16. What is $\frac{1}{x(x-y)(x-z)}+\frac{1}{y(y-z)(y-x)}+\frac{1}{z(z-x)(z-y)}$ equal to?

$\frac{1}{x(x-y)(x-z)}+\frac{1}{y(y-z)(y-x)}+\frac{1}{z(z-x)(z-y)}$ किसके बराबर है?

A) 0 ✗

B) 1 ✗

C) 1/xyz = $\frac{1}{6}$ ✓

D) -1/xyz ✗

put $x=1, y=2, z=3$

$\frac{1}{2}+\frac{1}{-2}+\frac{1}{3\times2\times1}$

$=\frac{1}{6}$

17. **Solve for x : $\frac{x-6}{2020}+\frac{x-5}{2021}+\frac{x-4}{2022}=3$?**

x हल करें: $\frac{x-6}{2020}+\frac{x-5}{2021}+\frac{x-4}{2022}=3$

A) 2026 ✓ $=x$ $1+1+1=3$

B) 2020

C) 2021

D) 2022

option से

18. If $\frac{A}{L}+\frac{M}{B}=1$ & $\frac{B}{M}+\frac{N}{C}=1$ then $\frac{L}{A}+\frac{C}{N}$

यदि $\frac{A}{L}+\frac{M}{B}=1$ & $\frac{B}{M}+\frac{N}{C}=1$, तो $\frac{L}{A}+\frac{C}{N}$ ज्ञात कीजिए?

A) 1

B) B/M

C) M/B

D) 0

$A+\frac{1}{B}=1$, $B+\frac{1}{C}=1$

$A=1-\frac{1}{B}$ $\quad \frac{1}{C}=1-B$

$=\frac{B-1}{B}$ $\quad C=\frac{1}{1-B}$

$\frac{1}{A}+C=\frac{B}{B-1}+\frac{1}{1-B}$

$=\frac{B-1}{B-1}=1$

eqn

but $L=M=N=1$

19. If $a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$ (where $a \neq b \neq c$), then abc is equal to

(Mains 2016)

यदि $a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$ (जहाँ $a \neq b \neq c$) तो **abc** किसके बराबर है?

(a) +1 (b) –1

(c) +1 & –1 (d) None of these/ इनमें से कोई नहीं

$a - b = \frac{b-c}{bc}$ ×

$b - c = \frac{c-a}{ac}$ ×

$c - a = \frac{a-b}{ab}$ ×

$1 = \frac{1}{(abc)^2}$

$(abc)^2 = 1$

$abc = \pm 1$

20. When $f(m) = m^5 + 5m^4 - 3m + 7$ is divided by (m-2), then the remainder is ____?

जब $f(m) = m^5 + 5m^4 - 3m + 7$ को (m-2) से विभाजित किया जाता है, तो शेषफल ____ होता है?

SSC CGL Pre 2024

A) 78
B) 95
C) 110
D) 113

put $m-2=0$

$m=2$

$Rem = 32+80-6+7$

$= 113$

21. If the polynomial $(2x^3 + ax^2 + 3x - 5)$ and $(x^3 + x^2 - 2x + a)$ leave the same remainder when divided by $(x - 2)$, find the remainder.

यदि बहुपद $(2x^3 + ax^2 + 3x - 5)$ और $(x^3 + x^2 - 2x + a)$ को $(x - 2)$ से विभाजित करने पर समान शेषफल प्राप्त होता है, तो शेषफल ज्ञात करें। **SSC CPO PRE 2024**

[A] 4
[B] 3
[C] 2
[D] 5

put $x-2=0$

$x=2$

Rem

$16+4a+1 = 8+a$

5

$3a=-9$

$a=-3$

22. If $x^3 - 6x^2 + ax + b$ is divisible by $(x^2 - 3x + 2)$, then the values of a and b are:

यदि $x^3 - 6x^2 + ax + b$, $(x^2 - 3x + 2)$ से विभाज्य है, तो a और b के मान हैं:

(SSC CHSL 2020)

