Multiples and Sub-Multiples

§§ **Definition:**

If A is an angle, then its integral multiples 2A,3A,4A,..... are called "Multiple angles of A" and the multiples of A by fractions like $\frac{A}{2},\frac{A}{3},\ldots\ldots$ are called "submultiple angles of A".

§§ • sin 2A = 2 sinA cos A = $\frac{2\tan A}{1+\tan^2 A}=\frac{2\cot A}{1+\cot^2 A}$

• sin A= $2\sin\frac{A}{2}\cos\frac{A}{2}$ $=\frac{2\tan\frac{A}{2}}{1+\tan^2\frac{A}{2}}=\frac{2\cot\frac{A}{2}}{1+\cot^2\frac{A}{2}}$

§§ • cos 2A = $\cos^2 A-\sin^2 A=2\cos^2 A-1$

$=1-2\sin^2 A=\frac{1-\tan^2 A}{1+\tan^2 A}=\frac{\cot^2 A-1}{\cot^2 A+1}$

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

$=\frac{1-\tan^2\frac{A}{2}}{1+\tan^2\frac{A}{2}}=\frac{\cot^2\frac{A}{2}-1}{\cot^2\frac{A}{2}+1}$

§§ • $\sqrt{\frac{1+\cos 2A}{2}}=\pm\cos A$ $\Rightarrow \cos A=\pm\sqrt{\frac{1+\cos 2A}{2}}$

$\sqrt{\frac{1+\cos A}{2}}=\pm\cos\frac{A}{2}$ $\Rightarrow \cos\frac{A}{2}=\pm\sqrt{\frac{1+\cos A}{2}}$

• $\sqrt{\frac{1-\cos 2A}{2}}=\pm\sin A$ $\Rightarrow \sin A=\pm\sqrt{\frac{1-\cos 2A}{2}}$

• $\sqrt{\frac{1-\cos A}{2}}=\pm\sin\frac{A}{2}$ $\Rightarrow \sin\frac{A}{2}=\pm\sqrt{\frac{1-\cos A}{2}}$

• $\tan\left(\frac{\Pi}{4}+A\right)=\frac{1+\tan A}{1-\tan A}=\frac{\cot A+1}{\cot A-1}$

$$= \frac{\cos A + \sin A}{\cos A - \sin A}$$

$$= \sqrt{\frac{1+\sin 2A}{1-\sin 2A}} = \sec 2A + \tan 2A$$

$$= \sqrt{\frac{\cos ec2A+1}{\cos ec2A-1}} = \frac{1+\sin 2A}{\cos 2A} = \frac{\cos 2A}{1-\sin 2A}$$

$$= \frac{\cos ec2A+1}{\cot 2A} = \frac{\cot 2A}{\cos ec2A-1}$$

$$= \frac{\sqrt{1+\cos 2A}+\sqrt{1-\cos 2A}}{\sqrt{1+\cos 2A}-\sqrt{1-\cos 2A}}$$

$$= \cot\left(\frac{\Pi}{4} - A\right)$$

- $\tan\left(\frac{\Pi}{4} - A\right) = \frac{1-\tan A}{1+\tan A} = \frac{\cot A - 1}{\cot A + 1}$

$$= \frac{\cos A - \sin A}{\cos A + \sin A}$$

$$= \sqrt{\frac{1-\sin 2A}{1+\sin 2A}} = \sec 2A - \tan 2A$$

$$= \sqrt{\frac{\cos ec2A-1}{\cos ec2A+1}} = \frac{1-\sin 2A}{\cos 2A} = \frac{\cos 2A}{1+\sin 2A}$$

$$= \frac{\cos ec2A-1}{\cot 2A} = \frac{\cot 2A}{\cos ec2A+1}$$

$$= \frac{\sqrt{1+\cos 2A}-\sqrt{1-\cos 2A}}{\sqrt{1+\cos 2A}+\sqrt{1-\cos 2A}}$$

