5. TRIGNOMETRIC RATIOS UPTO MAX MIN VALUES

TRIGONOMETRIC RATIOS

1. If sin 2θ and cos2θ are solutions of $x^2+bx-c=0$, then

[TS 6th MAY 2020_SHIFT–1]

1. $b^2+2c+1=0$ 2. $b^2+2c-1=0$
3. $b^2-2c+1=0$ 4. $b^2-2c-1=0$

2. If cotθ+tanθ=3, and $1-\cos^2\theta-\alpha\cos\theta=0$, then

[TS 6th MAY 2020_SHIFT–1]

1. $6\alpha^2(9-\alpha^2)=1$ 2. $6\alpha^2(\alpha^2-9)=1$
3. $9\alpha^2(6-\alpha^2)=1$ 4. $9\alpha^2(\alpha^2-6)=1$

3. If $\sin(\theta)+\operatorname{cosec}(\theta)=2$,then $\sin^{2020}(\theta)+\operatorname{cosec}^{2020}(\theta)=$ ___

[AP EAMCET 17-09-20_Shift-1]

1. 2^{2020} 2. 2020.2^{2019}
3. 2^{2019} 4. 2

4. If $\sec\theta=m, \tan\theta=n$, then $\frac{1}{m}\left[m+n+\frac{1}{m+n}\right]=$

[AP EAMCET 17-09-20_Shift-2]

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

5. In triangle ABC, $\frac{\tan A}{2}=\frac{\tan B}{3}=\frac{\tan C}{4}$ then the value of $\sec^2 A+\sec^2 B+\sec^2 C=$

[AP EAMCET 18-09-20_Shift-1]

1. $\frac{101}{8}$ 2. $\frac{111}{8}$
3. $\frac{121}{8}$ 4. $\frac{91}{8}$

6. If $4\cos x+3\sin x=5$, then find the value of $\tan x=$ **[AP EAMCET 18-09-20_Shift-1]**

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

7. The value of $(\sin 210^0)(\sin 585^0)$ is

[AP EAMCET 18-09-20_Shift-2]

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

8. Geometric mean of $\tan 1^0, \tan 2^0, \ldots, \tan 89^0$ is

[AP EAMCET 18-09-20_Shift-2]

1. $\frac{1}{89}$ 2. 1
3. $\frac{1}{3}$ 4. $\sqrt{3}$

9. $\sin(\frac{5\pi}{3})+\sec(\frac{13\pi}{3})=$

[AP EAMCET 21-09-20_Shift-1]

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

10. If $x\neq 0$, then

$$\frac{\sin(\pi+x)\cos(\frac{\pi}{2}+x)\tan(\frac{3\pi}{2}-x)\cot(2\pi-x)}{\sin(2\pi-x)\cos(2\pi+x)\operatorname{cosec}(-x)\sin(\frac{3\pi}{2}+x)}=$$

[AP EAMCET 21-09-20_Shift-1]

1. 0 2. -1
3. 1 4. 2

11. $\tan\left(-\frac{23\pi}{3}\right)-\cot\left(\theta-\frac{13\pi}{3}\right)=$

[AP EAMCET 21-09-20_Shift-1]

1. $\sqrt{3}+\cot\theta$ 2. $\sqrt{3}-\tan(\frac{\pi}{6}+\theta)$
3. $\sqrt{3}+\tan\theta$ 4. $\sqrt{3}+\cot(\frac{\pi}{3}-\theta)$

12. If $\frac{x}{\cos\alpha}=\frac{y}{\cos\left(\frac{2\pi}{3}-\alpha\right)}=\frac{z}{\cos\left(\frac{2\pi}{3}+\alpha\right)}$ then the value of (x+y+z) is equal to

[AP EAMCET 22-09-20_Shift-1]

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

13. If $\sec\theta+\tan\theta=\frac{2}{3}$, then in which the quadrant does θ lie in?

[AP EAMCET 22-09-20_Shift-2]

1. I 2. II
3. III 4. IV

14. If $\operatorname{cosec}\theta+\cot\theta=\frac{1}{3}$, then θ lies in the

[AP EAMCET 23-09-20_Shift-1]

1. 1st quadrant 2. 2nd quadrant
3. 3rd quadrant 4. 4th quadrant

15. $\dfrac{\tan 52^0 - \tan 38^0}{\tan 14^0} =$

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

16. $\cos^2\left(\dfrac{7\pi}{8}\right)+\cos^2\left(\dfrac{5\pi}{8}\right)+\cos^2\left(\dfrac{3\pi}{8}\right)$

$+\cos^2\left(\dfrac{\pi}{8}\right)=$

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

17. If θ is the angle of a pentagon, then

$\left|(\sin\theta)\hat{i}+(\cos\theta)\hat{j}+(\tan\theta)\hat{k}\right|=$

1. $|\sec 18|$
2. $|co\sec 18|$
3. $-\sec 18$
4. $co\sec 108$

18. If $A=\sin\theta|\sin\theta|, B=\cos|\cos\theta|$ and

$\dfrac{99\pi}{2}\le\theta\le\dfrac{100\pi}{2}$, then

[TS EAMCET 09-09-20_Shift-1]

1. $A+B=1$
2. $A+B=-1$
3. $B-A=1$
4. $B-A=-1$

19. $\sin^4\dfrac{\pi}{8}+\cos^4\dfrac{3\pi}{8}-\sin^4\dfrac{3\pi}{8}+\sin^4\dfrac{5\pi}{8}+\cos^4\dfrac{7\pi}{8}-\sin^4\dfrac{7\pi}{8}=$

[TS EAMCET 10-09-20_Shift-1]

1. $\dfrac{1}{4}$
2. $\dfrac{1}{2}$
3. 0
4. $\dfrac{3}{4}$

20. If $\alpha=\dfrac{\sin^3 x}{\cos^2 x}, \beta=\dfrac{\cos^3 x}{\sin^2 x}$ *and* $\sin x+\cos x=k$,

then $\alpha\sin x+\beta\cos x+3=$

[TS EAMCET 11-09-20_Shift-1]

1. $\dfrac{2}{(k^2-1)^2}$
2. $\dfrac{4}{(k^2-1)^2}$
3. $\dfrac{k^2-1}{2}$
4. $\dfrac{(k^2-1)^2}{4}$

21. What is the value of $\cos\left(22\dfrac{1}{2}\right)^0=$

[AP EAMCET 20-08-2021_Shift-1]

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

22. If $\cos\theta=-\dfrac{\sqrt{3}}{2}$ and $\sin\alpha=\dfrac{-3}{5}$ where 'θ' does not lie in the third quadrant , then the value of $\dfrac{2\tan\alpha+\sqrt{3}\tan\theta}{\cot^2\theta+\cos\alpha}$ is equal to

[AP EAMCET 20-08-2021_Shift-1]

1. $\dfrac{7}{22}$
2. $\dfrac{5}{22}$
3. $\dfrac{9}{22}$
4. $\dfrac{22}{5}$

23. Let θ be an angle in the standard position such that the point $(-5,12)$ lies on its terminal side, then **[AP EAMCET 20-08-2021_Shift-2]**

1. $|\sin\theta|=-\sin\theta$
2. $|\cos\theta|=\cos\theta$
3. $|\tan\theta|=-\tan\theta$
4. $|cosec\theta|=-cosec\theta$

24. Determine the value of 'a' in

$\tan 70°-\tan 20°=a.\tan 50°$?

[AP EAMCET 23-08-2021_Shift-1]

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

25. $\sin^2 5°+\sin^2 10°+\sin^2 15°+...+\sin^2 90°=$

[AP EAMCET 23-08-2021_Shift-1]

1. $8\dfrac{1}{2}$
2. 9
3. $9\dfrac{1}{2}$
4. $4\dfrac{1}{2}$

26. If $\sin\theta+\csc\theta=2$, then the value of

$\sin^{10}\theta+\csc^{10}\theta=$

[AP EAMCET 24-08-2021_Shift-2]

1. 2
2. 2^{10}
3. 2^9
4. 2^8

27. Given $\frac{\sin 1^\circ}{\sin x^\circ \sin(x+1)^\circ} = \cot x^\circ - \cot(x+1)^\circ$, then the value of $\frac{1}{\sin 45^\circ \sin 46^\circ} + \frac{1}{\sin 46^\circ \sin 47^\circ} + \ldots + \frac{1}{\sin 89^\circ \sin 90^\circ}$ is

[AP EAMCET 24-08-2021_Shift-2]

1. $\sin 1^\circ$
2. $\cot 1^\circ$
3. $-\cot 1^\circ$
4. $\operatorname{cosec} 1^\circ$

28. $(1-\tan 348^\circ)(1+\cot 417^\circ) =$

[AP EAMCET 25-08-2021_Shift-2]

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

29. If $0 < \theta < \frac{\pi}{2}$ and $\sin\theta\cos\theta = \frac{12}{25}$ then $\sin^4\theta + \cos^4\theta =$

[AP EAMCET 25-08-2021_Shift-2]

1. $\frac{327}{625}$
2. $\frac{337}{625}$
3. $\frac{347}{625}$
4. $\frac{340}{625}$

30. The value of $(1-\cos\theta)(1+\cos\theta)(1+\cot^2\theta)$ when $\theta = \frac{\pi}{15}$ is

[TS EAMCET 04-08-2021_Shift-2]

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

31. $\cot\frac{\pi}{16}.\cot\frac{2\pi}{16}.\cot\frac{3\pi}{16}.\cot\frac{4\pi}{16}.\cot\frac{5\pi}{16}.\cot\frac{6\pi}{16}.\cot\frac{7\pi}{16} =$

[TS EAMCET 04-08-2021_Shift-1]

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

32. $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) =$

[TS EAMCET 05-08-2021_Shift-1]

1. -1
2. 1
3. 0
4. 12

33. $\left(\frac{\sin 35^0}{\cos 55^0}\right)^2 + \left(\frac{\cos 55^0}{\sin 35^0}\right)^2 - 2\cos 30^0 =$

[TS EAMCET 05-08-2021_Shift-1]

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

34. If $\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha} = x$; then $\frac{1-\cos\alpha-\sin\alpha}{\cos\alpha} =$

[TS EAMCET 05-08-2021_Shift-2]

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

35. $\cos^4\frac{\pi}{8} + \cos^4\frac{2\pi}{8} + \cos^4\frac{3\pi}{8} + \cos^4\frac{4\pi}{8} + \cos^4\frac{5\pi}{8} + \cos^4\frac{6\pi}{8} + \cos^4\frac{7\pi}{8} + \cos^4\frac{8\pi}{8} =$

[TS EAMCET 06-08-2021_Shift-2]

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

36. If $(1+\tan 1^o)(1+\tan 2^o)\ldots(1+\tan 45^o) = 2^n$, then n = **[AP EAMCET 04-07-2022_Shift-1]**

1. 0
2. 32
3. 23
4. 2

37. $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1-\cot\theta} =$

[AP EAMCET 04-07-2022_Shift-1]

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

38. If A+B+C=π ,cos B=cos Acos C,then tan A tan C=

[AP EAMCET 04-07-2022_Shift-2]

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

39. $1+\sec^2 x\sin^2 x =$

[AP EAMCET 04-07-2022_Shift-2]

1. sin 2x
2. $\sin^2 x$
3. $\tan^2 x$
4. $\sec^2 x$

40. $\frac{1}{\sin 1^0 \sin 2^0}+\frac{1}{\sin 2^0 \sin 3^0}+...+\frac{1}{\sin 89^0 \sin 90^0}=$

[AP EAMCET 05-07-2022_Shift-1]

1. $\frac{\cos 1^0}{\sin 1^0}$
2. $\frac{\cos 1^0}{\sin^2 1^0}$
3. $\frac{\sin 1^0}{\cos 1^0}$
4. $\frac{\sin^2 1^0}{\cos 1^0}$

41. Which of the following trigonometric values are negative?

[AP EAMCET 05-07-2022_Shift-1]

I) $\sin(-292^0)$ II) $\tan(-103^0)$

III) $\cos(-207^0)$ IV) $\cot(-222^0)$

1. II, III and IV
2. III only
3. I and III
4. II and III

42. If $\sin\theta+\cos ec\theta=4$, then $\sin^2\theta+\cos ec^2\theta=$

[AP EAMCET 05-07-2022_Shift-1]

1. 12
2. 18
3. 16
4. 14

43. A true statement among the following identities is

[AP EAMCET 05-07-2022_Shift-2]

1. $\cos 5\theta=16\cos^5\theta-20\cos^3\theta-5\cos\theta$
2. $\cos 5\theta=20\cos^3\theta-16\cos^5\theta+5\cos\theta$
3. $\cos 5\theta=16\cos^5\theta+20\cos^3\theta-5\cos\theta$
4. $\cos 5\theta=16\cos^5\theta-20\cos^3\theta+5\cos\theta$

44. If

$\cos\theta-\sin\theta=\sqrt{5}\sin\theta,$

then $\cos\theta+4\sin\theta=$

[AP EAMCET 05-07-2022_Shift-2]

1. $5\cos\theta$
2. $\sqrt{5}\sin\theta$
3. $5\sin\theta$
4. $\sqrt{5}\cos\theta$

45. Let a and b be non – negative real numbers. If $\sin x+a\cos x=b$, *then* $|a\sin x-\cos x|=$

[AP EAMCET 06-07-2022_Shift-1]

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

46. $\sqrt{\sin^4 x+4\cos^2 x}-\sqrt{\cos^4 x+4\sin^2 x}=$

[AP EAMCET 06-07-2022_Shift-1]

1. $1-\cos 2x$
2. tan2x
3. $\sin 2x$
4. $\cos 2x$

47. $\frac{1}{1+\sin\theta}+\frac{1}{1-\sin\theta}=$

[AP EAMCET 06-07-2022_Shift-2]

1. $2\cos^2\theta$
2. $-2\cos^2\theta$
3. $2\tan^2\theta$
4. $2\sec^2\theta$

48. $\frac{\cos x}{1+\sin x}+\tan x=$

[AP EAMCET 06-07-2022_Shift-2]

1. 1
2. Cos x + sin x
3. Sin^2 x
4. Sec x

49. $1+\cot^2 30^o-\sec^2 45^0=$

[AP EAMCET 07-07-2022_Shift-1]

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

50. $\frac{1}{\sin 45^0 \sin 46^0}+\frac{1}{\sin 47^0 \sin 48^0}+..........+\frac{1}{\sin 133^0 \sin 134^0}=\frac{1}{\sin(n^0)}$

Is **[AP EAMCET 07-07-2022_Shift-1]**

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

51. $\frac{\sin x}{1+\cos x}+\frac{1+\cos x}{\sin x}=$

[AP EAMCET 07-07-2022_Shift-2]

1. 2sec x
2. 2cosec x
3. tan 2x
4. sin 2x

52. $2\cot^2\theta-\cot\theta-3=$

[AP EAMCET 07-07-2022_Shift-2]

1. $(2\cot\theta-3)(\cot\theta+1)$
2. $(2\cot\theta-1)(\cot\theta+3)$
3. $(2\cot\theta+3)(\cot\theta-1)$
4. $(2\cot\theta+1)(\cot\theta-3)$

53. $\cos\theta(\cos ec\theta-\sec\theta)-\cot\theta=$

[AP EAMCET 07-07-2022_Shift-2]

1. -1
2. 1
3. 0
4. $\cos^2\theta-\tan^2\theta$

54. $\tan x+\dfrac{\cos x}{1+\sin x}=$

[AP EAMCET 08-07-2022_Shift-2]

1. $\tan 2x$
2. $\operatorname{cosec} x$
3. $\sec x$
4. $\cos 2x$

55. If tan 15° and tan 30° are the roots of the equation $x^2+px+q=0$, then pq =

[TS EAMCET 18-07-2022_Shift-2]

1. $\dfrac{6\sqrt{3}+10}{\sqrt{3}}$
2. $\dfrac{10-6\sqrt{3}}{3}$
3. $\dfrac{10+6\sqrt{3}}{3}$
4. $\dfrac{10-6\sqrt{3}}{\sqrt{3}}$

56. If $\dfrac{1}{\sin 45^\circ \sin 46^\circ}+\dfrac{1}{\sin 46^\circ \sin 47^\circ}+....$upto 45 terms $=\dfrac{1}{\sin x^\circ}$, then $\sin\left(\dfrac{\pi}{2}x\right)=$

[TS EAMCET 19-07-2022_Shift-I]

1. 0
2. sin 1
3. 1
4. cos 1

57. If Sin A = $\dfrac{-7}{25}$, cos B = $\dfrac{8}{17}$, A does not lie in the 3rd quadrant and B does not lie in the 1st quadrant, then 8 tan A – 5 cot B =

[TS EAMCET 20-07-2022_Shift-2]

1. 0
2. $\dfrac{1}{3}$
3. $\dfrac{1}{2}$
4. 1

58. $\sin 21^\circ \cos 9^\circ - \cos 84^\circ \cos 6^\circ =$

[15th May 2023 Shift 1]

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

59. If $1+\sqrt{1+a}=\left(1+\sqrt{1-a}\right)\cot\alpha$ and 0 < a < 1, then $\sin\ 4\alpha =$

[15th May 2023 Shift 1]

1. A
2. 2a
3. 3a
4. 4a

60. If $A=\dfrac{\pi}{24}$, then $\dfrac{\cos A+\cos 3A+\cos 5A+\cos 7A}{\sin A+\sin 3A+\sin 5A+\sin 7A}=$

[15th May 2023 Shift 1]

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

61. If $\sec(\theta+\alpha)$, $\sec\theta$ and $\sec(\theta-\alpha)$ are in arithmetic progression, then $\sin^2\theta =$

[15th May 2023 Shift 1]

1. $\cos\alpha$
2. $2\cos\alpha$
3. $-2\cos\alpha$
4. $-\cos\alpha$

62. If $\cos\alpha+\cos\beta=a$ and $\sin\alpha+\sin\beta=b$, then match the items given in List-A with those of their values in List-B.

[15th May 2023 Shift 1]

(I)	$\tan\left(\dfrac{\alpha+\beta}{2}\right)=$	(a)	$\dfrac{b}{a}$
(II)	$\cos(\alpha+\beta)=$	(b)	$\dfrac{2ab}{a^2+b^2}$
(III)	$\sin(\alpha+\beta)=$	(c)	$\dfrac{2ab}{a^2-b^2}$
(IV)	$\tan(\alpha+\beta)=$	(d)	$\dfrac{a^2-b^2}{a^2+b^2}$
		(e)	$\dfrac{a^2+b^2}{a^2-b^2}$

1. (I)→(a) (II) →(e) (III) →(d) (IV)→(c)
2. (I)→(a) (II) →(c) (III) →(b) (IV)→(e)
3. (I)→(a) (II) →(d) (III) →(c) (IV)→(b)
4. (I)→(a) (II) →(d) (III) →(b) (IV)→(c)

63. If tan A+ tan B= x and cot A+ cot B=y, then tan (A+B)=

[15th May 2023 Shift 2]

1. $\dfrac{xy}{x-y}$
2. $\dfrac{xy}{y-x}$
3. $\dfrac{xy}{x+y}$
4. $\dfrac{x-y}{xy}$

64. If $\left[1-\cos\left(\frac{\pi}{2}+\alpha\right)+\sin\left(\frac{3\pi}{2}+\alpha\right)\right]^2+\left[1-\sin\left(\frac{3\pi}{2}-\alpha\right)-\cos\left(\frac{3\pi}{2}+\alpha\right)\right]^2$
$=a+b\sin^2\left(\frac{\pi}{4}+\alpha\right)$

then $a^2+b^2=$ **[15th May 2023 Shift 2]**

1. 20
2. 52
3. 40
4. 32

65. $\frac{\cot A}{1-\tan A}+\frac{\tan A}{1-\cot A}=$

[16th May 2023 Shift 2]

1. tan A+ cot A
2. sec A + cosec A
3. Sin A cos A+1
4. Sec A cosec A+1

66. $\frac{\tan A}{1-\cot A}+\frac{\cot A}{1-\tan A}=$

[17th May 2023 Shift 1]

1. $\sec A \operatorname{cosec} A-1$
2. $\tan A+\cot A$
3. $\tan A+\cot A+1$
4. $\sec A+\operatorname{cosec} A+1$

67. If $10\sin^4\alpha+15\cos^4\alpha=6$, then
$16\tan^6\alpha+27\cot^6\alpha=$

[17th May 2023 Shift 2]

1. 43
2. 54
3. 62
4. 59

68. $\sum_{k=0}^{4}\sin^2(2k+1)\frac{\pi}{20}=$ **[18th May2023 shift -1]**

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

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

[18th May2023 shift -1]

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

70. If $f_n(x)=\frac{1}{2n}[\sin^{2n}x+\cos^{2n}x]$, then
$f_1(x)+f_2(x)-f_3(x)=$ **[18th May 2023 Shift 2]**

1. 0
2. $\frac{5}{12}$
3. $\frac{11}{12}$
4. $\frac{7}{12}$

71. Match the items of List – A with those of the entries of List – B **[19th May 2023 Shift 1]**

List - A List - B

List – A	List –B
(I) $\sin^2 5^\circ+\sin^2 10^\circ+\sin^2 15^\circ+....+\sin^2 90^\circ=$	(A) 0
(II) $\tan^2 5^\circ.\tan^2 10^\circ.\tan^2 15^\circ....\tan^2 85^\circ=$	(B) $\frac{19}{2}$
(III) $\cos^2 5^\circ+\cos^2 10^\circ+\cos^2 15^\circ+.....+\cos^2 180^\circ=$	(C) 18
(IV) $\cot 5^\circ+\cot 10^\circ+\cot 15^\circ+.....+\cot 175^\circ=$	(D)1
	(E) –1

