TRANSFORMATION OF ANGLES

The following eight formulae derived here are Called the trigonometric transformation formulae, and they can be used to transform the sum or difference of trigononetric to their products and products of trigonometric functions to their sum or difference.

Synopsis

Sin (A + B) + Sin (A - B) = 2 SinA CosB

Sin (A + B) - Sin (A - B) = 2 CosA Sin B

Cos (A + B) + Cos (A - B) = 2 CosA CosB

Cos (A - B) - Cos (A + B) = 2 Sin A Sin B

$$\text{SinC} + \text{Sin D} = 2\,\text{Sin}\left(\frac{C+D}{2}\right)\text{Cos}\left(\frac{C-D}{2}\right)$$

$$\text{SinC} - \text{Sin D} = 2\,\text{Cos}\left(\frac{C+D}{2}\right)\text{Sin}\left(\frac{C-D}{2}\right)$$

$$\text{CosC} + \text{CosD} = 2\,\text{Cos}\left(\frac{C+D}{2}\right)\text{Cos}\left(\frac{C-D}{2}\right)$$

$$\text{CosC} - \text{CosD} = -2\text{Sin}\left(\frac{C+D}{2}\right)\text{Sin}\left(\frac{C-D}{2}\right) = 2\text{Sin}\left(\frac{C+D}{2}\right)\text{Sin}\left(\frac{D-C}{2}\right)$$

Identities

If A+B+C = 180^0 then

i) Sin2A+sin2B+sin2C = 4 sinA sinB sinC

ii) Sin2A +sin2B - sin2C = 4 cosA cosB sinC

iii) Cos2A +cos2B +cos2C = -1-4 CosA CosB cosC

iv) cos2A + cos2B -cos2C = 1-4 sinA sinB cosC

v) sinA+sinB+sinC = 4 $\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

vi)sinA - sinB + sinC = 4 $\sin\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

vii) CosA +cosB + cosC = 1+4 $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

viii) cosA +cosB -cosC = -1+4 $\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

ix) $\cos^2A + \cos^2B + \cos^2C$ = 1-2 cosA cosB cosC

x) $\sin^2A + \sin^2B + \sin^2C$ = 2+2 cosA cosB cosC

xi) $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}+\sin^2\frac{C}{2} = 1-2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

xii) $\cos^2\frac{A}{2}+\cos^2\frac{B}{2}+\cos^2\frac{C}{2} = 2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

1) $\sin 9^0 = \frac{1}{4}\left[\sqrt{3+\sqrt{5}}-\sqrt{5-\sqrt{5}}\right]$

$= \sqrt{\frac{4-\sqrt{10+2\sqrt{5}}}{8}}$

$= \frac{1}{4}\sqrt{8-2\sqrt{10+2\sqrt{5}}} \quad = \cos 81^0$

2) $\cos 9^0 = \frac{1}{4}\left[\sqrt{3+\sqrt{5}}+\sqrt{5-\sqrt{5}}\right]$

$= \sqrt{\frac{4+\sqrt{10+2\sqrt{5}}}{8}}$

$= \frac{1}{4}\sqrt{8+2\sqrt{10+2\sqrt{5}}} \quad = \sin 81^0$

3) $\cos x.\cos 2x.\cos 4x.........\cos(2^n x) = \frac{1}{2^{n+1}}\frac{\sin\left(2^{n+1}x\right)}{\sin x}$

4) $\sin\frac{\pi}{n}+\sin\frac{3\pi}{n}+\sin\frac{5\pi}{n}+....$ n terms = 0

5) $\forall x\in R$, $\tan x+\frac{1}{2}\tan\frac{x}{2}+\frac{1}{2^2}\cdot\tan\frac{x}{2^2}+....+\frac{1}{2^{n-1}}\tan\left(\frac{x}{2^{n-1}}\right)$

$= \frac{1}{2^{n-1}}\cot\left(\frac{x}{2^{n-1}}\right)-2\cot 2x$

6) $\sin\alpha+\sin(\alpha+\beta)+\sin(\alpha+2\beta)+....n$ terms $= \frac{\sin\frac{n\beta}{2}}{\sin\frac{\beta}{2}}\sin\left\{\alpha+\frac{n-1}{2}\beta\right\}$