$$= \cot\left(\frac{\Pi}{4} + A\right)$$

- $\tan(90^0 - \theta) - \tan\theta = 2\tan(90^0 - 2\theta)$

e.g:

$$\tan(90^0 - 40^0) - \tan 40^0 = 2\tan(90^0 - 80^0)$$

$$\Rightarrow \tan 50^0 - \tan 40^0 = 2\tan 10^0$$

§§ • $\tan 2A = \dfrac{2\tan A}{1-\tan^2 A} = \dfrac{2\cot A}{\cot^2 A - 1}$

• $\tan A = \dfrac{2\tan\frac{A}{2}}{1-\tan^2\frac{A}{2}} = \dfrac{2\cot\frac{A}{2}}{\cot^2\frac{A}{2}-1}$

$= \sqrt{\dfrac{1-\cos 2A}{1+\cos 2A}} = \sqrt{\dfrac{\sec 2A - 1}{\sec 2A + 1}} = \dfrac{\sec 2A - 1}{\tan 2A}$

$= \dfrac{\tan 2A}{\sec 2A + 1} = \dfrac{1-\cos 2A}{\sin 2A}$

$= \cos ec\, 2A - \cot 2A = \dfrac{\sin 2A}{1+\cos 2A}$

§§ • $\cot 2A = \dfrac{\cot^2 A - 1}{2\cot A}$

• $\cot A = \dfrac{\cot^2\frac{A}{2}-1}{2\cot\frac{A}{2}} = \sqrt{\dfrac{1+\cos 2A}{1-\cos 2A}} = \sqrt{\dfrac{\sec 2A+1}{\sec 2A-1}}$

$= \dfrac{\sec 2A + 1}{\tan 2A} = \dfrac{\tan 2A}{\sec 2A - 1} = \dfrac{1+\cos 2A}{\sin 2A}$

$= \dfrac{\sin 2A}{1-\cos 2A} = \cos ec\, 2A + \cot 2A$

§§ $\dfrac{\tan A + \tan B}{\tan A - \tan B} = \dfrac{\sin(A+B)}{\sin(A-B)}$

§§ $\tan\dfrac{A}{2} = \cos ec\, A - \cot A = \dfrac{1-\cos A}{\sin A}$

$= \dfrac{\sin A}{1+\cos A} = \sqrt{\dfrac{1-\cos A}{1+\cos A}} = \sqrt{\dfrac{\sec A - 1}{\sec A + 1}}$

$= \dfrac{\sec A - 1}{\tan A} = \dfrac{\tan A}{\sec A + 1}$

§§ $\cot\dfrac{A}{2} = \cos ec\, A + \cot A = \dfrac{1+\cos A}{\sin A}$

$$=\frac{\sin A}{1-\cos A}=\sqrt{\frac{1+\cos A}{1-\cos A}}=\sqrt{\frac{\sec A+1}{\sec A-1}}$$

$$=\frac{\sec A+1}{\tan A}=\frac{\tan A}{\sec A-1}$$

§§
- $\sin 3A = 3\sin A - 4\sin^3 A$
- $\cos 3A = 4\cos^3 A - 3\cos A$
- $\tan 3A=\frac{3\tan A-\tan^3 A}{1-3\tan^2 A}$, If $A,\ 3A \neq (2n+1)\frac{\pi}{2},\ n \in N$
- $\cot 3A=\frac{3\cot A-\cot^3 A}{1-3\cot^2 A}$, If $A, 3A \neq n\pi, n \in N$

§§
- $\cot A + \tan A = 2\ \text{cosec}\ 2A$
- $\cot A - \tan A = 2\cot 2A$

§§ $\tan A + 2\tan 2A + \ldots\ldots\ldots + 2^{n-1}\tan 2^{n-1}A + 2^n \cot 2^n A = \cot A$

(or)

$\cot A - \tan A - 2\tan 2A \ldots\ldots\ldots -2^{n-1}\tan 2^{n-1}A = 2^n \cot 2^n A$

