

1 [327改訂版 数学I 練習1]

解説

- (1) 係数は4, 次数は5
- (2) 係数は-2, 次数は2
- (3) 係数は-1, 次数は6

2 [327改訂版 数学I 練習2]

解説

- (1)  $x$ : 係数は $-5ay^2$ , 次数は3  
 $y$ : 係数は $-5ax^3$ , 次数は2  
 $a$ : 係数は $-5x^3y^2$ , 次数は1
- (2)  $x$ と $y$ : 係数は $2ab$ , 次数は4

3 [327改訂版 数学I 練習3]

解説

(1)  $4x^2 - 2x - 5 - 3x^2 + 8x - 3$   
 $= (4-3)x^2 + (-2+8)x + (-5-3)$   
 $= x^2 + 6x - 8$

この整式は2次式

(2)  $3a^2 - ab + 6b^2 - 5a^2 + 9ab - 4b^2$   
 $= (3-5)a^2 + (-1+9)ab + (6-4)b^2$   
 $= -2a^2 + 8ab + 2b^2$

この整式は2次式

(3)  $-2x^4 + x^3 - 8x^2 + 7x - 1 + 2x^4 - 3x^3 + x + 5$   
 $= (-2+2)x^4 + (1-3)x^3 - 8x^2 + (7+1)x + (-1+5)$   
 $= -2x^3 - 8x^2 + 8x + 4$

この整式は3次式

4 [327改訂版 数学I 練習4]

解説

- (1)  $x$ : 2次式, 定数項は-3  
 $a$ : 1次式, 定数項は $x-3$
- (2)  $x$ : 2次式, 定数項は $ab$
- (3)  $x$ : 3次式, 定数項は $-y^2+1$   
 $y$ : 2次式, 定数項は $5x^3+1$   
 $x$ と $y$ : 3次式, 定数項は1

5 [327改訂版 数学I 練習5]

解説

(1)  $2x^2 - 1 + 5x + x^4 - 3x^3 = x^4 - 3x^3 + 2x^2 + 5x - 1$

(2)  $2x^2 + xy + 3y^2 - 7x - 2y + 5 = 2x^2 + (y-7)x + (3y^2 - 2y + 5)$

6 [327改訂版 数学I 練習6]

解説

(1)  $A+B = (4-3)x^3 + (-3+1)x^2 + (-5-2)x + (2-7)$   
 $= x^3 - 2x^2 - 7x - 5$

$A-B = (4+3)x^3 + (-3-1)x^2 + (-5+2)x + (2+7)$   
 $= 7x^3 - 4x^2 - 3x + 9$

(2)  $A+B = (2-4)x^3 + (-1-1)x^2 + 2x + (-1+1)$

$$= -2x^3 - 2x^2 + 2x$$

$$A-B = (2+4)x^3 + (-1+1)x^2 - 2x + (-1-1)$$

$$= 6x^3 - 2x - 2$$

(3)  $A+B = (5-3)x^2 + (2+4)xy + (-1-2)y^2$   
 $= 2x^2 + 6xy - 3y^2$

$A-B = (5+3)x^2 + (2-4)xy + (-1+2)y^2 = 8x^2 - 2xy + y^2$

7 [327改訂版 数学I 練習7]

解説

$$2(A-B) - (4A+B-C) = -2A - 3B + C$$

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

$$= -4x^2 - 6xy + 2y^2 + 9x^2 + 3xy - 6y^2 - x^2 + xy + 3y^2$$

$$= (-4+9-1)x^2 + (-6+3+1)xy + (2-6+3)y^2$$

$$= 4x^2 - 2xy - y^2$$

8 [327改訂版 数学I 練習8]

解説

(1)  $2x^4 \times 7x^2 = (2 \times 7)x^{4+2} = 14x^6$

(2)  $4a^5bc^2 \times (-3a^4b^3c^2) = \{4 \times (-3)\}a^{5+4}b^{1+3}c^{2+2}$   
 $= -12a^9b^4c^4$

