**CBSE Class–12 Mathematics**

**NCERT solution**

**Chapter - 4**

**Determinants - Exercise 4.2**

**Using the properties of determinants and without expanding in Exercise 1 to 7, prove that:**

**1.** $\begin{vmatrix} x & a & x+a \\ y & b & y+b \\ z & c & z+c \end{vmatrix} = 0$

**Ans.** Given: $\begin{vmatrix} x & a & x+a \\ y & b & y+b \\ z & c & z+c \end{vmatrix} = 0$

Operating $C_1 \to C_1 + C_2$

$$\begin{vmatrix} x+a & a & x+a \\ y+b & b & y+b \\ z+c & c & z+c \end{vmatrix} = 0$$

$\Rightarrow$ 0 = 0 [ $\because$ $C_1$ and $C_2$ are identical]

$\Rightarrow$ L.H.S. = R.H.S.

**2.** $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$ **= 0**

**Ans.** $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$

Operating $C_1 \to C_1 + C_2 + C_3$

= $\begin{vmatrix} a-b+b-c+c-a & b-c & c-a \\ b-c+c-a+a-b & c-a & a-b \\ c-a+a-b+b-c & a-b & b-c \end{vmatrix}$

=> $\begin{vmatrix} 0 & b-c & c-a \\ 0 & c-a & a-b \\ 0 & a-b & b-c \end{vmatrix}$ = 0 = R.H.S.

[$\because$ All entries of one column here first are zero]

**3.** $\begin{vmatrix} 2 & 7 & 65 \\ 3 & 8 & 75 \\ 5 & 9 & 86 \end{vmatrix} = 0$

**Ans.** $\begin{vmatrix} 2 & 7 & 65 \\ 3 & 8 & 75 \\ 5 & 9 & 86 \end{vmatrix}$,

operating $C_3 \to C_3 - C_1$

$= \begin{vmatrix} 2 & 7 & 63 \\ 3 & 8 & 72 \\ 5 & 9 & 81 \end{vmatrix}$

= $9\begin{vmatrix} 2 & 7 & 7 \\ 3 & 8 & 8 \\ 5 & 9 & 9 \end{vmatrix}$

= 9 x 0 = 0 [∵ two columns are identical] Proved.

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**4.** $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix} = 0$

**Ans.** $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix}$

= $\begin{vmatrix} 1 & bc & ab+ac \\ 1 & ca & bc+ba \\ 1 & ab & ca+cb \end{vmatrix}$

Operating $C_3 \to C_3 + C_2$

$\begin{vmatrix} 1 & bc & ab+ab+ac \\ 1 & ca & ab+ab+ac \\ 1 & ab & ab+ab+ac \end{vmatrix}$

= $(ab+ab+ac)\begin{vmatrix} 1 & bc & 1 \\ 1 & ca & 1 \\ 1 & ab & 1 \end{vmatrix}$

= $(ab+ab+ac)(0)$ = 0 [∵ two columns are identical] Proved.

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**5.** $\begin{vmatrix} (b+c) & q+r & y+z \\ (c+a) & r+p & z+x \\ (a+b) & p+q & x+y \end{vmatrix} = 2\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$

**Ans.** L.H.S. = $\begin{vmatrix} (b+c) & q+r & y+z \\ (c+a) & r+p & z+x \\ (a+b) & p+q & x+y \end{vmatrix}$

operating $R_1 \rightarrow R_1 + R_2 + R_3$

$$= \begin{vmatrix} b+c+c+a+a+b & q+r+r+p+p+q & y+z+z+x+x+y \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix}$$

$$= \begin{vmatrix} 2(a+b+c) & 2(p+q+r) & 2(x+y+z) \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix}$$

$$= 2\begin{vmatrix} (a+b+c) & (p+q+r) & (x+y+z) \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix}$$

[operating $R_1 \rightarrow R_1 - R_2$]

$$= 2\begin{vmatrix} b & q & y \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix}$$

[operating $R_3 \rightarrow R_3 - R_1$]

$$= 2\begin{vmatrix} b & q & y \\ c+a & r+p & z+x \\ a & p & x \end{vmatrix}$$

[operating $R_2 \rightarrow R_2 - R_3$]

$= 2\begin{vmatrix} b & q & y \\ c & r & z \\ a & p & x \end{vmatrix}$

[Interchanging $R_2$ and $R_3$]

$= -2\begin{vmatrix} b & q & y \\ a & p & x \\ c & r & z \end{vmatrix}$

[Interchanging $R_2$ and $R_3$]

$= -(-2)\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$

$= 2\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$ = R.H.S.