1. $(I)\rightarrow(B),(II)\rightarrow(D),(III)\rightarrow(C),(IV)\rightarrow(A)$
2. $(I)\rightarrow(B),(II)\rightarrow(E),(III)\rightarrow(A),(IV)\rightarrow(C)$
3. $(I)\rightarrow(B),(II)\rightarrow(C),(III)\rightarrow(A),(IV)\rightarrow(D)$
4. $(I)\rightarrow(C),(II)\rightarrow(B),(III)\rightarrow(D),(IV)\rightarrow(E)$

72. $\sin\alpha+\cos\alpha=m\Rightarrow\sin^6\alpha+\cos^6\alpha=$

[12TH MAY 2023 SHIFT-1]

1. $\frac{4+3(m^2-1)^2}{4}$
2. $\frac{4-3(m^2-1)^2}{4}$
3. $\frac{3+4(m^2-1)^2}{4}$
4. $\frac{4-3(m^2+1)^2}{4}$

73. If $\frac{2\sin\theta}{1+\cos\theta+\sin\theta}=y$, then $\frac{1-\cos\theta+\sin\theta}{1+\sin\theta}=$

[12TH MAY 2023 SHIFT -2]

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

74. If $\cot\theta=-\frac{2}{3}$ and θ does not lie in the 4th quadrant , then $\frac{(5\sin\theta+\cos\theta)^2}{\tan\theta+\cot\theta}=$

[13TH MAY 2023 SHIFT-1]

1. -13
2. -6
3. $-\frac{1734}{169}$
4. 13

KEY

1)	2	2)	3	3)	4	4)	2	5)	2
6)	1	7)	1	8)	2	9)	1	10)	3
11)	4	12)	2	13)	4	14)	2	15)	2
16)	3	17)	2	18)	3	19)	4	20)	2
21)	2	22)	2	23)	3	24)	4	25)	3
26)	1	27)	4	28)	2	29)	2	30)	1
31)	2	32)	1	33)	2	34)	2	35)	1
36)	3	37)	3	38)	3	39)	4	40)	2
41)	4	42)	4	43)	4	44)	4	45)	1
46)	4	47)	4	48)	4	49)	3	50)	1
51)	2	52)	1	53)	1	54)	3	55)	2
56)	3	57)	2	58)	2	59)	1	60)	1
61)	4	62)	4	63)	2	64)	2	65)	2
66)	3	67)	3	68)	2	69)	1	70)	4
71)	1	72)	2	73)	1	74)	2		

COMPOUND ANGLES

1. Let α, β, and γ be such that $0 < \alpha < \beta < \gamma < 2\pi$. For any $x \in \mathbb{R}$ if $\cos(x+\alpha)+\cos(x+\beta)+\cos(x+\gamma)=0$, then $\tan(\gamma-\alpha)=$ **[TS 22APR_2020_SHIFT_1]**

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

2. If ABC is not a right angled triangle and $\sin\left(\frac{\pi}{4}-A\right)\sin\left(\frac{\pi}{4}-B\right)=-\frac{1}{2\sqrt{2}}\operatorname{cosec}\left(\frac{\pi}{4}-C\right)$, then $\tan A\tan B+\tan B\tan C+\tan C\tan A=$ **[TS 22APR_2020_SHIFT_1]**

   1. $\cot A+\cot B+\cot C$
   2. $\tan A+\tan B+\tan C$
   3. $\dfrac{1}{\tan A+\tan B+\tan C}$
   4. $\dfrac{1}{\cot A+\cot B+\cot C}$

3. $\cos^2(x)+\cos^2\left(x+\frac{\pi}{3}\right)+\cos^2\left(x-\frac{\pi}{3}\right)=$ **[AP EAMCET 17-09-20_Shift-1]**

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

4. $\dfrac{\sqrt{3}\sin(\theta)+\cos(\theta)}{\sin\left(\theta+\frac{\pi}{6}\right)}=$ **[AP EAMCET 18-09-20_Shift-2]**

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

5. If $\tan\alpha = 2\sin\beta\sin\gamma\operatorname{cosec}(\beta+\gamma)$, then **[TS EAMCET 09-09-20_Shift-2]**

   1. $\cot\beta, \cot\alpha, \cot\gamma$ are in harmonic progression
   2. $\tan\gamma, \tan\alpha, \tan\beta$ are in harmonic progression
   3. $\cot\alpha, \cot\beta, \cot\gamma$ are in arithmetic progression
   4. $\tan\alpha, \tan\beta, \tan\gamma$ are in arithmetic progression

6. **Assertion (A):** If $A=15^0, B=17^0$ *and* $C=13^0$ Then $\cot 2A+\cot 2B+\cot 2C=\cot 2A\cot 2B\cot 2C$
   Reason(R): In a ΔPQR,
   $Tan\frac{P}{2}Tan\frac{Q}{2}+Tan\frac{Q}{2}Tan\frac{R}{2}+Tan\frac{P}{2}Tan\frac{R}{2}=1$
   The correct option among the following is **[TS EAMCET 10-09-20_Shift-1]**

   1. (A) is true,(R) is true and(R) is the correct explanation for (A)
   2. (A) is true,(R) is true but(R) is not the correct explanation for (A)
   3. (A) is true but (R) is false
   4. (A) is false but (R) is true

7. In a triangle ABC, if $\cos A\cos B+\sin A\sin B\sin C=1$ then $a:b:c$ **[TS EAMCET 10-09-20_Shift-1]**

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

8. If A does not belong to the first quadrant, B does not belong to the second quadrant, $\sin A=\frac{11}{61}$ *and* $\cos B=\frac{-7}{25}$, then $A-B$ *and* $A+B$ lie respectively in the quadrants **[TS EAMCET 10-09-20_Shift-2]**

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

9. In a triangle ABC, if $3\sin A + 4\cos B = 6$ and $4\sin B + 3\cos A = 1$, then $\sin(A+B)$ is equal to

[AP EAMCET 19-08-2021_Shift-2]

1. 1
2. $\frac{1}{2}$
3. 0
4. $\cos C$

10. If $f(x) = \frac{\cot x}{1+\cot x}$ and $\alpha + \beta = \frac{5\pi}{4}$ then the value of $f(\alpha)f(\beta) =$

[AP EAMCET 19-08-2021_Shift-2]

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

11. If $x\cos\theta = y\cos\left(\theta + \frac{2\pi}{3}\right) = z\cos\left(\theta + \frac{4\pi}{3}\right)$ then $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} =$

[AP EAMCET 23-08-2021_Shift-1]

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

12. If $\cos\frac{\pi}{4}\cos\frac{\pi}{8}\cos\frac{\pi}{16}\cos\frac{\pi}{32} = 2^m \operatorname{cosec}\frac{\pi}{n}$ then $m+n=$

[AP EAMCET 20-08-2021_Shift-2]

1. 27
2. 25
3. 28
4. 29

13. $\sin\frac{2\pi}{5} + \sin\frac{4\pi}{5} + \sin\frac{6\pi}{5} + \sin\frac{8\pi}{5} =$

[AP EAMCET 23-08-2021_Shift-1]

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

14. $\sin\frac{\pi}{16}\sin\frac{3\pi}{16}\sin\frac{5\pi}{16}\sin\frac{7\pi}{16} =$

[AP EAMCET 24-08-2021_Shift-2]

1. $\frac{\sqrt{2}}{16}$
2. $\frac{1}{8}$
3. $\frac{1}{16}$
4. $\frac{\sqrt{2}}{32}$

15. $\cos^2 10° + \cos^2 50° - \sin 40° \sin 80° =$

[AP EAMCET 24-08-2021_Shift-1]

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

16. If $\alpha + \beta = \gamma$ then what is the values of $\cos^2\alpha + \cos^2\beta + \cos^2\gamma =$

[AP EAMCET 24-08-2021_Shift-1]

1. $1 + 2\cos^3\alpha\cos^3\beta\cos^3\gamma$
2. $1 + 2\cos^2\alpha\cos^2\beta\cos^2\gamma$
3. $1 + 2\cos\alpha\cos\beta\cos\gamma$
4. $1 + 4\cos\alpha\cos\beta\cos\gamma$

17. $\frac{\cot^2 15^0 - 1}{\cot^2 15^0 + 1} =$

[TS EAMCET 05-08-2021_Shift-2]

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

18. Let ACB be a triangle with right-angle at C. let AB = 29 units, BC = 21 units and $\angle ABC = \theta$. Then $\cos^2\theta - \sin^2\theta =$

[TS EAMCET 04-08-2021_Shift-1]

1. 1
2. $\frac{41}{841}$
3. $\frac{40}{441}$
4. $\frac{41}{800}$

19. $\sin 20^0 . \sin 40^0 . \sin 60^0 . \sin 80^0 =$

[TS EAMCET 06-08-2021_Shift-2]

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

20. $\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{6\pi}{7} + \cos\frac{7\pi}{7} =$

[TS EAMCET 06-08-2021_Shift-2]

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

21. If $\cot A = \frac{11}{60}, \cos B = \frac{7}{25}$ and neither A nor B in the first quadrant, then $\left(A+\frac{B}{2}\right)$ lies in the quadrant
[TS EAMCET 06-08-2021_Shift-1]
1. I
2. II
3. III
4. IV

22. $\sqrt{3}\operatorname{cosec}20^{\circ} - \sec 20^{\circ} =$
[TS EAMCET 06-08-2021_Shift-1]
1. 1
2. 2
3. 3
4. 4

23. The value of $\tan\left(\frac{7\pi}{8}\right)$ is
[AP EAMCET 04-07-2022_Shift-2]
1. $\sqrt{2}-1$
2. $1-\sqrt{2}$
3. $1+\sqrt{2}$
4. $\frac{1}{1+\sqrt{2}}$

24. $\sec^2 x + 5\tan x + 5 =$
[AP EAMCET 05-07-2022_Shift-2]
1. $(\tan x+2)(\tan x+3)$
2. $(\tan x+1)(\tan x+5)$
3. $(\tan x-2)(\tan x-3)$
4. $(\sin x+2)(\sin x+5)$

25. The value of $\cos^4 x$ *is*
[AP EAMCET 06-07-2022_Shift-1]
1. $\frac{3}{8}+\frac{1}{2}\cos 2x+\frac{1}{8}\cos 4x$
2. $\frac{3}{8}-\frac{1}{2}\cos 2x+\frac{1}{8}\cos 4x$
3. $\frac{3}{8}-\frac{1}{8}\cos 4x+\frac{1}{2}\cos 2x$
4. $\frac{1}{8}\cos 4x+\frac{1}{2}\cos 2x-\frac{3}{8}$

26. $\text{Sin } 22\frac{1}{2}^{0} =$
[AP EAMCET 06-07-2022_Shift-1]
1. $\sqrt{\frac{2+\sqrt{2}}{4}}$
2. $\frac{2+\sqrt{2}}{4}$
3. $\sqrt{\frac{2-\sqrt{2}}{4}}$
4. $\frac{2-\sqrt{2}}{4}$

27. $\text{Cos}^2 45^0+\cos^2 135^0+\cos^2 225^0+\cos^2 315^0=$
[AP EAMCET 06-07-2022_Shift-2]
1. 1
2. 2
3. 0
4. -1

28. $\sin(x+y)\sec x \sec y =$
[AP EAMCET 07-07-2022_Shift-1]
1. $\cos x\cos y$
2. $\tan x-\tan y$
3. $\cos x+\cos y$
4. $\tan x+\tan y$

29. In ΔABC, *if* $3\sin A+4\cos B=6$ and $4\sin B+3\cos A=1$, then the angle C is
[AP EAMCET 07-07-2022_Shift-1]
1. $\frac{\pi}{2}$
2. $\frac{\pi}{3}$
3. $\frac{\pi}{4}$
4. $\frac{\pi}{6}$

30. The value of $\sin\left(\frac{5\pi}{24}\right).\cos\left(\frac{\pi}{24}\right)$ is
[AP EAMCET 07-07-2022_Shift-2]
1. $\frac{1+\sqrt{2}}{4}$
2. $1+\sqrt{2}$
3. $\frac{1-\sqrt{2}}{4}$
4. $1-\sqrt{2}$

31. $\cos\frac{\pi}{12}$ **[AP EAMCET 08-07-2022_Shift-1]**
1. $\frac{\sqrt{2}-\sqrt{3}}{2}$
2. $\frac{\sqrt{2}+\sqrt{3}}{2}$
3. $\frac{\sqrt{2}-\sqrt{6}}{4}$
4. $\frac{\sqrt{2}+\sqrt{6}}{4}$

32. The value of $\cos\left(\frac{7\pi}{12}\right)$ is
[AP EAMCET 08-07-2022_Shift-1]
1. $\frac{\sqrt{2}+\sqrt{3}}{4}$
2. $\frac{\sqrt{2}-\sqrt{3}}{4}$
3. $\frac{\sqrt{2}-\sqrt{6}}{4}$
4. $\frac{\sqrt{2}+\sqrt{6}}{4}$

33. Let $\tan 30^0$ and $\tan 15^0$ be the roots of the quadratic equation $x^2+ax+b=0$, then 1+a-b =
[AP EAMCET 08-07-2022_Shift-2]
1. 0
2. 1
3. ab
4. a^2b^2

34. If $1-\cot 23^0 = \frac{x}{1-\cot 22^0}$, then x=

[AP EAMCET 08-07-2022_Shift-2]

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

35. If A and B (A > B) are acute angles, $\sin(A-B) = \frac{16}{65}$ and $\sin B = \frac{5}{13}$ then tan A + cot A = **[TS EAMCET 18-07-2022_Shift-1]**

1. $\frac{25}{12}$
2. $\frac{12}{25}$
3. $\frac{5}{12}$
4. $\frac{12}{5}$

36. If $\cos x + \cos y = p$, $\sin x + \sin y = q$, then $\cos\left(\frac{x-y}{2}\right)=$

[TS EAMCET 18-07-2022_Shift-2]

1. $\pm\frac{\sqrt{p^2+q^2}}{2}$
2. $\pm\frac{pq}{2}$
3. $\pm\left(\frac{p+q}{2}\right)$
4. $\pm\frac{\sqrt{p^2+q^2}}{4}$

37. If $\sin(A+B)\sin(A-B)+\cos(A+B)\cos(A-B)=\frac{1}{2}$ and $0 < B < \frac{\pi}{2}$, then B=

[TS EAMCET 20-07-2022_Shift-1]

1. $\frac{\pi}{6}$
2. $\frac{\pi}{4}$
3. $\frac{\pi}{3}$
4. $\frac{5\pi}{12}$

38. $\frac{1}{\cos 290^0} + \frac{1}{\sqrt{3}\sin 250^0} =$

[15th May 2023 Shift 2]

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

39. $In\,\Delta ABC$, if cos A cos B. cos C=$\frac{1}{5}$, then tan AtanB+tanB tanC + tan C tan A=

[16th May 2023 Shift 1]

1. 4
2. $\frac{11}{5}$
3. 6
4. $\frac{6}{5}$

40. *If* $\cos(\theta-\alpha), \cos\theta$ and $\cos(\theta+\alpha)$ are in harmonic progression, then $2\tan^2\theta =$

[16th May 2023 Shift 1]

1. $\tan^2\frac{\alpha}{2}-1$
2. $1+\tan^2\frac{\alpha}{2}$
3. $1+\cot^2\frac{\alpha}{2}$
4. $1-\cot^2\frac{\alpha}{2}$

41. If cos A + cos (A+B) + cos (A+2B)+ …upto n terms=$\cos\left(\frac{2A+(n-1)B}{2}\right)\sin\frac{nB}{2}\operatorname{cosec}\frac{B}{2}$. *then* $\cos\frac{\pi}{19}+\cos\frac{3\pi}{19}+....+\cos\frac{17\pi}{19}$

[16th May 2023 Shift 1]

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

42. In ΔABC, $(\cot A+\cot B)(\cot B+\cot C)(\cot C+\cot A)=$

[16th May 2023 Shift 2]

1. $\sec A \sec B \sec C$
2. $\tan A \tan B \tan C$
3. cosecA cosec Bcosec C
4. $\cot A \cot B \cot C$

43. If α, β are acute angles such that $\sin\beta = 2\sin\alpha$ *and* $3\cos\beta = 2\cos\alpha$, then $\sec(\alpha+\beta)=$ **[17th May 2023 Shift 1]**

1. 4
2. $\sqrt{15}$
3. $\sqrt{20}$
4. 5

44. If tan B$=\frac{2\sin A\sin C}{\sin(A+C)}$, then tan A, tan B and tan C are in [18th May2023 shift -1]

1.Arithmetic progression

2.Harmonic progression

3.Geometric progression

4.Arithmetic-geometric progression

45. If cosθ, sin θ and cot θ are in geometric progression, then $\sin^9\theta+\sin^6\theta+3\sin^5\theta+\sin^3\theta+\sin^2\theta=$ [18th May 2023 Shift 2]

1. 2 2. 7
3. 1 4. 5

46. If $P=\tan 15^\circ+\cot 15^\circ$, $Q=\tan 22\frac{1^\circ}{2}+\cot 22\frac{1^\circ}{2}$ *and* $R=\sin 54^\circ+\sin 18^\circ$, then their ascending order is [19th May 2023 Shift 1]

1. P, Q, R 2. P, R, Q
3. R, Q, P 4. R, P, Q

47. $\frac{(1+\tan 32^o)}{(1-\tan 148^o)}=$ [12TH MAY 2023 SHIFT-1]

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

KEY

1)	4	2)	2	3)	1	4)	3	5)	2
6)	1	7)	1	8)	3	9)	2	10)	4
11)	3	12)	3	13)	1	14)	1	15)	4
16)	3	17)	2	18)	2	19)	3	20)	4
21)	1	22)	4	23)	2	24)	1	25)	1
26)	3	27)	2	28)	4	29)	4	30)	1
31)	4	32)	3	33)	1	34)	2	35)	1
36)	1	37)	1	38)	2	39)	3	40)	1
41)	3	42)	3	43)	1	44)	2	45)	1
46)	3	47)	1						

MULTIPLE AND SUBMULTIPLE ANGLES

1. $\tan 9^0-\tan 27^0-\tan 63^0+\tan 81^0=$ [AP EAMCET 17-09-20_Shift-2]

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

2. If $\frac{1}{2}\left(\tan\left(\frac{\pi}{24}\right)+\cot\left(\frac{\pi}{24}\right)\right)=\sqrt{a^2+a}+\sqrt{a}$, then $a=$ [AP EAMCET 17-09-20_Shift-2]

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

3. $\frac{1-\cos(2x)+\sin(x)}{\sin(2x)+\cos(x)}=$ [AP EAMCET 18-09-20_Shift-1]

1. $\sin(x)$ 2. $\cos(x)$
3. $\tan(x)$ 4. $\operatorname{cosec}(x)$

4. The value of x in $\left(0,\frac{\pi}{2}\right)$ satisfying the equation $(\sin x)(\cos x)=\frac{1}{4}$ is [AP EAMCET 18-09-20_Shift-1]

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

5. If $\tan\left(\frac{x}{2}\right)=\frac{m}{n}$, then the value of msin(x) + ncos(x) is equal to [AP EAMCET 22-09-20_Shift-1]

1. m 2. -m
3. -n 4. n

6. If $\sin A+\sin B=\frac{1}{2}$ and $\cos A+\cos B=1$, then $\sin\left(\frac{A-B}{2}\right)$ equals [AP EAMCET 22-09-20_Shift-1]

1. $\pm\frac{\sqrt{13}}{4}$ 2. $\pm\frac{\sqrt{11}}{4}$
3. $\pm\frac{\sqrt{7}}{4}$ 4. $\pm\frac{\sqrt{17}}{4}$

7. If $\cos(\theta_1)+\cos(\theta_2)+\cos(\theta_3)+\cos(\theta_4)=-4$, then the value of $\cot\left(\frac{\theta_1}{2}\right)+\cot\left(\frac{\theta_2}{2}\right)+\cot\left(\frac{\theta_3}{2}\right)+\cot\left(\frac{\theta_4}{2}\right)=$

[AP EAMCET 23-09-20_Shift-1]

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

8. $\tan\left(\frac{3\pi}{16}\right)+\cot\left(\frac{3\pi}{16}\right)=$

1. $\sqrt{\sqrt{2}-1}$ 2. $2\sqrt{\sqrt{2}-1}$
3. $2^{3/4}\sqrt{\sqrt{2}-1}$ 4. $2^{\frac{7}{4}}\sqrt{\sqrt{2}-1}$

9. If α is a root of the equation $25\cos^2\theta+5\cos\theta-12=0$, for $\frac{\pi}{2}<\alpha<\pi$, then $\sin 2\alpha=$

[TS EAMCET 09-09-20_Shift-2]

1. $\frac{-3}{5}$ 2. $\frac{-24}{25}$
3. $\frac{-4}{25}$ 4. $\frac{-13}{18}$

10. $\operatorname{cosec}^{-1}\left(\left[\frac{\tan^2\left(\frac{\alpha-\pi}{4}\right)-1}{\tan^2\left(\frac{\alpha-\pi}{4}\right)+1}+\cos\frac{\alpha}{2}.\cot 5\alpha\right]\sec\frac{11\alpha}{2}\right)=$

[TS EAMCET 10-09-20_Shift-1]

1. 2α 2. 5α
3. $\frac{\pi}{2}-4\alpha$ 4. $\frac{5}{2}\alpha$

11. $\operatorname{Tan}2\alpha.\operatorname{Tan}(30^0-\alpha)+\operatorname{Tan}2\alpha.\operatorname{Tan}(60^0-\alpha)+\operatorname{Tan}(60^0-\alpha).\operatorname{Tan}(30^0-\alpha)$ is equal to

[AP EAMCET 19-08-2021_Shift-1]

1. $\tan 3\alpha$ 2. $\tan^2 2\alpha-\tan^2 60^0$
3. 1 4. 0

12. $\tan\alpha+2\tan 2\alpha+4\tan 4\alpha+8\cot 8\alpha=$

[AP EAMCET 19-08-2021_Shift-2]

1. $\tan 16\alpha$ 2. 0
3. $\cot\alpha$ 4. $\tan\alpha$

13. In a triangle ABC, suppose none of the angles are multiples of $\frac{\pi}{2}$, then what is the value $\cot A\cot B+\cot B\cot C+\cot A\cot C=$

[AP EAMCET 25-08-2021_Shift-1]

1. ∞ 2. 1
3. -1 4. 0

14. If $\alpha=\frac{180^\circ}{7}$, then $3\sin\alpha-4\sin^3\alpha$ is equal to

1. $\cot 4\alpha$ 2. $\sin 4\alpha$
3. $\cos 3\alpha$ 4. 0

15. In a triangle ΔABC, if $\tan(A/2),\tan(B/2),\tan(C/2)$ are in Arithmetic progression, then which of the following option is always correct?