§§ If $\alpha =$ 60^0 (or) 120^0 (or) 240^0 (or) 300^0

- $\sin\theta.\sin(\alpha-\theta).\sin(\alpha+\theta)=\frac{1}{4}\sin 3\theta$
- $\cos\theta.\cos(\alpha-\theta).\cos(\alpha+\theta)=\frac{1}{4}\cos 3\theta$
- $\tan\theta.\tan(60-\theta).\tan(60+\theta)=\tan 3\theta$

if $\theta = 20^0$

$$\tan 20^0.\tan 40^0.\tan 80^0 = \tan 60^0$$
$$=\sqrt{3}$$

- $\sqrt{2+\sqrt{2+\sqrt{2+\ldots\ldots\ldots n\ terms}}} = 2\cos\left(\frac{\pi}{2^{n+1}}\right)$
- $\sqrt{2+\sqrt{2+\sqrt{2+\ldots\ldots\sqrt{2+2\cos\theta}}}}$

$=2\cos\left(\frac{\theta}{2^n}\right)$ Where 'n' is the number of square roots.

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

e.g: $\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0$

$$= \frac{\sin 2^4.20^0}{2^4.\sin 20^0}$$
$$= \frac{\sin 8(20^0)}{16.\sin 20^0}$$
$$= \frac{\sin 160^0}{16.\sin 20^0}$$
$$= \frac{1}{16}.\frac{\sin(180^0 - 20^0)}{\sin 20^0}$$

$$= \frac{1}{16}.\frac{\sin 20^0}{\sin 20^0}$$
$$= \frac{1}{16}$$

§§ α, β are the solutions of $a\cos\theta + b\sin\theta = c$ then

- $\tan\left(\frac{\alpha+\beta}{2}\right) = \frac{b}{a}$
- $\sin(\alpha+\beta) = \frac{2ab}{a^2+b^2}$
- $\cos(\alpha+\beta) = \frac{a^2-b^2}{a^2+b^2}$
- $\tan(\alpha+\beta) = \frac{2ab}{a^2-b^2}$
- $\sin\alpha + \sin\beta = \frac{2bc}{a^2+b^2}$
- $\sin\alpha.\ \sin\beta = \frac{c^2-a^2}{a^2+b^2}$
- $\cos\alpha + \cos\beta = \frac{2ca}{a^2+b^2}$
- $\cos\alpha\ \cos\beta = \frac{c^2-b^2}{a^2+b^2}$
- $\tan\alpha + \tan\beta = \frac{2ab}{c^2-b^2}$

- $\tan\alpha \quad \tan\beta = \dfrac{c^2-a^2}{c^2-b^2}$
- $\tan\dfrac{\alpha}{2}+\tan\dfrac{\beta}{2}=\dfrac{2b}{c+a}$
- $\tan\dfrac{\alpha}{2}\,.\,\tan\dfrac{\beta}{2}=\dfrac{c-a}{c+a}$
- $\cot\dfrac{\alpha}{2}+\cot\dfrac{\beta}{2}=\dfrac{2b}{c-a}$
- $\sin 22\dfrac{1}{2}^0=\sqrt{\dfrac{\sqrt{2}-1}{2\sqrt{2}}}=\dfrac{1}{2}\sqrt{2-\sqrt{2}}=\cos\ 67\dfrac{1}{2}^0$
- $\cos\ \ 22\dfrac{1}{2}^0=\sqrt{\dfrac{\sqrt{2}+1}{2\sqrt{2}}}=\dfrac{1}{2}\sqrt{2+\sqrt{2}}=\sin\ \ 67\dfrac{1}{2}^0$
- $\tan 22\dfrac{1}{2}^0=\sqrt{2}-1=\cot 67\dfrac{1}{2}^0$
- $\cot 22\dfrac{1}{2}^0=\sqrt{2}+1=\tan\ 67\dfrac{1}{2}^0$