7) $\cos\alpha+\cos(\alpha+\beta)+\cos(\alpha+2\beta)+....n$ terms $= \frac{\sin\frac{n\beta}{2}}{\sin\frac{\beta}{2}}\cos\left\{\alpha+\frac{n-1}{2}\beta\right\}$

TEACHING TASK

I. MCQ with single correct answer

1. $\sin A+\sin 3A+\sin 5A+\sin 7A=$

A. $4\sin A\cos 2A\ \cos 4A$ B. $4\sin A\ \cos 2A\ \cos 2A$

C. $4\cos A\sin 2A\sin 4A$ D. $4\cos A\cos 2A\sin 4A$

2. $4\cos 6\theta\cos 4\theta\cos 2\theta$ =

A $\cos 12\theta+\cos 8\theta+\cos 4\theta+1$ B $\cos 12\theta+\cos 8\theta-\cos 4\theta+1$

C. $\cos 12\theta-\cos 8\theta+\cos 4\theta+1$ D $\cos 12\theta-\cos 8\theta-\cos 4\theta-1$

3. $Sin\frac{\theta}{2}.Sin\frac{7\theta}{2}+Sin\frac{3\theta}{2}.Sin\frac{11\theta}{2}-\sin 2\theta.\sin 5\theta$ =

A. 0 B.1 C. -1 D.2

4. $2\left(1-2\sin^2\theta\right)\cos 4\theta$ =

A. $\sin 6\theta+\cos 2\theta$ B. $\sin 6\theta+\sin 2\theta$ C. $\cos 6\theta+\cos 2\theta$ D. $\cos 6\theta+\sin 2\theta$

5. $\cot 16^0\cdot\cot 44^0+\cot 44^0\cdot\cot 76^0-\cot 76^0.\cot 16^0$ =

A. 3 B. 0 C. 1 D. 4

6. $\cos 48^0.\cos 12^0$ =

A. $\frac{1-\sqrt{5}}{8}$ B. $\frac{\sqrt{5}+3}{8}$ C. $\frac{\sqrt{5}-1}{8}$ D. $\frac{\sqrt{5}+1}{8}$

7. $\cos 66^0+\sin 84^0$ =

A. $\frac{\sqrt{15}-\sqrt{3}}{4}$ B. $\frac{\sqrt{15}-3}{4}$ C. $\frac{\sqrt{15}+\sqrt{3}}{4}$ D. $\frac{\sqrt{15}+3}{4}$

8. $4\sin\left(420^0-\alpha\right)\cos\left(60^0+\alpha\right)$ =

A. $\sqrt{3}-2\sin 2\alpha$ B. $\sqrt{3}+2\sin 2\alpha$ C. $\sqrt{3}-2\cos 2\alpha$ D. $\sqrt{3}+2\cos 2\alpha$

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

A. 3/16 B. 1/32 C. 1/16 D. 1/8

10. $\cos^2 76^0+\cos^2 16^0-\cos 76^0.\cos 16^0=$

A. 1/2 B -1/4 C. 0 D. 3/4

11. $\dfrac{\cos^2 33^0 - \cos^2 57^0}{\sin 21^0 - \cos 21^0} =$

A. $-1/\sqrt{2}$ B. 1/2 C. $1/\sqrt{2}$ D. $-1/2$

12. $\sin\alpha + \sin\beta = a,\ \cos\alpha + \cos\beta = b \ \Rightarrow \cos(\alpha+\beta) =$

A. $\dfrac{a^2+b^2}{2ab}$ B. $\dfrac{2ab}{a^2+b^2}$ C. $\dfrac{b^2-a^2}{b^2+a^2}$ D. $\dfrac{ab}{a^2+b^2}$

13. $\left(1+\sqrt{1+a}\right)\tan\alpha = 1+\sqrt{1-a} \Rightarrow \sin 4\alpha =$

A. -1 B. a C. 1 D. 0

14. $\pi < \alpha - \beta < 3\pi$, $\sin\alpha + \sin\beta = \dfrac{-21}{65}$, $\cos\alpha + \cos\beta = \dfrac{-27}{65} \Rightarrow \cos\left(\dfrac{\alpha-\beta}{2}\right) =$