[AP EAMCET 25-08-2021_Shift-2]

1. cos A, cos B, cos C are in Arithmetic Progression
2. cos A, cos B, cos C are in Geometric Progression
3. cos A, cos B, cos C are in Harmonic Progression
4. No conclusion can be made with given data

16. If $90^0<A<180^0$ and $\sin A=\frac{4}{5}$, then $\tan\frac{A}{2}=$

[TS EAMCET 04-08-2021_Shift-2]

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

17. If $\cos\theta=\frac{-3}{5}$ and $\pi<\theta<3\pi/2$, then $\tan\left(\frac{\theta}{2}\right)=$

[TS EAMCET 05-08-2021_Shift-1]

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

18. $\frac{1-\tan^2 15^0}{1+\tan^2 15^0}=$

[TS EAMCET 05-08-2021_Shift-1]

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

19. $\dfrac{1-\cos 2\theta+\sin 2\theta}{1+\cos 2\theta+\sin 2\theta}=$

[TS EAMCET 04-08-2021_Shift-1]

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

20. If A is not an integral multiple of $\frac{\pi}{2}$, then $\operatorname{cosec}2A+\cot 2A=$

[TS EAMCET 06-08-2021_Shift-2]

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

21. If the identity $\cos^4\theta=a\cos 4\theta+b\cos 2\theta+c$ holds for some a, b, c $\in Q$, then (a, b, c) =

[AP EAMCET 04-07-2022_Shift-1]

1. $\left(\frac{1}{8},\frac{3}{8},\frac{1}{2}\right)$
2. $\left(\frac{1}{8},\frac{1}{2},\frac{3}{8}\right)$
3. $\left(\frac{1}{2},\frac{1}{8},\frac{3}{8}\right)$
4. $\left(\frac{1}{2},\frac{3}{8},\frac{1}{8}\right)$

22. A true statement among the following identities is

[AP EAMCET 04-07-2022_Shift-2]

1. $\sin 5\theta=16\cos^4\theta\sin\theta-12\cos^2\theta\sin\theta+\sin\theta$
2. $\sin 5\theta=16\cos^4\theta-12\cos^2\theta+1$
3. $\sin 5\theta=16\cos^4\theta\sin\theta+12\cos^2\theta\sin\theta-\sin\theta$
4. $\sin 5\theta=16\cos^4\theta\sin\theta-12\cos^2\theta\sin\theta+\sin\theta$

23. In a triangle ABC, $\left(\tan\frac{A}{2}\tan\frac{B}{2}\tan\frac{C}{2}\right)^2\le$

[AP EAMCET 04-07-2022_Shift-2]

1. $\frac{1}{27}$
2. $\frac{1}{18}$
3. $\frac{1}{9}$
4. $\frac{1}{3}$

24. If $\sin^4\theta\cos^2\theta=\sum_{n=0}^{\infty}a_{2n}\cos 2n\theta$ then the least n for which $a_{2n}=0$ is

[AP EAMCET 05-07-2022_Shift-1]

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

25. If $\sin\theta=-\frac{3}{4}$, then $\sin 2\theta=$

[AP EAMCET 05-07-2022_Shift-1]

1. $\frac{3\sqrt{7}}{8}$
2. $-\frac{3\sqrt{7}}{8}$
3. $\frac{2\sqrt{3}}{7}$
4. $\frac{3\sqrt{7}}{8}$

26. $\sin^2\frac{2\pi}{3}+\cos^2\frac{5\pi}{6}-\tan^2\frac{3\pi}{4}=$

[AP EAMCET 05-07-2022_Shift-1]

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

27. In a triangle ABC, $\tan\frac{A}{2}\tan\frac{B}{2}+\tan\frac{B}{2}\tan\frac{C}{2}+\tan\frac{C}{2}\tan\frac{A}{2}=$

[AP EAMCET 05-07-2022_Shift-2]

1. 0
2. 1
3. $\frac{1}{2}$
4. π

28. If θ is any angle, then $\sin^2\theta\cos^2\theta=$

[AP EAMCET 06-07-2022_Shift-2]

1. 1-cos 2 θ
2. 1-cos4 θ
3. $\frac{1}{4}(1-\cos 4\theta)$
4. $\frac{1}{8}(1-\cos 4\theta)$

29. $(4\cos^2 9^0-3)(4\cos^2 27^0-3)=$

[AP EAMCET 06-07-2022_Shift-2]

1. Sin 9^0
2. cos 9^0
3. tan 9^0
4. cot 9^0

30. $\cos^4\frac{\pi}{24}-\sin^4\frac{\pi}{24}=$

[AP EAMCET 08-07-2022_Shift-1]

1. $\frac{\sqrt{2}-\sqrt{3}}{2}$
2. $\frac{\sqrt{2}+\sqrt{3}}{2}$
3. $\frac{\sqrt{2}-\sqrt{6}}{4}$
4. $\frac{\sqrt{2}+\sqrt{6}}{4}$

31. If $\tan A = \frac{2}{3}$, then $\sin 4A =$

[TS EAMCET 18-07-2022_Shift-1]

1. $\frac{8}{27}$
2. $\frac{120}{169}$
3. $\frac{144}{169}$
4. $\frac{16}{27}$

32. If $|\sin\alpha - \cos\alpha| = \frac{3}{4}$, then

$|\sec 2\alpha - \tan 2\alpha| =$

[TS EAMCET 19-07-2022_Shift-I]

1. $\frac{12}{17}$
2. $\frac{4}{\sqrt{23}}$
3. $\frac{3}{\sqrt{23}}$
4. $\frac{7}{\sqrt{23}}$

33. If θ does not lie in the second quadrant and

$\tan\theta = \frac{-3}{4}$ *then* $\tan\frac{\theta}{2} + \sin 2\theta =$

[TS EAMCET 19-07-2022_Shift-2]

1. $\frac{97}{75}$
2. $\frac{-97}{75}$
3. $\frac{-47}{75}$
4. $\frac{47}{75}$

34. $\frac{1}{\sin 250^o} + \frac{\sqrt{3}}{\cos 290^o} =$

[TS EAMCET 20-07-2022_Shift-1]

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

35. If $\sin\theta - \cos\theta = \frac{1}{\sqrt{3}}$, then

$\sin(2\theta) + \cos(4\theta) + \sin(6\theta) =$

[TS EAMCET 20-07-2022_Shift-2]

1. $\frac{37}{27}$
2. $\frac{-37}{27}$
3. $\frac{-43}{27}$
4. $\frac{43}{27}$

36. $Sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8} + \sin^4\frac{5\pi}{8} + \sin^4\frac{7\pi}{8}$

[16th May 2023 Shift 1]

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

37. If two angles α, β are such that

$0 < \alpha, \beta < \frac{\pi}{4}, \sqrt{1+\cos 2\alpha} = \frac{3}{\sqrt{5}}$

and $\sqrt{\frac{1-\cos 2\beta}{1+\cos 2\beta}} = \frac{1}{7}$, *then* $(2\alpha + \beta) =$

[16th May 2023 Shift 1]

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

38. If $\theta = \frac{\pi}{9}$, then

$1 + 27\tan^2\theta - 33\tan^4\theta + \tan^6\theta =$

[16th May 2023 Shift 2]

1. 3
2. 4
3. –3
4. –11

39. $\cot 18^\circ . \cot 36^\circ + 1 =$

[16th May 2023 Shift 2]

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

40. $\cos 12^0 . \cos 24^0 . \cos 36^0 . \cos 48^0 . \cos 72^0 . \cos 84^0 =$

[17th May 2023 Shift 1]

1. $\frac{1}{32}$
2. $\frac{1}{16}$
3. $\frac{1}{64}$
4. $\frac{1}{128}$

41. If $\sin\theta = \frac{3}{5}$ and θ is not in the first quadrant,

then $15\sin 2\theta - 20\cos 2\theta - 7\tan 2\theta =$

[17th May 2023 Shift 2]

1. –4
2. –12
3. 12
4. 4

42. $[1+\sec 2\theta][1+\sec 4\theta]=$

[17th May 2023 Shift 2]

1. $\tan\theta\tan4\theta$
2. $4\cot\theta\tan4\theta$
3. $\cot\theta\tan4\theta$
4. $4\tan\theta\tan4\theta$

43. $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{2\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)$
$\left(1+\cos\frac{4\pi}{8}\right)...\left(1+\cos\frac{7\pi}{8}\right)=$

[18th May 2023 Shift 2]

1. $\frac{1}{16}$
2. $\frac{1}{64}$
3. $\frac{3}{16}$
4. $\frac{3}{64}$

44. If $3\sin^4x+2\cos^4x=\frac{6}{5}$ and x is an acute angle, then tan 2x=

[18th May 2023 Shift 2]

1. $\frac{2\sqrt{6}}{5}$
2. $2\sqrt{6}$
3. $\frac{3\sqrt{2}}{5}$
4. $\frac{2\sqrt{3}}{5}$

45. $\cos\frac{\pi}{2^2}.\cos\frac{\pi}{2^3}.\cos\frac{\pi}{2^4}....\cos\frac{\pi}{2^{10}}=$

[19th May 2023 Shift 1]

1. $\frac{\sin\left(\frac{\pi}{2^{10}}\right)}{512}$
2. $\frac{\operatorname{cosec}\left(\frac{\pi}{2^{10}}\right)}{512}$
3. $\frac{\sin\left(\frac{\pi}{2^{10}}\right)}{1024}$
4. $\frac{\operatorname{cosec}\left(\frac{\pi}{2^{10}}\right)}{1024}$

46. If $\sin(\alpha+\beta)=5\sin(\alpha-\beta)$, then $\frac{\sin 2\beta}{5-\cos 2\beta}=$

[19th May 2023 Shift 1]

1. $\tan(\alpha+\beta)$
2. $\cot(\alpha+\beta)$
3. $\cot(\alpha-\beta)$
4. $\tan(\alpha-\beta)$

47. If $\cos A+\cos B+\cos C=0=\sin A+\sin B+\sin C$, then cos(A - B)=

[19th May 2023 Shift 1]

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

48. If $\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{4\pi}{7}=\frac{\sin\frac{8\pi}{7}}{8\sin\frac{\pi}{7}}$ then,

$\sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}=$

[12TH MAY 2023 SHIFT -2]

1. $\frac{1}{16}$
2. $\frac{1}{32}$
3. $\frac{1}{64}$
4. $\frac{1}{128}$

49. If $f(\theta)=\cos^3\theta+\cos^3\left(\frac{2\pi}{3}+\theta\right)+\cos^3\left(\theta-\frac{2\pi}{3}\right)$ then $f\left(\frac{\pi}{5}\right)=$

[12TH MAY 2023 SHIFT -2]

1. $\frac{-3\left(\sqrt{5}-1\right)}{16}$
2. $\frac{3\sqrt{10-2\sqrt{5}}}{8}$
3. $\frac{3\sqrt{10+2\sqrt{5}}}{8}$
4. $\frac{3\left(\sqrt{5}+1\right)}{16}$

50. If $540^0<\theta<630^0$ and $\tan\theta=\frac{5}{12}$, then $\frac{\cos\frac{\theta}{2}-5\sin\frac{\theta}{2}}{\sqrt{-(12\sec\theta+5\operatorname{cosec}\theta)}}=$

[13TH MAY 2023 SHIFT-1]

1. -26
2. 26
3. 1
4. -1

51. If $\cos\theta=\frac{-3}{5}$ and $\pi<\theta<\frac{3\pi}{2}$, then

$\operatorname{Tan}\frac{\theta}{2}+\sin\frac{\theta}{2}+2\cos\frac{\theta}{2}$

[EAPCET 14-05-23 SHIFT-1]

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

52. If $\sin 2\theta$ and $\cos 2\theta$ are solutions of $x^2+ax-c=0$, then

[EAPCET 14-05-23 SHIFT-1]

1. $a^2-2c-1=0$
2. $a^2+2c-1=0$
3. $a^2+2c+1=0$
4. $a^2-2c+1=0$

53. If $\tan\alpha = \frac{-12}{5}, \cot\beta = \frac{7}{24}, \alpha$ does not belong to second quadrant and β does not belong to the first quadrant, then

$\sqrt{13}\sin\frac{\alpha}{2}+\cos\frac{\beta}{2}+\tan\frac{\alpha}{2}\cot\frac{\beta}{2} =$

[EAPCET 13-05-23 SHIFT-2]

1. 31/10
2. 19/10
3. 21/10
4. $-9/10$

54. $\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7}\cos\frac{\pi}{14}\cos\frac{3\pi}{14}\cos\frac{5\pi}{14} =$

[EAPCET 13-05-23 SHIFT-2]

1. $\frac{1}{16}\left[\sin\frac{\pi}{7}+\sin\frac{2\pi}{7}+\sin\frac{3\pi}{7}\right]$
2. $\frac{1}{8}\left[\sin\frac{2\pi}{7}+\sin\frac{3\pi}{7}-\sin\frac{\pi}{7}\right]$
3. $\frac{1}{32}\left[\sin\frac{2\pi}{7}+\sin\frac{3\pi}{7}-\sin\frac{\pi}{7}\right]$
4. $\frac{1}{32}\left[\sin\frac{\pi}{7}-\sin\frac{2\pi}{7}+\sin\frac{3\pi}{7}\right]$

KEY

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

TRANSFORMATIONS

1. Let A,B and C be three angles of a triangle ABC such that $\cos A+\cos B+\cos C = \frac{3}{2}$, then the triangle ABC is

[AP EAMCET 18-09-20_Shift-2]

1. Equilateral
2. Right angled
3. Isosceles but not equilateral
4. Scalene

2. If $\frac{\cos(\theta_1+\theta_2)}{\cos(\theta_1-\theta_2)}+\frac{\cos(\theta_3-\theta_4)}{\cos(\theta_3+\theta_4)} = 0$, then

$\cot\theta_1.\cot\theta_2.\cot\theta_3.\cot\theta_4 =$

[TS EAMCET 09-09-20_Shift-1]

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

3. If $\sin 2\theta+\sin 2\varphi = \frac{1}{2}$ *and* $\cos 2\theta+\cos 2\varphi = \frac{3}{2}$,

Then $\cos^2(\theta-\varphi) =$

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

4. If $A+B+C = 60^0$, then $\cos(30^0-A)+\cos(30^0-B)+\cos(30^0-C)$ $+\sin(A+B+C) =$

[TS EAMCET 11-09-20_Shift-1]

1. $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$
2. $4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$
3. $4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$
4. $4\cos\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$

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

$\tan\frac{\alpha}{2}\tan\frac{\beta}{2} =$

TS EAMCET 11-09-20_Shift-2]

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

6. If $\sin\alpha - \cos\alpha = m$ and $\sin 2\alpha = n - m^2$, where $-\sqrt{2} \le m \le \sqrt{2}$, then '$n$' is equal to

[AP EAMCET 19-08-2021_Shift-1]

1. 0 2. 1
3. 2 4. -2

7. If $A+B+C=\frac{3\pi}{2}$, then $\cos 2A+\cos 2B+\cos 2C=$

[AP EAMCET 20-08-2021_Shift-2]

1. $1-4\sin A\sin B\sin C$
2. $1+4\sin A\sin B\sin C$
3. $1-2\sin A\sin B\sin C$
4. $1+2\sin A\sin B\sin C$

8. $\cos\frac{7\pi}{8}+\cos\frac{\pi}{4}+\cos\left(-\frac{\pi}{8}\right)-1=$

[TS EAMCET 05-08-2021_Shift-2]

1. $4\cos\frac{\pi}{16}\cos\frac{3\pi}{4}\cos\frac{5\pi}{8}$
2. $4\cos\frac{\pi}{16}\cos\frac{\pi}{4}\sin\frac{5\pi}{8}$
3. $4\cos\frac{\pi}{16}\cos\frac{3\pi}{8}\cos\frac{9\pi}{16}$
4. $-4\cos\frac{\pi}{16}\cos\frac{5\pi}{8}\cos\frac{\pi}{16}$

9. If $A+B+C=4S$, then $\cos(2S-A)+\cos(2S-B)-\cos(2S-C)-\cos 2S=$

[TS EAMCET 05-08-2021_Shift-2]

1. $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$ 2. $4\cos\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$
3. $4\sin\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$ 4. $4\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$

10. If $\frac{\sin(x+y)}{\sin(x-y)}=\frac{a+b}{a-b}$, then $\frac{\tan x}{\tan y}=$

[TS EAMCET 04-08-2021_Shift-2]

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

11. If $x\ne -y$ and $\sin x+\sin y=3(\cos y-\cos x)$, then $\tan(x-y)=$

[TS EAMCET 04-08-2021_Shift-2]

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

12. In a ΔABC, if $\cos A+\cos B+\cos C=a+b\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$, then $a+b=$ **[TS EAMCET 06-08-2021_Shift-1]**

1. 3 2. 0
3. 1 4. 5

13. If $\tan\beta=\frac{\tan\alpha+\tan\gamma}{1+\tan\alpha\tan\gamma}$ then $\frac{\sin 2\alpha+\sin 2\gamma}{1+\sin 2\alpha\sin 2\gamma}=$

[AP EAMCET 20-08-2021_Shift-1]

1. $\sin 2\beta$ 2. $\cos 2\beta$
3. $\tan 2\beta$ 4. $\sec 2\beta$

14. The value of $\frac{\sin\theta+\sin 3\theta}{\cos\theta+\cos 3\theta}$ is

[AP EAMCET 04-07-2022_Shift-1]

1. $\cos 2\theta$ 2. $\cot 2\theta$
3. $\tan 2\theta$ 4. $\operatorname{cosec}\theta+\sin\theta$

15. Let α,β be two real numbers such that $\pi<(\alpha-\beta)<3\pi$. If $\sin\alpha+\sin\beta=\frac{-21}{65}$ *and* $\cos\alpha+\cos\beta=\frac{27}{65}$, then $\cos\left(\frac{\beta-\alpha}{2}\right)=$

[AP EAMCET 05-07-2022_Shift-2]

1. $\frac{3}{\sqrt{130}}$ 2. $-\frac{3}{\sqrt{130}}$
3. $\frac{130}{\sqrt{3}}$ 4. $-\frac{\sqrt{130}}{3}$

16. Let x,y,z be real numbers and $x\ge y\ge z\ge\frac{\pi}{12}$. If $x+y+z=\frac{\pi}{2}$, then the minimum value of $\cos x.\sin y.\cos z$ is

[AP EAMCET 06-07-2022_Shift-1]

1. $\frac{1}{2}$ 2. $\frac{1}{4}$
3. $\frac{1}{6}$ 4. $\frac{1}{8}$

17. If $\sin\left(x+\frac{\pi}{3}\right)+\sin\left(x-\frac{\pi}{3}\right)=1$, then the value of x in the interval $[0,\pi]$

[AP EAMCET 07-07-2022_Shift-1]

1. $\frac{\pi}{2}$ 2. $\frac{\pi}{3}$
3. 0 4. $\frac{\pi}{4}$

18. In a triangle ABC, $\sin 2A+\sin 2B+\sin 2C=$

[AP EAMCET 08-07-2022_Shift-2]