§§

- $\sin 18^0=\dfrac{\sqrt{5}-1}{4}=\cos 72^0$
- $\cos 36^0=\dfrac{\sqrt{5}+1}{4}=\sin\ 54^0$
- $\cos 18^0=\dfrac{\sqrt{10+2\sqrt{5}}}{4}=\sin\ 72^0$
- $\sin 36^0=\dfrac{\sqrt{10-2\sqrt{5}}}{4}=\cos\ 54^0$

§§

- $\sin\ 7\dfrac{1}{2}^0=\sqrt{\dfrac{2\sqrt{2}-\sqrt{3}-1}{4\sqrt{2}}}=\dfrac{\sqrt{4-\sqrt{6}-\sqrt{2}}}{2\sqrt{2}}=\cos 82\dfrac{1}{2}^0$
- $\cos 7\dfrac{1}{2}^0=\sqrt{\dfrac{2\sqrt{2}+\sqrt{3}+1}{4\sqrt{2}}}=\dfrac{\sqrt{4+\sqrt{6}+\sqrt{2}}}{2\sqrt{2}}\qquad=\sin\ 82\dfrac{1}{2}^0$
- $\tan\ 7\dfrac{1}{2}^0=\left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{2}-1\right)=\cot 82\dfrac{1}{2}^0$

- $\tan 37\frac{1}{2}^0 = \left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{2}+1\right) = \cot 57\frac{1}{2}^0$
- $\tan 52\frac{1}{2}^0 = \left(\sqrt{3}+\sqrt{2}\right)\left(\sqrt{2}-1\right) = \cot 37\frac{1}{2}^0$
- $\tan 82\frac{1}{2}^0 = \left(\sqrt{3}+\sqrt{2}\right)\left(\sqrt{2}+1\right) = \cot 7\frac{1}{2}^0$

§§
- $\tan 18^0 = \sqrt{4\sqrt{5}-8}$ $\tan 36^0 = \sqrt{5-2\sqrt{5}}$
- $\sqrt{1+\sin 2A} = \pm(\cos A + \sin A)$

$\Rightarrow \cos A + \sin A = \pm\sqrt{1+\sin 2A}$

- $\sqrt{1-\sin 2A} = \pm(\cos A - \sin A)$

$\Rightarrow \cos A - \sin A = \pm\sqrt{1-\sin 2A}$

- $\sqrt{1+\sin A} = \pm\left(\cos\frac{A}{2}+\sin\frac{A}{2}\right)$

$\Rightarrow \cos\frac{A}{2}+\sin\frac{A}{2} = \pm\sqrt{1+\sin A}$

- $\sqrt{1-\sin A} = \pm\left(\cos\frac{A}{2}-\sin\frac{A}{2}\right)$

$\Rightarrow \cos\frac{A}{2}-\sin\frac{A}{2} = \pm\sqrt{1-\sin A}$

	$7\frac{1}{2}^0$	15^0	18^0	$22\frac{1}{2}^0$	36^0	$67\frac{1}{2}^0$	75^0
Sin	$\frac{\sqrt{8-2\sqrt{6}-2\sqrt{2}}}{4}$	$\frac{\sqrt{3}-1}{2\sqrt{2}}$	$\frac{\sqrt{5}-1}{4}$	$\frac{\sqrt{2-\sqrt{2}}}{2}$	$\frac{\sqrt{10-2\sqrt{5}}}{4}$	$\frac{\sqrt{2+\sqrt{2}}}{2}$	$\frac{\sqrt{3}+1}{2\sqrt{2}}$
Cos	$\frac{\sqrt{8+2\sqrt{6}+2\sqrt{2}}}{4}$	$\frac{\sqrt{3}+1}{2\sqrt{2}}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	$\frac{\sqrt{2+\sqrt{2}}}{2}$	$\frac{\sqrt{5}+1}{4}$	$\frac{\sqrt{2-\sqrt{2}}}{2}$	$\frac{\sqrt{3}-1}{2\sqrt{2}}$
Tan	$\left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{2}-1\right)$	$2-\sqrt{3}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	$\sqrt{2}-1$	$\sqrt{5-2\sqrt{5}}$	$\sqrt{2}+1$	$2+\sqrt{3}$
Cot	$\left(\sqrt{3}+\sqrt{2}\right)\left(\sqrt{2}+1\right)$	$2+\sqrt{3}$	$\sqrt{\left(5+2\sqrt{5}\right)}$	$\sqrt{2}+1$	$\sqrt{\left(1+\frac{2}{\sqrt{5}}\right)}$	$\sqrt{2}-1$	$2-\sqrt{3}$