A. $\dfrac{-6}{65}$ B. $\dfrac{-3}{\sqrt{130}}$ C. $\dfrac{3}{\sqrt{130}}$ D. $\dfrac{6}{65}$

15. $\cos x + \cos y = \dfrac{4}{5}$, $\cos x - \cos y = \dfrac{2}{7} \Rightarrow 14\tan\left(\dfrac{x-y}{2}\right) + 5\cot\left(\dfrac{x+y}{2}\right) =$

A. 0 B. 1/4 C. 5/4 D. 3/4

16. If n is an odd integer then $\left(\dfrac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\dfrac{\sin A + \sin B}{\cos A - \cos B}\right)^n =$

A. 0 B. $\cot^n\left(\dfrac{A+B}{2}\right)$ C. $\cot^n\left(\dfrac{A-B}{2}\right)$ D. $2\tan^n\left(\dfrac{A+B}{2}\right)$

17. $\cos 2B = \dfrac{\cos(A+C)}{\cos(A-C)} \Rightarrow \tan A, \tan B, \tan C$ are in

A. A.P. B. H.P C G.P. D. A.G.P

18. $A + B + C = 180^0 \quad \Rightarrow \cos 2A + \cos 2B + \cos 2C =$

A. $1 - 4\sin A\sin B\sin C$ B. $1 + 4\sin A\sin B\sin C$

C. $1 + 4\cos A\cos B\cos C$ D. $-1 - 4\cos A\cos B\cos C$

19. $A + B + C = 180^0 \quad \Rightarrow \sin 2A - \sin 2B + \sin 2C =$

A. $2\sin A\cos B\sin C$ B. $2\cos A\sin B\cos C$

C. $4\sin A\cos B\sin C$ D. $4\cos A\sin B\cos C$

20. $A+B+C=0^0 \Rightarrow \sin A+\sin B+\sin C=$

A. $2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ B. $-2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

C. $4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ D. $-4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

21. $A+B+C=2S \Rightarrow$ $\sin S+\sin(S-A)+\sin(S-B)-\sin(S-C)=$

A. $4\cos\frac{A}{2}.\cos\frac{B}{2}.\cos\frac{C}{2}$ B. $4\cos\frac{A}{2}.\cos\frac{B}{2}.\sin\frac{C}{2}$

C. $4\cos\frac{A}{2}.\sin\frac{B}{2}.\cos\frac{C}{2}$ D. $4\sin\frac{A}{2}.\sin\frac{B}{2}.\sin\frac{C}{2}$

22. $\frac{1-\cos A+\cos B-\cos(A+B)}{1+\cos A-\cos B-\cos(A+B)}=$

A. $\sin\frac{A}{2}.\cos\frac{B}{2}$ B. $\sec\frac{A}{2}\cos ec\frac{B}{2}$ C. $\tan\frac{A}{2}.\cot\frac{B}{2}$ D..2 $\sin\frac{A}{2}.\cos\frac{B}{2}$

23. $\frac{\sin A+\sin 5A+\sin 9A}{\cos A+\cos 5A+\cos 9A}=$

A. tan 3A B. tan 5A C. tan 4A D. tan 2A

24. $\sin x+\sin y=\frac{1}{4}$, $\sin x-\sin y=\frac{1}{5} \Rightarrow 4\cot\left(\frac{x-y}{2}\right)=$

A. $5\cot\left(\frac{x-y}{2}\right)$ B. $5\tan\left(\frac{x-y}{2}\right)$ C. $5\cot\left(\frac{x+y}{2}\right)$ D. $5\tan\left(\frac{x+y}{2}\right)$

25. $\cos x+\cos y=1/3$, $\sin x+\sin y=1/4$ $\Rightarrow \sin(x+y)$

A. $7/25$ B. $25/24$ C. $25/7$ D. $24/25$

26. $\sin\theta=n\sin(\theta+2\alpha)\Rightarrow(1-n)\tan(\theta+\alpha)=$

A.. $(n+1)\tan\alpha$ B. $(n+1)\tan\beta$ C. $(n-1)\tan\alpha$ D. $(n-1)\tan\beta$

