MATHS

BOOKS - KALYANI PUBLICATION

HARDER PRODUCT AND FACTORISATION

Example

1. Proof that

$(a+b+c)(bc+ca+ab)-abc=(b+c)(c+a)(a+b)$

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2. Expand

$(x+3y+12z)(12yz+4zx+xy)-12xyz$

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3. Resolve into factors

$x^2(3z-2y)+4y^2(x+3z)+9z^2(x-2y)-12xyz$

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4. Resolve into factors

$x\left(y^2-z^2\right)+y\left(z^2-x^2\right)+z\left(x^2-y^2\right)$

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5. Resolve into factors

$3y\left(16z^2+x^2\right)+4z\left(x^2+9y^2\right)+x\left(9y^2+16z^2\right)+24xyz$

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6. if a+b+c=9 and $a^2 + b^2 + c^2$ =35,then find the value of a^3+b^3+c^3-3abc

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7. Simplify

$(y-z)^2(z-y) + (z-x)^2(x-z) + (x-y)^2(y-x) + 3(y-z)(z-x)(x$

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8. Resolve into factors

$a(9b^2 + 16c^2) + 3b(16c^2 + a^2) + 4c(a^2 + 9b^2) + 24abc$

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9. if

$U = V = W = -(a-b)(b-c)(c-a)$

Proof $U = a^2(b-c) + b^2(c-a) + c^2(a-b)$

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10. Resolve into factors

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

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11. if

$R = -S = T = -(a+b+c)(a-b)(b-c)(c-a)$

Proof $R = a^3(b-c) + b^3(c-a) + c^3(a-b)$

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12. Factorise $(x-y)^3 + (y-z)^3 + (z-x)^3$

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13. Resolve the factors

$x^3(4y^2 - 9z^2) + 8y^3(9z^2 - x^2) + 27z^3(x^2 - 4y^2)$

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14. Proove that

$2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4 = (a + b + c)(b + a - c)(c + a - b)$

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15. Factorise

$x^4 + x^2y^2 + y^4$

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16. If $b + c - a = 7, c + a - b = 3, a + b - c = -10$ then find the value $2b^2c^2 + 2a^2b^2 + 2c^2a^2 - a^4 - b^4 - c^4$

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17. Prove that

$$\frac{a^2+2bc}{(a-b)(a-c)}+\frac{b^2+2ac}{(b-c)(b-a)}+\frac{c^2+2ab}{(c-a)(c-b)}=3$$

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18. If $a+b+c=0$, then prove that

$$\frac{a^2}{bc}+\frac{b^2}{ca}+\frac{c^2}{ab}=3$$

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19. If $a+b+c=0$, then prove that

$$\frac{(b+c)^2}{3bc}+\frac{(c+a)^2}{3ca}+\frac{(a+b)^2}{3ab}=1$$

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20. If $a+b+c=0$, then prove

$$a^3+b^3+c^3=3a(c+a)(b+a)=3b(b+c)(b+a)=3c(c+a)(c+b)$$

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21. If $a+b+c=0$, then prove that

$$a^4+b^4+c^4=\frac{1}{2}\left(a^2+b^2+c^2\right)^2$$

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22. Prove that

$$(a-2b)^3+(2b-c)^3+(c-a)^3=3(a-2b)(2b-c)(c-a)$$

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Exercise

1. In the formula,

$a^3+b^3+c^3-3abc=(a+b+c)\left(a^2+b^2+c^2-ab-bc-ca\right)$

if $a+b+c=0$, then show that

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

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2. In the formula,

$a^3+b^3+c^3-3abc=(a+b+c)\left(a^2+b^2+c^2-ab-bc-ca\right)$

if $a+b+c=0$, then show that

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

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3. In the formula,

$a^3+b^3+c^3-3abc=\frac{1}{2}(a+b+c)\left\{(a-b)^2+(b-c)^2+(c-a)^2\right\}$

,

if $a+b+c\neq 0$, Show that if $a^3+b^3+c^3=3abc\Rightarrow a=b=c$

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4. Find the product of the following.

$(x+2)(x+3)(x+4)$

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5. Find the product of the following.

$(x+2)(x+5)(x+7)$

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6. Find the product of the following.

$(x+8)(x+12)(x+15)$

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7. Find the product of the following.

$(x+5)(x+9)(x+11)$

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8. Find the product of the following.

$(x+a)(x+3a)(x+5a)$

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9. Find the product of the following.

$(x+3)(x+3)(x-6)(x+2)$

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10. Find the product of the following.

