MATHS

BOOKS - SHARAM PUBLICATION

DETERMINANT

Example

1. Write the value of $\begin{vmatrix} 2 & 7 & 65 \\ 3 & 8 & 75 \\ 5 & 9 & 86 \end{vmatrix}$

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2. What is the value of the determinant $\begin{vmatrix} 102 & 18 & 36 \\ 1 & 3 & 4 \\ 17 & 3 & 6 \end{vmatrix}$?

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3. Write the value of $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

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4. If every element of a third order determinant of value 8 in multiplied by 2. then write the value of the new determinant.

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5. Let the value of a 3rd order determinant be A and each element in multiplied by 2 then what will be the value of the new determinant.

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6. if $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ x & 0 & 1 \end{vmatrix}$ then what is the value of x?

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7. Find the value of $\begin{vmatrix} x^2 - x + 1 & x - 1 \\ x + 1 & x + 1 \end{vmatrix}$

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8. What is the value of $\begin{vmatrix} 0 & 8 & 0 \\ 25 & 520 & 25 \\ 1 & 410 & 0 \end{vmatrix}$?

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9. if omega be the cube root of unit then what is the value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$?

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10. Find the value of $\begin{vmatrix} 224 & 777 & 32 \\ 735 & 888 & 105 \\ 812 & 999 & 116 \end{vmatrix}$

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11. Answer the following:

What are the values of x and y if

$$\begin{bmatrix} x & y \\ 1 & 1 \end{bmatrix} = 2, \begin{bmatrix} x & 3 \\ y & 2 \end{bmatrix} = 1 ?$$

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12. Determine the maximum value of $\begin{vmatrix} \cos x \sin x \\ -\sin x \cos x - 1 \end{vmatrix}$.

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13. show that $\begin{vmatrix} a^2 + x^2 & ab & ac \\ ab & b^2 + x^2 & bc \\ ac & bc & c^2 + x^2 \end{vmatrix}$ is divisible x^4

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14. Evaluate $\begin{vmatrix} \sin^2 x & \cos^2 x & 1 \\ \cos^2 x & \sin^2 x & 1 \\ -10 & 12 & 2 \end{vmatrix}$?

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15. Evaluate $\begin{bmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{bmatrix}$

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16. Find the value of $\begin{vmatrix} a-b & b+c & a \\ b-a & c+a & b \\ c-a & a+b & c \end{vmatrix}$?

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17. If ω is a complex cube root of 1,then for what value of.

lamda the determinant $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \lambda & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = 0$?

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18. IF

$$\begin{vmatrix} 1+x & x & x^2 \\ x & 1+x & x^2 \\ x^2 & x & 1+x \end{vmatrix} = a + bx + cx^2 + dx^3 + ex^4 + fx^5$$

then write the value of a.

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19. if a_{ij} is the element in the ith row and jth column of a 3rd order determinant whose value is 1 and c_{ij} is the cofactor of a_{ij} then what is value of $a_{11}(c_{11}+c_{21})+a_{12}(c_{12}+c_{22})+a_{13}(c_{13}+c_{23})$?

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20. if a, b,c are in A.P. then what is the value of:

$$\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}?$$

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21. If p+q+r=0=a+b+c, then write the value of the determinant $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}$

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22. If x,y,z are positive and are the pth, qth and rth terms of a G.P. then prove that

$$\begin{vmatrix} \log x & p & 1 \\ \log y & q & 1 \\ \log z & r & 1 \end{vmatrix} = 0$$

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23. Answer the following:

What are the values of x and y if

$$\begin{bmatrix} x & y \\ 1 & 1 \end{bmatrix} = 2, \begin{bmatrix} x & 3 \\ y & 2 \end{bmatrix} = 1 ?$$

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24. Write the value of k, if

$$\begin{vmatrix} aa_1 & aa_2 & aa_3 \\ ab_1 & ab_2 & ab_3 \\ ac_1 & ac_2 & ac_3 \end{vmatrix} = k \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

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25. Answer the following:

What is the value of $\begin{bmatrix} \frac{1}{a} & 1 & bc \\ \frac{1}{b} & 1 & ca \\ \frac{1}{c} & 1 & ab \end{bmatrix}$

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26. Answer the following: In which inverval does the determinant

$A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$ lie?

