$$\frac{1}{\cos 80^\circ} - \frac{\sqrt{3}}{\sin 80^\circ} =$$

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

$$\frac{1}{\sin 10^0} - \frac{\sqrt{3}}{\cos 10^0}$$

By cross multiplication we get

$$\frac{\cos 10^0 - \sqrt{3}}{\sin 10^0 \cos 10^0}$$

Multiply and divide by 2 in the Numerator and also in the denominator

$$\frac{2\left(\frac{1}{2}\cos 10^0 + \frac{\sqrt{3}}{2}\sin 10^0\right)}{\frac{1}{2}\left(2\sin 10^0 \cos 10^0\right)} = \frac{2\left(\sin 30^0 \operatorname{Cos} 10^0 + \cos 30^0 \sin 10^0\right)}{\frac{1}{2}\sin 20^0}$$

$$= \frac{4\left(\sin\left(30^0 - 10^0\right)\right)}{\sin 20^0} = \frac{4\sin 20^0}{\sin 20^0} = 4$$

(4) 4

If $\cos 28^\circ + \sin 28^\circ = k^3$, then $\cos 17^\circ$ is equal to

(1) $\frac{k^3}{\sqrt{2}}$ (2) $-\frac{k^3}{\sqrt{2}}$ (3) $\pm\frac{k^3}{\sqrt{2}}$ (4) $-\frac{k^3}{\sqrt{3}}$

We know that $28^0+17^0=45^0 \Rightarrow 17^0=45^0-28$

Consider $\cos 17^0 = \operatorname{Cos}(45-28)$

$= \cos 45^0 \cos 28^0 + \sin 45^0 \sin 28^0$

$= \frac{1}{\sqrt{2}}\cos 28^0 + \frac{1}{\sqrt{2}}\sin 28^0$ (taking $\frac{1}{\sqrt{2}}$ as common)

$= \frac{1}{\sqrt{2}}\left(\cos 28^0 + \sin 28^0\right) = \frac{1}{\sqrt{2}}k^3$

(1) $\frac{k^3}{\sqrt{2}}$

The maximum value of $4\sin^2 x + 3\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

(1) $4+\sqrt{2}$ (2) $3+\sqrt{2}$ (3) 9 (4) 4

$$4\sin^2 x + 3\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$$

$= 3\sin^2 x + 3\cos^2 x + \sin^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ (Re write 4 $\sin^2$x as <u>3$\sin^2$x +$\sin^2$x</u>)

$= 3\left(\sin^2 x + \cos^2 x\right) + \sin^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ Since $-1 \le \sin x \le 1$

= 3+1+$\sqrt{1+1}$ = 4+$\sqrt{2}$

(1) $4+\sqrt{2}$

$$\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right) =$$

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

[We see that Cos $\frac{7\pi}{8}$ = Cos$\left(\pi - \frac{\pi}{8}\right)$ = -Cos$\frac{\pi}{8}$

Cos $\frac{5\pi}{8}$ = Cos$\left(\pi - \frac{3\pi}{8}\right)$ = - Cos$\frac{3\pi}{8}$]

$$\left(1+\cos\frac{\pi}{8}\right)\left(1-\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1-\cos\frac{3\pi}{8}\right)$$

$=\left(1-\cos^2\frac{\pi}{8}\right)\left(1-\cos^2\frac{3\pi}{8}\right)$ (since (a+b) (a-b) = a^2-b^2)

$$= \left(\sin^2\frac{\pi}{8}\right)\left(\sin^2\frac{3\pi}{8}\right)$$

$= \frac{1}{4}\left(2\sin^2\frac{\pi}{8}\right)\left(2\sin^2\frac{3\pi}{8}\right)$ (multiply and divide by 4)

$$=\frac{1}{4}\left(1-\cos\frac{\pi}{4}\right)\left(1-\left(-\cos\frac{\pi}{4}\right)\right)$$