(3)  $(-2x^2y)^3 \times (3xy^3)^2 = (-2)^3(x^2)^3y^3 \times 3^2x^2(y^3)^2$   
 $= (-8)x^6y^3 \times 9x^2y^6$   
 $= \{(-8) \times 9\}x^{6+2}y^{3+6}$   
 $= -72x^8y^9$

9 [327改訂版 数学I 練習9]

解説

(1)  $3x^2(3x^2 - 5x + 2) = 3x^2 \cdot 3x^2 + 3x^2 \cdot (-5x) + 3x^2 \cdot 2$   
 $= 9x^4 - 15x^3 + 6x^2$

(2)  $(x^2 - 2xy - 3y^2)(-xy^2) = x^2(-xy^2) - 2xy(-xy^2) - 3y^2(-xy^2)$   
 $= -x^3y^2 + 2x^2y^3 + 3xy^4$

(3)  $(x^3 + 3x^2 - 4)(x - 2) = (x^3 + 3x^2 - 4)x + (x^3 + 3x^2 - 4) \cdot (-2)$   
 $= x^4 + 3x^3 - 4x - 2x^3 - 6x^2 + 8$   
 $= x^4 + x^3 - 6x^2 - 4x + 8$

(4)  $(x^3 - 3 + 4x^2)(2 + x^2) = (x^3 + 4x^2 - 3)(x^2 + 2)$   
 $= (x^3 + 4x^2 - 3)x^2 + (x^3 + 4x^2 - 3) \cdot 2$   
 $= x^5 + 4x^4 - 3x^2 + 2x^3 + 8x^2 - 6$   
 $= x^5 + 4x^4 + 2x^3 + 5x^2 - 6$

(5)  $(x+y)(x^2 - xy + 2y^2) = x(x^2 - xy + 2y^2) + y(x^2 - xy + 2y^2)$   
 $= x^3 - x^2y + 2xy^2 + x^2y - xy^2 + 2y^3$   
 $= x^3 + xy^2 + 2y^3$

(6)  $(2x - 3y + 1)(x + y - 2) = (2x - 3y + 1)x + (2x - 3y + 1)y + (2x - 3y + 1) \cdot (-2)$   
 $= 2x^2 - 3xy + x + 2xy - 3y^2 + y - 4x + 6y - 2$   
 $= 2x^2 - xy - 3y^2 - 3x + 7y - 2$

10 [327改訂版 数学I 練習10]

解説

(1)  $(2x+3)^2 = 4x^2 + 12x + 9$

(2)  $(2x-5y)^2 = 4x^2 - 20xy + 25y^2$

(3)  $(4x+3)(4x-3) = 16x^2 - 9$

(4)  $(x+2)(x+8) = x^2 + 10x + 16$

(5)  $(x-4)(x-3) = x^2 - 7x + 12$

(6)  $(x-3y)(x+5y) = x^2 + 2xy - 15y^2$

11 [327改訂版 数学I 練習11]

解説

(1)  $(2x+3)(6x+5) = 12x^2 + 28x + 15$

(2)  $(5x+2)(3x-8) = 15x^2 - 34x - 16$

(3)  $(2x-y)(x+3y) = 2x^2 + 5xy - 3y^2$

(4)  $(3x-a)(4x-5a) = 12x^2 - 19ax + 5a^2$

12 [327改訂版 数学I 練習12]

解説

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

(2)  $(x-2y+z)^2 = \{(x-2y)+z\}^2$   
 $= (x-2y)^2 + 2(x-2y)z + z^2$   
 $= x^2 - 4xy + 4y^2 + 2xz - 4yz + z^2$   
 $= x^2 + 4y^2 + z^2 - 4xy - 4yz + 2zx$

13 [327改訂版 数学I 練習13]

解説

(1)  $(a+b)^2(a-b)^2 = \{(a+b)(a-b)\}^2$   
 $= (a^2 - b^2)^2$   
 $= a^4 - 2a^2b^2 + b^4$

(2)  $(x^2+1)(x+1)(x-1) = (x^2+1)(x^2-1)$   
 $= (x^2)^2 - 1 = x^4 - 1$

(3)  $(x^2+2x+3)(x^2-2x+3) = \{(x^2+3)+2x\}\{(x^2+3)-2x\}$   
 $= (x^2+3)^2 - (2x)^2$   
 $= x^4 + 6x^2 + 9 - 4x^2$   
 $= x^4 + 2x^2 + 9$