$(x+4)(x+5)(x-10)$

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11. Find the product of the following.

$(x-8)(x+3)(x+1)$

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12. Find the product of the following.

$(x-5)(x-2)(x+8)$

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13. Find the product of the following.

$(x-3)(x+7)(x-4)$

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14. Find the product of the following.

$(x-6)(x-7)(x-11)$

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15. Find the product of the following.

$(x-3)(x-6)(x-9)$

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16. Find the product of the following.

$(x-14)(x+8)(x+6)$

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17. Find the product of the following.

$(x+2a)(x-5a)(x+6a)$

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18. Find the product of the following.

$(x + 5a)(x - 8a)(x - 3a)$

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19. Resolve into factors :

$x^3 + y^3 + 3xy - 1$

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20. Resolve into factors :

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

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21. if a=3+b then prove that

$a^3 - b^3 - 9ab = 27$

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22. Resolve into factors :

$8a^3 + 27b^3 + 64c^3 - 72abc$

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23. Resolve into factors :

$a^3 - 18abc + 27b^3 + 8c^3$

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24. Resolve into factors :

$p^3 - 8q^3 - r^3 - 6pqr$

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25. Resolve into factors :

$a^3b^3 + b^3c^3 + c^3a^3 - 3a^2b^2c^2$

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26. Resolve into factors :

$x^6 + y^6 + z^6 - 3x^2y^2z^2$

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27. Resolve into factors :

$a^6 + 5a^3 + 8$

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28. Resolve into factors :

$p^6 + 18p^3 + 1$

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29. Resolve into factors :

$x^6 + 40x^3 + 8$

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30. Resolve into factors :

$m^6 - 8m^3 - 20$

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31. Resolve into factors :

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

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32. Resolve into factors :

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

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33. Resolve into factors :

$(4p-3q)^3+(3q-2)^3+(2-4p)^3$

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34. Resolve into factors :

$(5l-2m)^3+(m-2n)^3+(m+2n-5l)^3$

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35. Resolve into factors :

$(a+c)^3-(b+c)^3-(a-b)^3$

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36. Resolve into factors :

$(p+3r)^3-(2q+3r)^3-(p-2q)^3$

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37. Resolve into factors :

$(3x-y)^2-2(3x-y)-35$

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38. Find the division of

$\left(x^3+y^3-3xy+1\right)\div(x+y+1)$

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39. Find the division of

$$\left(a^3+b^3-c^3+3abc\right)\div(a+b-c)$$

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40. Find the division of

$$\left(8a^3-27b^3-72ab-64\right)\div(2a-3b-4)$$

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41. Find the division of

$$\left(x^3+8y^3-27z^3+18xyz\right)\div(x+2y-3z)$$

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42. Find the division of

$$\left(a^3+b^3+27-9ab\right) \div \left\{(a-b)^2+(b-3)^2+(3-a)^2\right\}$$

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43. Find the division of

$$\left(27x^3-64y^3-8-72xy\right) \div \left\{(3x+4y)^2+(3x+2)^2+(4y-2)^2\right\}$$

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44. Find the division of

$$\left\{a^3+8-9b\left(3b^2-2a\right)\right\} \div \left(a^2+9b^2+4-2a+3ab+6b\right)$$

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45. Find the product of the following.

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

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46. Find the product of the following.

$$\left(a^2+b^2+c^2-ab+bc+ca\right)(a+b-c)$$

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47. Find the product of the following.

$$\left(x^2+9y^2+4-3xy-2x-6y\right)(x+3y+2)$$

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48. Find the product of the following.

$$\left(p^2+4q^2+r^2+2pq+pr-2qr\right)(p-2q-r)$$

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49. Find the product of the following.

$$\left(4x^2 + 9y^2 + z^2 + 6xy + 2xz - 3yz\right)(2x - 3y - z)$$

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50. Find the product of the following.

$$\left(a^2 + 4b^2 + 2ab - 3a + 6b + 9\right)(a - 2b + 3)$$

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51. Find the product of the following.

$$\left(9a^2 + 25b^2 + 15ab + 12a - 20b + 16\right)(3a - 5b - 4)$$

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52. Find the product of the following.

$$\left(9x^2 + 16y^2 + 12xy + 6x - 8y + 4\right)(3x - 4y - 2)$$

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53. If $x - 2y = 4$ then prove that

$x^3 - 8y^3 - 24xy - 64 = 0$

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54. If $x - y = 6$ then prove that

$x^3 - y^3 - 18xy - 216 = 0$

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55. If $a + 2b = 4c$, then prove that