$= \frac{1}{4}\left(1-\cos\frac{\pi}{4}\right)\left(1-\left(-\cos\frac{\pi}{4}\right)\right) = \frac{1}{4}\left(1-\cos\frac{\pi}{4}\right)\left(1+\left(\cos\frac{\pi}{4}\right)\right)$ Since $\cos\frac{3\pi}{8} = -\cos\frac{\pi}{4}$

$$= \frac{1}{4}\left(1-\frac{1}{\sqrt{2}}\right)\left(1+\frac{1}{\sqrt{2}}\right) = \frac{1}{4}\left(1-\frac{1}{2}\right) = \left[\frac{1}{4}\right]\left[\frac{1}{2}\right] = \frac{1}{8}$$

(1) $\frac{1}{8}$

If $\pi < 2\theta < \frac{3\pi}{2}$, then $\sqrt{2+\sqrt{2+2\cos 4\theta}}$ equals to

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

$\sqrt{2+\sqrt{2+2\cos 4\theta}}\ \sqrt{2+\sqrt{2+2\cos 4\theta)}} = \sqrt{2+\sqrt{2(1+\cos 4\theta)}}$

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

$= \sqrt{2(1+\cos^2 2\theta)}$

Since 2θ in the 3[rd] quadrant cos2θ is negative

$= \sqrt{2-2\cos 2\theta} = \sqrt{2(1-\cos 2\theta} = \sqrt{2(2\sin^2\theta)} = \sqrt{4\sin^2\theta} = 2\sin\theta$

(4) $2\sin\theta$

If $\tan 40° = \lambda$, then $\frac{\tan 140° - \tan 130°}{1+\tan 140° \tan 130°} =$

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

tan(140) =tan(180-40) = - tan40

tan (130)= tan (90-50) = cot 50

$\frac{\tan 140 - \tan 130}{1+\tan 140\tan 130} = \frac{-\tan 40 + \cot 40}{1+\tan 40 \cot 40} = \frac{-\tan 40 + \frac{1}{\tan 40}}{1+\tan 40\frac{1}{\tan 40}} = \frac{-\lambda+\frac{1}{\lambda}}{1+\lambda\frac{1}{\lambda}} = \frac{\frac{-\lambda^2+1}{\lambda}}{1+1} = \frac{\frac{-\lambda^2+1}{\lambda}}{2} = \frac{-\lambda^2+1}{2\lambda}$

(4) $\frac{1-\lambda^2}{2\lambda}$

$\cos 1° + \cos 2° + \cos 3° + \ldots + \cos 179° =$

(1) 0 (2) 1 (3) -1 (4) 89

$\cos 1^2 + \cos 2^2 + \cos 3^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \cos 177^0 + \cos 178^o + \cos 179^0$

Cos 179 = Cos (180-1)= - $\cos 1^0$

Cos 178 = Cos (180-2) = - Cos 2^0

Cos 177 = C0s (180-3) = - Cos 3^0 and so on finally we have cos (91^0)= cos (180-89) = -cos 89

=(Cos1^0+Cos2^o+cos3^0 +……………cos 89^0)+ (cos 90^0)+(- cos 89^0-cos87^0 …- Cos3^0-Cos2^o-cos1^0)

=(Cos1^0+Cos2^o+cos3^0 +……………cos 89^0)+ (cos 90^0)+(- cos 89^0-cos87^0 …- Cos3^0-Cos2^o-cos1^0)

= 0 +0+………+0 + cos 90^0 = 0+0= 0 (By cancelling the terms)

(1) 0

Let $f_k(x) = \frac{1}{k}\left[\sin^k x + \cos^k x\right]$ where $x \in R$ and $k \geq 1$. Then $f_4(x) - f_6(x) =$

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

$$f_4(x) - f_6(x)$$

$$\frac{1}{4}\left[\sin^4 x + \cos^4 x\right] - \frac{1}{6}\left[\sin^6 x + \cos^6 x\right]$$

$$\frac{1}{4}\left[\left(\sin^2 x\right)^2 + \left(\cos^2 x\right)^2\right] - \frac{1}{6}\left[\left(\sin^3 x\right)^3 + \left(\cos^3 x\right)^3\right] \text{\_\_\_\_\_\_\_\_\_\_\_\_ (i)}$$

