2.10

1) $a\,x + b\,x + a\,y + b\,y = \underbrace{a\,x + b\,x}\ \underbrace{+ a\,y + b\,y} = x\,(a+b) + y\,(a+b) = (a+b)\,(x+y)$

2) $a + b + a\,x + b\,x = \underbrace{a + a\,x}\ \underbrace{+ b + b\,x} = a\,(1+x) + b\,(1+x) = (1+x)\,(a+b)$

3) $a\,x - b\,y - a\,y + b\,x = \underbrace{a\,x + b\,x}\ \underbrace{- a\,y - b\,y} = x\,(a+b) - y\,(a+b) = (a+b)\,(x-y)$

4) $a - b\,x + b - a\,x = \underbrace{a + b}\ \underbrace{- a\,x - b\,x} = 1\,(a+b) - x\,(a+b) = (a+b)\,(1-x)$

5) $a\,x - 4\,x + 4\,y - a\,y = \underbrace{a\,x - 4\,x}\ \underbrace{+ 4\,y - a\,y} = x\,(a-4) + y\,(4-a) = x\,(a-4) - y\,(a-4) = (a-4)\,(x-y)$

6) $a\,x + x - a - 1 = \underbrace{a\,x + x}\ \underbrace{- a - 1} = x\,(a+1) - 1\,(a+1) = (a+1)\,(x-1)$

7) $a^3 + a^2 + a + 1 = \underbrace{a^3 + a^2}\ \underbrace{+ a + 1} = a^2\,(a+1) + 1\,(a+1) = (a+1)\,(a^2+1)$

8) $x^3 + x - x^2 - 1 = \underbrace{x^3 + x}\ \underbrace{- x^2 - 1} = x\,(x^2+1) - 1\,(x^2+1) = (x^2+1)\,(x-1)$

9) $a^3 + 2\,a - a^2 - 2 = \underbrace{a^3 + 2\,a}\ \underbrace{- a^2 - 2} = a\,(a^2+2) - 1\,(a^2+2) = (a^2+2)\,(a-1)$

10) $2\,a^4 - 3 - 2\,a^3 + 3\,a = \underbrace{2\,a^4 - 2\,a^3}\ \underbrace{+ 3\,a - 3} = 2\,a^3\,(a-1) + 3\,(a-1) = (a-1)\,(2\,a^3+3)$

11) $a^2\,x - b\,x + a^2\,y^3 - b\,y^3 = \underbrace{a^2\,x - b\,x}\ \underbrace{+ a^2\,y^3 - b\,y^3} = x\,(a^2-b) + y^3\,(a^2-b) = (a^2-b)\,(x+y^3)$

12) $6\,x^2 + x\,y + 18\,x\,z + 3\,y\,z = \underbrace{6\,x^2 + x\,y}\ \underbrace{+ 18\,x\,z + 3\,y\,z} = x\,(6\,x+y) + 3\,z\,(6\,x+y) = (6\,x+y)\,(x+3\,z)$

13) $15\,y^2 - 5\,y\,z - 6\,y + 2\,z = \underbrace{15\,y^2 - 5\,y\,z}\ \underbrace{- 6\,y + 2\,z} = 5\,y\,(3\,y-z) + 2\,(-3\,y+z) = 5\,y\,(3\,y-z) - 2\,(3\,y-z) = (3\,y-z)\,(5\,y-2)$

14) $20\,x\,y + 4\,y - 5\,x - 1 = \underbrace{20\,x\,y - 5\,x}\ \underbrace{+ 4\,y - 1} = 5\,x\,(4\,y-1) + 1\,(4\,y-1) = (4\,y-1)\,(5\,x+1)$

15) $10\,x\,z - 10\,z - x^2 + x = \underbrace{10\,x\,z - 10\,z}\ \underbrace{- x^2 + x} = 10\,z\,(x-1) - x\,(x-1) = (x-1)\,(10\,z-x)$

16) $6\,x^2-5\,x\,z-6\,x+5\,z=\underbrace{6\,x^2-6\,x}\ \underbrace{-5\,x\,z+5\,z}=6\,x\,(x-1)-5\,z\,(x-1)=$
$(x-1)\,(6\,x-5\,z)$

17) $1+x^2+y^2+x^2\,y^2=\underbrace{1+x^2}\ \underbrace{+y^2+x^2\,y^2}=1\,(1+x^2)+y^2\,(1+x^2)=$
$(1+x^2)\,(1+y^2)$

18) $y^3-y-y^2+1=\underbrace{y^3-y}\ \underbrace{-y^2+1}=y\,(y^2-1)-1\,(y^2-1)=$
$\underbrace{(y^2-1)}_{(y+1)\,(y-1)}\,(y-1)=(y+1)\,(y-1)\,(y-1)=(y+1)\,(y-1)^2$

19) $x^2+x\,y+x\,z+y\,z=\underbrace{x^2+x\,y}\ \underbrace{+x\,z+y\,z}=x\,(x+y)+z\,(x+y)=$
$(x+y)\,(x+z)$

20) $x^3+3\,y^3+3\,x^2\,y+x\,y^2=\underbrace{x^3+x\,y^2}\ \underbrace{+3\,x^2\,y+3\,y^3}=$
$x\,(x^2+y^2)+3\,y\,(x^2+y^2)=(x^2+y^2)\,(x+3\,y)$

21) $x\,y-z\,y+x\,u-z\,u-x\,z+z^2=\underbrace{x\,y-z\,y}\ \underbrace{+x\,u-z\,u}\ \underbrace{-x\,z+z^2}=$
$y\,(x-z)+u\,(x-z)-z\,(x-z)=(x-z)\,(y+u-z)$

22) $x^2-x\,y+x\,z-x+y-z=\underbrace{x^2-x}\ \underbrace{-x\,y+y}\ \underbrace{+x\,z-z}=$
$x\,(x-1)-y\,(x-1)+z\,(x-1)=(x-1)\,(x-y+z)$

23) $1+x+x^2+x^3+x^4+x^5=\underbrace{1+x+x^2}\ \underbrace{+x^3+x^4+x^5}=$
$1\,(1+x+x^2)+x^3\,(1+x+x^2)=(1+x+x^2)\ \underbrace{(1+x^3)}_{A^3+B^3}=$
$(1+x+x^2)\,(1+x)\,(1-x+x^2)$

24) $1-x+x^2-x^3+x^4-x^5=\underbrace{1-x+x^2}\ \underbrace{-x^3+x^4-x^5}=$
$1\,(1-x+x^2)-x^3\,(1-x+x^2)=(1-x+x^2)\ \underbrace{(1-x^3)}_{A^3-B^3}=$
$(1-x+x^2)\,(1-x)\,(1+x+x^2)$