$= (x-2)\cdot(x-1)$

(a) a = 11 and b = 6
(b) a = – 6 and b = – 11
(c) a = 11 and b = – 6
(d) a = 6 and b = 11

put $x=2$
$x=1$

$1-6+a+b=0$

Rem

$8-24+2a+b=0$

$$\begin{cases} 2a+b=16 \\ a+b=5 \end{cases}$$

$f(x)$ को $(x-a)$ से divide करने पर Rem $= f(a)$

$$x-a \overline{)\, f(x) \,(} \; Q$$
$$R$$

Let $x = a$

$$f(x) = (x-a)Q + R$$

$$f(a) = R$$

23. What is the LCM of $x^4 + x^2y^2 + y^4, x^3 + y^3, x^3 - y^3$?

$x^4 + x^2y^2 + y^4, x^3 + y^3, x^3 - y^3$ का LCM क्या है? (CDS 2023)

A) $(x^2 - y^2)(x^4 + x^2y^2 + y^4)^2$

B) $(x^2 - y^2)(x^4 + 2x^2y^2 + y^4)$

C) $(x^6 - y^6)$

D) $(x^6 + y^6)$

$(x^2+xy+y^2)(x^2-xy+y^2)$

$(x+y)(x^2-xy+y^2)$

$(x-y)(x^2+xy+y^2)$

24. HCF and LCM of two polynomials are $(x + 3)$ and $(x^3 - 9x^2 - x + 105)$ respectively. If one of the two polynomials is $x^2 - 4x - 21$, then the other is

दो बहुपदों का **HCF** और **LCM** क्रमशः $(x + 3)$ और $(x^3 - 9x^2 - x + 105)$ हैं। यदि दो बहुपदों में से एक $x^2 - 4x - 21$ है, तो दूसरा है

(a) ~~$x^2 + 2x - 21$~~ ✓

(b) ~~$x^2 + 2x + 15$~~

(c) $x^2 - 2x - 15$

(d) ~~$x^2 - x - 15$~~ ✗

1 −2 −15

$(x+3) \times (x^3 - 9x^2 - x + 105) = (x^2 - 4x - 21) \times ?$

put $x = 0$

$3 \times 105 = -21 \times ?$

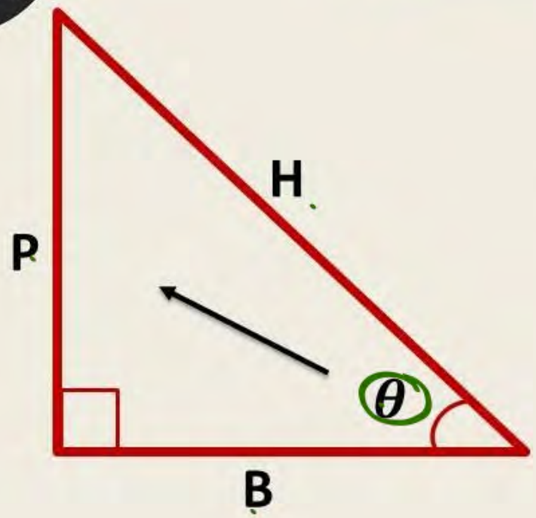
$-15 = ?$

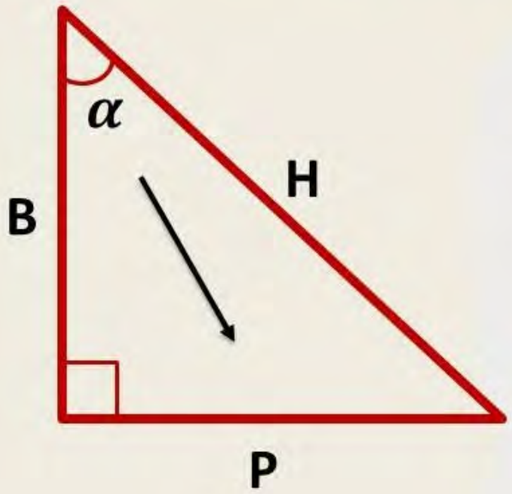
put $x = 1$

$4 \times 96 = -24 \times ?$

$-16 = ?$

Trigonometry (त्रिकोणमिति)





H → Hypotenuse (कर्ण)
P → Perpendicular (लम्ब)
B → Base (आधार)

$$H^2 = P^2 + B^2$$

Pythagoras Theorem

A Pythagoras triplet is a set of +ve integers a , b and c that fits the rule
(एक पाइथागोरेस त्रिक धनात्मक संख्याऐं a, b, c का एक ऐसा समूह है, जो इस नियम को संतुष्ट करता है)