$a^3 + 8b^3 - 64c^3 + 24abc = 0$

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56. If $x = b + c - 2a, y = c + a - 2b, z = a + b - 2c$, then prove that

$x^3 + y^3 + z^3 - 3xyz = 0$

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57. If $3x + 2y = -1$, then prove that

$27x^3 + 8y^3 + 1 - 18xy = 0$

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58. If

$x = a^2 - b^2, y = 2ab, z = a^2 + b^2$, then prove that

$x^6 + y^6 - z^6 + 3x^2y^2z^2 = 0$

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59. If $x = 658, y = 668, z = 674$, then prove that

$x^3 + y^3 + z^3 - 3xyz = 392000$

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60. If $a = 37, b = 36, c = 38$, then prove that

$a^3 + b^3 + c^3 - 3abc = 333$

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61. If $x + y + z = 6$, and $xy + yz + zx = 12$, then prove that

$x^3 + y^3 + z^3 = 3xyz$

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62. If $a = x + y, b = x - y$ and $c = x + 2y$, then show that

$a^3 + b^3 + c^3 - 3abc = 7y^2(3x + 2y)$

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63. If $a = x + y, b = y + z$, and $c = z + x$ then show that

$a^3 + b^3 + c^3 - 3abc = 2\left(x^3 + y^3 + z^3 - 3xyz\right)$

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64. If $x = a + p, y = b + p$, and $z = c + p$ then show that

$x^3 + y^3 + z^3 - 3xyz = \left\{a^3 + b^3 + c^3 - 3abc\right\}\left\{1 + \frac{3p}{a + b + c}\right\}$

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65. If $2s = a + b + c$, Then prove that

$(s - a)^3 + (s - b)^3 + (s - c)^3 - 3(s - a)(s - b)(s - c) = \frac{1}{2}(a^3 + b^3 + c$

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66. If $2s = a + b + c$, then prove that

$(s-a)^3 + (s-b)^3 + (s-c)^3 + 3abc = s^3$

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67. If $2s = a + b + c$, then prove that

$(s-a)^3 + (s-b)^3 + (s-c)^3 + 3abc = s^3$

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68. If $2s = a + b + c$, then prove that

$s^3 + (s-2a)^3 + (s-2b)^3 + (s-2c)^3 = 24(s-a)(s-b)(s-c)$

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69. If $3s = 2(a + b + c)$, then prove that

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

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70. If $s = x + y + z$, then prove that

$$s^3 + x^3 + y^3 + z^3 - (s - x)^3 - (s - y)^3 - (s - z)^3 = 6xyz$$

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71. If $b + c = 10$, $c + a = 16$, $a + b = 20$, then prove that

$$a^3 + b^3 + c^3 = 2567$$

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72. If $x = 32$, $y = -25$, and $z = -7$, Then prove that

$$x^3 + y^3 + z^3 = 16800$$

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73. If x = 10 , y = 64, and z = 2, then prove that