We Know that (a^2-b^2) = $(a+b)^2$-2ab

(a^3+b^3)=(a+b) -3ab(a+b)

Applying the above formula in equation (i)

$$\frac{1}{4}\left[\left\{\left(\sin^2 x\right)+\left(\cos^2 x\right)\right\}^2 - 2\sin^2 x\cos^2 x\right] - \frac{1}{6}\left[\left\{\left(\sin^2 x\right)+\left(\cos^2 x\right)\right\}^2 - 3\sin^2 x\cos^2 x\left(\sin^2 x + \cos^2 x\right)\right]$$

$$\frac{1}{4}\left[1 - 2\sin^2 x\cos^2 x\right] - \frac{1}{6}\left[1 - 3\sin^2 x\cos^2 x\right]$$

$$\left[\frac{1}{4} - \frac{1}{2}\sin^2 x\cos^2 x\right] - \frac{1}{6} + \frac{1}{2}\sin^2 x\cos^2 x$$

$$\frac{1}{4} - \frac{1}{6} = \frac{3-2}{12} = \frac{1}{12}$$

(2) $\frac{1}{12}$

Which of the following is not true?

(1) $\sin\theta = -\frac{3}{4}$ (2) $\cos\theta = -1$ (3) $\tan\theta = 25$ (4) $\sec\theta = \frac{1}{4}$

We know that -1≤ secθ ≤ 1

Since Sec4θ=$\frac{1}{4}$

Which is not lies between -1 and 1

But the other options are not like that

Hence the 4[th] option is wrong

$$(4)\ \sec\theta = \frac{1}{4}$$

$\cos 2\theta \cos 2\phi + \sin^2(\theta - \phi) - \sin^2(\theta + \phi)$ is equal to

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

We know that $\sin^2 A - \sin^2 B = \sin(A+B)\sin(A-B)$

Here $A = (\theta - \phi)$ and $B = (\theta + \phi)$

$\cos 2\theta \cos 2\phi + \sin^2 A - \sin^2 B$

$\cos 2\theta \cos 2\phi + \sin^2(\theta - \phi) - \sin^2(\theta + \phi)$

$\cos 2\theta \cos 2\phi + \sin(\theta - \phi + \theta + \phi)\ \sin(\theta - \phi - \theta - \phi)$

$\cos 2\theta \cos 2\phi + \sin 2\theta \sin(-2\phi)$

$\cos 2\theta \cos 2\phi - \sin 2\theta \sin 2\phi = \cos(2\theta + 2\phi) = \cos 2(\theta + \phi)$

(2) $\cos 2(\theta + \phi)$

$\dfrac{\sin(A-B)}{\cos A \cos B} + \dfrac{\sin(B-C)}{\cos B \cos C} + \dfrac{\sin(C-A)}{\cos C \cos A}$ is

(1) $\sin A + \sin B + \sin C$ (2) 1 (3) 0 (4) $\cos A + \cos B + \cos C$

$$\frac{\sin(A-B)}{\cos A \cos B} + \frac{\sin(B-C)}{\cos B \cos C} + \frac{\sin(C-A)}{\cos C \cos A}$$

$$\frac{\sin A \cos B - \cos A \sin B}{\cos A \cos B} + \frac{\sin B \cos C - \cos B \sin C}{\cos B \cos C} + \frac{\sin C \cos A - \cos C \sin A}{\cos C \cos A}$$

Split the terms we get

$$\frac{\sin A \cos B}{\cos A \cos B} - \frac{\cos A \sin B}{\cos A \cos B} + \frac{\sin B \cos C}{\cos B \cos C} - \frac{\cos B \sin C}{\cos B \cos C} + \frac{\sin C \cos A}{\cos C \cos A} - \frac{\cos C \sin A}{\cos C \cos A}$$