27 . $x=\cos 55^0, y=\cos 65^0$, $z=\cos 175^0 \Rightarrow xy+yz+zx=$

A. -3/4 B. 3/4 C 3/2 D. 1/2

II. MCQ with one or more than one correct answer :

1. Which of the following are true ?

A)$\cos^2 76^0 + \cos^2 16^0 - \cos 76^0 \cos 16^0 = 3/4$

B) $\cos^2 76^0 + \cos^2 16^0 - \cos 76^0 \cos 16^0 = 1/4$

C) In DABC sin2A + sin2B +sin2C =4sinA. sinB. sinC

D) In DABC sin2A - sin2B +sin2C =4cosA. sinB. cosC

2. Which of the following are true?

A)sin6q +sin4q = 2 sin5q cosq B)cos3q -cos7q = 2 sin5q sin2q

C)sin(2n+1)A. sinA= $\sin^2$ (n+1)A - $\sin^2$nA

D)2 cos11q. cos3q = cos14q +cos8q

III. Assertion and Resoning type questions

A) A is true, R is true and 'R' is correct explanation of A.

B) A is true, R is true and 'R' is not correct explanation of A.

C) A is true, R is false D) A is false, R is true

1. A : If A + B+ C = 180^0 then $\cos^2$ A + $\cos^2$ B + $\cos^2$ C = 1-2 cosA cosB cosc

R : If A + B +C = 180^0 then Cos2A +cos2B + cos2C = 1-4 cos cosB cos C

2. A : If x + y + z = xyz then $\Sigma\left(\frac{2x}{1-x^2}\right)=\pi\left(\frac{2x}{1-x^2}\right)$

R : It tan A +tan B +tan C = tan A tanB tanC then A+B+C = np,nÎN

3. A: If x = sin (a-b) sin (g-d), y = sin(b-g) sin (a-d), z= sin (g-a) sin (b-d) then x + y +z = 0

R : 2sin A sinB = cos (A-B) + cos (A+B)

4. A : a= tanq, b= tan2q, a¹0, b¹0 and tanq + tan2q = tan3q then a + b=0

R : If A-B = C, then tan A- tan B -tan C = tan A tanB tanC

5. A : In DABC, $\sum\frac{\cos A}{\sin B\sin C}=2$

R : In DABC, sinA + sin B + sinC = 4 cos$\frac{A}{2}$ cos$\frac{B}{2}$ cos$\frac{C}{2}$

IV Match the following

1. If A + B +C = 180^0 then match the following

List - I	List - II
1) cosA + cosB + cosC=	a) 2+2cosA cosB cosC
2) $\sin^2$A + $\sin^2$B +$\sin^2$C =	b) 4 cos$\frac{A}{2}$ cos$\frac{B}{2}$ cos$\frac{C}{2}$
3) sin2A +sin2B + sin2C=	c) 1+4 sin$\frac{A}{2}$ sin$\frac{B}{2}$ sin$\frac{C}{2}$
4) sinA + sinB +sin C =	d)4 sin A sinB sinC

A) c,a,d,b B) d,b,a,c C) a,c,b,d D)b,d,c,a

V. Comprehension type questions

1. If A + B+ C = 180^0 then

a) $\cos^2 A+\cos^2 B+\cos^2 C$ =

A) $1+2\cos A\cos B\cos C$ B) $1+2\sin A\sin B\sin C$

C) $1-2\cos A\cos B\cos C$ D) $1-2\sin A\sin B\sin C$

b) $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}+\sin^2\frac{C}{2}=$

A) $1+2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ B) $1+2\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