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

19. $\frac{\sqrt{2}\cos 45^0+\cos 56^0+\cos 58^0-\cos 66^0}{\sqrt{2}\cos 28^0\cos 29^0\sin 33^0}=$

[TS EAMCET 18-07-2022_Shift-1]

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

20. If $A+B+C=\frac{3\pi}{2}$ then
4sinAsinBsinC+cos2A+cos2B+cos2C=

[TS EAMCET 18-07-2022_Shift-2]

1. -sin(A+B+C) 2. cos(A+B+C)
3. sin(A+B+C) 4. 2–cos(A+B+C)

21. $\cos^2 76^\circ+\sin^2 46^\circ+\sin 76^\circ\cos 46^\circ=$

[TS EAMCET 19-07-2022_Shift-2]

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

22. If A+B+C=$\frac{\pi}{2}$, then
$\sqrt{2}\cos\left(\frac{\pi}{4}-A\right)+\sqrt{2}\cos\left(\frac{\pi}{4}-B\right)+\sqrt{2}\cos\left(\frac{\pi}{4}-C\right)+1=$

[TS EAMCET 20-07-2022_Shift-1]

1. $4\sqrt{2}\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$
2. $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$
3. $4\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$
4. $4\sqrt{2}\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$

23. If $a\tan\alpha+b\tan\beta=(a+b)\tan\left(\frac{\alpha+\beta}{2}\right)$ and $\alpha-\beta\neq 2n\pi$ then $\frac{\cos\beta}{\cos\alpha}=$

[TS EAMCET 20-07-2022_Shift-2]

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

24. If $\cos^3 x\sin 4x=\sum_{r=0}^{n}a_r\sin rx\ \forall x\in R$, then $a_3+a_5:a_1+a_7=$

[16th May 2023 Shift 2]

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

25. In $\Delta ABC,\frac{\sin 2A+\sin 2B+\sin 2C}{\cos A+\cos B+\cos C-1}=$

[17th May 2023 Shift 1]

1. $2[\sin A+\sin B+\sin C]$
2. $\sin A+\sin B+\sin C$
3. $4[\sin A+\sin B+\sin C]$
4. $8[\sin A+\sin B+\sin C]$

26. $\cot 16^\circ\cot 44^\circ+\cot 44^\circ\cot 76^\circ-\cot 76^\circ\cot 16^\circ=$

[17th May 2023 Shift 2]

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

27. In Δ ABC, if $\cos^2 A+\cos^2 B+\cos^2 C=1$, then Δ ABC is **[17th May 2023 Shift 2]**

1. An equilateral triangle
2. An isosceles triangle
3. A right angled triangle
4. A scalene triangle

28. If two acute angles A and B are such that $A\neq B$ and $\frac{x}{y}=\frac{\cos A}{\cos B}$ then $\frac{x\tan A-y\tan B}{x+y}=$

[18th May2023 shift -1]

1. $\tan\left(\frac{A-B}{2}\right)$ 2. $\tan\left(\frac{B-A}{2}\right)$
3. $\tan\left(\frac{A+B}{2}\right)$ 4. $\cot\left(\frac{A+B}{2}\right)$

29. If m.tan(θ-30°)=n.tan(θ+120°), then $\frac{m+n}{m-n}=$

[18th May2023 shift -1]

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

30. If $\cos\alpha+\cos\beta=\frac{1}{3}$ and $\sin\alpha+\sin\beta=\frac{1}{4}$, then $\cos(\alpha+\beta)=$ [18th May 2023 Shift 2]

1. $\frac{24}{25}$
2. $\frac{7}{25}$
3. $\frac{13}{25}$
4. $\frac{12}{13}$

31. If $A+B+C+D=2\pi, then\ \cos A-\cos B+\cos C-\cos D=$

[13TH MAY 2023 SHIFT-1]

1. $-4\sin\frac{A+B}{2}\cos\frac{A+C}{2}\sin\frac{A+D}{2}$
2. $4\sin\frac{A+B}{2}\sin\frac{A+C}{2}\sin\frac{A+D}{2}$
3. $-4\sin\frac{A+B}{2}\sin\frac{A+C}{2}\sin\frac{A+D}{2}$
4. $4\sin\frac{A+B}{2}\cos\frac{A+C}{2}\sin\frac{A+D}{2}$

32. $\sin 6^0+\sin 54^0+\sin 126^0+\cos 156^0=$

[EAPCET 13-05-23 SHIFT-2]

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

KEY

1)	1	2)	2	3)	2	4)	1	5)	3
6)	2	7)	1	8)	3	9)	4	10)	2
11)	3	12)	4	13)	1	14)	3	15)	2
16)	4	17)	1	18)	1	19)	2	20)	1
21)	1	22)	1	23)	4	24)	4	25)	1
26)	4	27)	3	28)	1	29)	1	30)	2
31)	4	32)	1	33)		34)		35)	

MAXIMUM AND MINIMUM VALUES AND PERIODICITY

1. If $\cos(x)+\cos^2(x)=1, then\ \sin^2(x)+\sin^4(x)$ is equal to [AP EAMCET 21-09-20_Shift-2]

1. 0
2. 1
3. -1
4. 2

2. If θlies in the third quadrant and $\cos\theta=\frac{-3}{5}$ find value of $\tan\theta$.

[AP EAMCET 21-09-20_Shift-2]

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

3. Find the value of $\cos ec750^0-2\left(\cot 765^0\right)$

[AP EAMCET 21-09-20_Shift-2]

1. 0
2. 1
3. 2
4. -1

4. Let $f(x)=\cos(ax)+\sin(x)$ be periodic .then a must be [AP EAMCET 21-09-20_Shift-2]

1.Irrational
2.rational
3.Positive real number
4.Negative real number

5. The minimum and maximum values of $\cos\left(x+\frac{\pi}{3}\right)+2\sqrt{2}\sin\left(x+\frac{\pi}{3}\right)$ are respectively

[AP EAMCET 22-09-20_Shift-2]

1. $-\left(2\sqrt{3}-1\right)$ & $2\sqrt{3}-1$
2. $-\left(1+2\sqrt{2}\right)$ & $2\sqrt{2}+1$
3. -3 and 3
4. -2 and 2

6. Let a be maximum value of $\left(3\cos\theta-4\sin\theta\right)$and $\theta\neq\frac{n\pi}{2}$.If $\alpha=a\sin^2\theta.\cos^3\theta$ and $\beta=a\sin^3\theta.\cos^2\theta$,then $\sqrt{\frac{\left(\alpha^2+\beta^2\right)^5}{(\alpha\beta)^4}}=$

[TS EAMCET 10-09-20_Shift-2]

1. $5sin\frac{\theta}{2}\cos^2\frac{\theta}{2}$
2. $-3\sin\theta$
3. 5
4. 16

7. The period of $\frac{\sin x}{\cos 3x}+\frac{\sin 3x}{\cos 9x}+\frac{\sin 9x}{\cos 27x}+\frac{\sin 27x}{\cos 81x}$ is

[TS EAMCET 11-09-20_Shift-1]

1. $\frac{2\pi}{3}$
2. $\frac{\pi}{81}$
3. 2π
4. π

8. Match the items of List – I with those of List – II

List – I	List – II
A) If $A=\begin{bmatrix}\cos^2 37^0 & \cos^2 53^0 & \cot 135^0\\ \sin^2 76^0 & \sin 270^0 & \sin^2 14^0\\ \cos 180^0 & \cos^2 28^0 & \cos^2 62^0\end{bmatrix}$, then 3 - |A|=	I) -4
B) If the period of $\frac{\cos(6x-4)-\sec(3-4x)}{\cot(5x+3)+\sin(3x+4)}$ is $\frac{2k\pi}{5}$, then k=	II) 2
C) The maximum value of $\cos^2\left(\frac{\pi}{4}-x\right)+(\sin x-\cos x)^2$ is	III) 3
D) If $x+y+z=0^0$, then $\frac{\sin 2x+\sin 2y+\sin 2z}{\sin(-x)\sin(-y)\sin(-z)}=$	IV) 4
	V) 5

The correct match is

[TS EAMCET 11-09-20_Shift-2]

1. $A\to III, B\to V, C\to II, D\to IV$
2. $A\to III, B\to I, C\to II, D\to IV$
3. $A\to I, B\to III, C\to IV, D\to V$
4. $A\to II, B\to I, C\to III, D\to V$

9. The period of $\cos(3x+5)+7$ is

[TS EAMCET 11-09-20_Shift-2]

1. $\frac{2\pi}{5}$
2. $\frac{2\pi}{3}$
3. $\frac{2\pi}{15}$
4. $\frac{2\pi}{7}$

10. Minimum value of $5\tan^2\alpha+\frac{9}{\tan^2\alpha}+4\sec^2\alpha$ is **[AP EAMCET 23-08-2021_Shift-1]**

1. 24
2. 22
3. 32
4. 28

11. The larger of $\cos(\log\theta)$ and $\log(\cos\theta)$ if $e^{-\pi/2}<\theta<\pi/2$ is

[AP EAMCET 25-08-2021_Shift-1]

1. $\cos(\log\theta)$
2. $\log(\cos\theta)$
3. None of function is larger
4. One of the two function is undefined on domain even to compare

12. Let $y=4\sin^2\theta-\cos 2\theta$. If l and m are the minimum and maximum values of y respectively, then **[TS EAMCET 04-08-2021_Shift-1]**

1. $lm=\frac{m}{l}$
2. $lm=\frac{l}{m}$
3. $l+m=\frac{l}{m}$
4. $\frac{lm}{l-m}=1+m$

13. The period of $\tan ky+\sin ky$, where $k=1+4+9+....20$ terms, is

[TS EAMCET 06-08-2021_Shift-1]

1. $\frac{\pi}{1435}$
2. $\frac{2\pi}{1435}$
3. π
4. 2π

14. Let α be the period of $3\sin\frac{\pi x}{3}-\cos\frac{\pi x}{2}+\tan\frac{\pi x}{4}$, β be the period of $\sin^2\left(\frac{\pi}{7}+\frac{x}{4}\right)-\sin^2\left(\frac{\pi}{7}-\frac{x}{4}\right)$. and γ be the period of $\cos^4 x+\sin^4 x$. Then $\frac{\alpha\gamma}{\beta}=$

[TS EAMCET 19-07-2022_Shift-2]

1. $\frac{3}{2}$
2. $\frac{3}{4}$
3. 3
4. 6

15. The range of $\dfrac{1}{\sin^2 x+3\sin x\cos x+5\cos^2 x}$ *is*

[15th May 2023 Shift 2]

1. $\left[2,\frac{11}{2}\right]$
2. $\left[\frac{1}{2},\frac{11}{2}\right]$
3. $\left[\frac{2}{11},\frac{1}{2}\right]$
4. $\left[\frac{2}{11},2\right]$

16. Match the ranges of the functions given in List –A with those of the items given in List-B

[17th May 2023 Shift 1]

	List –A		List-B
I.	$3\sin^2 x+4\cos^2 x-2$	a.	$\left[\frac{1}{4},1\right]$
II.	$\cos^2 x+\sin^4 x$	b.	$\left[-\frac{1}{4},\frac{1}{4}\right]$
III.	$\sin^6 x+\cos^6 x$	c.	$[1,2]$
IV.	$\cos x\cos\left(\frac{2\pi}{3}+x\right)\cos\left(\frac{2\pi}{3}-x\right)$	d.	$\left[\frac{3}{4},1\right]$
		e.	$[0,1]$

1. $(I)\to(c)(II)\to(a)(III)\to(d)(IV)\to(b)$
2. $(I)\to(c)(II)\to(d)(III)\to(a)(IV)\to(b)$
3. $(I)\to(b)(II)\to(d)(III)\to(a)(IV)\to(e)$
4. $(I)\to(b)(II)\to(e)(III)\to(d)(IV)\to(c)$

17. The period of the function

$f(x)=e^{\log(\sin x)}+(\tan x)^3-\operatorname{cosec}(3x-5)$ is

[EAPCET 14-05-23 SHIFT-1]

1. π
2. $\pi/2$
3. 2π
4. $\frac{2\pi}{3}$

KEY

1)	2	2)	4	3)	1	4)	2	5)	3
6)	3	7)	4	8)	1	9)	2	10)	2
11)	1	12)	1	13)	1	14)	1	15)	4
16)	2	17)	3						

SOLUTIONS

TRIGONOMETRIC RATIOS

1. $x^2+bx-c=0$

$\sin 2\theta+\cos 2\theta=-b;\sin 2\theta.\cos 2\theta=-c$

$\sin^2 2\theta+b\sin 2\theta-c=0.......(1)$

$\cos^2 2\theta+b\cos 2\theta-c=0.....(2)$

Adding (1) & (2)

$1+b(\sin 2\theta+\cos 2\theta)-2c=0$

$1+b(-b)-2c=0$

$1-b^2-2c=0$

$b^2+2c-1=0$

2. $\cot\theta+\tan\theta=3$

$\frac{\cos\theta}{\sin\theta}+\frac{\sin\theta}{\cos\theta}=3$

$\sin\theta.\cos\theta=\frac{1}{3}$

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

$\sin^2\theta=\alpha\cos\theta..............(1)$

$\sin^2\theta=\alpha\left(\frac{1}{3\sin\theta}\right)$

on simplifying we get $9\alpha^2(6-\alpha^2)=1$

3. $\sin\theta+\operatorname{cosec}\theta=2$

$\Rightarrow\sin^2\theta+1-2\sin\theta=0$

$\Rightarrow\sin\theta=1$

$\sin^{2020}\theta+\operatorname{cosec}^{2020}\theta=1+1=2$

4. Given $m=\sec\theta$, $n=\tan\theta$

$\frac{1}{m}\left[m+n+\frac{1}{m+n}\right]$

$=\frac{1}{\sec\theta}\left[\sec\theta+\tan\theta+\frac{\sec^2\theta-\tan^2\theta}{\sec\theta+\tan\theta}\right]$

$=\frac{1}{\sec\theta}[\sec\theta+\tan\theta+\sec\theta-\tan\theta]$

$=\frac{1}{\sec\theta}(2\sec\theta)=2$

5. $\frac{TanA}{2}=\frac{TanB}{3}=\frac{TanC}{4}=k$

If $A+B+C=\pi$

$S_1=S_3$

$TanA+TanB+TanC=TanATanBTanC$

$9k=24k^3$

$k^2=\frac{9}{24}$

$\sec^2 A+\sec^2 B+\sec^2 C=$

$3+Tan^2A+Tan^2B+Tan^2C$

$=3+4k^2+9k^2+16k^2=3+29\left(\frac{9}{24}\right)=\frac{111}{8}$

---

6. If $a\cos x+b\sin x=c$ then $\tan x=\frac{b}{a}$

---

7. $\sin\left(180^0+30^0\right)\sin\left(\frac{6\pi}{2}+45^0\right)=\frac{-1}{2\sqrt{2}}$

---

8. $\tan 1^0.\tan 2^0.....\tan 89^0=1$

Required geometric mean is 1

---

9. $\sin(\frac{5\pi}{3})+\sec(\frac{13\pi}{3})=$

$=\sin(2\pi-\frac{\pi}{3})+\sec(4\pi+\frac{\pi}{3})$

$=-\sin\frac{\pi}{3}+\sec\frac{\pi}{3}$

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

---

10. $=\frac{-\sin x.-\sin x.\cot x.-\cot x}{-\sin x.\cos x.-\cos ecx.-\cos x}$

$=\frac{\sin x.\frac{\cos x}{\sin x}.\frac{\cos x}{\sin x}}{\cos x.\frac{1}{\sin x}.\cos x}=1$

---

11. $-\tan\left(\frac{23\pi}{3}\right)+\cot\left(\frac{13\pi}{3}-\theta\right)$

$=-\tan\left(8\pi-\frac{\pi}{3}\right)+\cot\left(4\pi+\left(\frac{\pi}{3}-\theta\right)\right)$

$=\sqrt{3}+\cot\left(\frac{\pi}{3}-\theta\right)$

---

12. $x+y+z=k\left(\cos\alpha+\cos\left(\frac{2\pi}{3}-\alpha\right)+\cos\left(\frac{2\pi}{3}+\alpha\right)\right)$

$=k\left[\cos\alpha+2\cos\frac{2\pi}{3}\cos\alpha\right]$

$=k(\cos\alpha-\cos\alpha)=0$

---

13. $\sec\theta+\tan\theta=\frac{2}{3}$

$\sec\theta-\tan\theta=\frac{3}{2}$

add $\sec\theta=\frac{1}{2}\left(\frac{2}{3}+\frac{3}{2}\right)>0$

subtract $\tan\theta=\frac{1}{2}\left(\frac{2}{3}-\frac{3}{2}\right)<0$

$\theta\in IV$

---

14. $\cos ec\theta+\cot\theta=\frac{1}{3}$

$\cos ec\theta-\cot\theta=3$

From above $\theta\in Q_2$

---

15. $\tan 52=\frac{\tan 38+\tan 14}{1-\tan 38\tan 14}$

---

16. $\cos^2\left(\frac{7\pi}{8}\right)+\cos^2\left(\frac{5\pi}{8}\right)+\cos^2\left(\frac{3\pi}{8}\right)+\cos^2\left(\frac{\pi}{8}\right)$

$=2\left(\cos^2\frac{\pi}{8}+\sin^2\frac{\pi}{8}\right)=2$

---

17. Each angle in a pentagon

$=\frac{(n-2)180^0}{n}=\frac{3\times 180}{5}=108$

$\therefore\theta=108^0$

$\sqrt{\sin^2\theta+\cos^2\theta+\tan^2\theta}=\sqrt{1+\tan^2\theta}$

$=|\sec\theta|=|\cos ec18^0|$

---

18. From data $\theta\in Q_4$ $\quad A=-\sin^2\theta \quad B=\cos^2\theta$

$B-A=\cos^2\theta+\sin^2\theta=1$

---

19. $\sin^4\frac{\pi}{8}+\cos^4\left(\frac{\pi}{2}-\frac{\pi}{8}\right)-\sin^4\frac{3\pi}{8}+\sin^4\left(\pi-\frac{3\pi}{8}\right)$

$+\cos^4\left(\pi-\frac{\pi}{8}\right)-\sin^4\left(\pi-\frac{\pi}{8}\right)$

20. Given

$$\alpha=\frac{\sin^3 x}{\cos^2 x},\beta=\frac{\cos^3 x}{\sin^2 x} \, and \, \sin x+\cos x=k,$$

$$now, \alpha\sin x+\beta\cos x+3=\frac{\sin^4 x}{\cos^2 x}+\frac{\cos^4 x}{\sin^2 x}+3$$

$$=\frac{\sin^6 x+\cos^6 x+3\sin^2 x\cos^2 x}{\sin^2 x\cos^2 x}$$

$$=\frac{1-3\sin^2 x\cos^2 x+3\sin^2 x\cos^2 x}{\sin^2 x\cos^2 x}$$

$$=\frac{1}{\left(\frac{k^2-1}{2}\right)^2}\left[\begin{array}{l}\because \sin x+\cos x=k\\ \sin x\cos x=\frac{k^2-1}{2}\end{array}\right]$$

$$=\frac{4}{\left(k^2-1\right)^2}$$

21. $A=22\frac{1}{2}^0 \quad \cos A=\sqrt{\frac{\sqrt{2}+1}{2\sqrt{2}}}(\because A\in Q_1)$

22. $\cos\theta=-\frac{\sqrt{3}}{2};\sin\alpha=-\frac{3}{5}$

$\theta\in Q_2 \qquad \alpha\in Q_3$

$$\therefore \frac{2\tan\alpha+\sqrt{3}\tan\theta}{\cot^2\theta+\cos\alpha}=\frac{\frac{1}{2}}{\frac{11}{5}}\Rightarrow\frac{5}{22}$$

23. $\sin\theta=\frac{12}{13},\cos\theta=\frac{-5}{13},\tan\theta=\frac{-12}{5}$

Option 3 satisfies

24. $70^0-20^0=50^0$

25. $\sin^2 5^0+\sin^2 10^0+\sin^2 15^0+.......$

$+\sin^2 80^0+\sin^2 85^0+\sin^2 90^0$

$\left(\sin^2 5^0+\cos^2 5^0\right)+\left(\sin^2 10^0+\cos^2 10^0\right)$

$+\left(\sin^2 15^0+\cos^2 15^0\right)+....+\sin^2 45^0+\sin^2 90^0$

$$8+\frac{1}{2}+1\Rightarrow 9+\frac{1}{2}=9\frac{1}{2}$$

26. $\sin\theta+\cos ec\theta=2\Rightarrow\sin\theta+\frac{1}{\sin\theta}=2$

$\Rightarrow \sin^2\theta-2\sin\theta+1=0$

$\sin\theta=1$

$\therefore \sin^{10}\theta+\cos ec^{10}\theta$

$=1+1$

$=2$

27. $\frac{\sin 1^0}{\sin x^0.\sin(x+1)^0}=\cot x^0-\cot(x+1)^0\to(1)$

$$\frac{1}{\sin 45^0\sin 46^0}+\frac{1}{\sin 46^0\sin 47^0}+......+\frac{\sin 1^0}{\sin 89^0\sin 90^0}$$

$$=\frac{1}{\sin 1^0}[1-0]=\cos ec1^0.$$

28. $\left(1-\tan 348^0\right)\left(1+\cot 417^0\right)=\left(1+\tan 12^0\right)\left(1+\cot 57^0\right)$

