1. $a^2x - b^2x + a^2y^2 - b^2y^2 - 2a^2 + 2b^2$

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

2. $5a\,(a - 2) - a^2 + 4$

$$= 5a(a - 2) - (a^2 - 4) = 5a\,(a - 2) - (a - 2)(a + 2) = (a - 2)[5a - (a + 2)] = (a - 2)(4a - 2) = \mathbf{2(a - 2)(2a - 1)}$$

3. $\frac{3}{4}a^2y - \frac{1}{4}ay^2 + \frac{3}{2}a^2 - \frac{1}{2}ay$

$$= \frac{1}{2}a\left(\frac{3}{2}ay - \frac{1}{2}y^2 + 3a - y\right) = \frac{1}{2}a\left[\frac{1}{2}y\,(3a - y) + (3a - y)\right] = \mathbf{\frac{1}{2}a\,(3a - y)\left(\frac{1}{2}y + 1\right)}$$

4. $-a^6b^3 + 25\,a^{2n+6}b$

$$= a^6b\,(-b^2 + 25\,a^{2n}) = \mathbf{a^6b\,(-b + 5a^n)(b + 5a^n)}$$

5. $x - 9 - a^4x + 9a^4$

$$= x - 9 - a^4\,(x - 9) = (x - 9)(1 - a^4) = (x - 9)(1 + a^2)(1 - a^2) = \mathbf{(x - 9)(1 + a^2)(1 + a)(1 - a)}$$

6. $(a + b)^2(2b - 3) - 2\,(a + b)(2b - 3)^2$

$$= (a + b)(2b - 3)[a + b - 2\,(2b - 3)] = (a + b)(2b - 3)(a + b - 4b + 6) = \mathbf{(a + b)(2b - 3)(a - 3b + 6)}$$

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

$$= -(x - 4)(4 + x) + (x - 4)^2 + 3\,(x - 4)(x + 3) = (x - 4)[-(4 + x) + x - 4 + 3\,(x + 3)] =$$

$$= (x - 4)(-4 - x + x - 4 + 3x + 9) = \mathbf{(x - 4)(3x + 1)}$$

8. $3\,(a + b) + x\,(a - b) - 3\,(a - b) - x\,(a + b)$

$$= 3[(a + b) - (a - b)] - x\,[(a + b) - (a - b)] = 3(a + b - a + b) - x(a + b - a + b) = 6b - 2bx = \mathbf{2b\,(3 - x)}$$

oppure: $(3 - x) - (a - b)(3 - x) = (3 - x)[a + b - (a - b)] = (3 - x)(a + b - a + b) = \mathbf{2b\,(3 - x)}$

9. $2a^3 + 4a^2 - 3a - 6$

$$= 2a^2(a + 2) - 3\,(a + 2) = \mathbf{(a + 2)(2a^2 - 3)}$$

10. $x^3 - x^2 - x + 1$

$$= x^2(x - 1) - 1(x - 1) = (x - 1)(x^2 - 1) = (x - 1)(x - 1)(x + 1) = \mathbf{(x - 1)^2(x + 1)}$$