TEACHING TASK

LEVEL - I

I) MCQ's with single correct answer

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

1. $\tan\frac{\theta}{2}$ 2. $\cot\frac{\theta}{2}$ 3. $\sec\frac{\theta}{2}$ 4. $\operatorname{cosec}\frac{\theta}{2}$

2. $\frac{\sin 3\theta}{1+2\cos 2\theta}$

1. $\cos\theta$ 2. $\sin\theta$ 3. $-\cos\theta$ 4. $-\sin\theta$

3. $x=\sqrt{\frac{1-\cos\theta}{1+\cos\theta}} \Rightarrow \frac{2x}{1-x^2}=$

1. $\sin\theta$ 2. $\cos\theta$ 3. $\tan\theta$ 4. $\cot\theta$

4.. $\cos^6A + \sin^6A = 1 - k\sin^2(2A) \Rightarrow k=$

1. $\frac{1}{4}$ 2. $\frac{1}{2}$ 3. $\frac{3}{4}$ 4. 1

5. $\cos^3 10^0 + \cos^3 110^0 + \cos^3 130^0 =$

1. $\frac{3}{4}$ 2. $\frac{3}{8}$ 3. $\frac{3\sqrt{3}}{8}$ 4. $\frac{3\sqrt{3}}{4}$

6. $\cos^2 25^0 + \cos^2 95^0 + \cos^2 145^0 =$

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

7. If $A-B=60^0$ *then* $\cos^2 A+\cos^2 B-\cos A\cos B=$

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

8. $x^2+y^2=1 \Rightarrow (3x-4x^3)^2 + (3y-4y^3)^2 =$

1. 1 2. 2 3. 3 4. 4

9. $\cos^2\frac{3\pi}{5}+\cos^2\frac{4\pi}{5}=$

1. 4/5 2. 5/2 3. 5/4 4. 3/4

10. $2A+B=\frac{\pi}{2}\Rightarrow\sqrt{\frac{1+\sin B}{1-\sin B}}=$

1. $\tan A$ 2. $\cot A$ 3. $\tan B$ 4. $\cot B$

11. $\theta<\frac{\pi}{16},\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}}=k\cos\theta$ then k= ?

1. 2 2. 4 3. 8 4. 16

12. $8\sin\theta\cos\theta.\cos 2\theta\cos 4\theta=\sin x\Rightarrow x=$

1. 16θ 2. 8θ 3. 4θ 4. 32θ

13. $4\cos^3 40^0-3\sin 50^0=$

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

14. $\cos^2 72^0-\sin^2 54^0=$

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

15. $\sec 72^0-\sec 36^0=$

1. 2 2. $\frac{1}{2}$ 3. 4 4. $\frac{1}{4}$

16. If $180^0<\theta<270^0,\sin\theta=-\frac{3}{5}$, then $\cos\frac{\theta}{2}=$

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

17. $\frac{\sin\alpha}{3}=\frac{\cos\alpha}{4}\Rightarrow 3\sin 2\alpha+4\cos 2\alpha=$

1. 5 2. 4 3. 3 4. 1

LEVEL-II

18. $\frac{\sin\theta+\sin 2\theta}{1+\cos\theta+\cos 2\theta}=$

1. $\tan\frac{\theta}{2}$ 2. $\cot\frac{\theta}{2}$ 3. $\tan\theta$ 4. $\cot\theta$

19. $\frac{\cos A-\cos 3A}{\cos A}+\frac{\sin A+\sin 3A}{\sin A}=$

1. 1 2. 2 3. 3 4. 4

20. $\frac{1-\tan^2 30^o}{1+\tan^2 30^o} =$

1. 1 2. 1/2 3. 2 4. 0

21. $\cos^3 A \sin 3A + \sin^3 A \cos 3A = k \sin 4A$ then k=?