$=\left(1+\cot 78^0\right)\left(1+\cot 57^0\right)$

We know that if $A+B=135^0$ then

$=(1+\cot A)(1+\cot B)=2$

here $\left(1+\cot 78^0\right)\left(1+\cot 57^0\right)=2$

29. $\theta\in Q_1$ & $\sin\theta\cos\theta=\frac{12}{25}$

$\sin^4\theta+\cos^4\theta=\left(\sin^2\theta\right)^2+\left(\cos^2\theta\right)^2$

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

$$=1-\frac{1}{2}.\left(\frac{24}{25}\right)^2=1-\frac{1}{2}.\frac{576}{625}=\frac{337}{625}$$

30. $(1-\cos\theta)(1+\cos\theta)\left(1+\cot^2\theta\right)$

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

31. $\cot\frac{\pi}{16}.\cot\frac{2\pi}{16}.\cot\frac{3\pi}{6}.\cot\frac{4\pi}{16}.\cot\frac{5\pi}{16}.\cot\frac{6\pi}{16}.\cot\frac{7\pi}{16}$

$$\cot\frac{\pi}{16}.\cot\frac{2\pi}{16}.\cot\frac{3\pi}{16}.1.\cot\left(\frac{\pi}{2}-\frac{3\pi}{16}\right).\cot\left(\frac{\pi}{2}-\frac{2\pi}{16}\right).\cot\left(\frac{\pi}{2}-\frac{\pi}{16}\right)$$

$$\cot\frac{\pi}{16}.\cot\frac{2\pi}{16}.\cot\frac{3\pi}{16}.1.\tan\frac{3\pi}{16}.\tan\frac{2\pi}{16}.\tan\frac{\pi}{16}=1$$

32. Given,

$2(\sin^6\theta+\cos^6\theta)-3(\sin^4\theta+\cos^4\theta)$

$=2\left((\sin^2\theta)^3+(\cos^2\theta)^3\right)-3\left((\sin^2\theta)^2+(\cos^2\theta)^2\right)$

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

$-3\left[(\sin^2\theta+\cos^2\theta)^2-2\sin^2\theta\cos^2\theta\right]$

$=2\left[(\sin^2\theta+\cos^2\theta)^2-3\sin^2\theta\cos^2\theta\right]$

$-3\left[(\sin^2\theta+\cos^2\theta)^2-2\sin^2\theta\cos^2\theta\right]$

$=2-3=-1$

33. $\left(\dfrac{\sin 35^0}{\cos 55^0}\right)^2+\left(\dfrac{\cos 55^0}{\sin 35^0}\right)^2-2\cos 30^0$

$\sin 35^0=\sin(90^0-55^0)=\cos 55^0$

$\left(\dfrac{\cos 55^0}{\cos 55^0}\right)^2+\left(\dfrac{\cos 55^0}{\cos 55^0}\right)^2-2\left(\dfrac{\sqrt{3}}{2}\right)$

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

34. $x=\dfrac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$

$=\dfrac{2\sin\alpha}{1+(\cos\alpha+\sin\alpha)}\times\dfrac{1-(\cos\alpha+\sin\alpha)}{1-(\cos\alpha+\sin\alpha)}$

$=\dfrac{2\sin\alpha(1-\cos\alpha-\sin\alpha)}{-2\sin\alpha\cos\alpha}=\dfrac{1-\cos\alpha-\sin\alpha}{-\cos\alpha}$

$\dfrac{1-\cos\alpha-\sin\alpha}{\cos\alpha}=-x$

35. $\cos^4\dfrac{\pi}{8}+\cos^4\dfrac{2\pi}{8}+\cos^4\dfrac{3\pi}{8}+\cos^4\dfrac{4\pi}{8}+$

$\cos^4\dfrac{5\pi}{8}+\cos^4\dfrac{6\pi}{8}+\cos^4\dfrac{7\pi}{8}+\cos^4\dfrac{8\pi}{8}$

$=2\cos^4\dfrac{\pi}{8}+2\cos^4\dfrac{3\pi}{8}+\dfrac{1}{4}+\dfrac{1}{4}+1$

$=2-\dfrac{1}{2}+\dfrac{3}{2}=3$

36. $(1+\text{Tan}\,1^o)(1+\text{Tan}\,2^o)-----(1+\text{Tan}\,45^o)=2^n$

$\left[(1+\text{Tan}\,1^o)(1+\text{Tan}\,44^o)\right.$

$\left.+.......+(1+\tan 22^o)(1+\tan 23^o)\right](1+\tan 45^o)=2^n$

$2^{22}.2^1=2^n$

$n=23$

37. $\dfrac{\cos\theta}{1-\text{Tan}\,\theta}+\dfrac{\sin\theta}{1-\cot\theta}=\dfrac{\cos^2\theta}{\cos\theta-\sin\theta}+\dfrac{\sin^2\theta}{\sin\theta-\cos\theta}$

$=\cos\theta+\sin\theta$

38. A+ B + C π

B = π – (A+C) = $\dfrac{2\cos B}{\cos B}=2$

39. $1+\sec^2 x.\sin^2 x=1+\text{Tan}^2 x=\sec^2 x$

40. $\dfrac{1}{\sin 1^0.\sin 2^0}+\dfrac{1}{\sin 2^0.\sin 3^0}+........+$

$\dfrac{1}{\sin 89^0.\sin 90^0}$

$=\dfrac{1}{\sin 1^0}\left[\dfrac{\sin(2^0-1^0)}{\sin 1^0.\sin 2^0}+\dfrac{\sin(3^0-2^0)}{\sin 2^0.\sin 3^0}+......+\dfrac{\sin(90^0-89^0)}{\sin 89^0+\sin 90^0}\right]$

$=\dfrac{1}{\sin 1^0}\left[\dfrac{\cos 1^0}{\sin 1^0}\right]=\dfrac{\cos 1^0}{\sin^2 1^0}$

41. i) $\sin(-292^0)=-\sin(292^0)=-\sin(270^0+22^0)\rightarrow$ positive

ii) $\tan(-103^0)=-\tan(103^0)=-\tan(90^0+13^0)\rightarrow$ positive

iii) $\cos(-207^0)=\cos 207^0=\cos(180^0+27^0)\rightarrow$ negative

iv) $\cot(-222^0)=-\cot 222^0=-\cot(180^0+42^0)\rightarrow$ negative

42. $\sin\theta+\text{cosec}\,\theta=4$

$\sin^2\theta+\text{cosec}^2\theta+2=16$

$\sin^2\theta+\text{cosec}^2\theta=14$

43. $\cos 5\theta=\cos(3\theta+2\theta)$

$=\cos 3\theta\cos 2\theta-\sin 3\theta.\sin 2\theta$

$=[4\cos^3\theta-3\cos\theta][2\cos^2\theta-1)-[3\sin\theta-4\sin^3\theta](2\sin\theta\cos\theta]$

$16\cos^5\theta-20\cos^3\theta+5\cos\theta$

44. Squaring and adding

45. Squaring and adding

46. Given $\sqrt{\sin^4 x+4\cos^2 x}-\sqrt{\cos^4 x+4\sin^2 x}$

$=1+\cos^2 x-1-\sin^2 x$

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

47. $\dfrac{1}{1+\sin\theta}+\dfrac{1}{1-\sin\theta}=\dfrac{1-\sin\theta+1+\sin\theta}{\cos^2\theta}=2\sec^2\theta$

48. $\dfrac{\cos x}{1+\sin x}+\tan x$

$=\dfrac{\cos x(1-\sin x)}{\cos^2 x}+\tan x$

$=\sec x(1-\sin x)+\tan x=\sec x-\tan x+\tan x=\sec x$

49. $1+\cot^2 30^0-\sec^2 45^0=2$

50. $\dfrac{1}{\sin 45^0.\sin 46^0}+\dfrac{1}{\sin 47^0.\sin 48^0}+.......+$

$\dfrac{1}{\sin 133^0.\sin 134^0}=\dfrac{1}{\sin\left(n^0\right)}$

$\dfrac{1}{\sin 1^0}\left[\cot 45^0-\cot 46^0+\cot 47^0-......+\cot 133^0-\cot 134^0\right]=\dfrac{1}{\sin n^0}$

$\Rightarrow \dfrac{1}{\sin 1^0}=\dfrac{1}{\sin n^0}$

$\therefore [n=1]$

51. $\dfrac{\sin x}{1+\cos x}+\dfrac{1+\cos x}{\sin x}=\dfrac{\sin^2 x+(1+\cos x)^2}{\sin x(1+\cos x)}=2\operatorname{cosec} x$

52. $2\cot^2\theta-\cot\theta-3=2\cot\theta(\cot\theta+1)-3(\cot\theta+1)$

$=(2\cot\theta-3)(\cot\theta+1)$

53. $\cos\theta(\operatorname{cosec}\theta-\sec\theta)-\cot\theta=-1$

54. $\tan x+\dfrac{\cos x}{1+\sin x}=\tan x+\dfrac{1-\sin x}{\cos x}$

$=\sec x$

55. $\tan 15^0+\tan 30^0=-p$

$2-\sqrt{3}+\dfrac{1}{\sqrt{3}}=-p$

$\therefore p=-2+\sqrt{3}-\dfrac{1}{\sqrt{3}}$

$\tan 15^0\tan 30^0=q$

$\left(2-\sqrt{3}\right)\dfrac{1}{\sqrt{3}}=q$

$q=\dfrac{2}{\sqrt{3}}-1$

$\therefore pq=\left(-2+\sqrt{3}-\dfrac{1}{\sqrt{3}}\right)\left(\dfrac{2}{\sqrt{3}}-1\right)$

$=\dfrac{10-6\sqrt{3}}{3}$

56. $\dfrac{1}{\sin 45^0.\sin 46^0}+\dfrac{1}{\sin 46^0.\sin 47^0}$

$+.......upto\ 45\ terms=\dfrac{1}{\sin x^0}$

$\dfrac{1}{\sin 1^0}\left[\cot 45^0-\cot 46^0+\cot 47^0.....\right]=\dfrac{1}{\sin x^0}$

$\dfrac{1}{\sin 1^0}=\dfrac{1}{\sin x^0}$

$\therefore [x=1]\therefore \sin\left(\dfrac{\pi}{2}x\right)=\sin\dfrac{\pi}{2}=1$

57. $\sin A=-7/25, \cos B=8/17, A\notin Q_3\ \&\ B\notin Q_1,$

$\therefore 8\tan A-5\cot B=8\left(\dfrac{-7}{24}\right)-5\left(\dfrac{-8}{15}\right)$

$=1/3$

58. $\dfrac{1}{2}\left[2\sin 21^\circ\cos 9^\circ-2\cos 84^\circ\cos 6^\circ\right]$

$\dfrac{1}{2}\left[\sin(21+9)+\sin(21-9)-\cos(84+6)-\cos(84-6)\right]$

$\dfrac{1}{2}\times\dfrac{1}{2}=\dfrac{1}{4}$

59. $\left(1+\sqrt{1+a}\right)\sin\alpha=\left(1+\sqrt{1-a}\right)\cos\alpha$

Use 2 times

Squaring on both sides

60. $\dfrac{2\cos4A\cos3A+2\cos4A\cos A}{2\sin4A\cos3A+2\sin4A\cos A}$

$=\dfrac{2\cos4A\left(\cos3A+\cos A\right)}{2\sin4A\left(\cos3A+\cos A\right)}$

$=\cot 4A=\cot 4\times\dfrac{\pi}{24}$

$=\cot\dfrac{\pi}{6}=\sqrt{3}$

61. $2\sec\theta=\sec(\theta+\alpha)+\sec(\theta-\alpha)$

$\dfrac{2}{\cos\theta}=\dfrac{\cos(\theta-\alpha)+\cos(\theta+\alpha)}{\cos(\theta+\alpha)\cos(\theta-\alpha)}$

$2\left(\cos^2\theta-\sin^2\alpha\right)=2\cos^2\theta\cos\alpha$

$\cos^2\theta\left(1-\cos\alpha\right)=\left(1+\cos\alpha\right)\left(1-\cos\alpha\right)$

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

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

62. $2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)=a$

$2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)=b,$

$\text{Tan}\left(\frac{\alpha+\beta}{2}\right)=\frac{b}{a}, \cos(\alpha+\beta)=\frac{a^2-b^2}{a^2+b^2},$

$\sin(\alpha+\beta)=\frac{2ab}{a^2+b^2}, \ \text{Tan}(\alpha+\beta)=\frac{2ab}{a^2-b^2}$

63. Given $\text{Tan}\,A+TanB=x\rightarrow(1)$

$\cot A+\cot B=y$

$\frac{1}{Tan\ A}+\frac{1}{Tan\ B}=y$

$TanA.TanB=\frac{x}{y}\rightarrow(2)$

$Tan(A+B)=\frac{TanA+TanB}{1-TanA.TanB}=\frac{x}{1-\frac{x}{y}}=\frac{xy}{y-x}$

64. $(1+\sin\alpha-\cos\alpha)^2+(1-(\sin\alpha-\cos\alpha))^2$

$=2(2-\sin 2\alpha)$

$Given\Rightarrow 4-2\sin 2\alpha=a+\frac{b}{2}+\frac{b}{2}\sin 2\alpha$

$a+\frac{b}{2}=4, \frac{b}{2}=-2$

$\Rightarrow b=-4\ \&\ a=6$

$a^2+b^2=36+16=52$

65. IPE

66. IPE

67. $10\sin^4\alpha+15\cos^4\alpha=6$

$10\ Tan^4\alpha+15=6\left(1+Tan^2\alpha\right)^2$

$4(\text{Tan}^2\alpha)^2-12\ Tan^2\alpha+9=0$

$Tan^2\alpha=\frac{3}{2}$

$16\ Tan^6\alpha+27cot^6\alpha=16.\frac{27}{8}+27.\frac{8}{27}=62$

68. $\sin\frac{\pi}{20}+\sin^2\frac{3\pi}{20}+\sin^2\frac{5\pi}{20}+\sin\frac{7\pi}{20}+\sin^2\frac{9\pi}{20}$

$=\sin^2\frac{\pi}{20}+\sin^2\frac{3\pi}{20}+\frac{1}{2}+\cos^2\frac{3\pi}{20}+\cos^2\frac{\pi}{20}$

$=1+1+\frac{1}{2}=\frac{5}{2}$

69. $\frac{1+\cos\theta-\sin\theta}{1+\cos\theta+\sin\theta}+\frac{1+\cos\theta+\sin\theta}{1+\cos\theta-\sin\theta}$

$=\frac{(1+\cos\theta-\sin\theta)^2+(1+\cos\theta+\sin\theta)^2}{(1+\cos\theta)^2-\sin^2\theta}=2\sec\theta$

70. Given,

$$f_n(x)=\frac{1}{2n}\left[\sin^{2n}x+\cos^{2n}x\right]$$

$$f_1(x)=\frac{1}{2}(\sin^2 x+\cos^2 x)=\frac{1}{2}$$

$f_2(x)=\frac{1}{4}\left[\sin^4 x+\cos^4 x\right]=\frac{1}{4}\left[1-2\sin^2 x.\cos^2 x\right]$

$f(x)=\frac{1}{6}\left[\sin^6 x+\cos^6 x\right]=\frac{1}{6}\left[1-3\sin^2 x.\cos^2 x\right]$

$f_1(x)+f_2(x)-f_3(x)$

$\frac{1}{2}+\frac{1}{4}-\frac{1}{2}\sin^2 x\cos^2 x-\frac{1}{6}+\frac{1}{2}\sin^2 x\cos^2 x$

$$=\frac{7}{12}$$

71. By verification

72. *Given* $\sin\alpha+\cos\alpha=m$ S.O.B.S. we get

$\sin\alpha\cos\alpha=\frac{m^2-1}{2}\ \rightarrow(1)$

Now $\sin^6\alpha+\cos^6\alpha=1-3\sin^2\alpha\cos^2\alpha$

$=1-3\left(\frac{m^2-1}{2}\right)^2=\frac{4-3\left(m^2-1\right)^2}{4}$

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

$y=\frac{2\sin\theta}{1+\cos\theta+\sin\theta}\times\frac{1-\cos\theta+\sin\theta}{1-\cos\theta+\sin\theta}$

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

74. $\cot\theta = -2/3$, $\theta \in Q_2$

$\sin\theta = 3/\sqrt{13}, \cos\theta = -2/\sqrt{13}, \tan\theta = -3/2$

$$\Rightarrow \frac{(5\sin\theta+\cos\theta)^2}{\tan\theta+\cot\theta} = -6$$

COMPOUND ANGLES

1. $0 < \alpha < \beta < \gamma < 2\pi$

$$\cos(x+\alpha)+\cos(x+\beta)+\cos(x+\gamma)=0$$

$$\cos x\cos\alpha - \sin x\sin\alpha + \cos x\cos\beta$$

$$-\sin x\sin\beta + \cos x\cos\gamma - \sin x\sin\gamma = 0$$

$$\cos x[\cos\alpha+\cos\beta+\cos\gamma]$$

$$-\sin x[\sin\alpha+\sin\beta+\sin\gamma]=0$$

$$\cos\alpha+\cos\beta+\cos\gamma = \sin\alpha+\sin\beta+\sin\gamma = 0$$

$(\therefore \sin x, \cos x$ *not be zero*$)$

$$\therefore \cos\alpha+\cos\gamma = -\cos\beta$$

$$\&\sin\alpha+\sin\gamma = -\sin\beta$$

Squaring and adding we get

$$2+2\cos(\alpha-\gamma)=1$$

$$2\cos(\alpha-\gamma)=-1$$

$$\cos(\alpha-\gamma)=\frac{-1}{2}$$

$$\alpha-\gamma = 120^\circ$$

Now

$$Tan(\gamma-\alpha) = \tan(-120^0)$$

$$= -\tan 120^0$$

$$= -\tan(180^0-60^0) = \sqrt{3}$$

2. $\sin\left(\frac{\pi}{4}-A\right).\sin\left(\frac{\pi}{4}-B\right) = \frac{-1}{2\sqrt{2}}\operatorname{cosec}\left(\frac{\pi}{4}-c\right)$

$$\Rightarrow \sin\left(\frac{\pi}{4}-A\right).\sin\left(\frac{\pi}{4}-\text{B}\right).\sin\left(\frac{\pi}{4}-C\right) = \frac{-1}{2\sqrt{2}}$$

$$\Rightarrow \left(\frac{1}{\sqrt{2}}\right)^3(\cos A-\sin A)(\cos B-\sin B)(\cos C-\sin C) = \frac{-1}{2\sqrt{2}}$$

$$\cos A\cos B\cos C(1-\tan A)(1-\tan B)(1-\tan C) = -1$$

$$\cos A\cos B Cos C\begin{pmatrix}1-\tan A-\tan B-\tan C+\tan A\tan B+\\ \tan B\tan C+\tan C\tan A-tanA\tan B\tan C\end{pmatrix}$$

$$=\cos(A+B+C) \ (\because \ A+B+C=\pi)$$

Further simplify above,

$$-2(\tan A+\tan B+\tan C) = -2\begin{pmatrix}\tan A\tan B+\tan B\tan C\\ +\tan C\tan A\end{pmatrix}$$

$$\therefore \tan A\tan B + \tan B\tan C + \tan C\tan A$$

$$= \tan A + \tan B + \tan C$$

3. $1+\cos^2 x+\cos^2\left(x-\frac{\pi}{3}\right)-\sin^2\left(x+\frac{\pi}{3}\right)$

$$1+\cos^2 x+\cos 2x\cos\left(\frac{2\pi}{3}\right)=\frac{3}{2}$$

4. $$\frac{2\left(\frac{\sqrt{3}}{2}\sin(\theta)+\frac{1}{2}\cos(\theta)\right)}{\sin\left(\theta+\frac{\pi}{6}\right)}$$

$$=\frac{2\sin\left(\theta+\frac{\pi}{6}\right)}{\sin\left(\theta+\frac{\pi}{6}\right)}$$

$$=2$$

5. $\tan\alpha = 2\sin\beta\sin\gamma\operatorname{cosec}(\beta+\gamma)$

$$\sin(\beta+\gamma)\tan\alpha = 2\sin\beta\sin\gamma$$

$$(\sin\beta\cos\gamma+\cos\beta\sin\gamma)\tan\alpha = 2\sin\beta\sin\gamma$$

divide with $\sin\beta\sin\gamma$

$$(\cot\gamma+\cot\beta)\tan\alpha = 2$$

$$2\cot\alpha = \cot\gamma+\cot\beta$$

$\tan\gamma, \tan\alpha, \tan\beta$ *are in H.P.*

6. $A: A+B+C=45^0$

$$2A+2B = 90^0-2C$$

$$cot(2A+2B) = \cot(90^0-2C)$$

$$\frac{\cot 2A\cot 2B-1}{\cot 2A+\cot 2B} = \frac{1}{\cot 2C}$$

$$\cot 2A+\cot 2B+\cot 2C = \cot 2A\cot 2B\cot 2C$$

$R: P+Q+R=180^0$

$$\frac{P}{2}+\frac{Q}{2}=\frac{180^0}{2}-\frac{R}{2}$$

$$\frac{Tan\frac{P}{2}+Tan\frac{Q}{2}}{1-Tan\frac{P}{2}Tan\frac{Q}{2}}=\frac{1}{Tan\frac{R}{2}}$$

$$Tan\frac{P}{2}Tan\frac{Q}{2}+Tan\frac{Q}{2}Tan\frac{R}{2}+Tan\frac{R}{2}Tan\frac{P}{2}=1$$