C) $1-2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ D) $1-2\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

c) $\cos^2 2A+\cos^2 2B+\cos^2 2C =$

A) 1+2 sin A sin B sin C B) 1+2 cos A cos B cos C

C) 1+2 sin 2A sin 2B sin 2C D) 1+2 cos 2A cos 2B cos 2C

2. If A + B +C = 90^0 then

a) $\Rightarrow \cos^2 A+\cos^2 B+\cos^2 C=$

A) 1+2 sin Asin B sin C B) 1+2 cosA cosB cos C

c) 2+2sinAsinB sinC D) 2+2 cosAcosB cosC

b). $\Rightarrow \sin^2 A+\sin^2 B+\sin^2 C=$

A) 1+2 cos A cos B cos C B) 1+2 sin A sin B sin C

C) 1-2 sin A sin B sin C D) 1-2 cos A cos B cos C

VI. Descriptive type questions

1. Prove that $\frac{\sin A+\sin 3A+\sin 5A+\sin 7A}{\cos A+\cos 3A+\cos 5A+\cos 7A}=\tan 4A$

2. Prove that $\frac{\sin A+\sin B}{\sin A-\sin B}=\tan\left(\frac{A+B}{2}\right)\cot\left(\frac{A-B}{2}\right)$

3. In DABC prove the following identities

a) $\sin^2 2A+\sin^2 2B+\sin^2 2C = 2(1-\cos2A.\cos2B.\cos2C)$

b) sin3A+sin3B+sin3C= $-4\cos\frac{3A}{2}\cos\frac{3B}{2}\cos\frac{3C}{2}$

c) $\cos^2\frac{A}{2}\cos^2\frac{B}{2}\cos^2\frac{C}{2}=2+2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

4. Prove that

i) If a+b+g= p then $\sin^2 a+\sin^2 b-\sin^2 g = 2\sin a\sin b\cos g$

ii) If a+b+g+d = 2p then cos2a+cos2b+cos2g+cos2d

= 4cos(a+b) cos(a+g) cos(a+d)

5. If A+B+C = 2S then prove that

cos(S-A) +cos(S-B) +cos (S-C) - sin S = $4\cos\left(\frac{S-A}{2}\right)\cos\left(\frac{S-B}{2}\right)$ cosC/2 -1

LEARNER'S TASK

BEGINNERS (Level - I)

I. MCQ'S with single correct answer.

1. $\sin 6\theta - \sin 2\theta =$

A. $2\sin 6\theta \cos 4\theta$ B. $2\cos 4\theta \sin 2\theta$ C. $2\sin 4\theta \cos 6\theta$ D. $2\sin 4\theta \cos 2\theta$

2. $\left(2\cos^2 3\theta - 1\right)\cos 5\theta$ =

A. $\frac{1}{2}\left[\cos 11\theta + \cos\theta\right]$ B. $\frac{1}{2}\left[\sin 11\theta + \sin\theta\right]$

C. $\frac{1}{2}\left[\sin 11\theta + \cos\theta\right]$ D. $\frac{1}{2}\left[\cos 11\theta + \sin\theta\right]$

3. $\cos 25^0 - \cos 65^0$ =

A. $\sqrt{2}\cos 20^0$ B. $\sqrt{2}\sin 20^0$ C. $\sqrt{3}\cos 20^0$ D. $\sqrt{3}\sin 20^0$

4. $\sin 65^0 + \sin 25^0$ =

A. $\sqrt{2}\cos 20^0$ B. $\sqrt{2}\sin 20^0$ C. $\sqrt{3}\cos 20^0$ D. $\sqrt{3}\sin 20^0$

5. $\cos 40^0 + \cos 80^0 + \cos 160^0$ =

A. 2 B. 1 C. 0 D. 3

6. $\sin 47^0 - \sin 25^0 + \sin 61^0 - \sin 11^0$ =

A. $\sin 7^0$ B. $2\cos 7^0$ C. $2\sin 7^0$ D. $\cos 7^0$

7. $\sin 10^0 + \sin 20^0 + \sin 40^0 + \sin 50^0 - \sin 70^0 - \sin 80^0$ =

A. 1/2 B. 0 C. -1/2 D. 1

8. $\sin 48^0 . \sin 12^0$ =

A. $\frac{\sqrt{5}+1}{8}$ B. $\frac{1+\sqrt{5}}{8}$ C. $\frac{1-\sqrt{5}}{8}$ D. $\frac{\sqrt{5}-1}{8}$

9. $\cos 66^0 + \cos 6^0$ =

A. $\frac{\sqrt{3}\left(\sqrt{5}-1\right)}{4}$ B. $\frac{\sqrt{2}\left(\sqrt{5}+1\right)}{4}$ C. $\frac{\sqrt{2}\left(\sqrt{5}-1\right)}{4}$ D. $\frac{\sqrt{3}\left(\sqrt{5}+1\right)}{4}$

