

Formulas:

$$\text{Difference of Squares: } a^2 - b^2 = (a - b)(a + b)$$

$$\text{Difference of Cubes: } a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$$

$$\text{Quantity Squared: } (a \pm b)^2 = a^2 \pm 2ab + b^2$$

1.  $16 - (3a + 2b)^2 = 4^2 - (3a + 2b)^2 = \boxed{(4 - 3a - 2b)(4 + 3a + 2b)}$

2.  $\boxed{(a^2 + b^2)(a + b)(a - b)}$

3.  $\boxed{5ax(2ax + 3y)(2ax - 3y)}$

4.  $\boxed{(x^4 + y^4)(x^2 + y^2)(x + y)(x - y)}$

5.

$$\begin{aligned} (5x^2 + 2x - 3)^2 - (x^2 - 2x - 3)^2 &= (5x^2 + 2x - 3 + x^2 - 2x - 3)(5x^2 + 2x - 3 - x^2 + 2x + 3) \\ &= (6x^2 - 6)(4x^2 + 4x) \\ &= 6(x^2 - 1) \cdot 4x(x + 1) \\ &= 24x(x + 1)(x - 1)(x + 1) \\ &= \boxed{24x(x + 1)^2(x - 1)} \end{aligned}$$

6.  $8a^3b^3c^3 - 1 = (2abc)^3 - 1^3 = \boxed{(2abc - 1)(4a^2b^2c^2 + 2abc + 1)}$

7.  $x^2(a + b)^2 - 2xy(a^2 - b^2) + y^2(a - b)^2 = (x(a + b))^2 - 2(x(a + b))(y(a - b)) + (y(a - b))^2$ . This is the Quantity Squared formula (on the top of the page). Let  $p = x(a + b)$  and  $q = y(a - b)$ . Then the equation gives us  $p^2 - 2pq + q^2$ , so we can factor as  $(p - q)^2$ . So the answer is  $\boxed{(x(a + b) - y(a - b))^2}$

8.  $4y^2 - (2z - x)^2 = (2y)^2 - (2z - x)^2 = (2y + (2z - x))(2y - (2z - x)) = \boxed{(2y + 2z - x)(2y - 2z + x)}$

9.  $\boxed{x(4x^2 + 1)(2x + 1)(2x - 1)}$

10.  $64x^6y^3 + y^{15} = y^3(64x^6 + y^{12}) = y^3((4x^2)^3 + (y^4)^3)$ . Use difference of cubes to obtain  $\boxed{y^3(4x^2 + y^4)(16x^4 - 4x^2y^4 + y^8)}$