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27. Evaluate the following determinants:

$$\begin{bmatrix} 1 & 0 & -5863 \\ -7361 & 2 & 7361 \\ 1 & 0 & 4137 \end{bmatrix}$$

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28. what is value of: $\begin{vmatrix} \cos ec^2\theta & \cot^2\theta & 1 \\ \cot^2\theta & \cos ec^2\theta & -1 \\ 42 & 40 & 2 \end{vmatrix}$?

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29. Evaluate the following determinants.

$$\begin{bmatrix} 1 & x & y \\ 0 & \sin x & \sin y \\ 0 & \cos x & \cos y \end{bmatrix}$$

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30. Evaluate the following determinants:

$$\begin{bmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{bmatrix}$$

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31. Write the value of $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

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32. What is the value of : $\begin{vmatrix} 4 & a & b+c \\ 4 & b & c+a \\ 4 & c & a+b \end{vmatrix}$

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33. What is the value of the determinant $\begin{vmatrix} 102 & 18 & 36 \\ 1 & 3 & 4 \\ 17 & 3 & 6 \end{vmatrix}$?

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34. Solve the following : $\begin{bmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{bmatrix}$ =0

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35. Solve the following : $\begin{bmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{bmatrix}$ =0

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36. Prove that the following.

$$\begin{bmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{bmatrix} = (a+b+c)^3$$

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37. Prove without expanding that

$$\begin{vmatrix} bc & a & a^2 \\ ca & b & b^2 \\ ab & c & c^2 \end{vmatrix} = \begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$$

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38. Factorise the determinant $\begin{vmatrix} x^3 - a^3 & x^2 & x \\ b^2 - a^3 & b^2 & b \\ c^3 - a^3 & c^2 & c \end{vmatrix}$ without expanding.

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39. Show that $(a+1)$ is a factor of $\begin{vmatrix} (a+1) & 2 & 3 \\ 1 & a+1 & 3 \\ 3 & -6 & a+1 \end{vmatrix}$

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40. Prove that the following.

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

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41. Prove the following:

$$\begin{bmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{bmatrix} = 1 + a^2 + b^2 + c^2$$

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42. Solve for x,

$$\begin{vmatrix} 15-2x & 11 & 10 \\ 11-3x & 17 & 16 \\ 7-x & 14 & 13 \end{vmatrix} = 0$$

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43. What is the value of $\begin{vmatrix} i^{103} & 3 & i^{101} \\ i^{56} & 5 & i^{54} \\ i^{23} & 7 & i^{21} \end{vmatrix}$

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44. Without expanding find the value of the deteminant

$$\begin{vmatrix} 3 & 6 & 9 \\ -2 & 4 & -6 \\ 8 & 16 & 24 \end{vmatrix}.$$

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45. Prove that: $\begin{vmatrix} 1 & a & a^2 \\ a^2 & 1 & a \\ a & a^2 & 1 \end{vmatrix}$ is a perfect square.

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46. Without expanding prove that:

$$\begin{vmatrix} 12 & 2 & 4 & -5 & 1 \\ -8 & 1 & -5 & 2 & -1 \\ 6 & 4 & a & -3 & 2 \\ -10 & 2 & 1 & 3 & 4 \\ -2 & 4 & 6 & 8 & -5 \end{vmatrix} = \begin{vmatrix} 12 & -4 & -8 & 10 & -2 \\ 4 & 1 & -5 & 2 & -1 \\ -3 & 4 & a & -3 & 2 \\ 5 & 2 & 1 & 3 & 4 \\ 1 & 4 & 6 & 8 & -5 \end{vmatrix}.$$

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47. Prove that: $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$

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48. Solve : $\begin{vmatrix} x-a & 0 & 0 \\ a & x-b & 0 \\ a & b & x-c \end{vmatrix} = 0$

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49. What is the value of the determinant $\begin{vmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \\ 2 & 0 & 0 \end{vmatrix}$

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50. Solve the following : $\begin{bmatrix} 1+x & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+x \end{bmatrix}$ =0

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51. Find the value of $\begin{vmatrix} 17 & 58 & 97 \\ 19 & 60 & 99 \\ 18 & 59 & 98 \end{vmatrix}$ without expanding.

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52. Prove that the following. $\begin{bmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{bmatrix}$

= abc(1+1/a+/b+1/c)

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53. Evaluate the following determinants:

$\begin{bmatrix} 0 & a^2 & b \\ b^2 & 0 & a^2 \\ a & b^2 & 0 \end{bmatrix}$

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54. Prove that:

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

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55. Without expanding prove that $\begin{vmatrix} 1 & a & a^2 & -bc \\ 1 & b & b^2 & -ca \\ 1 & c & c^2 & -ab \end{vmatrix} = 0$

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56. Prove the following : $\begin{bmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{bmatrix}$ =0

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57. Given the equations

x=cy+bz, y=az+cx and z=bx+ay

where x,y and z are not all zero, prove that $a^2 + b^2 + c^2 + 2abc = 1$ by determinant method.