1. $\frac{1}{4}$ 2. $\frac{3}{4}$ 3. $\frac{1}{2}$ 4. $\frac{5}{2}$

22. $\cos^2 10^0 + \cos^2 50^0 + \cos^2 70^0 =$

1. $\frac{1}{2}$ 2. 1 3. $\frac{3}{2}$ 4. 2

23.. $\sec(45^0+A)\sec(45^0-A) =$

1. sec 2A 2. cos 2A 3. 2 cos 2A 4. 2 sec 2A

24 $\frac{\cos^2\left(\frac{\pi}{4}-A\right)-\sin^2\left(\frac{\pi}{4}-A\right)}{\cos^2\left(\frac{\pi}{4}+A\right)+\sin^2\left(\frac{\pi}{4}+A\right)} =$

1. cos 2A 2. tan 2A 3. sin 2A 4. cot 2A

25. $\frac{\cos A+\sin A}{\cos A-\sin A}-\frac{\cos A-\sin A}{\cos A+\sin A} =$

1. 2 tan 2A 2. 2 cosec 2A 3. 2 cot 2A 4. 2 sec 2A

26. $\frac{Sin2\theta}{1+Cos2\theta} =$

1) $Sin\theta$ 2) $Cot\theta$ 3) $Cos\theta$ 4) $Tan\theta$

27. $\frac{Cos3\theta}{2Cos2\theta-1} =$

1) $Sin\theta$ 2) $Cot\theta$ 3) $Cos\theta$ 4) $Tan\theta$

28. $\tan\left(\frac{\pi}{4}+A\right)+\tan\left(\frac{\pi}{4}-A\right) =$

1) $2\sec 2A$ 2) $2\sec 2A$ 3) $2\tan 2A$ 4) $2\cos ec2A$

27. $\frac{Cos3\theta}{2Cos2\theta-1} =$

1) $Sin\theta$ 2) $Cot\theta$ 3) $Cos\theta$ 4) $Tan\theta$

28. $\tan\left(\frac{\pi}{4}+A\right)+\tan\left(\frac{\pi}{4}-A\right) =$

1) $2\sec 2A$ 2) $2\sec 2A$ 3) $2\tan 2A$ 4) $2\cos ec2A$

27. $\frac{Cos3\theta}{2Cos2\theta-1}=$

1) $Sin\theta$ 2) $Cot\theta$ 3) $Cos\theta$ 4) $Tan\theta$

28. $\tan\left(\frac{\pi}{4}+A\right)+\tan\left(\frac{\pi}{4}-A\right)=$

1) $2\sec 2A$ 2) $2\sec 2A$ 3) $2\tan 2A$ 4) $2\cos ec2A$

29. A quadratic equation whose roots are $Tan22\frac{1}{2}^0$ and $Cot22\frac{1}{2}^0$ is

1) $x^2-2\sqrt{2}x+1=0$ 2) $2x^2-\sqrt{2}x+1=0$

3) $x^2+2\sqrt{2}x-1=0$ 4) $x^2-2\sqrt{2}x-1=0$

30. $\sqrt{2+\sqrt{2(1+Cos4A)}}=$

1) $\cos A$ 2) $\cos 2A$ 3) $2\cos A$ 4) $2\cos 2A$

31. $\frac{Sin^3\theta+Sin3\theta}{\cos^3\theta-Cos3\theta}=$

1) $Tan\theta$ 2) $-Tan\theta$ 3) $Cot\theta$ 4) $-Cot\theta$

32. $If\ \theta<22\frac{1}{2}^0$ then $\sqrt{2+\sqrt{2+\sqrt{2+2Cos4\theta}}}=$

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

33. $\frac{\sec 8\theta-1}{\sec 4\theta-1}=$

1) $\frac{\tan 4\theta}{\tan 2\theta}$ 2) $\frac{\tan 8\theta}{\tan 2\theta}$ 3) $\frac{\tan 6\theta}{\tan\theta}$ 4) $\frac{\tan 6\theta}{\tan 2\theta}$

