \sin 40^0 \sin 60^0 \sin 80^0$ is *Difficult*

1) $-\frac{3}{16}$ 2) $\frac{5}{16}$ 3) $\frac{3}{16}$ 4) $\frac{1}{16}$

**55.** If $\sin x - \sin y = \frac{1}{2}$ and $\cos x - \cos y = 1$ then $\tan(x+y) =$ ***Difficult***

1) $\frac{3}{8}$ 2) $-\frac{3}{8}$ 3) $\frac{4}{3}$ 4) $-\frac{4}{3}$

**56.** The value of $\sin 50^0 - \sin 70^0 + \sin 10^0$ is equal to ***Average***

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

**57.** $\frac{\sin 70^0 + \cos 40^0}{\cos 70^0 + \sin 40^0} =$ ***Average***

1) 1 2) $\sqrt{3}$ 3) $\frac{1}{2}$ 4) $\frac{1}{\sqrt{3}}$

**58.** If $\sin x + \sin^2 x = 1$ then $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x =$ ***Difficult***

1) 1 2) 0 3) 3 4) 2.

**59.** The domain of the function $\sqrt{\cos x}$ is ***Easy***

1) $\left[\frac{3\pi}{2}, 2\pi\right]$ 2) $\left[0, \frac{\pi}{2}\right]$ 3) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ 4) $\left[0, \frac{\pi}{2}\right] \cup \left[\frac{3\pi}{2}, 2\pi\right]$

**60.** The value of $\sin\frac{\pi}{10}\sin\frac{13\pi}{10}$ is ***Difficult***

1) $\frac{1}{2}$ 2) $-\frac{1}{2}$ 3) $-\frac{1}{4}$ 4) 1

***TRIGONOMETRIC FUNCTIONS***

| ***1*** | ***2*** | ***3*** | ***4*** | ***5*** | ***6*** | ***7*** | ***8*** | ***9*** | ***10*** |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 2 | 1 |
| ***11*** | ***12*** | ***13*** | ***14*** | ***15*** | ***16*** | ***17*** | ***18*** | ***19*** | ***20*** |
| 2 | 2 | 2 | 3 | 4 | 2 | 2 | 3 | 4 | 2 |
| ***21*** | ***22*** | ***23*** | ***24*** | ***25*** | ***26*** | ***27*** | ***28*** | ***29*** | ***30*** |
| 1 | 3 | 3 | 2 | 4 | 3 | 2 | 4 | 2 | 4 |
| ***31*** | ***32*** | ***33*** | ***34*** | ***35*** | ***36*** | ***37*** | ***38*** | ***39*** | ***40*** |
| 3 | 3 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 2 |
| ***41*** | ***42*** | ***43*** | ***44*** | ***45*** | ***46*** | ***47*** | ***48*** | ***49*** | ***50*** |
| 3 | 4 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 4 |
| ***51*** | ***52*** | ***53*** | ***54*** | ***55*** | ***56*** | ***57*** | ***58*** | ***59*** | ***60*** |
| 2 | 2 | 4 | 3 | 3 | 2 | 2 | 1 | 4 | 3 |

***Additional Questions***

1. **The angle subtended at the centre of a circle of radius 3metres by an arc of length 1metre is equal to** ***Easy***

1)20° 2) 60° 3) 1/3 radian 4) 3 radians.

2. **Two different arcs of same length of two circles subtend 300 and 450 at the centre of the two circles. Then the areas of the two circles are in the ratio** ***Average***

1) 4 : 9 2) 9 : 4 3) 3 : 2 4) 2 : 3

3. **The value of $(2^{\sin^2\theta})(2^{\cos^2\theta})$** ***Easy***

1) 2 2) $\sqrt{2}$ 3) 1 4) 1/ $\sqrt{2}$

4. **If A and B are complementary angle then $\cos^2 A + \cos^2 B =$** ***Easy***

1) 0 2) 1 3) $-1$ 4) 2

5. **The angles of a triangle are in A.P and the greatest angle is double the least angle, 'then sine of the third angle is** ***Average (KCET 2026)***