7. If $SinC=1 \Rightarrow C=90^0$

$\cos A\cos B+\sin A\sin B=1$

$\cos(A-B)=1$

$\cos(A-B)=\cos 0^0$

$A-B=0^0$

$A=B$

$\angle C=90^0, \angle A=45^0, \angle B=45^0$

$a:b:c=1:1:\sqrt{2}$

8. $\sin A=\frac{11}{61}$; $\cos B=\frac{-7}{25}$

$A\in Q_2 \qquad B\in Q_3$

$\cos A=\frac{-60}{61}$; $\sin B=\frac{-24}{25}$

Clearly $\sin(A+B)>0$

$\cos(A+B)>0$

$\therefore A+B\in Q_1$

$\sin(A-B)<0$

$\cos(A-B)>0$

$\therefore A-B\in Q_4$

9. Squaring and adding both equations

$9\sin^2 A+16\cos^2 B+24\sin A\cos B$

$+16\sin^2 B+9\cos^2 A+24\sin B\cos A=37$

$25+24\left[\sin(A+B)\right]=37$

$24\sin(A+B)=12 \Rightarrow \sin(A+B)=\frac{1}{2}$

10. $f(x)=\frac{\cot x}{1+\cot x}$ & $\alpha+\beta=\frac{5\pi}{4}$

$$\frac{\cot\beta\cot\alpha-1}{\cot\beta+\cot\alpha}=1$$

$\therefore \cot\beta\cot\alpha=\cot\alpha+\cot\beta+1$

$$\therefore f(\alpha).f(\beta)=\frac{\cot\alpha}{1+\cot\alpha}.\frac{\cot\beta}{1+\cot\beta}$$

$$=\frac{\cot\alpha.\cot\beta}{1+\cot\beta+\cot\alpha+\cot\alpha\cot\beta}=\frac{\cot\alpha\cot\beta}{2\cot\alpha\cot\beta}=\frac{1}{2}$$

11. $x\cos\theta=y\cos\left(\theta+\frac{2\pi}{3}\right)=z\cos\left(\theta+\frac{4\pi}{3}\right)=k$

$$\cos\theta=\frac{k}{x};\cos\left(\theta+\frac{2\pi}{3}\right)=\frac{k}{y}:\cos\left(\theta+\frac{4\pi}{3}\right)=\frac{k}{z}$$

$$\therefore \frac{k}{x}+\frac{k}{y}+\frac{k}{z}=\cos\theta+\cos\left(\theta+\frac{2\pi}{3}\right)+\cos\left(\theta+\frac{4\pi}{3}\right)$$

$$k\left[\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right]=0$$

$$\therefore \frac{1}{x}+\frac{1}{y}+\frac{1}{z}=0$$

12. $C=\cos\frac{\pi}{4}\cos\frac{\pi}{8}\cos\frac{\pi}{16}\cos\frac{\pi}{32}$

$$S=\sin\frac{\pi}{4}\sin\frac{\pi}{8}\sin\frac{\pi}{16}\sin\frac{\pi}{32}$$

$$C.S=\frac{1}{2}\left(2\cos\frac{\pi}{4}\cos\frac{\pi}{4}\right)$$

$$\frac{1}{2}\left(2\sin\frac{\pi}{8}\cos\frac{\pi}{8}\right)\frac{1}{2}\left(2\sin\frac{\pi}{32}\cos\frac{\pi}{32}\right)$$

$$C=\frac{1}{2^4}\cos ec\frac{\pi}{32}$$

$$C=2^{-4}\cos ec\frac{\pi}{32}$$

$\therefore m=-4; n=32$

$\therefore m+n=28$

13. $=\sin\frac{2\pi}{5}+\sin\frac{4\pi}{5}+\sin\frac{6\pi}{5}+\sin\frac{8\pi}{5}$

$=\sin 72^0+\sin 144^0+\sin 216^0+\sin 288^0$

$=\cos 18^0+\sin 36^0-\sin 36^0-\cos 18^0=0$

14. $\frac{1}{2}\left[2\sin\frac{\pi}{16}\sin\frac{3\pi}{16}\right].\frac{1}{2}\left(2\sin\frac{5\pi}{16}\sin\frac{2\pi}{16}\right)$

$$=\frac{1}{4}\left[\cos^2\frac{\pi}{8}-\frac{1}{\sqrt{2}}\right]$$

$$=\frac{1}{4}\left[\frac{\sqrt{2}+1}{2\sqrt{2}}-\frac{1}{2}\right]=$$

$$\frac{1}{4}\left[\frac{\sqrt{2}+1-\sqrt{2}}{2\sqrt{2}}\right]\Rightarrow\frac{1}{8\sqrt{2}}\ or\ \frac{\sqrt{2}}{16}$$

15. $\cos^2 10^0+\cos^2 50^0-\sin 40^0\sin 80^0$

$$=\cos^2 10^0+\cos^2 50^0-\frac{1}{2}\left[2\sin 40^0\sin 80^0\right]$$

$$=\cos^2 10^0+\cos^2 50^0-\frac{1}{2}\left[\cos 40^0+\frac{1}{2}\right]$$

$$=\frac{3}{4}$$

16. Given $\alpha+\beta+\gamma$

Now

$$\cos^2\alpha+\cos^2\beta+\cos^2\gamma$$

$$=\cos^2\alpha+1-\sin^2\beta+\cos^2\gamma$$

$$=1+\cos(\alpha+\beta).\cos(\alpha-\beta)+\cos^2\gamma$$

$$=1+\cos\gamma.\cos(\alpha-\beta)+\cos^2\gamma$$

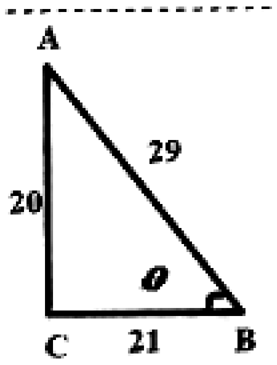
$$=1+\cos\gamma\left[\cos(\alpha-\beta)+\cos(\alpha+\beta)\right]$$

$$=1+2\cos\alpha\cos\beta\cos\gamma$$

17. $$\frac{\frac{\cos^2 15^0}{\sin^2 15^0}-1}{\frac{\cos^2 15^0}{\sin^2 15^0}+1}=\frac{\cos^2 15^0-\sin^2 15^0}{\cos^2 15^0+\sin^2 15^0}$$

$$=\frac{\cos 2(15^0)}{1}=\cos 30^0=\frac{\sqrt{3}}{2}$$

18.



$$29^2=S^2+21^2$$

$$841-441=S^2$$

$$S=20$$

$$\therefore\cos^2\theta-\sin^2\theta=\left(\frac{21}{29}\right)^2-\left(\frac{20}{29}\right)^2=\frac{441-400}{841}=\frac{41}{841}$$

19. $\sin 20^0.\sin 40^0.\sin 60^0.\sin 80^0$

$$=\sin 20^0\sin\left(60^0-20^0\right).\sin\left(60^0+20^0\right).\sin 60^0$$

$$=\frac{1}{4}\sin^2 60^0=\frac{3}{16}$$

20. Conceptual

21. $\cot A=\frac{11}{60},\qquad \cos B=\frac{7}{25},\ A,B\notin Q_1$

$A\in Q_3,\ B\in Q_4$

$\tan A=\frac{60}{11}\ \tan B=\frac{24}{7}$

$\cos A=\frac{-11}{61}\ \sin B=\frac{24}{25}$

$\sin A=\frac{-60}{61}\ \tan\frac{B}{2}=-\sqrt{\frac{1-\cos A}{1+\cos A}},\ \frac{B}{2}\in Q_2$

$\tan\frac{B}{2}=-3/4$

$\cos\frac{B}{2}=\frac{-4}{5}$

$$\tan\left(A+\frac{B}{2}\right)=\frac{240-33}{44+180}>0$$

$A+\frac{B}{2}\in Q_1\ (or)\ Q_3.......(1)$

$$\sin\left(A+\frac{B}{2}\right)=\frac{240-33}{305}>0$$

$A+\frac{B}{2}\in Q_1\ (or)\ Q_2.........(2)$

Common in (1) and (2),

$A+\frac{B}{2}\in Q_1$

22. $\sqrt{3}\,\mathrm{cos}ec 20^0-\sec 20^0$

$$=\frac{\sqrt{3}}{\sin 20^0}-\frac{1}{\cos 20^0}=\frac{\sqrt{3}\cos 20^0-\sin 20^0}{\sin 20^0\cos 20^0}$$

$$=\frac{4\left[\sin\left(60^0-20^0\right)\right]}{\sin 40^0}=4$$

23. $\tan\frac{7\pi}{8}=\mathrm{Tan}\left(\pi-\frac{\pi}{8}\right)=-\mathrm{Tan}\frac{\pi}{8}=-\mathrm{Tan}\,22\frac{1}{2}$

$$=-\mathrm{Tan}\frac{45}{2}$$

W.K.T $\mathrm{Tan}\frac{A}{2}=\sqrt{\frac{1-\cos A}{1+\cos A}}$

$\therefore-\left(\sqrt{2}-1\right)=1-\sqrt{2}$

24. $\sec^2 x+5\mathrm{Tan}\,x+5=1+\mathrm{Tan}^2 x+5Tanx+5$

$= \mathrm{Tan}^2 x + 5\,\mathrm{Tanx} + 6$

$= \mathrm{Tan}^2 x + 3\,\mathrm{Tanx} + 2\,\mathrm{Tanx} + 6$

$= \mathrm{Tanx}(\mathrm{Tanx}+3) + 2(\mathrm{Tanx}+3)$

$= (\mathrm{tanx}+2)(\mathrm{Tanx}+3)$

25. $\mathrm{Cos}^4 x = (\cos^2 x)^2 = \left(\dfrac{1+\cos 2x}{2}\right)^2$

$= \dfrac{1+\cos^2 2x + 2\cos 2x}{4}$

$= \dfrac{1}{4} + \dfrac{1}{4}\left(\dfrac{1+\cos 4x}{2}\right) + \dfrac{1}{2}\cos 2x$

$= \dfrac{1}{4} + \dfrac{1}{8} + \dfrac{1}{8}\cos 4x + \dfrac{1}{2}\cos 2x$

$= \dfrac{3}{8} + \dfrac{1}{8}\cos 4x + \dfrac{1}{2}\cos 2x$

26. $\sin 22\dfrac{1^o}{2} = \sin\dfrac{45^o}{2}$

$\sin\dfrac{45^0}{2} = \sqrt{\dfrac{1-\cos\theta}{2}} \therefore \sin\dfrac{45^o}{2} = \sqrt{\dfrac{1-\cos 45^o}{2}}$

$= \sqrt{\dfrac{1-\frac{1}{\sqrt{2}}}{2}} = \sqrt{\dfrac{\sqrt{2}-1}{2\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}} = \sqrt{\dfrac{2-\sqrt{2}}{4}}$

27. Given

$Cos^2 45^0 + cos^2 135^0 + cos^2 225^0 + cos^2 315^0$

$= \left(\dfrac{1}{\sqrt{2}}\right)^2 + \left(\dfrac{1}{\sqrt{2}}\right)^2 + \left(\dfrac{1}{\sqrt{2}}\right)^2 + \left(\dfrac{1}{\sqrt{2}}\right)^2 = 2$

28. Given

$\sin(x+y)\sec x \sec y$

$= (\sin x \cos y + \cos x \sin y)\sec x \sec y$

$= \tan + \tan y$

29. Squaring and adding

30. $\dfrac{1}{2}\left(2\sin\left(\dfrac{5\pi}{24}\right).\cos\left(\dfrac{\pi}{24}\right)\right) = \dfrac{1}{2}\left(\dfrac{1}{\sqrt{2}} + \dfrac{1}{2}\right) = \dfrac{\sqrt{2}+1}{4}$

31. $\cos\dfrac{\pi}{12} = \cos 15^0 = \cos(45^0 - 30^0)$

32. $\cos\left(\dfrac{7\pi}{12}\right) = -\cos\left(\dfrac{5\pi}{12}\right) = -\cos\left(\dfrac{\pi}{4} + \dfrac{\pi}{6}\right)$

33. $\tan 30^0 + \tan 15^0 = -a$

$\tan 30^0 \tan 15^0 = b$

$\tan 45^0 = \dfrac{-a}{1-b}$

$1 + a - b = 0$

34. $(1-\cot A)(1-\cot B) = 2$

$\therefore x = 2$

35. $\sin(A-B) = \dfrac{16}{65}; \cos(A-B) = \dfrac{63}{65}$

$\sin B = \dfrac{5}{13};\ \cos B = \dfrac{12}{13}$

$\sin(A-B+B) = \dfrac{3}{5}$

$\tan A + \cot A = \dfrac{3}{4} + \dfrac{4}{3} = \dfrac{25}{12}$

36. Squaring and adding

37. $\cos(A+B-A+B) = \dfrac{1}{2}$

$\cos 2B = \dfrac{1}{2}$

$B = \dfrac{\pi}{6}$

38. $\dfrac{1}{\sin 20^0} - \dfrac{1}{\sqrt{3}\cos 20^0}$

$= \dfrac{4}{\sqrt{3}}$

39. $\mathrm{Cos\ A\ Cos\ B\ Cos\ C} = \dfrac{1}{5}$

Tan A tan B + tan B.tan C +tan C.tan A

$= \dfrac{\sin A \sin B}{\cos A \cos B} + \dfrac{\sin B \sin C}{\cos B \cos C} + \dfrac{\sin C \sin A}{\cos C \cos A}$

5 sin A sin B cos C +5 sin B sin C cos A+ 5 sin C sin A cos B

= 5sin B sin (A+C)+ 5 sin A sin C cos B

$= 5\sin^2 B + 5\sin C \sin A \cos B$

$= 5 - 5\cos^2 B + 5\sin A \cos B \sin C$

$=5+5\cos B[\sin A\sin C-\cos B]$

$=5+5\cos B[\sin A\sin C+\cos(A+C)]$

$=5+5\cos A\cos B\cos C$

$=5+5\frac{1}{5}=5+1=6$

40. $\cos(\theta-\alpha),\cos\theta,\cos(\theta+\alpha)$ are in $H.P$

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

$\frac{2}{Cos\theta}=\frac{\cos(\theta-\alpha)+\cos(\theta+\alpha)}{\cos(\theta-\alpha)\cos(\theta+\alpha)}$

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

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

$\cos^2\theta(1-\cos\alpha)=\sin^2\alpha$

$\cos^2\theta=\frac{\sin^2\alpha}{2.\sin^2\frac{\alpha}{2}}=\frac{4.\sin^2\frac{\alpha}{2.}\cos^2\frac{\alpha}{2}}{2.\sin^2\frac{\alpha}{2}}$

$\cos^2\theta=2\cos^2\frac{\alpha}{2}$

$\Rightarrow\sec^2\theta=\frac{1}{2}\sec^2\frac{\alpha}{2}$

$2\sec^2\theta=\sec^2\frac{\alpha}{2}$

$2(1+\tan^2\theta)=\sec^2\frac{\alpha}{2}$

$2\tan^2\theta=\tan^2\frac{\alpha}{2}-1$

41. Here a = $\frac{\pi}{19}$, d = $\frac{2\pi}{19}$

a + (n – 1) d = $\frac{17\pi}{19}$

A = $\frac{\pi}{19}$, B = $\frac{2\pi}{19}$, n=9

$\therefore\cos\frac{\pi}{19}+\cos\frac{3\pi}{19}+......+\cos\frac{17\pi}{19}$

$=$

$\cos\left(\frac{\frac{2\pi}{19}+\frac{16\pi}{9}}{2}\right)\sin\left(\frac{\frac{18\pi}{19}}{2}\right)\operatorname{cosec}\frac{\frac{2\pi}{19}}{2}$

$=\frac{2\cos\left(\frac{9\pi}{19}\right)\sin\left(\frac{9\pi}{19}\right)\operatorname{cosec}\frac{\pi}{19}}{2}$

$=\frac{\sin\frac{18\pi}{19}\operatorname{cosec}\frac{\pi}{19}}{2}$

$=\frac{1}{2}$

42. If A+B+C= π , then
cotAcotB+cotBcotC+cotCcotA=1
Now
=(cotA+cotB)(cotB+cotC)(cotC+cotA)
=[cotAcotB+cotBcotC+cotCcotA+ $\cot^2 B$]
[cotC+ cotA]

$=\left[1+\cot^2 B\right]\left[\frac{\text{sinAcosC}+\text{cosAsinC}}{\sin A\,\text{sinC}}\right]$

$=\frac{1}{\sin^2 B}\cdot\frac{\cancel{\sin}B}{\sin A.\sin c}$

= cosecA.cosecB.cosecC.

43. Given $\sin\beta=2\sin\alpha$ and

$9\cos^2\beta=4\cos^2\alpha\ \rightarrow(1)$

$\sin^2\beta=4\sin^2\alpha$

$\sin^2\beta=4(1-\cos^2\alpha)$

$\sin^2\beta=4-4\cos^2\alpha$

$\sin^2\beta=4-9\cos^2\beta(\because\text{from}(1))$

$\sin^2\beta+\cos^2\beta+8\cos^2\beta=4$

$\cos^2\beta=\frac{3}{8}\Rightarrow\cos\beta=\frac{\sqrt{3}}{2\sqrt{2}}$

$1-\sin^2\beta=\frac{3}{8}$

$\sin^2\beta=5/8\Rightarrow\sin\beta=\frac{\sqrt{5}}{2\sqrt{2}}$

$(1) \Rightarrow 9\left(\frac{3}{8}\right) = 4\cos^2\alpha$

$$\cos^2\alpha = \frac{27}{32} \Rightarrow \cos\alpha = \frac{3\sqrt{3}}{4\sqrt{2}}$$

$$1 - \sin^2\alpha = \frac{27}{32}$$

$$\sin\alpha = \frac{\sqrt{5}}{4\sqrt{2}}$$

Consider

$$\sec(\alpha+\beta) = \frac{1}{\cos(\alpha+\beta)}$$

$$= \frac{1}{\cos\alpha\cos\beta - \sin\alpha\sin\beta}$$

$$= \frac{1}{\frac{9}{16} - \frac{5}{16}} = 4$$

44. $\tan B = \frac{2\sin A\sin C}{\sin(A+C)}$

$$\Rightarrow \cot B = \frac{\sin(A+C)}{2\sin A\sin C}$$

$$\Rightarrow 2\cot B = \frac{\sin A\cos C + \cos A\sin C}{\sin A\sin C}$$

$$\Rightarrow 2\cot B = \cot C + \cot A$$

$\Rightarrow \cot A, \cot B, \cot C$ are in AP

$\therefore \tan A, \tan B, \tan C$ are in HP

45. $\sin^2\theta = \cot\theta.\cos\theta$

$$\Rightarrow \sin^3\theta = \cos^2\theta$$

$$1^3 - 3\cos^2\theta\sin^2\theta + 3\cos^2\theta.\sin^2\theta + 1$$

46. $P = 2\operatorname{cosec}30^\circ = 2\times 2 = 4$

$$Q = 2\operatorname{cosec}(45) = 2\sqrt{2}$$

$$R = \frac{\sqrt{5}+1}{4} + \frac{\sqrt{5}-1}{4} = \frac{\sqrt{5}}{2}$$

$$\therefore R < Q < P$$

47.

$$\frac{1+Tan32^\circ}{1-Tan148^\circ} = \frac{1+Tan32^\circ}{1+Tan32^\circ} = 1$$