(4)  $(x-y+z)(x+y-z) = \{x-(y-z)\}\{x+(y-z)\}$   
 $= x^2 - (y-z)^2$   
 $= x^2 - (y^2 - 2yz + z^2)$   
 $= x^2 - y^2 - z^2 + 2yz$

14 [327改訂版 数学I 練習14]

解説

(1)  $2x^2y - 6xy^2 + 10xyz = 2xy \cdot x - 2xy \cdot 3y + 2xy \cdot 5z$   
 $= 2xy(x - 3y + 5z)$

(2)  $4xy^2z - x^2yz^2 + 2xyz = xyz \cdot 4y - xyz \cdot xz + xyz \cdot 2$   
 $= xyz(4y - xz + 2)$

(3)  $a(x-y) - bx + by = a(x-y) - b(x-y)$   
 $= (x-y)(a-b)$

$$(4) \quad y(5x-3) + 2(3-5x) = y(5x-3) - 2(5x-3) \\ = (5x-3)(y-2)$$

15 [327改訂版 数学I 練習15]

解説

$$(1) \quad x^2 - 8x + 16 = x^2 - 2 \cdot x \cdot 4 + 4^2 \\ = (x-4)^2$$

$$(2) \quad 4x^2 + 28xy + 49y^2 = (2x)^2 + 2 \cdot 2x \cdot 7y + (7y)^2 \\ = (2x+7y)^2$$

$$(3) \quad 9a^2 - 48ab + 64b^2 = (3a)^2 - 2 \cdot 3a \cdot 8b + (8b)^2 \\ = (3a-8b)^2$$

$$(4) \quad 16x^2 - 25y^2 = (4x)^2 - (5y)^2 \\ = (4x+5y)(4x-5y)$$

$$(5) \quad x^2 + 6x + 8 = x^2 + (2+4)x + 2 \cdot 4 \\ = (x+2)(x+4)$$

$$(6) \quad x^2 - 5xy + 6y^2 = x^2 + (-2y-3y)x + (-2y) \cdot (-3y) \\ = (x-2y)(x-3y)$$

$$(7) \quad x^2 + xy - 12y^2 = x^2 + (-3y+4y)x + (-3y) \cdot 4y \\ = (x-3y)(x+4y)$$

$$(8) \quad x^2 - 2ax - 15a^2 = x^2 + (3a-5a)x + 3a \cdot (-5a) \\ = (x+3a)(x-5a)$$

16 [327改訂版 数学I 練習16]

解説

$$(1) \quad 2x^2 + 3x + 1 = (x+1)(2x+1)$$

$$(2) \quad 4x^2 - 15x + 9 = (x-3)(4x-3)$$

$$(3) \quad 6x^2 - 5x - 6 = (2x-3)(3x+2)$$

$$(4) \quad 3x^2 - 2xy - y^2 = (x-y)(3x+y)$$

$$(5) \quad 3a^2 - 14ab + 8b^2 = (a-4b)(3a-2b)$$

$$(6) \quad 4x^2 + 7ax - 2a^2 = (x+2a)(4x-a)$$

17 [327改訂版 数学I 練習17]

解説

$$(1) \quad x^2 - y^2 + 6y - 9 = x^2 - (y^2 - 6y + 9) \\ = x^2 - (y-3)^2 \\ = \{x+(y-3)\}\{x-(y-3)\} \\ = (x+y-3)(x-y+3)$$

$$(2) \quad x^2 - 4x + 4 - 9y^2 = (x^2 - 4x + 4) - 9y^2 \\ = (x-2)^2 - (3y)^2 \\ = \{(x-2)+3y\}\{(x-2)-3y\} \\ = (x+3y-2)(x-3y-2)$$

18 [327改訂版 数学I 練習18]