10. $\sin 24^0 + \cos 6^0 =$

A. $\frac{\sqrt{15}+\sqrt{3}}{4}$ B. $\frac{\sqrt{15}+3}{4}$ C. $\frac{\sqrt{15}-3}{4}$ D. $\frac{\sqrt{15}-\sqrt{3}}{4}$

11. $2\cos\theta - \cos 3\theta - \cos 5\theta - 16\cos^3\theta.\sin^2\theta =$

A. 2 B. 0 C. 1 D. -1

12. $\cos 10^0.\cos 30^0.\cos 50^0.\cos 70^0 =$

A. 3/16 B. 1/16 C. 1/8 D. 1/32

13. $4\left(\cos 66^0 + \sin 84^0\right) =$

A. $\sqrt{5}-1$ B. $\sqrt{3}\left(\sqrt{5}-1\right)$ C. $\left(\sqrt{5}+1\right)$ D. $\sqrt{3}\left(\sqrt{5}+1\right)$

14 . $\frac{\cos\left(45^0+A\right)-Cos\left(45^0-A\right)}{\sin\left(120^0+A\right)-\sin\left(120^0-A\right)} =$

A. 2 B. $\sqrt{2}$ C. $2\sqrt{2}$ D. $\pm\sqrt{2}$

15. $\sin 85^0 - \sin 35^0 - \cos 65^0$

A. 0 B. 1 C. 2 D. 3

16. $m.\tan\left(\theta-30^0\right) = n.\tan\left(\theta+120^0\right), \Rightarrow \cos 2\theta =$

A. $\frac{m-n}{2(m-n)}$ B. $\frac{m+n}{2(m-n)}$ C. $\frac{m-n}{2(m+n)}$ D. $\frac{m-n}{(m+n)}$

17. $\tan(\alpha+\theta) = n.\tan(\alpha-\theta), \Rightarrow (n+1)\sin 2\theta =$

A. $(n+1)\sin 2\alpha$ B. $(n+1)\sin 2\beta$ C. $(n-1)\sin 2\alpha$ D. $(n-1)\sin 2\beta$

18. $\cot\left(15^0-A\right)+\tan\left(15^0+A\right)=$

A. $\frac{4\cos 2A}{1+2\cos 2A}$ B. $\frac{4\cos 2A}{1-2\sin 2A}$ C. $\frac{4\cos 2A}{1+2\sin 2A}$ D. $\frac{4\cos 2A}{1-2\cos 2A}$

19 $A+B+C=180^0 \Rightarrow \cos A - \cos B + \cos C =$

A. $1+4\cos\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$ B. $1+4\sin\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

C. $-1+4\cos\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$ D. $-1-4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

20. $A+B+C=180^0 \Rightarrow \sin A+\sin B+\sin C =$

A. $2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ B. $2\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

C. $4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

D. $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

21. A+B+C $=90^0 \Rightarrow \cos 2A+\cos 2B+\cos 2C=$

A. $1-4\cos A\cos B\cos C$

B. $1-4\sin A\sin B\sin C$

C. $1+4\cos A\cos B\cos C$

D. $1+4\sin A\sin B\sin C$

22. $A+B+C=90^0 \Rightarrow \sin 2A+\sin 2B-\sin 2C=$

A. 2 cos A cos B sinC

B. 2 sin A sin B sin C

C. 4 cos A cos B sin C

D. 4 sin A sin B cos C

ACHIEVERS (Level - II)

II. Descriptive type questions

1. Prove that $\frac{\cos A+\cos B}{\cos B-\cos A}=\cot\frac{A+B}{2}\cot\frac{A-B}{2}$
2. If A+B+C = 0^0 then prove that sin A +sin B + sin C = -4sinA/2 sinB/2sinC/2
3. If A + B + C = 2S then prove that
sin(S-A) + sin (S-B) + sin(S-C)-sinS = 4sinA/2 sinB/2 sinC/2
4. If A+B+C+D=2p then prove that sinA -sinB +sinC-sin D
$= -4\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A+D}{2}\right)\cos\left(\frac{A+D}{2}\right)$
5. If A+B+C=180^0 then prove that
$\sin^2 A/2 + \sin^2 B/2 + \sin^2 C/2 = 1-2\sin A/2 \sin B/2 \sin C/2$.

