① c) $y = -(x-3)^2(x+1)^2$

$y = -(x-3)(x-3)(x+1)(x+1)$

(i) 4th Degree

(ii) Roots ($y=0$)

$\boxed{x = -1, -1, 3, 3}$

↑
Double Roots
(Just Touches)

(iii) y intercept ($x=0$)

$y = -(0-3)^2(0+1)^2$

$y = -(9)(1)$

$\boxed{y = -9}$

(v) Local min ($x=\underline{1}$)

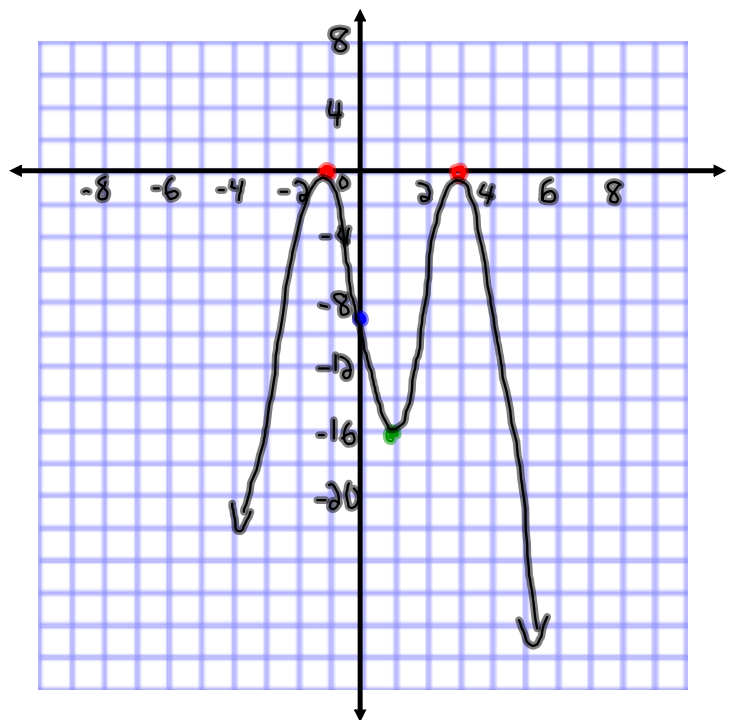$y = -(x-3)^2(x+1)^2$

$y = -(1-3)^2(1+1)^2$

$y = -(4)(4)$

$y = -16$

$\boxed{(1, -16)}$

1

Specialized Factoring Techniques

- **Common Factors**
- **The Sum and Difference of Cubes**
- **Grouping to Find a Common Factor**
- **Quartic Expressions Factored as Trinomials**
- **Grouping to get the Difference of Squares**

Let's Start with a quick refresher!

Common Factor

$$12x^7 y^8 + 24x^9 y^4$$

$$12x^7 y^4 \left(y^4 + 2x^2 \right)$$

Simple Trinomials

$$x^2 - 5x + 6$$

$$-3 \times -2 = 6$$
$$-3 + -2 = -5$$

$$(x-3)(x-2)$$

Trinomial Decomposition

$$4x^2 + 5x - 6$$

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

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

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

$$8 \times -3 = -24$$

$$8 + -3 = 5$$

Difference of Squares

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

$$81x^2 - 49b^2$$

$$(9x - 7b)(9x + 7b)$$

Common Factor

$$x^3 - x^2 - 12x$$

$$x(x^2 - x - 12) \quad \leftarrow \text{Simple Trinomial}$$

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

Difference of Cubes

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

$$x^3 - 8$$

$$27x^3 - 64$$