解説

$$(1) \quad x^4 - 5x^2 + 4 = (x^2)^2 - 5x^2 + 4 \\ = (x^2-1)(x^2-4) \\ = (x+1)(x-1)(x+2)(x-2)$$

$$(2) \quad x^4 - 81 = (x^2)^2 - 9^2 = (x^2+9)(x^2-9)$$

$$= (x^2+9)(x+3)(x-3)$$

$$(3) \quad (x^2+3x)^2 - 2(x^2+3x) - 8 = \{(x^2+3x)+2\}\{(x^2+3x)-4\} \\ = (x^2+3x+2)(x^2+3x-4) \\ = (x+1)(x+2)(x-1)(x+4)$$

19 [327改訂版 数学I 練習19]

解説

$$(1) \quad x^2 - yz + zx - y^2 = (x-y)z + (x^2 - y^2) \\ = (x-y)z + (x+y)(x-y) \\ = (x-y)(x+y+z)$$

$$(2) \quad 9b - 9 - 3ab + a^2 = -3b(a-3) + (a^2 - 9) \\ = -3b(a-3) + (a+3)(a-3) \\ = (a-3)(a-3b+3)$$

$$(3) \quad 2x^2 + 6xy + x - 3y - 1 = 3y(2x-1) + (2x^2 + x - 1) \\ = 3y(2x-1) + (x+1)(2x-1) \\ = (2x-1)(x+3y+1)$$

20 [327改訂版 数学I 練習20]

解説

$$(1) \quad x^2 + 3xy + 2y^2 + 2x + 5y - 3 = x^2 + (3y+2)x + (2y^2 + 5y - 3) \\ = x^2 + (3y+2)x + (y+3)(2y-1) \\ = \{x+(y+3)\}\{x+(2y-1)\} \\ = (x+y+3)(x+2y-1)$$

$$(2) \quad 3x^2 - xy - 2y^2 + 6x - y + 3 = 3x^2 - (y-6)x - (2y^2 + y - 3) \\ = 3x^2 - (y-6)x - (y-1)(2y+3) \\ = \{x-(y-1)\}\{3x+(2y+3)\} \\ = (x-y+1)(3x+2y+3)$$

21 [327改訂版 数学I 練習21]

解説

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

22 [327改訂版 数学I 練習1]

解説

$$(1) \quad (x+1)^3 = x^3 + 3x^2 + 3x + 1$$

$$(2) \quad (x-2)^3 = x^3 - 3 \cdot x^2 \cdot 2 + 3 \cdot x \cdot 2^2 - 2^3 = x^3 - 6x^2 + 12x - 8$$

$$(3) \quad (3a+b)^3 = (3a)^3 + 3 \cdot (3a)^2 \cdot b + 3 \cdot 3a \cdot b^2 + b^3 \\ = 27a^3 + 27a^2b + 9ab^2 + b^3$$

$$(4) \quad (2x-3y)^3 = (2x)^3 - 3 \cdot (2x)^2 \cdot 3y + 3 \cdot 2x \cdot (3y)^2 - (3y)^3 \\ = 8x^3 - 36x^2y + 54xy^2 - 27y^3$$

23 [327改訂版 数学I 練習2]

解説

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

$$= a^3 - a^2b + ab^2 + a^2b - ab^2 + b^3 = a^3 + b^3 \\ (a-b)(a^2 + ab + b^2) = a(a^2 + ab + b^2) - b(a^2 + ab + b^2) \\ = a^3 + a^2b + ab^2 - a^2b - ab^2 - b^3 = a^3 - b^3$$

別解 (後半)  $(a+b)(a^2 - ab + b^2) = a^3 + b^3$  において、 $b$  を  $-b$  におき換えると

$$\{a+(-b)\}\{a^2 - a(-b) + (-b)^2\} = a^3 + (-b)^3 \\ すなわち \quad (a-b)(a^2 + ab + b^2) = a^3 - b^3$$

24 [327改訂版 数学I 練習3]

解説

$$(1) \quad (x+2)(x^2 - 2x + 4) = (x+2)(x^2 - x \cdot 2 + 2^2) \\ = x^3 + 2^3 = x^3 + 8$$

$$(2) \quad (x-3)(x^2 + 3x + 9) = (x-3)(x^2 + x \cdot 3 + 3^2) \\ = x^3 - 3^3 = x^3 - 27$$

$$(3) \quad (3x+y)(9x^2 - 3xy + y^2) = (3x+y)\{(3x)^2 - 3x \cdot y + y^2\} \\ = (3x)^3 + y^3 = 27x^3 + y^3$$

$$(4) \quad (2a-3b)(4a^2 + 6ab + 9b^2) = (2a-3b)\{(2a)^2 + 2a \cdot 3b + (3b)^2\} \\ = (2a)^3 - (3b)^3 = 8a^3 - 27b^3$$