EXPLORERS (Level - III)

III. MCQs with one or more than one correct answers

♦ *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. If x/y = $\frac{\cos A}{\cos B}$ where A ¹B then..........

A) $\tan\left(\frac{A+B}{2}\right)=\frac{x\tan A+y\tan B}{x+y}$

B) $\tan\left(\frac{A-B}{2}\right)=\frac{x\tan A-y\tan B}{x+y}$

C) $\frac{\sin(A+B)}{\sin(A-B)}=\frac{y\sin A+x\sin B}{y\sin A-x\sin B}$

D) xcos A +ycosB = 0

IV. Assertion and Reason type Questions

1. A : $\frac{\sin(A+B)+\sin(A-B)}{\cos(A+B)+\cos(A-B)}=\tan A$
R : sin(A+B) + sin(A-B) = sin A and cos (A+B) + cos(A-B) = cos A
2. A : If x = sin(a-b) sin (g-d), y= sin (b-g) sin (a-d), z= sin (g-a) sin(b-d) then x +y+z = 0
R :2sinA sin B = cos(A-B) + cos(A+B)

3. A : If A+B+C = 180^0 then $\cos^2 A + \cos^2 B + \cos^2 C$ = 1-2 cosA cosB cosC
R : If A+B+C = 180^0 then cos 2 A + cos 2B +cos2C = -1-4 cosA cosB cosC

4. A : If x + y + z = xyz then $\Sigma\left(\frac{2x}{1-x^2}\right) = \pi\left(\frac{2x}{1-x^2}\right)$
R : If tan A + tan B + tanC = tan A tanB tanC, then A + B + C= $n\pi$, $n \in z$

V. Match the following:

♦ *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

If cosa+ cosb = 1/2 and sina +sinb = 1/3

i) $\cos\left(\frac{\alpha+\beta}{2}\right)$ =	a) $\pm\frac{\sqrt{13}}{12}$
ii) $\cos\left(\frac{\alpha-\beta}{2}\right)$=	b)2/3
iii) $\tan\left(\frac{\alpha+\beta}{2}\right)$=	c) $\pm 3/\sqrt{13}$
iv) $\tan\left(\frac{\alpha-\beta}{2}\right)$=	d) $\pm\sqrt{\frac{131}{13}}$

A)d,b,a,c B)d,b,c,a C) c,a,b,d D) c,a,d,b

VI. Comprehensive type

♦ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

1. In DABC ëA +B+ëC= 180^0 then
a) cosA +cosB + cos C=
A)1+4sinA/2 sinB/2 sinC/2 B) 4 sinA sinB sinC
C)-4sinA sinB sinC D) 1- 4sinA/2 sinB/2 sinC/2
b) $\sin^2 A + \sin^2 B + \sin^2 C$=
A)4cosA/2 cosB/2 cosC/2 B)-4cosA/2 cosB/2 cosC/2
C)4sinA/2 sinB/2 sinC/2 D) 2+2cosA. cosB. cosC
c) sin2A +sin2B +sin2C
A)2-2cosA cosB cosC B)2+2cosA cosB cosC
C) 2-2sin A sin B sin C D) 4sinA sinB sinC
2. If A+B+C=270^0 then
a) $\Rightarrow \cos^2 A + \cos^2 B - \cos^2 C =$
A) -2 sin A sin B cos C B) -2 cos A cos B sin C
C) 2 sin A sin B cos C D) 2 cosA cos B sin C
b). $\Rightarrow \sin 2A - \sin 2B + \sin 2C =$
A) 4 sin A cos B sin C B) 4 cos A sin B cos C
C) -4 sin A cos B sin C D) -4 cos A sin B cos C

RESEARCHERS (Level - IV)