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

6. **If $\tan\theta = 3$ and $\theta$ lies in third quadrant , then the value of $\sin\theta$ is** ***Easy***

1) $\frac{1}{\sqrt{10}}$ 2) $-\frac{1}{\sqrt{10}}$ 3) $-\frac{3}{\sqrt{10}}$ 4) $\frac{3}{\sqrt{10}}$

7. **If A is in the *III* quadrant, $3\tan A - 4 = 0$ then** $5\sin 2A + 3\sin A + 4\cos A =$ ***Average***

1) 0 2) $-\frac{24}{5}$ 3) $\frac{24}{5}$ 4) $\frac{5}{24}$

8. **If $\tan x = \frac{3}{4}$, $\pi < x < \frac{3\pi}{2}$, then the value of $\cos\frac{x}{2}$ is** ***Average***

1) $-\frac{1}{\sqrt{10}}$ 2) $-\frac{3}{\sqrt{10}}$ 3) $\frac{1}{\sqrt{10}}$ 4) $-\frac{1}{\sqrt{10}}$

9. **The value of $\cos1^0\cos2^0\cos3^0 \ldots\ldots \cos179^0$ is** ***Easy***

1) $\frac{1}{\sqrt{2}}$ 2) 0 3) 1 4) $-1$

10. $\cos1^0 + \cos2^0 + \cos3^0 + \ldots\ldots\ldots\ldots\ldots \cos 180^0 =$ ***Average***

1) 1 2) 0 3) 2 4) $-1$

11. **The value of $e^{\log_{10}\tan1^0 + \log_{10}\tan2^0 + \log_{10}\tan3^0 + \ldots\ldots\ldots\ldots + \log_{10}\tan89^0}$ is** ***Average (KCET 2023)***

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

12. $\cot5^0 \cdot \cot10^0 \cdot \cot15^0 \ldots\ldots\ldots \cot85^0 =$ ***Average***

1) $\frac{1}{\sqrt{2}}$ 2) 1 3) $\frac{1}{2}$ 4) 0.

13. $\frac{\cot 54^\circ}{\tan 36^\circ} + \frac{\tan 20^\circ}{\cot 70^\circ} =$ ***Average***

1) 1 2) 0 3) 2 4) 3

**14.** $\sin^2\left(17\frac{1}{2}\right)^0 + \sin^2\left(72\frac{1}{2}\right)^0 =$ ***Easy***

1) $\cos^2 90^\circ$ 2) $\tan^2 45^\circ$ 3) $\sin^2 45^\circ$ 4) $\cos^2 30^\circ$

**15.** If $\sin x + \sin^2 x = 1$ then $\cos^2 x + \cos^4 x =$ ***Easy***

1) 1 2) 0 3) $-1$ 4) 2

**16.** If $\sin\theta + \cos\theta = 1$, then the value of $\sin 2\theta$ is equal to ***Easy***

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

**17.** If $\tan A = \frac{1}{2}$ , $\tan B = \frac{1}{3}$, then $\tan(2A + B)$ is equal to ***Difficult***

1) 1 2) 2 3) 3 4) 4

**18.** If $\tan A = \frac{1-\cos B}{\sin B}$ then $\tan 2A =$ ***Average***

1) $\tan\frac{B}{2}$ 2) $\tan B$ 3) $\tan 2B$ 4) none of these

**19.** The value of $\cos^2 48^0 - \sin^2 12^0$ is ***Difficult***

1) $\frac{\sqrt{5}+1}{8}$ 2) $\frac{\sqrt{5}-1}{8}$ 3) $\frac{\sqrt{5}+1}{5}$ 4) $\frac{\sqrt{5}+1}{2\sqrt{2}}$

**20.** $\tan 25^0 \cdot \tan 20^0 + \tan 25^0 + \tan 20^0 =$ ***Difficult***

1) 0 2) 1 3) $-1$ 4) 2

***Additional Questions***

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 | 1 | 2 | 1 | 3 | 1 | 4 | 2 | 4 |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| 1 | 2 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 |