MULTIPLE AND SUBMULTIPLE ANGLES

1. $\tan 9^0 - \tan 27^0 - \tan 63^0 + \tan 81^0$

$$= \tan 9^0 + \tan 81^0 - \left(\tan 27^0 + \tan 63^0\right)$$

$$= \tan 9^0 + \cot 9^0 - \left(\tan 27^0 + \cot 27^0\right)$$

$$= \frac{1+\tan^2 9^0}{\tan 9^0} - \left(\frac{1+\tan^2 27^0}{\tan 27^0}\right)$$

$$= 2\left(\operatorname{cosec}18^0 - \operatorname{cosec}54^0\right)$$

$$= 2\left(\frac{4}{\sqrt{5}-1} - \frac{4}{\sqrt{5}+1}\right) = 4$$

2. Given

$$\frac{1}{2}\left(\tan\left(\frac{\pi}{24}\right) + \cot\left(\frac{\pi}{24}\right)\right)$$

$$= \frac{1}{2}\left[\frac{1+\tan^2\frac{\pi}{24}}{\tan\frac{\pi}{24}}\right] = \frac{1}{\sin 2\left(\frac{\pi}{24}\right)} = \frac{1}{\sin\frac{\pi}{12}}$$

$$= \frac{1}{\sin 15^0} = \frac{2\sqrt{2}}{\sqrt{3}-1}$$

but given $\frac{1}{2}\left(\tan\left(\frac{\pi}{24}\right) + \cot\left(\frac{\pi}{24}\right)\right) = \sqrt{a^2+a} + \sqrt{a}$

$$\Rightarrow \frac{2\sqrt{2}}{\sqrt{3}-1} = \sqrt{a^2+a} + \sqrt{a}$$

$$\Rightarrow \sqrt{6} + \sqrt{2} = \sqrt{a^2+a} + \sqrt{a}$$

$$\therefore a = 2$$

3. $\frac{2\sin^2(x) + \sin(x)}{2\sin(x)\cos(x) + \cos(x)}$

$$= \frac{\sin(x)(2\sin(x)+1)}{\cos(x)(2\sin(x)+1)} = \tan x$$

4. $(\sin x)(\cos x) = \frac{1}{4}$

$$\Rightarrow \sin 2x = \frac{1}{2}$$

$$\Rightarrow 2x = \frac{\pi}{6}(or)\frac{5\pi}{6}$$

$$\Rightarrow x = \frac{\pi}{12}(or)\frac{5\pi}{12}$$

5. Given $\tan\frac{x}{2}=\frac{m}{n}$

$m\sin x+n\cos x$

$$=m.\frac{2\tan\frac{x}{2}}{1+\tan^2\frac{x}{2}}+\frac{n\left(1-\tan^2\frac{x}{2}\right)}{\left(1+\tan^2\frac{x}{2}\right)}$$

$$=\frac{2m\times\frac{m}{n}}{1+\frac{m^2}{n^2}}+\frac{n\left(1-\frac{m^2}{n^2}\right)}{1+\frac{m^2}{n^2}}$$

6. $\sin A+\sin B=\frac{1}{2}$ .....(1)

$\cos A+\cos B=1$ ....(2)

$(1)^2+(2)^2$

$1+1+2(\cos(A-B))=\frac{5}{4}\ \cos(A-B)=\frac{-3}{8}$

$1-2\sin^2\left(\frac{A-B}{2}\right)=\frac{-3}{8}$

$\sin^2\left(\frac{A-B}{2}\right)=\frac{11}{16}$

$\Rightarrow\sin\left(\frac{A-B}{2}\right)=\pm\frac{\sqrt{11}}{4}$

7. $\theta_1=\theta_2=\theta_3=\theta_4=\pi$

$\cot\frac{\theta_1}{2}+\cot\frac{\theta_2}{2}+\cot\frac{\theta_3}{2}+\cot\frac{\theta_4}{2}=0$

8. $\tan\left(\frac{3\pi}{16}\right)+\cot\left(\frac{3\pi}{16}\right)$

$$=\frac{\sin\left(\frac{3\pi}{16}\right)}{\cos\left(\frac{3\pi}{16}\right)}+\frac{\cos\left(\frac{3\pi}{16}\right)}{\sin\left(\frac{3\pi}{16}\right)}$$

$$=\frac{2}{\sin\left(\frac{3\pi}{8}\right)}=\frac{2}{\left(\frac{\sqrt{2+\sqrt{2}}}{2}\right)}$$

$=2^{7/4}\sqrt{\sqrt{2}-1}.$

9. $25\cos^2\alpha+20\cos\alpha-15\cos\alpha-12=0$

$5\cos\alpha(5\cos\alpha+4)-3(5\cos\alpha+4)=0$

$\cos\alpha=\frac{-4}{5},\cos\alpha=\frac{3}{5},\alpha\in Q_2$

$\cos\alpha=\frac{-4}{5},\sin\alpha=\frac{3}{5}$

$\sin2\alpha=2\left(\frac{3}{5}\right)\left(\frac{-4}{5}\right)=\frac{-24}{25}$

10. conceptual

11. $\tan2\alpha\left[\tan(30^0-\alpha)+\tan(60^0-\alpha)+\tan(60^0-\alpha),\tan(30^0-\alpha)\right]$

By verification $\alpha=30^0$

$=\tan60^0\left[\tan0^0+\tan30^0\right]+\tan30^0.\tan0^0$

$=\sqrt{3}\left(\frac{1}{\sqrt{3}}\right)+0$

$=1$

12. $\cot\alpha-\tan\alpha=2\cot2\alpha$

$\therefore\tan\alpha=\cot\alpha-2\cot2\alpha$

$\therefore\cot\alpha-2\cot2\alpha+2[\cot2\alpha-2\cot4\alpha]$

$+4[\cot4\alpha-2\cot8\alpha]+8\cot8\alpha$

$=\cot\alpha-2\cot2\alpha+2\cot2\alpha-4\cot4\alpha$

$+\cot4\alpha-8\cot8\alpha+8\cot8\alpha=\cot\alpha$

13. $A+B+C=180^0$

$A+B=180^0-C$

$\frac{\cot B\cot A-1}{\cot B+\cot B}=-\cot C$

$\therefore\cot A\cot B+\cot B\cot C+\cot C\cot A=1$

14. $\alpha=\frac{180^0}{7}$

$3\alpha+4\alpha=180^0$

$\sin3\alpha=\sin(180^0-4\alpha)=\sin4\alpha$

15. $\tan\frac{\beta}{2}-\tan\frac{A}{2}=\tan\frac{C}{2}-\tan\frac{B}{2}$

$$\frac{\sin\left(\frac{B-A}{2}\right)}{\cos\frac{B}{2}\cos\frac{A}{2}}=\frac{\sin\left(\frac{C-B}{2}\right)}{\cos\frac{C}{2}\cos\frac{B}{2}}$$

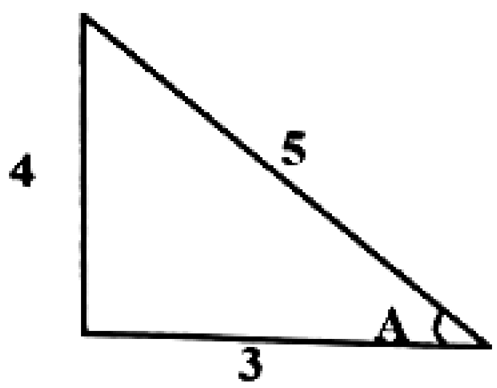
$\cos A-\cos B=\cos B-\cos C$

$2\cos B=\cos A+\cos C$

$\therefore\cos A,\cos B,\cos C$ *are in A.P*

16. $\sin A = \frac{4}{5}$

$\cos A = \frac{-3}{5}$



$90^0 < A < 180^0$

$45^0 < \frac{A}{2} < 90^0$

$$\tan\frac{A}{2} = \sqrt{\frac{1-\cos A}{1+\cos A}} = \sqrt{\frac{1+\frac{3}{5}}{1-\frac{3}{5}}} = \sqrt{4}$$

$\tan\frac{A}{2} = \pm 2$

$\tan\frac{A}{2} = 2$

---

17. Given that $\cos\theta = \frac{-3}{5}$, $\frac{\pi}{2} < \frac{\theta}{2} < \frac{3\pi}{4}$

$\tan\frac{\theta}{2} = \sqrt{\frac{1-\cos\theta}{1+\cos\theta}}$, $\frac{\theta}{2} \in 2^{nd} Q$

$$= \sqrt{\frac{1+\frac{3}{5}}{1-\frac{3}{5}}} = 2$$

$\frac{\theta}{2} \in 2^{nd} \Rightarrow \boxed{\tan\frac{\theta}{2} = -2}$

---

18. $\frac{1-\tan^2 15^0}{1+\tan^2 15^0}\left(\frac{1-\tan^2\theta}{1+\tan^2\theta} = \cos 2\theta\right)$

$= \cos 2\left(15^0\right) = \cos 30^0 = \frac{\sqrt{3}}{2}$

---

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

$= \frac{2\sin\theta(\sin\theta+\cos\theta)}{2\cos\theta(\cos\theta+\sin\theta)}$

$= \tan\theta$

---

20. $\cos ec 2A + \cot 2A = \frac{1}{\sin 2A} + \frac{\cos 2A}{\sin 2A}$

$= \cot A = TanA + 2\cot 2A$

---

21. $\cos^4\theta = a\cos 4\theta + b\cos 2\theta + c$

$$\left[\cos^2\theta\right]^2 = \left(\frac{1+\cos 2\theta}{2}\right)^2 = \frac{1+\cos^2 2\theta+2\cos 2\theta}{4}$$

$$= \frac{1}{4} + \frac{1}{4}\left(\frac{1+\cos 4\theta}{2}\right) + \frac{1}{2}\cos 2\theta$$

$$= \frac{3}{8} + \frac{1}{8}\cos 4\theta + \frac{1}{2}\cos 2\theta$$

wave (a,b,c) = $\left(\frac{1}{8}, \frac{1}{2}, \frac{3}{8}\right)$

---

22. By verification $\theta = \frac{\pi}{4}$

From opp(1) $\Rightarrow$ L.H.S = $\sin 5\theta$

$= \sin 5\frac{\pi}{4} = -\frac{1}{\sqrt{2}}$

R.H.S = $16\cos^4\theta\sin\theta - 12\cos^2\theta\sin\theta + \sin\theta$

$= \frac{4}{\sqrt{2}} - \frac{6}{\sqrt{2}} + \frac{1}{\sqrt{2}} = -\frac{1}{\sqrt{2}}$

---

23. Let A = B = C = 60^0

$$\therefore \left(\tan\frac{60^0}{2}.\tan\frac{60^0}{2}.\tan\frac{60^0}{2}\right)^2 = \frac{1}{27}$$

---

24. **L.H.S**

$\sin^4\theta.\cos^2\theta = \frac{1}{4}\left[4\sin^2\theta.\cos^2\theta\right]\sin^2\theta$

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

$= \frac{1}{16}\left[1-\cos 2\theta-\cos 4\theta+\cos 4\theta.\cos 2\theta\right]$

R.H.S = $a_0 + a_2\cos 2\theta + a_4\cos 4\theta + a_6\cos 6\theta + \ldots\ldots$

Now $= \frac{1}{16} - \frac{1}{32}\cos 2\theta - \frac{1}{16}\cos 4\theta + \frac{1}{32}\cos 6\theta$

Clearly $a_8 = 0 \Rightarrow a_{2(4)} = 0, [n=4]$

25. $\sin\theta = \frac{-3}{4}$

$\cos\theta = \frac{\sqrt{7}}{4}$

$\sin 2\theta = 2\sin\theta.\cos\theta = 2\left(\frac{-3}{4}\right).\left(\frac{\sqrt{7}}{4}\right) = \frac{-3\sqrt{7}}{8}$

26. $\sin^2\frac{2\pi}{3} + \cos^2\frac{5\pi}{6} - \tan^2\frac{3\pi}{4} = \frac{3}{4} + \frac{3}{4} - 1 = 1/2$

27. **Given** $A+B+C=180^0$

$\frac{\tan A/2 + \tan B/2}{1 - \tan A/2 \tan B/2} = \frac{1}{\tan c/2}$

$\tan\frac{A}{2}.\tan\frac{B}{2} + \tan\frac{B}{2}\tan\frac{C}{2} + \tan\frac{C}{2}.\tan\frac{A}{2} = 1$

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

$= \frac{1-\cos 4\theta}{8}$

29. **Given** $\left(4\cos^2 9^0 - 3\right)\left(4\cos^2 27^0 - 3\right)$

$= \frac{1}{\cos 9^0.\cos 27^0}\left[4\cos^3 9^0 - 3\cos 9^0\right]$

$\left(4\cos^3 27^0 - 3\cos 27^0\right)$

$= \frac{\cos 27^0.\cos 81^0}{\cos 9^0.\cos 27^0} = \frac{\cos 81^0}{\cos 9^0} = \tan 9^0$

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

$= \cos^2\frac{\pi}{24} - \sin^2\frac{\pi}{24}$

$= \cos\frac{\pi}{12} = \frac{\sqrt{3}+1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6}+\sqrt{2}}{4}$

31. $\tan A = \frac{2}{3}$

Then $\sin 4A = 2\sin 2A.\cos 2A$

$= 2\left(\frac{2\tan A}{1+\tan^2 A}\right)\left(\frac{1-\tan^2 A}{1+\tan^2 A}\right)$

$= \frac{24}{13}.\frac{5}{13} = \frac{120}{169}$

32. **Given** $|\sin\alpha - \cos\alpha| = \frac{3}{4}$

Then $|\sec 2\alpha - \tan 2\alpha|$

$= \left|\frac{1}{\cos 2\alpha} - \frac{\sin 2\alpha}{\cos 2\alpha}\right|$

$= \left|\frac{1-\cos\left(90^0 - 2\alpha\right)}{\sin\left(90^0 - 2\alpha\right)}\right|$

$= \tan\left(\frac{\pi}{4} - \alpha\right)$

$= \frac{\cos\alpha - \sin\alpha}{\cos\alpha + \sin\alpha} = \frac{\frac{3}{4}}{\cos\alpha + \sin\alpha}$

$\frac{3}{4k} = \cos\alpha + \sin\alpha$

S.O.B.S

$2 - \frac{9}{16} = \frac{9}{16k^2}$

$\therefore k = \frac{3}{\sqrt{23}}$

33. **Given** $\theta \notin Q_2$

$\tan\theta = -3/4$

$\theta \in Q_4$

$= \tan\frac{\theta}{2} + \sin 2\theta$

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

$$= \sqrt{\frac{1-4/5}{1+4/5}} + 2\left(\frac{-3}{5}\right)\left(\frac{4}{5}\right)$$

$$= \frac{1}{3} - \frac{24}{25} = \frac{25-72}{75} = \frac{-47}{75}$$

34. $$\frac{\cos 290^0 + \sqrt{3}\sin 25^0}{\sin 250^0 \cos 290^0} = \frac{\sin 20^0 - \sqrt{3}\cos 20^0}{-\cos 20^0 \sin 20^0}$$

$$= \frac{2\left(\frac{\sqrt{3}}{2}\cos 20^0 - \frac{1}{2}\sin 20^0\right)}{\sin 20^0 . \cos 20^0}$$

$$= \frac{2\sin 40^0 \times 2}{2\sin 20^0 . \cos 20^0} = \frac{4\sin 40^0}{\sin 40^0} = 4$$

35. IPE

36. IPE

37. IPE

38. $$\theta = \frac{\pi}{9} \Rightarrow 3\theta = \frac{\pi}{3}$$

$$Tan3\theta = Tan\frac{\pi}{3} = \sqrt{3}$$

$$\Rightarrow Tan^6\theta - 33Tan^4\theta + 27Tan^2\theta + 1 = 4$$

39. IPE

40. IPE

41. IPE

42. $(1+\sec 2\theta)(1+\sec 4\theta)$

$Take\ \theta = 30^0\ then\ G.E = (1+2)(1-2) = -3$

43. IPE

44. $3\sin 4x + 2\cos 4x = \frac{6}{5}$

$$3\left(\frac{1-\cos 2x}{2}\right)^2 + 2\left(\frac{1+\cos 2x}{2}\right)^2 = \frac{6}{5}$$

$$\frac{5}{4} - \frac{1}{2}\left(\frac{1-\tan^2 x}{1+\tan^2 x}\right) + \frac{5}{4}\left(\frac{1-\tan^2 x}{1+\tan^2 x}\right)^2 = \frac{6}{5}$$

Let tan x = t

$$\frac{5}{4} - \frac{1}{2}\frac{(1-t^2)}{(1+t^2)} + \frac{5}{4}\left(\frac{1-t^2}{1+t^2}\right)^2 = \frac{6}{5}$$

$$t = \sqrt{2/3} \Rightarrow \tan x = \sqrt{2/3}$$

$$\tan 2x = \frac{2\tan x}{1-\tan^2 x} = 2\sqrt{6}$$

45. $$c = \cos\left(\frac{\pi}{2^{10}}\right)\cos\left(2.\frac{\pi}{2^{10}}\right)\cos\left(2.^2\frac{\pi}{2^{10}}\right)...\cos\left(2^8.\frac{\pi}{2^{10}}\right)$$

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

$$c = \frac{\sin\left(2^9.\frac{\pi}{2^{10}}\right)}{2^9.\sin\frac{\pi}{2^{10}}} = \frac{1}{2^9.\sin\left(\frac{\pi}{2^{10}}\right)}$$

$$c = \frac{\text{cosec}\left(\frac{\pi}{2^{10}}\right)}{512}$$

46. $$\Rightarrow \frac{\sin(\alpha+\beta)}{\sin(\alpha-\beta)} = \frac{5}{1}$$

By compodendo and dividendo

47. Cos A + Cos B =-Cos C$\rightarrow$(1)

Sin A + Sin B =-Sin C$\rightarrow$(2)

Squaring and adding

48. $$\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{4\pi}{7} = \frac{\sin\frac{8\pi}{7}}{8\sin\frac{\pi}{7}}$$

$$= \sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}$$

$$= \sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\left(\pi-\frac{5\pi}{14}\right)\sin\left(\pi-\frac{3\pi}{14}\right)$$

$$\sin\left(\pi-\frac{\pi}{14}\right) = \sin^2\frac{\pi}{14}\sin^2\frac{3\pi}{14}\sin^2\frac{5\pi}{14}$$

$$=\left(\cos\left(\frac{\pi}{2}-\frac{\pi}{14}\right)\cos\left(\frac{\pi}{2}-\frac{3\pi}{14}\right)\cos\left(\frac{\pi}{2}\frac{-5\pi}{14}\right)\right)^2$$

$$= \cos^2\frac{3\pi}{7}\cos^2\frac{2\pi}{7}\cos^2\frac{\pi}{7} = \left(\frac{\sin\frac{8\pi}{7}}{8\sin\frac{\pi}{7}}\right)^2 = \frac{1}{64}$$

49.

$$f(\theta) = \frac{3}{4}\cos 3\theta$$

$$= \frac{3}{4}\cos 108 = \frac{-3}{4}\sin 18^0$$

$$= -\frac{3}{4}\left(\frac{\sqrt{5}-1}{4}\right) = \frac{-3}{16}\left(\sqrt{5}-1\right)$$

50. **Given**

$$540^0 < \theta < 630^0, \tan\theta = \frac{5}{12}$$

$$180^0 < \theta < 270^0$$

$$90^0 < \theta/2 < 135^0 \left(\theta/2 \in \theta_2\right)$$

$$\Rightarrow \cot\theta = 12/5, \sin\theta = -5/13, \operatorname{cosec}\theta = -13/5, \cos\theta = -12/13$$

$$\sec\theta = -13/12$$

$$\cos\theta/2 = -1/\sqrt{26}, \sin\theta/2 = 5/\sqrt{26}$$

$$\Rightarrow \frac{\cos\theta/2 - 5\sin\theta/2}{\sqrt{-(12\sec\theta + 5\operatorname{cosec}\theta)}} = -1$$

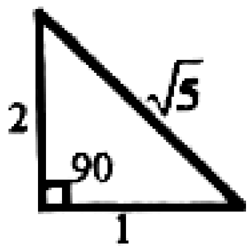
51.