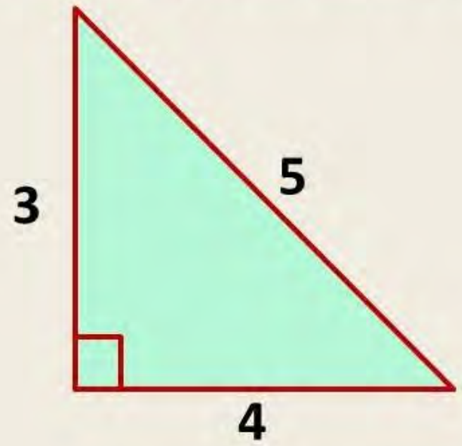
$$a^2 + b^2 = c^2$$

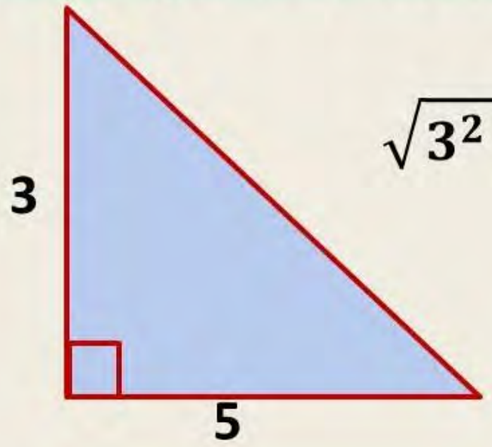
$3^2 + 4^2 = 5^2$ ∴ 3, 4 , 5 are Triplets

Some Pythagorean Triplets

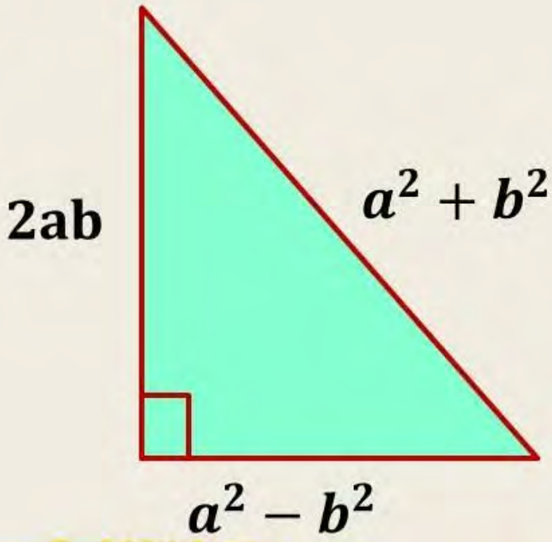
(3 , 4 , 5)	(5 , 12 , 13)	(7 , 24 , 25)	(8 , 15 , 17)
(9 , 40 , 41)	(11 , 60 , 61)	(12 , 35 , 37)	(13 , 84 , 85)
(16 , 63 , 65) ✓	(20 , 21 , 29) ✓	(28 , 45 , 53) ✓	(33 , 56 , 65) ✓
(36 , 77 , 85) ✓	(39 , 80 , 89) ✓	(48 , 55 , 73) ✓	(65 , 72 , 97) ✓
(20 , 99 , 101) ✓			

In a triplet largest side is hypotenuse (त्रिक में सबसे बड़ी भुजा कर्ण होती है)





$$\sqrt{3^2 + 5^2} = \sqrt{34}$$



$$a^2 - b^2 , 2ab , a^2 + b^2 \longrightarrow \text{Triplets}$$

H

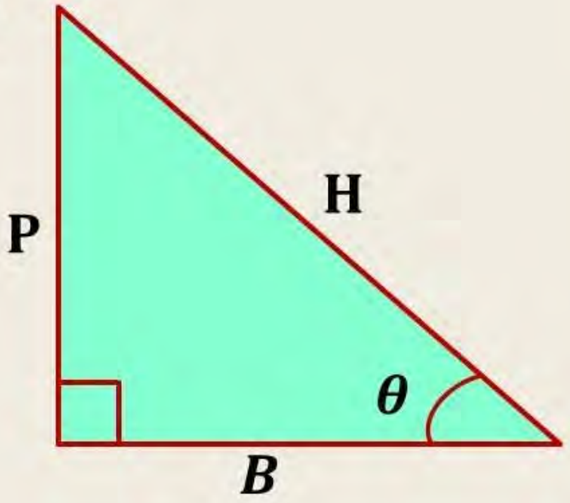
$x^2-1, 2x, x^2+1$

Multiplication and division of basic triplets results into other triplets
(मूल त्रिक के गुणन और विभाजन से अन्य त्रिक बनाये जा सकते है)