$(x+y+z)^3$= 438976

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74. Prove that

$(3x-2y)^3+(y+2z)^3+(y-2z-3x)^3=3(3x-2y)(y+2z)(y-2z-$

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75. Prove

$(a+2b)^3+(b+2c)^3+(c+2a)^3+3(a+3b+2c)(b+3c+2a)(c+3a+$

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76. Prove that

$(3x-2y)^3+(y-2z)^3+(y+2z-3x)^3=3(3x-2y)(y-2z)(y+2z-$

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77. Prove that

$$(a-2b)^3+(2b-c)^3+(c-a)^3=3(a-2b)(2b-c)(c-a)$$

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78. Prove that

$$(a+c)^3-(b+c)^3-(a-b)^3=3(a+c)(b+c)(a-b)$$

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79. Prove that

$$(x+2y+3z)^3-x^3-8y^3-27z^3=3(2y+3z)(x+3z)(x+2y)$$

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80. prove

$8(a+b+c)^3-(a+b)^3-(b+c)^3-(c+a)^3=3(a+b+2c)(a+2b+$

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81. Prove that

$8a^3-(a+b)^3-(a-c)^3-(c-b)^3=3(a-b)(a+c)(2a+b-c)$

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82. Prove that

$a^3-(2a-b-c)^3+(b-2c)^3-(2b-c-a)^3=3(b+c-a)(a+b-2c$

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83. Prove that

$64(x+y+z)^3-(2x+y+z)^3-(x+2y+z)^3-(x+y+2z)^3=3(3x$

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84. Prove that

$(b+c-a)^3+(c+a-b)^3+(a+b-c)^3-(a+b+c)^3+108abc=84a$

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85. Prove that

$(b+c)^3+(c+a)^3+(a+b)^3-3(b+c)(c+a)(a+b)=2\left(a^3+b^3+c^3\right.$

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86. Prove that

$(a-b)^3+(b-c)^3+(c-a)^3=3(a-b)(b-c)(c-a)$

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87. Prove that

$(3x-2y)^3+(y+2z)^3+(y-2z-3x)^3=3(3x-2y)(y+2z)(y-2z-$

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88. Prove that

$(a-2b)^3+(2b-1)^3+(1-a)^3=3(a-2b)(2b-1)(1-a)$

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89. Factorise

$(5x+3y+z)(15xy+3yz+5xz)-15xyz$

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90. Factorise

$(2a+b+c)(2ab+bc+2ca)-2abc$

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91. Factorise

$(2a + 3b + 4c)(6ab + 8ac + 12bc) - 24abc$

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92. Factorise

$(a - b + 2c)(2ca - 2bc - ab) + 2abc$

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93. Factorise

$(a - 2b - 3c)(6bc - 2ab - 3ac) - 6abc$

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94. Resolve into factors

$9a^2(2b+c)+4b^2(3a+c)+c^2(3a+2b)+12abc$

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95. factorise

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

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96. Resolve into factors

$x^2(y+2z)+y^2(x+2z)+4z^2(x+y)+4xyz$

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97. Resolve into factors

$4x^2(y-z)+y^2(2x-z)+z^2(2x+y)-4xyz$

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98. Resolve into factors

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

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99. Resolve into factors

$(a-b)^3+(b-c)^3+(c-a)^3$

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100. Resolve into factors

$a^2(b-c)+b^2(a-c)+c^2(a-b)-2abc$

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101. Resolve into factors

$a(b-c)^2+b(c-a)^2+c(a-b)^2+8abc$

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102. Resolve into factors

$x^2(2y+3z)+4y^2(3z+x)+9z^2(x+2y)+18xyz$

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103. Resolve into factors

$y^2(2x-z)+z^2(2x-y)-4x^2(y+z)+6xyz$

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104. Resolve into factors

$12a^2b+4a^2c+9b^2c+18ab^2+2ac^2+3bc^2+18abc$

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105. Resolve into factors

$a(b-c)^2+b(c-a)^2+c(a-b)^2+8abc$

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106. Resolve into factors

$bc(b+c)-ca(c-a)-ab(b-a)-2abc$

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107. Resolve into factors

$3xy(y+3x)+2yz(y+2z)+6xz(3x+2z)+12xyz$

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108. Resolve into factors

$$x\left(y^2+4z^2\right)+y\left(x^2+4z^2\right)+2z\left(x^2+y^2\right)+4xyz$$

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109. Resolve into factors

$$x\left(y^2+z^2\right)-y\left(z^2+x^2\right)-z\left(x^2+y^2\right)+2xyz$$

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110. Resolve into factors

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

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111. Resolve into factors

$$a^2\left(b^4-c^4\right)+b^2\left(c^4-a^4\right)+c^2\left(a^4-b^4\right)$$

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112. Resolve into factors

$$\left(a^3+1\right)(b-c)+\left(b^3+1\right)(c-a)+\left(c^3+1\right)(a-b)$$

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113. Resolve into factors

$$x^6\left(y^2-z^2\right)+y^6\left(z^2-x^2\right)+z^6\left(x^2-y^2\right)$$

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114. Resolve into factors

$$(b-c)^3+(c-a)^3+(a-b)^3$$

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115. Resolve into factors

$b^2c^2(b-c)+c^2a^2(c-a)+a^2b^2(a-b)$

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116. Resolve into factors

$a^6\left(b^4-c^4\right)+b^6\left(c^4-a^4\right)+c^6\left(a^4-b^4\right)$

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117. Resolve into factors

$a^4b^4\left(a^2-b^2\right)+b^4c^4\left(b^2-c^2\right)+c^4a^4\left(c^2-a^2\right)$

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118. Resolve into factors

$xy\left(z^2+1\right)+z\left(x^2+y^2\right)$

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119. Resolve into factors

$2b^2c^2y^2z^2 + 2c^2a^2z^2x^2 + 2a^2b^2x^2y^2 - a^4x^4 - b^4y^4 - c^4z^4$

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120. Resolve into factors

$72y^2z^2 + 18z^2x^2 + 8x^2y^2 - x^4 - 16y^4 - 81z^4$

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121. Prove that

$x^3 + 8y^3 - 27z^3 + 18xyz = (x + 2y - 3z)\left(x^2 + 4y^2 + 9z^2 + 3xz + 6yz -$