Given $\cos\theta = \frac{-3}{5}$, $\pi < \theta < \frac{3\pi}{2}$

$$\cos\frac{\theta}{2} = \sqrt{\frac{1+\cos\theta}{2}} \qquad \Rightarrow \frac{\pi}{2} < \frac{\theta}{2} < \frac{3\pi}{4}$$

$$Cos\frac{\theta}{2} = \frac{1-3/5}{2} = \frac{-1}{\sqrt{5}} \qquad \frac{\theta}{2} \in Q_2$$

$$Cos\frac{\theta}{2} = \frac{-1}{\sqrt{5}}$$



$$\cos\frac{\theta}{2} = \frac{-1}{\sqrt{5}}$$

$$\therefore Tan\frac{\theta}{2} + \sin\frac{\theta}{2} + 2\cos\frac{\theta}{2} = -\frac{2}{1} + \frac{2}{\sqrt{5}} + 2\left(\frac{-1}{\sqrt{5}}\right)$$

$$= -2$$

52. $\sin 2\theta$, $\cos 2\theta$ are solutions at $x^2 + ax - c = 0$

$\sin 2\theta + \cos 2\theta = -a \qquad (sin2\theta)(\cos 2\theta) = -c$

$$1 + 2\sin 2\theta.\cos 2\theta = a^2$$

$$1+2(-c) = a^2$$

$$\Rightarrow a^2 + 2c - 1 = 0$$

53. $Tan\alpha = \frac{-12}{5}$, $\cot\beta = \frac{7}{24}$

$\alpha \in \theta_4 \qquad \beta \in \theta_3$

$\& \ \frac{\alpha}{2}, \frac{\beta}{2} \in \theta_2$

$\sin^2\frac{\alpha}{2} = \frac{4}{13}, \quad \cos^2\frac{\alpha}{2} = \frac{9}{13}$

$\sin^2\frac{\beta}{2} = \frac{16}{25}$, $\cos^2\frac{\beta}{2} = \frac{9}{25}$

Now ,

$$\sqrt{13}\ \sin\frac{\alpha}{2} + \cos\frac{\beta}{2} + Tan\frac{\alpha}{2}.\cot\frac{\beta}{2}$$

$$= \sqrt{13}.\frac{2}{\sqrt{13}} - \frac{3}{5} + \frac{2}{3}.\frac{3}{4} = \frac{19}{10}$$

54. $\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7}\cos\frac{\pi}{14}\cos\frac{3\pi}{14}\cos\frac{5\pi}{14}$

$$= \sin\frac{\pi}{7}\cos\frac{\pi}{7}\sin\frac{2\pi}{7}\cos\frac{2\pi}{7}\ \sin\frac{3\pi}{7}\cos\frac{3\pi}{7}$$

$$= \frac{1}{8}\left[\sin\frac{2\pi}{7}\sin\frac{4\pi}{7}\sin\frac{6\pi}{7}\right]$$

$$= \frac{1}{16}\left[\cos\frac{2\pi}{7} - \cos\frac{6\pi}{7}\right]\sin\frac{6\pi}{7}$$

$$= \frac{1}{32}\left[\sin\frac{8\pi}{7} + \sin\frac{4\pi}{7} - \sin\frac{12\pi}{7}\right]$$

$$=\frac{1}{32}\left[\sin\frac{2\pi}{7}+\sin\frac{3\pi}{7}-\sin\frac{\pi}{7}\right]$$

TRANSFORMATIONS

1. $A=B=C=60^0$

$\therefore \Delta ABC$ is equilateral triangle

2. $$\frac{\cos(\theta_1+\theta_2)}{\cos(\theta_1-\theta_2)}=\frac{-\cos(\theta_3-\theta_4)}{\cos(\theta_3+\theta_4)}$$

$$\frac{\cos(\theta_1+\theta_2)+\cos(\theta_1-\theta_2)}{\cos(\theta_1+\theta_2)-\cos(\theta_1-\theta_2)}=\frac{-\cos(\theta_3-\theta_4)+\cos(\theta_3+\theta_4)}{-\cos(\theta_3-\theta_4)-\cos(\theta_3+\theta_4)}$$

$$\frac{2\cos\theta_1\cos\theta_2}{-2\sin\theta_1\sin\theta_2}=\frac{-2\sin\theta_3\sin\theta_4}{-2\cos\theta_3\cos\theta_4}$$

$$-\cot\theta_1\cot\theta_2=\frac{1}{\cot\theta_3\cot\theta_4}$$

$$\cot\theta_1\cot\theta_2\cot\theta_3\cot\theta_4=-1$$

3. $$2\sin(\theta+\phi)\cos(\theta-\phi)=\frac{1}{2}$$

$$2\cos(\theta+\phi)\cos(\theta-\phi)=\frac{3}{2}$$

$$\tan(\theta+\phi)=\frac{1}{3}$$

$$\sin(\theta+\phi)=\frac{1}{\sqrt{10}}$$

$$\cos(\theta-\phi)=\frac{\sqrt{10}}{4}$$

$$\cos^2(\theta-\phi)=\frac{10}{16}=\frac{5}{8}$$

4. $A+B+C=60^0$,

$$\cos(30^0-A)+\cos(30^0-B)+\cos(30^0-C)$$

$$=2\cos\frac{C}{2}\left[2\cos\frac{B}{2}\cos\frac{A}{2}\right]$$

$$=4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$$

5. $$\frac{\cos\left(\frac{\alpha-\beta}{2}\right)}{\cos\left(\frac{\alpha+\beta}{2}\right)}=\frac{2}{1}$$

By componendo and dividend

$$\Rightarrow\frac{\cos\left(\frac{\alpha-\beta}{2}\right)+\cos\left(\frac{\alpha+\beta}{2}\right)}{\cos\left(\frac{\alpha-\beta}{2}\right)-\cos\left(\frac{\alpha+\beta}{2}\right)}=\frac{2+1}{2-1}$$

$$\tan\frac{\alpha}{2}.\tan\frac{\beta}{2}=\frac{1}{3}$$

6. $\sin\alpha-\cos\alpha=m;\sin 2\alpha=n-m^2$

$\sin^2+\cos^2-2\sin\alpha\cos\alpha=m^2$ $\qquad$ $\sqrt{2}\left[\frac{1}{\sqrt{2}}\sin\alpha-\frac{1}{\sqrt{2}}\cos\alpha\right]=m$

$1-\sin 2\alpha=m^2$ $\qquad$ $\sin\left(\alpha-\frac{\pi}{4}\right)=\frac{m}{\sqrt{2}}$

$1-n+m^2=m^2$ $\qquad$ $-1\le\frac{m}{\sqrt{2}}\le 1$

$n=1$ $\qquad$ $-\sqrt{2}\le m\le\sqrt{2}$

7. $A+B+C=\frac{3\pi}{2}$

$PA\quad A=B=C=90^0$

$\therefore\cos 2A+\cos 2B+\cos 2C=-1-1-1=-3$

$1-4=-3$

By verification option (1) satisfies

8. $$\cos\frac{7\pi}{8}+\frac{1}{\sqrt{2}}+\cos\frac{\pi}{8}-1$$

$$=2\cos\left(\frac{\frac{7\pi}{8}+\frac{\pi}{8}}{2}\right)\cos\left(\frac{\frac{7\pi}{8}-\frac{\pi}{8}}{2}\right)+\frac{1}{\sqrt{2}}-1$$

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

$$=4\cos\frac{\pi}{16}.\cos\frac{9\pi}{16}.\cos\frac{3\pi}{16}$$

$$=2\left[2\cos\frac{9\pi}{16}\cos\frac{\pi}{16}\right]\cos\frac{3\pi}{8}$$

$$=2\left[\cos\left(\frac{10\pi}{16}\right)+\cos\left(\frac{8\pi}{16}\right)\right]\cos\frac{3\pi}{8}$$

$$=2\cos\frac{5\pi}{8}.\cos\frac{3\pi}{8}$$

$$=\cos\left(\frac{8\pi}{8}\right)+\cos\left(\frac{2\pi}{8}\right)=-1+\frac{1}{\sqrt{2}}$$

9. Put $A=2S,B=2S,C=0$

$$1+1-2\cos 2S=2(1-\cos 2S)$$

$$=2\left(2\sin^2 S\right)=4\sin^2 S$$

Verify options

10. Componendo and dividendo

$$\frac{\sin(x+y)+\sin(x-y)}{\sin(x+y)-\sin(x-y)}=\frac{a+b+a-b}{a+b-a+b}$$

$$\frac{\sin x\cos y}{\cos x\sin y}=\frac{2a}{2b}\Rightarrow\frac{\tan x}{\tan y}=\frac{a}{b}$$

11. $\sin x+\sin y=3(\cos y-\cos x)$

$$2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)=3.2.\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$$

$$\tan\left(\frac{x-y}{2}\right)=\frac{1}{3}$$

$$\tan(x-y)=\frac{2\tan\left(\frac{x-y}{2}\right)}{1-\tan^2\left(\frac{x-y}{2}\right)}$$

$$=\frac{2(1/3)}{1-(1/3)^2}=3/4$$

12. We have $A+B+C=\pi$,

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

$\Rightarrow a=1,b=4$

now $a+b=1+4=5$

13. $\tan\beta=\dfrac{\sin(\alpha+\gamma)}{\cos(\alpha-\gamma)}$

$$\sin 2\beta=\frac{2\tan\beta}{1+\tan^2\beta}$$

14. $\dfrac{\sin\theta+\sin 3\theta}{\cos\theta+\cos 3\theta}=\dfrac{4\sin\theta-4\sin^3\theta}{4\cos^3\theta-2\cos\theta}$

$$=\frac{\sin 2\theta}{\cos 2\theta}=\tan 2\theta$$

15. Squaring and adding on both sides

16. Given:

$$x\ge y\ge z\ge\frac{\pi}{12};x+y+z=\frac{\pi}{2}$$

take $x=60^0, y=z=15^o$

min *value*

$\therefore \cos x.\sin y.\cos z$

17. $\sin(x+\pi/3)+\sin(x-\pi/3)=1$

$\sin x=1$

$x=\pi/2$

18. $A+B+C=180^o$

$A=B=C=60^o$

$L.H.S\Rightarrow \sin 2A+\sin 2B+\sin 2C$

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

Opp. verification

19. $\dfrac{1-\cos 66^o+2\cos 57^o.\cos 1^o}{\sqrt{2}\cos 28^o.\cos 29^o.\sin 33^o}$

$$\frac{2\sin 33^o\left[\sin 33^o+\sin 89^o\right]}{\sin 33^o\left[\frac{\sqrt{2}}{2}(2\cos 28^o.\cos 29^o\right]}$$

$$\Rightarrow\frac{2\left[\sin 33^o+\sin 89^o\right]}{\frac{\sqrt{2}}{2}\left[\cos 57^o+\cos 1^o\right]}$$

$$=\frac{4}{\sqrt{2}}=2\sqrt{2}$$

20. Given:

$$A+B+C=\frac{3\pi}{2}$$

$A=B=C=90^o$

$L.H.S=1$

Opp.

1. $=-\sin(270^o)=1$
2. $\cos(270^o)=0$
3. $\sin 270^o=-1$
4. $2-\cos(270^o)=2$

21. $\cos^2 76^o+\sin^2 46^o+\sin 76^o.\cos 46^o$

$$=1+\sin(46^o+76^o).\sin(46^o-76^o)+\frac{1}{2}$$

$$\left[\sin(76^o+46^o)+\sin(76^o-46^o)\right]$$

$$=1+\sin 122^o.\sin(-30^o)+\frac{1}{2}\left[\sin 122^o+\sin(-30^o)\right]$$

$$=1+\frac{1}{2}\left(\frac{-1}{2}\right)=1-\frac{1}{4}=\frac{3}{4}$$

22. Given:

$$A+B+C=\frac{\pi}{2}$$

$A = B = C = 30^o$

$$= \sqrt{2}\cos(45^o - 30^o) + \sqrt{2}\cos(45^o - 30^o)$$

$$= \frac{3\sqrt{3}+3+2}{2} = \frac{3\sqrt{3}+5}{2}$$

Opp. Verifications

23. $a\tan\alpha + b\tan\beta = (a+b)\tan\left(\frac{\alpha+\beta}{2}\right)$

$$a\left[\tan\alpha - \tan\left(\frac{\alpha+\beta}{2}\right)\right] = b\left[\tan\left(\frac{\alpha+\beta}{2}\right) - \tan\beta\right]$$

$$a\left[\frac{\sin\alpha}{\cos a} - \frac{\sin\left(\frac{\alpha+\beta}{2}\right)}{\cos\left(\frac{\alpha+\beta}{2}\right)}\right] = b\left[\frac{\sin\left(\frac{\alpha+\beta}{2}\right)}{\cos\left(\frac{\alpha+\beta}{2}\right)} - \frac{\sin B}{\cos\beta}\right]$$

$$\frac{a\sin\left(\frac{\alpha-\beta}{2}\right)}{\cos\alpha} = \frac{b\sin\left(\frac{\alpha-\beta}{2}\right)}{\cos\beta}$$

$a\cos\beta = b\cos\alpha$

$\therefore \boxed{\frac{\cos\beta}{\cos\alpha} = \frac{b}{a}}$

24. $\cos^3 x\sin 4x = \frac{(3\cos x + \cos 3x)\sin 4x}{4}$

$$= \frac{3\sin 4x\cos x + \sin 4x\cos 3x}{4}$$

$$= \frac{3}{4}\sin 4x\cos x + \frac{1}{4}\sin 4x\cos 3x$$

$$= \frac{3}{8}[\sin 5x + \sin 3x] + \frac{1}{8}[\sin 7x + \sin x]$$

$$= \frac{1}{8}\sin 7x + \frac{3}{8}\sin 5x + \frac{3}{8}\sin 3x + \frac{1}{8}\sin x$$

now $a_3 + a_5 : a_1 + a_7$

$$\frac{3}{8} + \frac{3}{8} : \frac{1}{8} + \frac{1}{8} = 6:2$$

$$= 3:1$$

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

$$= \frac{4\sin A\sin B\sin C}{1 + 4\sin A/2\sin B/2\sin C/2 - 1}$$

$$= 8\cos A/2\cos B/2\cos C/2$$

By verification

$2[\sin A + \sin B + \sin C] = 8\cos A/2\cos B/2\cos C/2$

26. $\cot(44^0 + 16^0) = \frac{1}{\sqrt{3}} \Rightarrow \frac{\cot 44^0\cot 16^0 - 1}{\cot 16^0 + \cot 44^0} = \frac{1}{\sqrt{3}}$

$$\text{Req} = 1 + \frac{\cot 16^0 + \cot 44^0}{\sqrt{3}} + 1 - \frac{\cot 44^0\cot 76^0}{\sqrt{3}}$$

$$+ 1 - \frac{\cot 16^0}{\sqrt{3}} + \frac{\cot 76^0}{\sqrt{3}} = 3.$$

27. IPE

28. IPE

29. $\frac{m}{n} = \frac{\text{Tan}(\theta + 120^o)}{\text{Tan}(\theta - 30^o)}$ by C&D

$$\frac{m+n}{m-n} = \frac{\text{Tan}(\theta+120^o) + \text{Tan}(\theta-30^o)}{\text{Tan}(\theta+120^o) - \text{Tan}(\theta-30^o)}$$

$$= \frac{\sin(\theta + 120^o + \theta - 30^o)}{\sin(\cancel{\theta} + 120^o - \cancel{\theta} + 30^o)}$$

$$= \frac{\cos 2\theta}{1/2} = 2\cos 2\theta$$

30. IPE

31. By using transformations

32. By using transformations

MAXIMUM AND MINIMUM VALUES AND PERIODICITY

1. Given

$$\cos(x) + \cos^2(x) = 1$$

$$\cos x = \sin^2 x \ldots (1)$$

$$now \sin^2(x) + \sin^4(x) = \cos x + \cos^2 x = 1(from(1))$$

2. IPE

3. IPE

4. Given $f(x)=\cos(ax)+\sin(x)$

w.k.t $f(x)+g(x)\to \dfrac{L.C.M\ of\ (2\pi,2\pi)}{H.C.F\ of\ (1,|a|)}=\dfrac{2\pi}{\lambda}$

since λ *is H.C.F of* $1,|a|$

$\frac{1}{\lambda}\ \&\ \frac{|a|}{\lambda}\to$ *integers*

let $\frac{1}{\lambda}=p\ \&\ \frac{|a|}{\lambda}=q$

$\therefore \dfrac{\frac{|a|}{\lambda}}{\frac{1}{\lambda}}=\dfrac{q}{p}$

$|a|=\dfrac{q}{p}$

p,q are integers

therefore 'a' is must be rational.

5. IPE

6. $a=c+\sqrt{a^2+b^2}$

$a=5$

$\alpha=5\sin^2\theta\cos^3\theta;\beta=5\sin^3\theta\cos^2\theta$

$\alpha^2+\beta^2=25\sin^4\theta\cos^4\theta$

$\alpha\beta=25\sin^5\theta\cos^5\theta$

$\dfrac{(\alpha^2+\beta^2)^5}{(\alpha\beta)^4}=25$

$\sqrt{\dfrac{(\alpha^2+\beta^2)^5}{(\alpha\beta)^4}}=5$

7. $\dfrac{\sin x}{\cos 3x}+\dfrac{\sin 3x}{\cos 9x}+\dfrac{\sin 9x}{\cos 27x}+\dfrac{\sin 27x}{\cos 81x}$

on simplifying we get $\frac{1}{2}(\tan 81x-\tan x)$

period of $\frac{1}{2}(\tan 81x-\tan x)$ *is* $'\pi'$

8. Period of $\dfrac{\cos(6x-4)-\sec(3-4x)}{\cot(5x+3)+\sin(3x+4)}$

Period of $\cos(6x-4)=\dfrac{2\pi}{6}=\dfrac{\pi}{3}=60^0$

Period of $\sec(3-4x)=\dfrac{2\pi}{|-4|}=\dfrac{\pi}{2}=90^0$

Period of $\cot(5x+3)=\dfrac{\pi}{5}=36^0$

Period of $\sin(3x+4)=\dfrac{2\pi}{3}=120^0$

Period $=$ *L.C.M of* $36,90,120=360^0$

$\dfrac{2K\pi}{5}=2\pi\Rightarrow K=5$

9. Period of $\cos(3x+5)+7=\dfrac{2\pi}{3}$

10. $5\tan^2\alpha+9\cot^2\alpha+4\sec^2\alpha$

$5\tan^2\alpha+4(1+\tan^2\alpha)+9\cot^2\alpha$

$5\tan^2\alpha+4+4\tan^2\alpha+9\cot^2\alpha$

$9\underbrace{(\tan^2\alpha+\cot^2\alpha)}_{A.M\ge G.M}+4$

$\dfrac{\tan^2\alpha+\cot^2\alpha}{2}\ge\sqrt{\tan^2.\cot^2\alpha}$

$\therefore \tan^2\alpha+\cot^2\alpha\ge 2$

$\therefore 9(2)+4=22$

11. $e^{\frac{-\pi}{2}}<\theta<\frac{\pi}{2}<e$

$\frac{-\pi}{2}<\cos\theta<\cos\frac{\pi}{2}<1$

$\cos(\cos\theta)>0$ is –ve

$\therefore \cos(\cos\theta)$ is larger

12. $y=4\sin^2\theta-\cos 2\theta$

$=4\left(\dfrac{1-\cos 2\theta}{2}\right)-\cos 2\theta$

$=2-3\cos 2\theta$

$l=c-\sqrt{a^2+b^2}=2-\sqrt{(-3)^2+0^2}=2-3=-1$

$m=c+\sqrt{a^2+b^2}=2+\sqrt{(-3)^2+0^2}=2+3=5$

option$(1)\Rightarrow lm=\dfrac{m}{l}\Rightarrow -5=\dfrac{5}{-1}$ satisfies

remaining options not satisfies.

13. Period of

$\tan ky+\sin ky,\ k=1+4+9+...20$ *term*

$k=\frac{20.21.41}{6}=2870$

Period = LCM of $\left\{\frac{\pi}{k},\frac{2\pi}{k}\right\}$

$=\frac{2\pi}{k}=\frac{2\pi}{2870}=\frac{\pi}{1435}$

14. $\alpha=L.C.M\{6,6,4\}=12$

$\beta=\sin^2\left(\frac{\pi}{7}+\frac{x}{4}\right)-\sin^2\left(\frac{\pi}{7}-\frac{x}{4}\right)$

$=\sin\left(\frac{2\pi}{7}\right).\sin\left(\frac{x}{2}\right)$

Periodicity is $=4\pi$

$\gamma=\cos^4 2+\sin^4\alpha$

$=(\cos^2\alpha)^2+(\sin^2\alpha)^2$

$=1-2\sin^2\alpha.\cos^2\alpha$

$-1-\frac{1}{2}\left[\sin^2 2\alpha\right]$

$=1-\frac{1}{4}+\frac{1}{4}\cos 4\alpha$

$=\frac{3}{4}+\frac{1}{4}\cos 4x$

Periodicity is $\frac{\pi}{2}$ Then $\frac{\alpha-\gamma}{\beta}=\frac{12\times\frac{\pi}{2}}{4\pi}=\frac{3}{2}$

15. $=\frac{1}{4\cos^2 x+1+\frac{3}{2}\sin 2x}=\frac{1}{\frac{1}{2}(4\cos 2x+3\sin 2x+6)}$

Extreme values $=c\pm\sqrt{a^2+b^2}$

Range is $\left[\frac{2}{11},2\right]$

16. $(i)3\sin^2 x+4\cos^2 x-2$

$=3\left(\frac{1-\cos 2x}{2}\right)+4\left(\frac{1+\cos 2x}{2}\right)-2$

$=\frac{1}{2}\cos 2x+\frac{3}{2}$

Max value $=c+\sqrt{a^2+b^2}=2$

Min value $=c-\sqrt{a^2+b^2}=1$

Range = [1,2]

ii) $f(x)=\cos^2 x+\sin^4 x$

$=1-\sin^2 x\cos^2 x\times\frac{4}{4}=1-\frac{1}{4}(\sin 2x)^2$

$0\le(\sin 2x)^2\le 10$

$\frac{-1}{4}\le\frac{-1}{4}(\sin 2x)^2\le 0$

$\frac{3}{4}\le f(x)\le 1$

Range $=\left[\frac{3}{4},1\right]$

(iii) $f(x)=\sin^6 x+\cos^6 x$

$=1-3\sin^2 x\cos^2 x=1-\frac{3}{4}(\sin 2x)^2$

Range $=\left[\frac{1}{4},1\right]$

iv) $\cos x\cos\left(\frac{2\pi}{3}+x\right)\cos\left(\frac{2\pi}{3}-x\right)=\frac{1}{4}\cos 3x$

Range $=\left[\frac{-1}{4},\frac{1}{4}\right]$

17. $f(x)=e^{\log(\sin x)}+(\tan x)^3\ \_\ \cos e\ c(3x-5)$

Periods are 2π, π, $\frac{2\pi}{3}$

$\therefore$ period $=\frac{LCM\ of(2\pi,\pi,2\pi\ \_)}{H.C.F\ of(1,1,3)}$

$=\frac{2\pi}{1}=2\pi$