1. $\sin\alpha + \sin\beta = a,\ \cos\alpha + \cos\beta = b \Rightarrow \sin(\alpha+\beta) =$ **(EAM-2010)**

1. ab 2. a+b 3. $\frac{2ab}{a^2-b^2}$ 4. $\frac{2ab}{a^2+b^2}$

2. $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b} \Rightarrow \frac{\tan x}{\tan y} =$ **(EAM-2011)**

1. b/a 2. a/b 3. 1 4. 0

3. If $A+B+C=270^0$, then $\cos 2A+\cos 2B+\cos 2C + 4\sin A\sin B\sin C =$ **(EAM-2013)**

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

4. $\tan 7\frac{1}{2}^0$ = **(AIEEE-2005)**

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

5. $A+C=2B \Rightarrow \frac{\cos C-\cos A}{\sin A-\sin C} =$ **(AIEEE-2010)**

1) $\cot B$ 2) $\cot 2B$ 3) $\tan 2B$ 4) $\tan B$

6. $\cos\alpha.\sin(\beta-\gamma)+\cos\beta.\sin(\gamma-\alpha)+\cos\gamma.\sin(\alpha-\beta) =$ **(AIEEE-2013)**

1) 0 2) 1/2 3) 1 4) $4\cos\alpha\cos\beta\cos\gamma$

7. $\cos 6^0.\sin 24^0.\cos 72^0$ = **(EAM-2014)**

1. -1/8 2. 1/8 3. -1/4 4. 1/4

8. The value of $\cos\left(\frac{2\pi}{15}\right)\cos\left(\frac{4\pi}{15}\right)\cos\left(\frac{8\pi}{15}\right)\cos\left(\frac{14\pi}{15}\right)$= **(EAM-2006)**

1) 1/16 2) 1/8 3) 3/4 4) 1/12

1. -1/8 2. 1/8 3. -1/4 4. 1/4

9. $\cos 255^0 + \sin 165^0$ = **(EAM-2005)**

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

10. $A+B+C=180^0 \Rightarrow \sin^2 A+\sin^2 B+\sin^2 C$ = **(EAM-1998)**

1. $1+\cos A\cos B\cos C$ 2. $1+\sin A\sin B\sin C$

3. $2(1+\cos A\cos B\cos C)$ 4. $2(1+\sin A\sin B\sin C)$

11. Cos(a+b+g) +cos (a-b-g)+Cos(b-g-a)+cos(g-a-b)= **(EAM-1996)**

1) 2cosa cosb cosg 2) 3cosa cosb cosg
3) 4cosa cosb cosg 4) 6cosa cosb cosg

12. $\cos A = \frac{3}{4} \Rightarrow 32\sin\left(\frac{A}{2}\right)\sin\left(\frac{5A}{2}\right) =$ **(EAM-2011)**

1)7 2)8 3)13 4)11

KEY

ΦΦ TEACHING TASK

I. MCQ with single correct answer

I. 1.D 2.A 3.A 4.C 5.A 6.B 7.C 8.A 9.C 10.D 11.A
12.C 13.D 14.B 15.A 16.A 17.C 18.D 19.D 20.D 21.B 22.C
23.B 24.C 25.D 26.A 27.A

II. MCQ with one or more than one correct answer :

II. 1.A,C,D 2. A,B,C,D

III. Assertion and Resoning type questions

III. 1.A 2.A 3.C 4.A 5.B

IV Match the following

IV. 1.A

V. Comprehension type questions

V. 1) a)C b)C c)D
2) a)C b)C

ΦΦ STUDENT TASK

I. MCQ'S with single correct answer.

1.B 2.A 3.B 4.A 5.C 6.D 7.B 8.D 9.D 10.A 11.B
12.A 13.D 14.B 15.A 16.B 17.C 18.C 19.C 20.D 21.D 22.D

III. MCQs with one or more than one correct answers

I) 1.A,C

IV. Assertion and Resoning :

1.C 2.C 3.A 4.A

III. Match the following :

1. C

V. Comprehensive type:

1) a)A b)D c)D 2.a)B b)A

VI. Researchers:

1.4 2.2 3.2 4.1 5.4 6.1 7.4
8.1 9.1 10.3 11.3 12.4