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**6.** $\begin{vmatrix} 0 & a & -b \\ -a & 0 & -c \\ b & c & 0 \end{vmatrix}$ **= 0**

**Ans.** Let $\Delta = \begin{vmatrix} 0 & a & -b \\ -a & 0 & -c \\ b & c & 0 \end{vmatrix}$

[Taking $(-1)$ common from each row]

=> $\Delta = (-1)^3 \begin{vmatrix} 0 & -a & b \\ a & 0 & c \\ -b & -c & 0 \end{vmatrix}$

Interchanging rows and columns in the determinants on R.H.S.,

$\Delta = -\begin{vmatrix} 0 & a & -b \\ -a & 0 & -c \\ b & c & 0 \end{vmatrix}$

$\Rightarrow \ \Delta = -\Delta$

$\Rightarrow \Delta + \Delta = 0$

$\Rightarrow \ 2\Delta = 0$

$\Rightarrow \ \Delta = 0$ Proved.

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**7.** $\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4a^2b^2c^2$

**Ans.** L.H.S. = $\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix}$

Taking common $a, b, c$ from $R_1, R_2, R_3$ respectively,

= $abc \begin{vmatrix} -a & b & c \\ a & -b & b \\ a & b & -c \end{vmatrix}$

[operating $R_1 \rightarrow R_1 + R_2$]

= $abc\begin{vmatrix} 0 & 0 & 2c \\ a & -b & c \\ a & b & -c \end{vmatrix}$

= $abc.2c\begin{vmatrix} a & -b \\ a & b \end{vmatrix}$

= $abc.2c(ab+ab)$

= $abc.2c.2ab$ = $4a^2b^2c^2$ = R.H.S.

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**8. (i)** $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$

**(ii)** $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$

**Ans. (i)** L.H.S. = $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$

$R_2 \rightarrow R_2 - R_1$ and $R_3 \rightarrow R_3 - R_1$,

= $\begin{vmatrix} 1 & a & a^2 \\ 0 & b-a & b^2-a^2 \\ 1 & c-a & c^2-a^2 \end{vmatrix}$

$$\begin{vmatrix} 1 & a & a^2 \\ 0 & b-a & (b-a)(b+a) \\ 0 & c-a & (c-a)(c+a) \end{vmatrix}$$

Taking (b-a) and (c-a) common from $R_2$ and $R_3$ respectively.

$$= (b-a)(c-a)\begin{vmatrix} 1 & a & a^2 \\ 0 & 1 & (b+a) \\ 0 & 1 & (c+a) \end{vmatrix}$$

$R_2 \to R_2 - R_3$

$$= (b-a)(c-a)\begin{vmatrix} 1 & a & a^2 \\ 0 & 0 & (b-c) \\ 0 & 1 & (c+a) \end{vmatrix}$$

[Expanding along 1st column]

$$= (b-a)(c-a)\begin{vmatrix} 0 & (b+a) \\ 1 & (c+a) \end{vmatrix}$$

$$= (b-a)(c-a)(0-(b-c))$$

$$= (b-a)(c-a)(c-b)$$

$= (a-b)(b-c)(c-a)$ = R.H.S. Proved.

**(ii)** L.H.S. = $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$

operating $C_2 \to C_2 - C_1$ and $C_3 \to C_3 - C_1$

$= \begin{vmatrix} 1 & 0 & 0 \\ a & b-a & c-a \\ a^3 & b^3-a^3 & c^3-a^3 \end{vmatrix}$

$= 1\begin{vmatrix} b-a & c-a \\ b^3-a^3 & c^3-a^3 \end{vmatrix}$

$$= 1\begin{vmatrix} b-a & c-a \\ (b-a)(b^2+a^2+ab) & (c-a)(c^2+a^2+ac) \end{vmatrix}$$

$$= (b-a)(c-a)\begin{vmatrix} 1 & 1 \\ (b^2+a^2+ab) & (c^2+a^2+ac) \end{vmatrix}$$

$$= (b-a)(c-a)(c^2+a^2+ac-b^2-a^2-ab)$$

$$= (b-a)(c-a)(c^2-b^2+ac-ab)$$

$$= (b-a)(c-a)[(c-b)(c+b)+a(c-b)]$$

$$= (b-a)(c-a)(c-b)(c+b+a)$$

$$= -(a-b)(c-a)[-(b-c)(c+b+a)]$$

$$= (a-b)(b-c)(c-a)(a+b+c)$$ = R.H.S.