## *Analytical Thinking MCQs*

**1.** The value of the product $\cot 10^\circ \cot 20^\circ \cot 30^\circ \cot 45^\circ \cot 60^\circ \cot 70^\circ \cot 80^\circ$ is equal to

1) $\sqrt{3}$ 2) $\frac{\sqrt{3}}{3}$ 3) 3 4) 1

**2.** If $\tan\alpha = \frac{1}{2}$, then the value of $\tan^2(2\alpha)\sec^2(2\alpha)$ is equal to

1) $\frac{200}{9}$ 2) $\frac{400}{9}$ 3) $\frac{200}{81}$ 4) $\frac{400}{81}$

**3.** If $(3\cos x - 2\sec x)^2 = 9\cos^2 x + 4\tan^2 x + k$, where $k$ is a constant, then the value of $k$ is equal to

1) 12 2) -8 3) -4 4) 8

**4.** If $\alpha$ and $\beta$ are real constants such that $\alpha - \beta = \frac{\pi}{4}$, then the value of $(\sin\alpha + \sin\beta)^2 + (\cos\alpha + \cos\beta)^2$ is equal to

1) $2 + \sqrt{2}$ 2) $\sqrt{2}$ 3) $2\sqrt{2}$ 4) $2 - \sqrt{2}$

*5.* **If $\operatorname{cosec} t + \cot t = \frac{5}{2}$, then the value of $\tan t$ is equal to**

1) $\frac{10}{21}$ 2) $\frac{21}{20}$ 3) $\frac{20}{21}$ 4) $\frac{21}{10}$

*6.* **If $\sin\theta = \frac{3}{5}$ and $\cos\theta < 0$, then the value of $\tan\theta$ is**

1) $-\frac{3}{4}$ 2) $-\frac{3}{5}$ 3) $\frac{3}{4}$ 4) $-\frac{4}{3}$

*7.* **$\sin 15^\circ \sin 45^\circ \sin 75^\circ =$**

1) $\frac{\sqrt{2}}{4}$ 2) $\frac{\sqrt{2}}{2}$ 3) $\frac{\sqrt{2}}{8}$ 4) $-\frac{\sqrt{2}}{8}$

*8.* **The value of $\sin\left(x + \frac{7\pi}{4}\right) + \sin\left(x - \frac{7\pi}{4}\right)$ is equal to**

1) $\sqrt{2}\sin x$ 2) $-\sqrt{2}\cos x$ 3) $-\sqrt{2}\sin x$ 4) $\sqrt{2}\cos x$

*9.* **If $\sin\theta\cos\theta > 0$, then $\theta$ lies**

1) only in the first quadrant
2) only in the second quadrant
3) in the first quadrant or in the fourth quadrant
4) in the first quadrant or in the third quadrant

*10.* **If $4\sin^2 x - 2(1+\sqrt{3})\sin x + \sqrt{3} = 0$ and $15^\circ < x < 150^\circ$, then the values of $x$ are**

1) $30^\circ, 45^\circ, 90^\circ$ 2) $45^\circ, 100^\circ, 120^\circ$ 3) $30^\circ, 60^\circ, 120^\circ$ 4) $35^\circ, 45^\circ, 90^\circ$

*11.* **If $\tan\alpha = \frac{5}{6}$ and $\tan\beta = \frac{1}{11}$, where $0 < \alpha, \beta < \frac{\pi}{2}$ then $\alpha + \beta =$**

1) $\frac{\pi}{6}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

*12.* **The value of $\sin 6^\circ \cos 36^\circ \sin 66^\circ + \cos 12^\circ \sin 42^\circ \sin 18^\circ$ is equal to**

1) $\frac{1}{4}(\sin 18^\circ + \cos 36^\circ)$ 3) $\frac{1}{3}(\sin 18^\circ + \cos 36^\circ)$

3) $\frac{1}{16}(\sin 18^\circ + \cos 36^\circ)$ 4) $\frac{1}{12}(\sin 18^\circ + \cos 36^\circ)$

*13.* **The value of $3\cot(-405^\circ)\tan 315^\circ - 5\cot 495^\circ \tan(-585^\circ)$ is equal to**