25 [327改訂版 数学I 練習4]

解説

$$(1) \quad x^3 + 27 = x^3 + 3^3 \\ = (x+3)(x^2 - 3x + 9)$$

$$(2) \quad x^3 - 64 = x^3 - 4^3 \\ = (x-4)(x^2 + 4x + 16)$$

$$(3) \quad 8x^3 - 125y^3 = (2x)^3 - (5y)^3 \\ = (2x-5y)(4x^2 + 10xy + 25y^2)$$

26 [327改訂版 数学I 問題1]

解説

$$(1) \quad \text{与式} = (3x^2 - 2x - 4) + (2x^3 - 2x + 4) + (-3x^2 + 3x - 12) \\ = 2x^3 + (3-3)x^2 + (-2-2+3)x + (-4+4-12) \\ = 2x^3 - x - 12$$

$$(2) \quad \text{与式} = (x^2 + 2xy + y^2) + (x^2 - 2xy + y^2) \\ = 2x^2 + 2y^2$$

$$(3) \quad \text{与式} = (x^2 + 2xy + y^2) - (x^2 - 2xy + y^2) = 4xy$$

別解 (1)

$$\begin{array}{r} 3x^2 - 2x - 4 \\ 2x^3 \quad - 2x + 4 \\ +) \quad -3x^2 + 3x - 12 \\ \hline 2x^3 \quad - x - 12 \end{array}$$

27 [327改訂版 数学I 問題2]

解説

$$(1) \quad \text{与式} = 10a^2 - 19ab - 56b^2$$

$$(2) \quad \text{与式} = (2x^2)^2 - 2 \cdot 2x^2 \cdot y + y^2 \\ = 4x^4 - 4x^2y + y^2$$

$$(3) \quad \text{与式} = \{(3a+b) - 2c\}^2 \\ = (3a+b)^2 - 2(3a+b) \cdot 2c + (2c)^2 \\ = 9a^2 + 6ab + b^2 - 12ac - 4bc + 4c^2$$

$$=9a^2 + b^2 + 4c^2 + 6ab - 4bc - 12ca$$

(4) 与式  $=\{(x^2-2x)-1\}\{(x^2-2x)-2\}$   
 $= (x^2-2x)^2 - 3(x^2-2x) + 2$   
 $= x^4 - 4x^3 + 4x^2 - 3x^2 + 6x + 2$   
 $= x^4 - 4x^3 + x^2 + 6x + 2$

(5) 与式  $=\{(a-b)(a+b)\}(a^2+b^2)$   
 $= (a^2-b^2)(a^2+b^2) = a^4 - b^4$

(6) 与式  $= (x^4+1)(x^2+1)\{(x+1)(x-1)\}$   
 $= (x^4+1)\{(x^2+1)(x^2-1)\}$   
 $= (x^4+1)(x^4-1) = x^8 - 1$

(7) 与式  $=\{(x-4)(x+4)\}\{(x-1)(x+1)\}$   
 $= (x^2-16)(x^2-1)$   
 $= x^4 - 17x^2 + 16$

(8) 与式  $=\{(x+4)(x-3)\}\{(x+2)(x-1)\}$   
 $=\{(x^2+x)-12\}\{(x^2+x)-2\}$   
 $= (x^2+x)^2 - 14(x^2+x) + 24$   
 $= x^4 + 2x^3 - 13x^2 - 14x + 24$

28 [327改訂版 数学 I 問題3]

解説

(1) 
$$\begin{array}{r} 1 \times 3 \rightarrow 9 \\ 3 \times 1 \rightarrow 1 \\ \hline 3 \quad 3 \quad 10 \end{array}$$
  