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122. Prove that

$$a^6 + 8a^3 + 27 - 18a^3 = \left(a^2 + 2a + 3\right)\left(a^4 + 4a^2 + 9 - 2a^3 - 6a - 3a^2\right)$$

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123. Prove that

$$(x-y)^3 + (y-z)^3 + (z-x)^3 = 3(x-y)(y-z)(z-x)$$

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124. Prove that

$$(a+b+c)^3 - \left(a^3 + b^3 + c^3\right) = 3(b+c)(c+a)(a+b)$$

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125. Prove that

$$(a-b)^3 + (b-c)^3 + (c-a)^3 = 3(a-b)(b-c)(c-a)$$

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126. if x+y+z=0,then Prove that

$$\frac{xyz}{(x+y)(y+z)(z+x)} = -1 where(x \neq -y, y \neq -z, z \neq -x)$$

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127. Prove that

If a=2, b=3, c=5. Then prove that

$$2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4 = 0$$

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128. Prove that

If $3x + 2y = -1$, then prove that

$$81x^4 + 16y^4 + 1 - 72x^2y^2 - 18x^2 - 8y^2 = 0$$

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129. If $x - y = 7$and xy=9, then find the value of

$(x^2 + y^2)$

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130. Prove that

$4x^2(y - z) + y^2(2x - z) + z^2(2x + y) - 4xyz = (2x + y)(y - z)(2x - z)$

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131. Prove that

$$\frac{(x-a)^2}{(a-b)(a-c)} + \frac{(x-b)^2}{(b-a)(b-c)} + \frac{(x-c)^2}{(c-a)(c-b)} = 1$$

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132. Prove that

$$\frac{1}{a(a-b)(a-c)} + \frac{1}{b(b-c)(b-a)} + \frac{1}{c(c-a)(c-b)} = \frac{1}{abc}$$

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133. Prove that

$$\frac{a}{bc(a-b)(a-c)}+\frac{b}{ca(b-c)(b-a)}+\frac{c}{ab(c-a)(c-a)}=\frac{1}{abc}$$

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134. Prove that

$$2(s-a)(s-b)(s-c)+a(s-b)(s-c)+b(s-c)(s-a)+c(s-a)(s$$

Where $2S=a+b+c$

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135. Factorise $a^3-b^3+1+3ab$

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136. If $a+b+c=0$, then prove that

$$\frac{1}{2a^2+bc}+\frac{1}{2b^2+ca}+\frac{1}{2c^2+ab}=0$$

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137. If $a^2+b^2+c^2-ab-bc-ca=0$, then prove that

$a=b=c$

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138. If $a+b+c=0$, then prove that

$$\frac{(a+b)^2}{ab}+\frac{(b+c)^2}{bc}+\frac{(c+a)^2}{ca}=3$$

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139. If $a+b+c=0$, then prove that

$$\frac{2a^2}{a^2-b^2-c^2}+\frac{2b^2}{b^2-c^2-a^2}+\frac{2c^2}{c^2-a^2-b^2}=3$$

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140. If $a+b+c=0$, then prove that

$$\frac{a^2+b^2+c^2}{a^3+b^3+c^3}+\frac{2}{3}\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)=0$$

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141. If $a+b=c$ then prove that

$$\frac{1}{b^2+c^2-a^2}+\frac{1}{c^2+a^2-b^2}+\frac{1}{a^2+b^2-c^2}=0$$

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142. If $a+b+c=0$, then prove that

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

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143. If $a+b+c=0$, then prove that

$a(b+c)^2+b(c+a)^2+c(a+b)^2=3abc$

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144. If $A=ax+by+cz,\ B=bx+cy+az,\ C=cx+ay+bz$ and

$a+b+c=0$, then prove that

$A^3+B^3+C^3=3ABC$

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145. If $x^{\frac{1}{3}}+y^{\frac{1}{3}}+z^{\frac{1}{3}}=0$, then prove that $(x+y+z)^3=27xyz$

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146. If $a+b+c=0$, then prove that

$a^4+b^4+c^4=2(ab+bc+ca)^2$

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147. If $a+b+c=0$, then prove that

$$\left(a^2+b^2+c^2\right)^2=4\left(a^2b^2+b^2c^2+c^2a^2\right)$$

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148. If $a+b+c=0$, then prove that

$$a(b+c)^2+b(c+a)^2+c(a+b)^2=3abc$$

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