$(3,4,5) \xrightarrow{x2} (6,8,10) \xrightarrow{x2} (12,16,20)$

$(5,12,13) \xrightarrow{x2} (10,24,26) \xrightarrow{x1.5} (15,36,39)$

$a \to x$
$b \to 1$



$$\sin\theta = \frac{P(\text{लम्ब})}{H(\text{कर्ण})}$$

$$\cos\theta = \frac{B(\text{आधार})}{H(\text{कर्ण})}$$

$$\tan\theta = \frac{P(\text{लम्ब})}{B(\text{आधार})}$$

$$\operatorname{cosec}\theta = \frac{H(\text{कर्ण})}{P(\text{लम्ब})}$$

$$\sec\theta = \frac{H(\text{कर्ण})}{B(\text{आधार})}$$

$$\cot\theta = \frac{B(\text{आधार})}{P(\text{लम्ब})}$$

$$\operatorname{cosec}\theta = \frac{1}{\sin\theta} \Longrightarrow \sin\theta \times \operatorname{cosec}\theta = 1$$

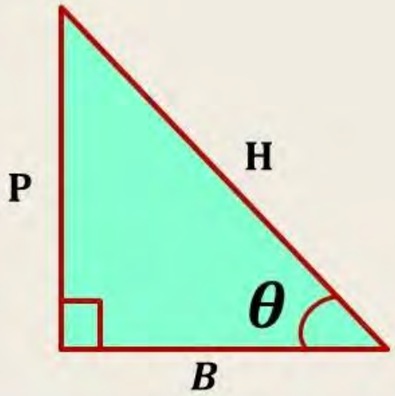
$$\sec\theta = \frac{1}{\cos\theta} \Longrightarrow \cos\theta \times \sec\theta = 1$$

$$\cot\theta = \frac{1}{\tan\theta} \Longrightarrow \tan\theta \times \cot\theta = 1$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\sec\theta}{\operatorname{cosec}\theta}$$

$$\cot\theta = \frac{\cos\theta}{\sin\theta} = \frac{\operatorname{cosec}\theta}{\sec\theta}$$

Basic Trigonometric Identities



$$H^2 = P^2 + B^2$$

$$\left(\frac{P}{H}\right)^2 + \left(\frac{B}{H}\right)^2 = 1 \Rightarrow \boxed{\sin^2\theta + \cos^2\theta = 1}$$

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

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

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

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

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

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

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

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

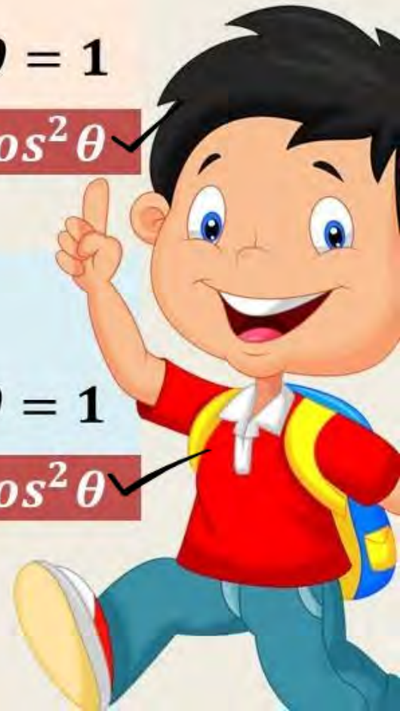
$$\sin^4\theta + \cos^4\theta + 2\sin^2\theta\cos^2\theta = 1$$

$$\boxed{\sin^4\theta + \cos^4\theta = 1 - 2\sin^2\theta\cos^2\theta}$$

$$\left(\sin^2\theta + \cos^2\theta\right)^3 = (1)^3$$

$$\sin^6\theta + \cos^6\theta + 3\sin^2\theta\cos^2\theta = 1$$

$$\boxed{\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta}$$



$(\sin^2\theta + \cos^2\theta = 1) \div \cos^2\theta$

$\sec^2\theta = 1 + \tan^2\theta$

$\tan^2\theta + 1 = \sec^2\theta$

$\tan^2\theta = \sec^2\theta - 1 \longrightarrow \tan^2\theta = (\sec\theta - 1)(\sec\theta + 1)$