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**9.** $\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$

**Ans.** $\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$

L.H.S. = $\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix}$

[Multiplying $R_1, R_2, R_3$ by $x, y, z$ respectively]

$$= \frac{1}{xyz}\begin{vmatrix} x^2 & x^3 & xyz \\ y^2 & y^3 & xyz \\ z^2 & z^3 & xyz \end{vmatrix}$$

$$= \begin{vmatrix} x^2 & x^3 & xyz \\ y^2 & y^3 & xyz \\ z^2 & z^3 & xyz \end{vmatrix}$$

Taking xyz commong from $C_3$

$$= \frac{xyz}{xyz}\begin{vmatrix} x^2 & x^3 & 1 \\ y^2 & y^3 & 1 \\ z^2 & z^3 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} x^2 & x^3 & 1 \\ y^2 & y^3 & 1 \\ z^2 & z^3 & 1 \end{vmatrix}$$

[operating $R_2 \to R_2 - R_1, R_3 \to R_3 - R_1$]

$$= \begin{vmatrix} x^2 & x^3 & 1 \\ y^2 - x^2 & y^3 - x^3 & 0 \\ z^2 - x^2 & z^3 - x^3 & 0 \end{vmatrix}$$

$$= 1\begin{vmatrix} y^2 - x^2 & y^3 - x^3 \\ z^2 - x^2 & z^3 - x^3 \end{vmatrix}$$

$$= \begin{vmatrix} (y-x)(y+x) & (y-x)(y^2+x^2+yx) \\ (z-x)(z+x) & (z-x)(z^2+x^2+zx) \end{vmatrix}$$

= $(y-x)(z-x)\begin{vmatrix} y+x & y^2+x^2+yx \\ z+x & z^2+x^2+zx \end{vmatrix}$

= $(y-x)(z-x)\left[(y+x)(z^2+x^2+zx)-(z+x)(y^2+x^2+xy)\right]$

= $(y-x)(z-x)\left[yz^2+yx^2+xyz+xz^2+x^3+x^2z-zy^2-zx^2-xyz-xy^2-x^3-x^2y\right]$

= $(y-x)(z-x)\left[yz^2-zy^2+xz^2-xy^2\right]$

= $(y-x)(z-x)\left[yz(z-y)+x(z^2-y^2)\right]$

= $(y-x)(z-x)\left[yz(z-y)+x(z-y)(z+y)\right]$

= $(y-x)(z-x)(z-y)\left[yz+x(z+y)\right]$

= $-(x-y)(z-x)\left[-(y-z)\right]\left[yz+xz+xy\right]$

= $(x-y)(y-z)(z-x)(xy+yz+zx)$ = R.H.S.

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**10. (i)** $\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix}=(5x+4)(4-x)^2$

**(ii)** $\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix}=k^2(3y+k)$

**Ans. (i)** L.H.S. = $\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix}$

$\left[R_1 \to R_1+R_2+R_3\right]$

= $\begin{vmatrix} 5x+4 & 5x+4 & 5x+4 \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix}$

Taking 5x+4 common from $R_1$

= $(5x+4)\begin{vmatrix} 1 & 1 & 1 \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix}$

[operating $C_2 \to C_2 - C_1$ and $C_3 \to C_3 - C_1$]

= $(5x+4)\begin{vmatrix} 1 & 0 & 0 \\ 2x & 4-x & 0 \\ 2x & 0 & 4-x \end{vmatrix}$

= $(5x+4).1\begin{vmatrix} 4-x & 0 \\ 0 & 4-x \end{vmatrix}$

= $(5x+4)(4-x)^2$ = R.H.S.