 $3a^2 + 10a + 3 = (a+3)(3a+1)$

(2) 
$$\begin{array}{r} 1 \times -6 \rightarrow -48 \\ 8 \times -3 \rightarrow -3 \\ \hline 8 \quad 18 \quad -51 \end{array}$$
  
 $8x^2 - 51x + 18 = (x-6)(8x-3)$

(3) 
$$\begin{array}{r} 3 \times 4y \rightarrow 20y \\ 5 \times -6y \rightarrow -18y \\ \hline 15 \quad -24y^2 \quad 2y \end{array}$$
  
 $15x^2 + 2xy - 24y^2 = (3x+4y)(5x-6y)$

(4)  $9x^2 - 30ax - 24a^2 = 3(3x^2 - 10ax - 8a^2)$   

$$\begin{array}{r} 1 \times -4a \rightarrow -12a \\ 3 \times 2a \rightarrow 2a \\ \hline 3 \quad -8a^2 \quad -10a \end{array}$$
  
 $9x^2 - 30ax - 24a^2 = 3(3x^2 - 10ax - 8a^2)$   
 $= 3(x-4a)(3x+2a)$

29 [327改訂版 数学 I 問題4]

解説

(1) 与式  $= 2x(x^2 - 6xy + 9y^2) = 2x(x-3y)^2$

(2) 与式  $= (x^2 - 2xy + y^2) - 4$   
 $= (x-y)^2 - 2^2$

$$= (x-y+2)(x-y-2)$$

(3) 与式  $= (4x^2 - 4xy + y^2) - z^2$   
 $= (2x-y)^2 - z^2$   
 $= (2x-y+z)(2x-y-z)$

(4) 与式  $= (x^2+1)(x^2-4) = (x^2+1)(x+2)(x-2)$

(5) 与式  $=\{(ac+bd)+(ad+bc)\}\{(ac+bd)-(ad+bc)\}$   
 $=\{a(c+d)+b(c+d)\}\{a(c-d)-b(c-d)\}$   
 $= (a+b)(c+d)(a-b)(c-d)$

別解 与式  $= (a^2c^2 + 2acbd + b^2d^2) - (a^2d^2 + 2adbc + b^2c^2)$   
 $= a^2(c^2 - d^2) - b^2(c^2 - d^2)$   
 $= (a^2 - b^2)(c^2 - d^2)$   
 $= (a+b)(a-b)(c+d)(c-d)$

30 [327改訂版 数学 I 問題5]

解説

(1) 与式  $= (x^3 - 2x^2y) + (xy - 2y^2)$   
 $= x^2(x-2y) + y(x-2y)$   
 $= (x^2+y)(x-2y)$

(2) 与式  $= x^2 + (2y-5)x - (3y^2 - y - 4)$   
 $= x^2 + (2y-5)x - (y+1)(3y-4)$   
 $= \{x-(y+1)\}\{x+(3y-4)\}$   
 $= (x-y-1)(x+3y-4)$

$$\begin{array}{r} 1 \times -(y+1) \rightarrow -y-1 \\ 1 \times 3y-4 \rightarrow 3y-4 \\ \hline 1 \quad -(y+1)(3y-4) \quad 2y-5 \end{array}$$

(3) 与式  $= 2x^2 + (8a-1)x + (6a^2 + a - 1)$   
 $= 2x^2 + (8a-1)x + (2a+1)(3a-1)$   
 $= \{x+(3a-1)\}\{2x+(2a+1)\}$   
 $= (x+3a-1)(2x+2a+1)$

$$\begin{array}{r} 1 \times 3a-1 \rightarrow 6a-2 \\ 2 \times 2a+1 \rightarrow 2a+1 \\ \hline 2 \quad (3a-1)(2a+1) \quad 8a-1 \end{array}$$

(4) 与式  $= \{a+(b+c)\}\{(b+c)a+bc\} - abc$   
 $= (b+c)a^2 + \{(b+c)^2 + bc\}a + bc(b+c) - abc$   
 $= (b+c)a^2 + (b+c)^2a + bc(b+c)$   
 $= (b+c)\{a^2 + (b+c)a + bc\}$   
 $= (b+c)(a+b)(a+c)$   
 $= (a+b)(b+c)(c+a)$