$\tan A - \tan B + \tan B - \tan C + \tan C - \tan A = 0$

(3) 0

If $\cos p\theta + \cos q\theta = 0$ and if $p \neq q$, then θ is equal to (n is any integer)

(1) $\frac{\pi(3n+1)}{p-q}$ (2) $\frac{\pi(2n+1)}{p \pm q}$ (3) $\frac{\pi(n \pm 1)}{p \pm q}$ (4) $\frac{\pi(n+2)}{p+q}$

$$\text{Cos C+Cos D} = 2\text{Cos}\left(\frac{A+B}{2}\right)\text{Cos}\left(\frac{A-B}{2}\right)$$

$$2\text{Cos}\left(\frac{p+q}{2}\right)\theta\,\text{Cos}\left(\frac{p-q}{2}\right)\theta = 0$$

$2\text{Cos}\left(\frac{p+q}{2}\right)\theta = 0 = \cos\frac{\pi}{2}$

$\left(\frac{p+q}{2}\right)\theta = 2n\pi \pm \frac{\pi}{2}$

$\theta = \frac{2\left(2n\pi \pm \frac{\pi}{2}\right)}{p+q}$

$\theta = \frac{\pi(4n \pm 1)}{p+q}$ -------- (i)

$\text{Cos}\left(\frac{p-q}{2}\right)\theta = 0 = \cos\frac{\pi}{2}$

$\left(\frac{p-q}{2}\right)\theta = 2n\pi \pm \frac{\pi}{2}$

$\theta = \frac{2\left(2n\pi \pm \frac{\pi}{2}\right)}{p-q}$

$\theta = \frac{\pi(4n \pm 1)}{p-q}$ --------------(ii)

By combining (i) and (ii) we have

(2) $\frac{\pi(2n+1)}{p \pm q}$

If $\tan\alpha$ and $\tan\beta$ are the roots of $x^2 + ax + b = 0$, then $\frac{\sin(\alpha+\beta)}{\sin\alpha\sin\beta}$ is equal to

(1) $\frac{b}{a}$ (2) $\frac{a}{b}$ (3) $-\frac{a}{b}$ (4) $-\frac{b}{a}$

From the quadratic equation

Sum of the roots = $\tan\alpha + \tan\beta = -a$

Product of the roots = $\tan\alpha\tan\beta = b$

LHS = $\frac{\sin(\alpha+\beta)}{\sin\alpha\sin\beta} = \frac{\sin\alpha\cos\beta + \cos\alpha\sin\beta}{\sin\alpha\sin\beta}$

Separating the terms we have

$\frac{\sin\alpha\cos\beta}{\sin\alpha\sin\beta} + \frac{\cos\alpha\sin\beta}{\sin\alpha\sin\beta} = \frac{\tan\alpha + \tan\beta}{\tan\alpha\tan\beta} = \frac{-a}{b}$ (divide Nr and Dr by Cos αCosβ)

(3) $-\frac{a}{b}$

In a triangle ABC, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is

(1) equilateral triangle (2) isosceles triangle (3) right triangle (4) scalene triangle.

WE know that $Sin^2A+Sin^2B+Sin^2C = 2+2CosACosBCosC$

$Sin^2A+Sin^2B+Sin^2C - 2=2CosACosBCosC$

$0 = 2CosACosBCosC$

Therefore Cos A = 0 $\Rightarrow$ A = 90^0

The given triangle is a right angle

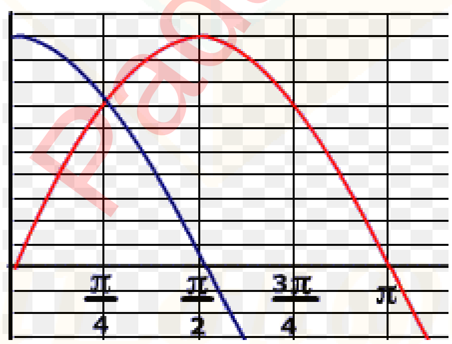
(3) right triangle

If $f(\theta) = |\sin\theta| + |\cos\theta|, \theta \in R$, then $f(\theta)$ is in the interval