1) 8 2) $-8\sqrt{2}$ 3) -2 4) -8

*14.* **$\sin\left(\frac{3\pi}{4} + x\right) + \cos\left(\frac{3\pi}{4} + x\right) - \sin\left(\frac{3\pi}{4} - x\right) - \cos\left(\frac{3\pi}{4} - x\right) =$**

1) $-2\sqrt{2}\sin x$ 2) $\sqrt{2}\sin x$ 3) $2\sqrt{2}\sin x$ 4) $3\sqrt{2}\sin x$

*15.* **$2^{11}\sin\left(\frac{x}{2^{10}}\right)\cos\left(\frac{x}{2}\right)\cos\left(\frac{x}{2^2}\right)\cos\left(\frac{x}{2^3}\right)\ldots\cos\left(\frac{x}{2^{10}}\right)$ is equal to**

1) $\sin x$ 2) $2\sin x$ 3) $-2\sin x$ 4) $4\sin x$

*16.* **The value of $\sin 5^\circ \sin 10^\circ \sin 15^\circ \sin 20^\circ \ldots \sin 240^\circ$ is equal to**

1) $\frac{1}{2^{24}}(\sin 15^\circ + \cos 15^\circ)$ 2) 0

3) $\frac{1}{2^{22}}(\sin 15^\circ + \cos 15^\circ)$ 4) 1

*17.* **Let $L$ be an arc of a circle which subtends $45^\circ$ at the centre. If the radius of circle is 4 $cm$, then the length of the $L$ in centimeter is**

1) $\frac{\pi}{6}$ 2) $\pi$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$

***18.*** **If $\tan\left(\frac{\pi}{4}+\theta\right)=\frac{1}{2}$ then the value of $\sin 2\theta$ is**

1) $\frac{-1}{5}$ 2) $\frac{2}{5}$ 3) $\frac{-3}{5}$ 4) $\frac{4}{5}$

***19.*** **If $1+\cos x=\alpha, 0\le x\le\frac{\pi}{2}$, then $\sin\frac{x}{2}$ is equal to**

1) $\sqrt{\frac{2+\alpha}{2}}$ 2) $\sqrt{\frac{2-\alpha}{2}}$ 3) $\sqrt{2-\frac{\alpha}{2}}$ 4) $\sqrt{\frac{1+\alpha}{2}}$

***20.*** **The value of $\frac{\sqrt{3}(\sin 40^\circ+\sin 20^\circ)}{\cos 40^\circ+\cos 20^\circ}$ is**

1) 1 2) $\sqrt{3}$ 3) $\sqrt{2}$ 4) $\frac{1}{2}$

***21.*** **If $\sec^2\theta+\tan^2\theta=7, 0<\theta<\frac{\pi}{2}$, then $\tan 2\theta$ is equal to**

1) 1 2) $\sqrt{3}$ 3) $\sqrt{2}$ 4) $-\sqrt{3}$

***22.*** **The value of $\frac{\tan 75^\circ+\tan 15^\circ}{\tan 75^\circ-\tan 15^\circ}$ is equal to**

1) $\frac{2}{\sqrt{3}}$ 2) $\sqrt{3}$ 3) 1 4) $-\sqrt{3}$

***23.*** **The value of $4\cos 36^\circ\cos 72^\circ$ is equal to**

1) 1 2) 2 3) $\sqrt{2}$ 4) 2

***24.*** **Let $f(x)=(8\sin x+15\cos x+3)^2-15, x\in\mathbb{R}$. Then the maximum value of $f$ is**

1) 325 2) 365 3) 385 4) 430

***25.*** **Consider the following statements:**

**1.** $\cos\theta+\sin\theta$ **can never be equal to 1.5** **2.** $\tan\theta+\cot\theta$ **can never be less than 2**

**Which of the above statements is/are correct?**

1) 1 only 2) 2 only 3) Both 1 & 2 4) Nether 1 nor 2

***26.*** **Express** $50^0 37' 30''$ **in radian**

1) $\frac{7\pi}{32}$ 2) $\frac{5\pi}{32}$ 3) $\frac{9\pi}{32}$ 4) $\frac{\pi}{32}$