34. $If\ \pi<x<2\pi$ Then $\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}=$

1) $\cot\left(\frac{x}{2}+\frac{\pi}{4}\right)$ 2) $\cot\left(\frac{x}{2}-\frac{\pi}{4}\right)$ 3) $\tan\left(\frac{x}{2}-\frac{\pi}{4}\right)$ 4) $\tan\left(\frac{x}{2}+\frac{\pi}{4}\right)$

35. If $\sin\alpha+\sin\beta=a$ and $\cos\alpha+\cos\beta=b$ then $\frac{\alpha-\beta}{2}=$

1) $\pm\sqrt{\frac{4+a^2+b^2}{a^2-b^2}}$ 2) $\pm\sqrt{\frac{4+a^2-b^2}{a^2+b^2}}$ 3) $\pm\sqrt{\frac{4-a^2-b^2}{a^2+b^2}}$ 4) $\pm\sqrt{\frac{4+a^2+b^2}{a^2+b^2}}$

36. if $(1+\tan\alpha)(1+\tan\beta)=2$ $\alpha\in\left(0,\frac{\pi}{16}\right)$ then α =

1) $\frac{\pi}{10}$ 2) $\frac{\pi}{20}$ 3) $\frac{\pi}{30}$ 4) $\frac{\pi}{50}$

37. If $A=\sin 45^0+\cos 45^0$ and $B=\sin 44^0+\cos 44^0$ then

1) $A>B$ 2) $A<B$ 3) $A=B$ 4) *None*

38. If in a triangle ABC, $\sin A\cos B=1/4$ and $3\tan A=\tan B$,then the triangle is

1)right angled 2) equilateral 3) isosceles 4) *None*

39. If $y=(1+\tan A)(1+\tan B)$ where $A-B=\frac{\pi}{4}$ then $(y+1)^{y+1}$ is

1)9 2) 4 3)27 4)81

40. Let $f(\theta)=\frac{\cot\theta}{1+\cot\theta}$ and $\alpha+\beta=\frac{5\pi}{4}$ then the value of $f(\alpha)f(\beta)$ is

1)1/2 2) 2 3)-1/2 4) *None*

41. If $\frac{\cos(x-y)}{\cos(x+y)}+\frac{\cos(z+t)}{\cos(z-t)}=0$ then the value of tanx.tany.tanz.tant=

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

LEARNER'S TASK

BEGINNERS (Level - I)

1. If $\tan\theta=b$ then $\cos 2\theta+b\sin 2\theta=$

(A) 0 (B) 1 (C) 2 (D) 3

2. $\cos\frac{2\Pi}{15}.\cos\frac{4\Pi}{15}.\cos\frac{8\Pi}{15}.\cos\frac{14\Pi}{15}$ = --------

(A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{3}{4}$ (D) $\frac{1}{4}$

3. If k = $\tan 25^0$ then $\frac{k-1}{k+1}+\frac{k+1}{k-1}=$

(A) $2\cos ec130^0$ (B) $2\cos ec45^0$ (C) $2\sec 130^0$ (D) $2\sec 400^0$

4. If $\frac{\tan 3A}{\tan A}=k$ then find the value of $\tan^2 A$ in terms of k

(A) $\frac{3k-1}{k-3}$ (B) $\frac{3k+1}{k-3}$ (C) $\frac{k-3}{3k+1}$ (D) $\frac{k-3}{3k-1}$