(1) $[0, 2]$ (2) $[1, \sqrt{2}]$ (3) $[1, 2]$ (4) $[0, 1]$

When $\theta = 0^0$ f(0) = $|\sin 0| + |\cos 0| = 0 + 1 = 1$

$\theta=45°$ f(45^0) = $|\sin 45^0| + |\cos 45^0| = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$



(2) $[1, \sqrt{2}]$

$\frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$ is equal to

(1) $cos2x$ (2) $\cos x$ (3) $\cos 3x$ (4) $2\cos x$

$$\frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x} = \frac{\cos 6x + \cos 4x + 5\cos 4x + 5\cos 2x + 10\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$$

$$= \frac{2cos5x\cos x + 5(\cos 4x + \cos 2x) + 10(\cos 2x + 1)}{\cos 5x + 5\cos 3x + 10\cos x}$$

$$= \frac{2\cos 5x \cos x + 5(2\cos 3x \cos x) + 10(2\cos^2 x)}{\cos 5x + 5\cos 3x + 10\cos x}$$

$$= \frac{2\cos x(\cos 5x + 5\cos 3x + 10\cos x)}{(\cos 5x + 5\cos 3x + 10\cos x)}$$ = 2cosx (by cancellation)

The triangle of maximum area with constant perimeter $12m$

(1) is an equilateral triangle with side $4m$ (2) is an isosceles triangle with sides $2m, 5m, 5m$
(3) is a triangle with sides $3m, 4m, 5m$ (4) Does not exist.

For a fixed perimeter 2s, the area of a triangle is maximum only when a=b=c

Which means that the triangle must be an equilateral triangle

Since 2s = 12 $\Rightarrow$ s = 6

$\Rightarrow$ (a + b + c) =12 (s = perimeter of triangle)

a + a + a =12 (a=b=c $\therefore$ equilateral triangle)

3a = 12$\Rightarrow$ a =4m

(1) is an equilateral triangle with side $4m$

A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?

(1) 10π seconds (2) 20π seconds (3) 5π seconds (4) 15π seconds

For one full rotation = 2π radian

For 10 complete rotation = 10 x 2π = 20π

Time taken for 2 radian /second

Time taken for 20π = $\frac{20\pi}{2} = 10\pi$ second

(1) 10π seconds

If $\sin\alpha + \cos\alpha = b$, then $\sin 2\alpha$ is equal to

(1) $b^2 - 1$, if $b \le \sqrt{2}$ (2) $b^2 - 1$, if $b > \sqrt{2}$ (3) $b^2 - 1$, if $b \ge 1$ (4) $b^2 - 1$, if $b \ge \sqrt{2}$

Given that $\text{Sin}\alpha + \text{Cos}\alpha = b$

Squaring on both sides we get

$Sin^2\alpha+Cos^2\alpha+2sin\alpha\ cos\alpha= b^2$

$1 + sin2\alpha = b^2$ (since $Sin^2\theta=Cos^2\theta = 1$)

$Sin\ 2\alpha = b^2-1$

(1) b^2-1, if $b \le \sqrt{2}$

In a $\triangle ABC$, if

(i) $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} > 0$

(ii) $\sin A \sin B \sin C > 0$ then

(1) Both (i) and (ii) are true (2) Only (i) is true

(3) Only (ii) is true (4) Neither (i) nor (ii) is true.

Since A+B+C=180

Divide by 2 we get $\frac{A}{2}+\frac{B}{2}+\frac{C}{2}=90^o$

$\frac{A}{2},\frac{B}{2}\ and\ \frac{C}{2}$ are acute angles

In a triangle ABC $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{c}{2}>0$

$\text{Sin}\,A\,\text{Sin}\,B\,\text{Sin}\,C > 0$

Both (i) and (ii) are true

(1) Both (i) and (ii) are true

By G NARASIMHAN

Retried Headmaster

J.G . NATIONAL HIGHER SECONDARY SCHOOL

EAST TAMBARAM CHENNAI -59 PHONE No 9884588989