**(ii)** L.H.S. = $\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & 2x & y+k \end{vmatrix}$

$[C_1 \to C_1 + C_2 + C_3]$

= $\begin{vmatrix} 3y+k & y & y \\ 3y+k & y+k & y \\ 3y+k & y & y+k \end{vmatrix}$

Taking 3y+k common from $C_1$

= $(3y+k)\begin{vmatrix} 1 & y & y \\ 1 & y+k & y \\ 1 & y & y+k \end{vmatrix}$

[operating $C_2 \to C_2 - C_1$ and $C_3 \to C_3 - C_1$]

= $(3y+k)\begin{vmatrix} 1 & y & y \\ 0 & k & 0 \\ 0 & 0 & k \end{vmatrix}$

= $(3y+k).1\begin{vmatrix} k & 0 \\ 0 & k \end{vmatrix}$

= $(3y+k)k^2$ = $k^2(3y+k)$

= R.H.S. Proved.

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**11. (i)** $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

**(ii)** $\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix} = 2(x+y+z)^3$

**Ans. (i)** L.H.S. = $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$

$[R_1 \to R_1 + R_2 + R_3]$

$$= \begin{vmatrix} a+b+c & a+b+c & a+b+c \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

Taking a+b+c common from $R_1$

$$= (a+b+c)\begin{vmatrix} 1 & 1 & 1 \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$[C_2 \to C_2 - C_1 \text{ and } C_3 \to C_3 - C_1]$

$$= (a+b+c)\begin{vmatrix} 1 & 0 & 0 \\ 2b & -b-c-a & 0 \\ 2c & 0 & -c-a-b \end{vmatrix}$$

$$= (a+b+c).1.\begin{vmatrix} -b-c-a & 0 \\ 0 & -c-a-b \end{vmatrix}$$

$$= (a+b+c)\{-(b+c+a)\}\{-(c+a+b)\}$$

$= (a+b+c)^3$ = R.H.S. Proved.

**(ii)** L.H.S. = $\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix}$

$[C_1 \to C_1 + C_2 + C_3]$

$$= \begin{vmatrix} 2(x+y+z) & x & y \\ 2(x+y+z) & y+z+2x & y \\ 2(x+y+z) & x & z+x+2y \end{vmatrix}$$

Taking 2(x+y+z) common from $C_1$

$$= 2(x+y+z)\begin{vmatrix} 1 & x & y \\ 1 & y+z+2x & y \\ 1 & x & z+x+2y \end{vmatrix}$$

$[R_2 \to R_2 - R_1 \text{ and } R_3 \to R_3 - R_1]$

$$= 2(x+y+z)\begin{vmatrix} 1 & x & y \\ 0 & x+y+z & 0 \\ 0 & 0 & x+y+z \end{vmatrix}$$

$$= 2(x+y+z).1.\begin{vmatrix} x+y+z & 0 \\ 0 & x+y+z \end{vmatrix}$$

$$= 2(x+y+z)\left[(x+y+z)^2 - 0\right]$$

$= 2(x+y+z)^3$ = R.H.S. Proved.

**12.** $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2$

**Ans.** L.H.S. = $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix}$

$[R_1 \to R_1 + R_2 + R_3]$

$$= \begin{vmatrix} 1+x+x^2 & 1+x+x^2 & 1+x+x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} \text{T}$$

Taking $1+x+x^2$ common from $R_1$

$$= \left(1+x+x^2\right)\begin{vmatrix} 1 & 1 & 1 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix}$$

$$\left[C_2 \to C_2 - C_1 \text{ and } C_3 \to C_3 - C_1\right]$$

$$= \left(1+x+x^2\right)\begin{vmatrix} 1 & 0 & 0 \\ x^2 & 1-x^2 & x-x^2 \\ x & x^2-x & 1-x \end{vmatrix}$$

$$= \left(1+x+x^2\right).1.\begin{vmatrix} 1-x^2 & x-x^2 \\ x^2-x & 1-x \end{vmatrix}$$

$$= \left(1+x+x^2\right).1.\begin{vmatrix} (1-x)(1+x) & x(1-x) \\ -x(1-x) & 1-x \end{vmatrix}$$

$$= \left(1+x+x^2\right)\left[(1-x)^2(1+x)+x^2(1-x)^2\right]$$

$$= \left(1+x+x^2\right)(1-x)^2\left(1+x+x^2\right)$$

$$= \left(1+x+x^2\right)^2(1-x)^2$$

$$= \left[\left(1+x+x^2\right)(1-x)\right]^2$$

$$= \left(1-x+x-x^2+x^2-x^3\right)^2$$

= $\left(1-x^3\right)^2$ = R.H.S. Proved.