***27.*** $\sqrt{\frac{(1-\sin\theta)(1+\cos\theta)}{(1-\cos\theta)(1+\sin\theta)}}=$

1) $(\sec\theta+\tan\theta)(\operatorname{cosec}\theta-\cot\theta)$ 2) $(\sec\theta-\tan\theta)(\operatorname{cosec}\theta+\cot\theta)$

3) $(\sec\theta+\tan\theta)(\operatorname{cosec}\theta+\cot\theta)$ 4) $(\sec\theta-\tan\theta)(\operatorname{cosec}\theta-\cot\theta)$

***28.*** **If** $\theta\in(-\pi,0)$ **and** $\cos\theta=-\frac{12}{13}$, **then** $\sin\left(\frac{\theta}{2}\right)=$

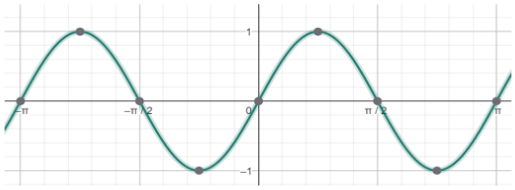
1) $-\frac{5\sqrt{26}}{26}$ 2) $\frac{5\sqrt{26}}{26}$ 3) $-\frac{5\sqrt{13}}{13}$ 4) $\frac{5\sqrt{13}}{13}$

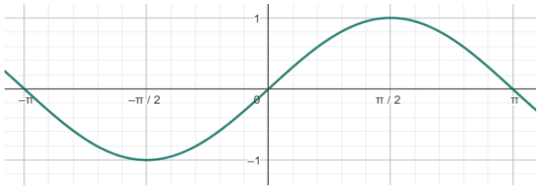
***29.*** **Match the exact values of the trigonometric ratios in Column I with the constants in Column II**

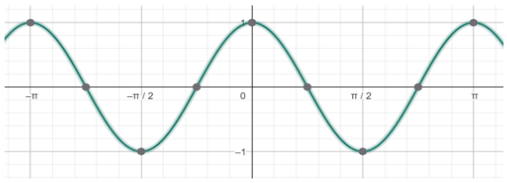
| **Column I:** | **Column II:** |
|---|---|
| A. $\sin 18^0$ | p. $2-\sqrt{3}$ |
| B. $\cos 36^0$ | q. $\frac{\sqrt{5}-1}{4}$ |
| C. $\tan 15^0$ | r. $\frac{\sqrt{5}+1}{4}$ |

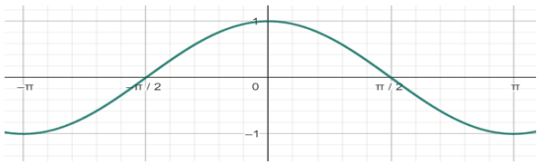
1) A $\rightarrow$ q, B $\rightarrow$ r, C $\rightarrow$ p
2) A $\rightarrow$ r, B $\rightarrow$ q, C $\rightarrow$ p
3) A $\rightarrow$ q, B $\rightarrow$ p, C $\rightarrow$ r
4) A $\rightarrow$ p, B $\rightarrow$ q, C $\rightarrow$ r

***30.*** **Identify which of the following graph is** $\cos 2x$

1) 


2) 


3) 


4) 


| ***Analytical Thinking MCQs*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***1*** | ***2*** | ***3*** | ***4*** | ***5*** | ***6*** | ***7*** | ***8*** | ***9*** | ***10*** |
| 4 | 4 | 2 | 1 | 3 | 1 | 3 | 1 | 4 | 3 |
| ***11*** | ***12*** | ***13*** | ***14*** | ***15*** | ***16*** | ***17*** | ***18*** | ***19*** | ***20*** |
| 4 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 1 |
| ***21*** | ***22*** | ***23*** | ***24*** | ***25*** | ***26*** | ***27*** | ***28*** | ***29*** | ***30*** |
| 4 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 1 | 3 |