5. If $\cos\alpha = \frac{3}{5}$, $\cos\beta = \frac{5}{13}$ then $\cos^2\left(\frac{\alpha-\beta}{2}\right) =$

(A) $\frac{64}{65}$ (B) $\frac{1}{65}$ (C) $\frac{65}{64}$ (D) 65

6. $\sin^2 42^0 - \sin^2 12^0 =$

(A) $\frac{\sqrt{5}-1}{4}$ (B) $\frac{\sqrt{5}+1}{4}$ (C) $\frac{\sqrt{5}-1}{8}$ (D) $\frac{\sqrt{5}+1}{8}$

7. If $\frac{\cos\alpha}{a} = \frac{\sin\alpha}{b}$ then $a\cos 2\alpha + b\sin 2\alpha =$

(A) a (B) b (C) 1/a (D) ab

8. If $\cos 2\theta = x \, then \, \sin\theta =$

(A) $\sqrt{\frac{1-x^2}{2}}$ (B) $\sqrt{\frac{1-x}{2}}$ (C) $\sqrt{\frac{1+x}{2}}$ (D) $\sqrt{\frac{x-1}{2}}$

9. $\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0 =$

(A) 1/2 (B) 1/4 (C) 1/8 (D) 1/16

10. $\sin^2 22^0 + \sin^2 38^0 + \sin^2 22^0.\sin^2 38^0 =$

(A) 1/4 (B) 3/4 (C) 5/4 (D) 1/2

11. $\cos^2 84^0 + \cos^2 24^0 - \cos 84^0.\cos 24^0 =$

(A) 1/4 (B) 3/4 (C) 5/4 (D) 1/2

ACHIEVERS (Level - II)

SOLVE THE FOLLOWING

1. If tanA = $\frac{4}{3}$ then find

(i) tan2A (ii) tan3A (iii) cos2A

2. Prove that $\sin^2 72^0 - \sin^2 60^0 = \frac{\sqrt{5}-1}{8}$

3. Prove that $\sin\frac{\Pi}{5}.\sin\frac{2\Pi}{5}.\sin\frac{3\Pi}{5}.\sin\frac{4\Pi}{5} = \frac{5}{16}$

4. Show that $\cos^2 9^0 - \cos^2 81^0 = \cos 18^0$.

5. Find the value of $\frac{6\sin 6^0 - 8\sin^3 6^0}{8\cos^3 12^0 - 6\cos 12^0}$

6. Find the value of $\tan 9^0 - \tan 27^0 - \tan 63^0 + \tan 81^0$

7. Find the values of (i) $\sin 18^0 \sin 54^0$ (ii) $2\cos ec 9^0.\sec 9^0$

EXPLORERS (Level - III)

III) MCQ's With More Than One Answer Correct

1. If A and B are acute angles such that $\sin A = \sin^2 B, 2\cos^2 A = 3\cos^2 B$ then

(A) $A = \frac{\Pi}{6}$ (B) $A = \frac{\Pi}{2}$ (C) $B = \frac{\Pi}{4}$ (D) $B = \frac{\Pi}{3}$

2. cos2A =

(A) $\cos^2 A - \sin^2 A$ (B) $2\cos^2 A - 1$ (C) $1 - 2\sin^2 A$ (D) $\frac{1-\tan^2 A}{1+\tan^2 A}$

KEY

ΦΦ LEARNER'S TASK :

Φ BEGINNERS: 1. B 2. A 3. C 4. D 5. A 6. D 7. A 8. B 9. D 10. B 11. B

Φ ACHIEVERS: 1. $-\frac{24}{7}, -\frac{44}{117}, -\frac{7}{25}$ 2. $\frac{\sqrt{5}-1}{\sqrt{5}+1}$ 3. 4 4. $\frac{1}{4}$, $4(\sqrt{5}+1)$

Φ EXPLORERS: 1. A,C 2. A,B,C,D

KEY