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58. Eliminate x,y,z from

a=x/y-z, b=y/z-x, c=z/x-y

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

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60. Prove that the following. $\begin{bmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{bmatrix}$

= abc(1+1/a+/b+1/c)

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61. Prove that $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$

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62. Using properties of determinants prove that

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

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63. Prove that the following. $\begin{bmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{bmatrix}$ =4ab

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64. Prove the following:

$$\begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{bmatrix}$$

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

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65. Prove that

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

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66. Prove that the following. $\begin{bmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ bc & ca & ab \end{bmatrix}$ =(b-c)(c-a)(a-b)

(bc+ca+ab)

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67. Prove the following:

$$\begin{bmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{bmatrix}$$

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

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68. Using the properties of determinants, show that

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

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69. Prove that:

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

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70. If $\begin{bmatrix} x & x^2 & x^3-1 \\ y & y^2 & y^3-1 \\ z & z^2 & z^3-1 \end{bmatrix} = 0$

then prove that xyz=1 when x,y,z are non zero and unequal.

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71. Using properties of the determinants, prove that:

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

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72. Prove that: $\begin{vmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 1+3p+2p \\ 3 & 6+3p & 1+6p+3q \end{vmatrix} = 1$

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73. Show that:

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

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74. Prove

$$\begin{bmatrix} a^3 - x^3 & a^2 & a \\ b^3 - x^3 & b^2 & b \\ c^3 - x^3 & c^2 & c \end{bmatrix} = (a-b)(a-c)(b-c)\left(abc - x^3\right)$$

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75. Prove that:

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

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76. Prove that: $\begin{vmatrix} y+z & z & y \\ z & z+x & x \\ y & x & x+y \end{vmatrix} = 4xyz$

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77. Prove that: $\begin{vmatrix} a+3b & a+5b & a+7b \\ a+4b & a+6b & a+8b \\ a+5b & a+7b & a+9b \end{vmatrix} = 0$

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78. Prove the following:

$$\begin{bmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{bmatrix} = 1+a^2+b^2+c^2$$

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79. Prove the following:

$$\begin{bmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{bmatrix} = 4a^2b^2c^2$$

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80. Prove the following:

$$\begin{bmatrix} b^2-ab & b-c & bc-ac \\ ab-a^2 & a-b & b^2-ab \\ bc-ac & c-a & ab-a^2 \end{bmatrix} = 0$$

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81. Show that:

$$\begin{vmatrix} (y+z)^2 & xy & zx \\ xy & (x+z)^2 & yz \\ xz & yz & (x+y)^2 \end{vmatrix} = 2xyz(x+y+z)^3$$

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82. If a, b, c, are in A.P. find the value of

$$\begin{vmatrix} 2y+4 & 5y+7 & 8y+a \\ 3y+5 & 6y+8 & 9y+b \\ 4y+6 & 7y+9 & 10y+c \end{vmatrix}$$

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83. Prove the following:

$$\begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{bmatrix}$$

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

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84. If $\begin{bmatrix} x & x^2 & x^3-1 \\ y & y^2 & y^3-1 \\ z & z^2 & z^3-1 \end{bmatrix} = 0$

then prove that xyz=1 when x,y,z are non zero and unequal.

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85. Prove the following:

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

=2(b+c)(c+a)(a+b)

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86. Prove the following:

$$\begin{bmatrix} b+c & a+b & a \\ c+a & b+c & b \\ a+b & c+a & c \end{bmatrix}$$

$=a^3+b^3+c^3-3abc$

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87. If ax+hy+g=0, hx+by+f=0 and gx+fy+c=λ, find the value of λ in the form of a determinant.

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88. Prove that

$$\begin{vmatrix} -2a & a+b & c+a \\ a+b & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(b+c)(c+a)(a+b)$$

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89. If 2s=a+b+c show that

$$\begin{bmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{bmatrix} =$$

$2s^3(s-a)(s-b)(s-c)$

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90. If A+B+C = π, prove that

$$\begin{bmatrix} \sin^2 A & \cot A & 1 \\ \sin^2 B & \cot B & 1 \\ \sin^2 C & \cot C & 1 \end{bmatrix} = 0$$

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