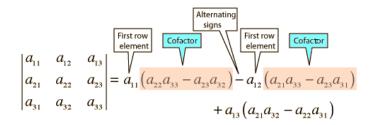
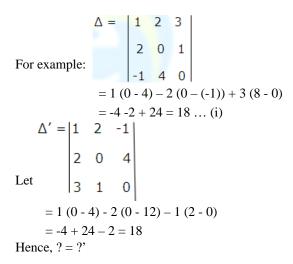
PROPERTIES OF DETERMINANTS

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Property I



The value of the determinant remains unchanged if its rows and columns are interchanged.



Property II

If any two rows (or columns) of a determinant are interchanged, then sign of determinant changes. For example: We know ? = 18 from [equation (i) above] Let us interchange 2nd and 3rd rows of ?' and find its value $\Delta' = \begin{vmatrix} 1 & 2 & -1 \\ 3 & 1 & 0 \\ 2 & 0 & 4 \end{vmatrix}$

= 1 (4 - 0) - 2 (12 - 0) - 1 (0 - 2)= 4 - 24 + 2 = -18Hence, ?' = -?

Property III

If any two rows (or columns) of a determinant are identical, then the value of the determinant is zero.

R₃]

	∆=	2	0	-1	
		1	1	4	[R ₁ =
For example:		2	0	-1	

$$= 2[-1 - 0] - 0[-1 - 8] - 1[0 - 2]$$
$$= -2 - 0 + 2 = 0$$

Property IV

If each element of a row (or a column) of a determinant is multiplied by a constant 'k', then its value gets multiplied by k Let $\Delta = |\mathbf{k}a_1 \mathbf{k}b_1 \mathbf{k}c_1| |\mathbf{a}_1 \mathbf{b}_1 \mathbf{c}_1|$

		1				- 1	-1
a2	b ₂	C ₂	=	k	a2	b ₂	C ₂
a3	b₃	C ₃			a ₃	b3	C ₃

Property V

If some or all elements of a row or column of a determinant are expressed as sum of two (or more) terms, then the determinant can be expressed as sum of two (or more) determinants.

$a_1 + \lambda_1$	$a_2 + \lambda_2$	a₃+λ₃		a ₁	a ₂	a ₃		λ1	λ2	λ3
b1	a ₂ +λ ₂ b ₂	b3	=	b1	b ₂	b₃	+	b1	b ₂	b3
C1	C ₂	C ₃		C1	C ₂	C ₃		C1	C2	C ₃

Property VI

The value of the determinant remains same if we apply the operation $R_i \longrightarrow R_i + kR_j$ or $C_i \longrightarrow C_i + kC_j$ For example: Using<u>properties</u> of determinants: Solve

```
1 \quad bc \quad a(b+c) \\ 1 \quad ca \quad b(c+a) \\ 1 \quad ab \quad c(a+b) \end{vmatrix} = 0
1 \quad ab \quad c(a+b) \begin{vmatrix} 1 & bc & ab+ac \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix} = \begin{vmatrix} 1 & bc & ab+ac \\ 1 & ca & bc+ab \\ 1 & ab & ac+bc \end{vmatrix}
= \begin{vmatrix} 1 & bc & ab+ac+bc \\ 1 & ca & bc+ab+ca \\ 1 & ab & ac+bc+ab \end{vmatrix}
C_3 \longrightarrow C_2 + C_3
= ab+ac+bc \begin{vmatrix} 1 & bc & 1 \end{vmatrix}
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= (ab + ac + bc) \ge 0= 0
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Reference Links:

- <u>http://en.wikipedia.org/wiki/Determinant</u>
- http://en.wikipedia.org/wiki/Row_and_column_spaces
- <u>http://en.wikipedia.org/wiki/Determinant#Properties_characterizing_the_determinant</u>

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