$\dfrac{\tan\theta}{(\sec\theta+1)} = \dfrac{(\sec\theta-1)}{\tan\theta}$

$\sec^2\theta - \tan^2\theta = 1$

$(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

$(\sec\theta - \tan\theta) = \dfrac{1}{(\sec\theta + \tan\theta)}$

$(\sin^2\theta + \cos^2\theta = 1) \div \sin^2\theta$

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

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

$\cot^2\theta = \operatorname{cosec}^2\theta - 1 \longrightarrow \cot^2\theta = (\operatorname{cosec}\theta - 1)(\operatorname{cosec}\theta + 1)$

$\operatorname{cosec}^2\theta - \cot^2\theta = 1$

$\dfrac{\cot\theta}{(\operatorname{cosec}\theta+1)} = \dfrac{(\operatorname{cosec}\theta-1)}{\cot\theta}$

$(\operatorname{cosec}\theta + \cot\theta)\cdot(\operatorname{cosec}\theta - \cot\theta) = 1$

$(\operatorname{cosec}\theta + \cot\theta) = \dfrac{1}{(\operatorname{cosec}\theta - \cot\theta)}$

$$sec^2\theta + cosec^2\theta \longrightarrow \frac{1}{cos^2\theta} + \frac{1}{sin^2\theta} \longrightarrow \frac{sin^2\theta+cos^2\theta}{sin^2\theta cos^2\theta} \longrightarrow \frac{1}{sin^2\theta cos^2\theta}$$

$$sec^2\theta + cosec^2\theta = sec^2\theta . cosec^2\theta$$

$$tan^2\theta - sin^2\theta \longrightarrow \frac{sin^2\theta}{cos^2\theta} - sin^2\theta \longrightarrow \frac{sin^2\theta - sin^2\theta cos^2\theta}{cos^2\theta} \longrightarrow \frac{sin^2\theta(1-cos^2\theta)}{cos^2\theta} \longrightarrow \frac{sin^2\theta . sin^2\theta}{cos^2\theta}$$

$$tan^2\theta - sin^2\theta = tan^2\theta . sin^2\theta$$

$$cot^2\theta - cos^2\theta \longrightarrow \frac{cos^2\theta}{sin^2\theta} - cos^2\theta \longrightarrow \frac{cos^2\theta - sin^2\theta cos^2\theta}{sin^2\theta} \longrightarrow \frac{cos^2\theta(1-sin^2\theta)}{sin^2\theta} \longrightarrow \frac{cos^2\theta . cos^2\theta}{sin^2\theta}$$

$$cot^2\theta - cos^2\theta = cot^2\theta . cos^2\theta$$

$$(\tan\theta + \cot\theta) \longrightarrow \frac{\sin\theta}{(\cos\theta)} + \frac{\cos\theta}{(\sin\theta)} \longrightarrow \frac{1}{\sin\theta.\cos\theta} \longrightarrow \sec\theta.\operatorname{cosec}\theta \longrightarrow 2\operatorname{cosec}2\theta$$

$$(\cot\theta - \tan\theta) = 2\cot 2\theta$$

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

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

$$(\tan\theta + \cot\theta)^2 = \tan^2\theta + \cot^2\theta + 2 = \sec^2\theta + \operatorname{cosec}^2\theta = \sec^2\theta.\operatorname{cosec}^2\theta$$

Trigonometry Ratio Table

Angle (in Degrees)	0°	30°	45°	60°	90°
Angle (in Radians)	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
Sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not Defined
Cot	Not Defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
Sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not Defined
Cosec	Not Defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1

ASTC (+ve)

❖ θ ⟶ Any Acute Angle ($\theta < 90°$)

90°,450°

II

I

sin & cosec (+ve)

$90° + \theta$

$180° - \theta$

All (+ve)

$0° + \theta$

$90° - \theta$

180°,540°

0°,360°

$180° + \theta$

$270° - \theta$

tan & cot (+ve)

$270° + \theta$

$360° - \theta$

$0° - \theta$

cos & sec (+ve)