**13.** $\begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix} = \left(1+a^2+b^2\right)^3$

**Ans.** L.H.S. = $\begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix}$

$[C_1 \to C_1 - b\ C_3 \text{ and } C_2 \to C_2 + a\ C_3]$

= $\begin{vmatrix} 1+a^2+b^2 & 0 & -2b \\ 0 & 1+a^2+b^2 & 2a \\ b\left(1+a^2+b^2\right) & -a\left(1+a^2+b^2\right) & 1-a^2-b^2 \end{vmatrix}$

= $\left(1+a^2+b^2\right)^2 \begin{vmatrix} 1 & 0 & -2b \\ 0 & 1 & 2a \\ b & -a & 1-a^2-b^2 \end{vmatrix}$

$[R_3 \to R_3 - b\ R_1]$

= $\left(1+a^2+b^2\right)^2 \begin{vmatrix} 1 & 0 & -2b \\ 0 & 1 & 2a \\ 0 & -a & 1-a^2+b^2 \end{vmatrix}$

= $\left(1+a^2+b^2\right)^2 \begin{vmatrix} 1 & 2a \\ -a & 1-a^2+b^2 \end{vmatrix}$

= $\left(1+a^2+b^2\right)^2 \left(1-a^2+b^2+2a^2\right)$

= $\left(1+a^2+b^2\right)^3$ = R.H.S.

**14.** $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$

**Ans.** L.H.S. = $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix}$

Multiplying $C_1, C_2, C_3$ by $a, b, c$ respectively and then dividing the determinant by $abc$,

= $\dfrac{1}{abc}\begin{vmatrix} a\left(a^2+1\right) & ab^2 & ac^2 \\ a^2b & b\left(b^2+1\right) & bc^2 \\ a^2c & b^2c & c\left(c^2+1\right) \end{vmatrix}$

Taking a,b, and c common from $R_1$, $R_2$ and $R_3$ respectively.

= $\dfrac{abc}{abc}\begin{vmatrix} a^2+1 & b^2 & c^2 \\ a^2 & b^2+1 & c^2 \\ a^2 & b^2 & c^2+1 \end{vmatrix}$

$\left[C_1 \to C_1 + C_2 + C_3\right]$

= $\dfrac{abc}{abc}\begin{vmatrix} 1+a^2+b^2+c^2 & b^2 & c^2 \\ 1+a^2+b^2+c^2 & b^2+1 & c^2 \\ 1+a^2+b^2+c^2 & b^2 & c^2+1 \end{vmatrix}$

= $\left(1+a^2+b^2+c^2\right)\begin{vmatrix} 1 & b^2 & c^2 \\ 1 & b^2+1 & c^2 \\ 1 & b^2 & c^2+1 \end{vmatrix}$

$\left[R_2 \to R_2 - R_1 \text{ and } R_3 \to R_3 - R_1\right]$

= $\left(1+a^2+b^2+c^2\right)\begin{vmatrix} 1 & b^2 & c^2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

= $\left(1+a^2+b^2+c^2\right)(1)(1-0)$

= $1+a^2+b^2+c^2$ = R.H.S. Proved.

**Choose the correct answer in Exercises 15 and 16.**

**15. Let A be a square matrix of order 3 x 3, then $|kA|$ is equal to:**

**(A)** $k|A|$

**(B)** $k^2|A|$

**(C)** $k^3|A|$

**(D)** $3k|A|$

**Ans.** Let A = $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ be a square matrix of order 3 x 3. ..........(i)

$\therefore \; kA = \begin{bmatrix} ka_{11} & ka_{12} & ka_{13} \\ ka_{21} & ka_{22} & ka_{23} \\ ka_{31} & ka_{32} & ka_{33} \end{bmatrix}$

$$\Rightarrow \quad |kA| = \begin{vmatrix} ka_{11} & ka_{12} & ka_{13} \\ ka_{21} & ka_{22} & ka_{23} \\ ka_{31} & ka_{32} & ka_{33} \end{vmatrix}$$

$$\Rightarrow \quad |kA| = k^3 \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

= $k^3 |A|$ [From eq. (i)]

Therefore, option (C) is correct.

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**16. Which is the following is correct:**

**(A) Determinant is a square matrix.**

**(B) Determinant is a number associated to a matrix.**

**(C) Determinant is a number associated to a square matrix.**

**(D) None of these.**

**Ans.** Since, Determinant is a number associated to a square matrix.

Therefore, option (C) is correct.