III

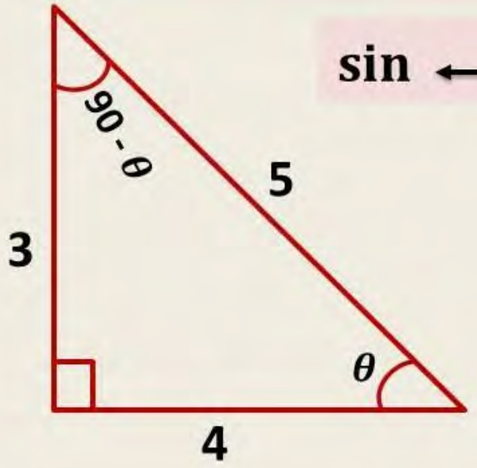
IV

270°,630°

CHANE OF T- RATIO

90° , 270°.....change (90 के odd multiple पर change)

180° , 360°.....no change (90 के even multiple पर No change)



sin ⟷ cos tan ⟷ cot sec ⟷ cosec

$\text{Sin}(90°- \theta) = \frac{4}{5} = cos\theta$

$\cos(90°- \theta) = \frac{3}{5} = sin\theta$

$\text{Sin}(90°- \theta) = cos\theta$

$\cos(90°- \theta) = sin\theta$

$\tan(90°- \theta) = \cot\theta$

$\cot(90°- \theta) = \tan\theta$

$\sec(90°- \theta) = cosec\theta$

$\text{cosec}(90°- \theta) = sec\theta$

If A + B = 90° ⟶ A , B are complementary to each other

sinA = cosB ✓ sinA . secB = 1

tanA = cotB ✓ tanA . tanB = 1 (or) cotA . cotB = 1

secA = cosecB ✓ cosA . cosecB = 1

$sin^2A + sin^2B = 1$ ✓

$cos^2A + cos^2B = 1$ ✓

Ex:- sin49° x sec41° = 1

Ex:- tan31° x tan59° = 1

Ex:- cos74° x cosec16° = 1

$$\sin(A + B) = \sin A\cos B + \cos A\sin B$$

$$\sin(A - B) = \sin A\cos B - \cos A\sin B$$

$$\cos(A + B) = \cos A\cos B - \sin A\sin B$$

$$\cos(A - B) = \cos A\cos B + \sin A\sin B$$

$$2\sin A \cdot \cos B = \sin(A + B) + \sin(A - B)$$

$$2\cos A \cdot \sin B = \sin(A + B) - \sin(A - B)$$

$$2\cos A \cdot \cos B = \cos(A + B) + \cos(A - B)$$

$$2\sin A \cdot \sin B = \cos(A - B) - \cos(A + B)$$

$$\sin(A + B) \cdot \sin(A - B) = \sin^2 A \cdot \cos^2 B - \cos^2 A \cdot \sin^2 B$$

$$= \sin^2 A(1 - \sin^2 B) - \sin^2 B(1 - \sin^2 A)$$

$$= \sin^2 A - \sin^2 B = \cos^2 B - \cos^2 A$$

$$\cos(A + B) \cdot \cos(A - B) = \cos^2 A - \sin^2 B = \cos^2 B - \sin^2 A$$

$$\sin C + \sin D = 2\sin\frac{C+D}{2} \cdot \cos\frac{C-D}{2}$$

$$\sin C - \sin D = 2\cos\frac{C+D}{2} \cdot \sin\frac{C-D}{2}$$

$$\cos C + \cos D = 2\cos\frac{C+D}{2} \cdot \cos\frac{C-D}{2}$$

$$\cos C - \cos D = 2\sin\frac{C+D}{2} \cdot \sin\frac{D-C}{2}$$

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

$$\sin A = 2\sin\frac{A}{2} \cdot \cos\frac{A}{2}$$

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

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

$$\cos 2A = 2\cos^2 A - 1 \longrightarrow 2\cos^2 A = 1 + \cos 2A$$

$$\cos^2 A = \frac{1+\cos 2A}{2}$$

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

$$\cos 2A = 1 - 2\sin^2 A \longrightarrow 2\sin^2 A = 1 - \cos 2A$$

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

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

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\cot(A + B) = \frac{\cot A \cot B - 1}{\cot A + \cot B}$$

$$\cot(A - B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$$

$$\sin 3A = 3\sin A - 4\sin^3 A$$

$$\cos 3A = 4\cos^3 A - 3\cos A$$

$$\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

$$\cot 3A = \frac{\cot^3 A - 3\cot A}{3\cot^2 A - 1}$$