1. Factor the following binomial if possible.

$8y^3 + 125x^6$

Signs that this can be factored as sum of cubes:
1. $y^3$ and $x^6$ are perfect cubes.
2. 8 and 125 are perfect cubes.
3. It's the sum of two perfect cubes.

\[
\sqrt[3]{8}y^3 = \sqrt[3]{8} \cdot \sqrt[3]{y^3} = 2y
\]

\[
\sqrt[3]{125}x^6 = \sqrt[3]{125} \cdot \sqrt[3]{x^6} = 5x^2
\]

\[
8y^3 + 125x^6 = (2y + 5x^2)(4y^2 - 10xy^2 + 25x^4)
\]

To confirm this:

\[
\begin{align*}
(2y + 5x^2)(4y^2 - 10xy^2 + 25x^4) &= (2y)(4y^2) + (2y)(10xy^2) + (2y)(25x^4) \\
&\quad + (5x^2)(4y^2) - (5x^2)(10xy^2) + (5x^2)(25x^4) \\
&= 8y^3 + 20y^2x^2 + 50y^4 + 20x^2y^2 - 50xy^4 + 125x^6
\end{align*}
\]

\[
= 8y^3 + 125x^6.
\]
Factorable Trinomials

\[ x^2 + bx + c \].

To factor this trinomial, start by looking for 2 numbers that multiply to get \( c \), and locate the pair that add to \( b \).

**Ex. 1** \( x^2 + 7x + 12 \)

\[ = (x+3)(x+4) \].

**Ex. 2** \( x^2 + 9x + 14 \)

\[ = (x+2)(x+7) \].

**Ex. 3** \( x^2 - 12x + 20 \)

\[ = (x-2)(x-10) \].

**Ex. 4** \( x^2 - 2x - 35 \)

\[ = (x+5)(x-7) \].

**Ex. 5** \( x^2 + 4x - 12 \)

\[ = (x-2)(x+6) \].

**Ex. 6** \( x^2 + 2x + 1 \)

\[ = (x+1)^2 \].

**Ex. 7** \( x^2 - 8x + 16 \)

\[ = (x-4)^2 \].

**Ex. 8** \( x^2 + 3x + 2 \)

\[ \text{is prime, no factorization possible.} \]
Factorable Trinomials

\[ ax^2 + bx + c. \]

To factor this trinomial, follow these steps:

1. multiply \( a \cdot c \)

2. find a pair of numbers that multiply to get \( a \cdot c \) and add to give \( b \).

3. replace \( b \) with the pair of numbers that you found in step two.

4. you have four terms now, so factor by grouping.

Example 1: \( 6x^2 + 19x + 15 \)

\[
= 6x^2 + 9x + 10x + 15 \\
= (6x^2 + 9x) + (10x + 15) \\
= 3x(2x + 3) + 5(2x + 3) \\
= (2x + 3)(3x + 5) \\

\]

Example 2: \( 20x^2 - 17x + 3 \)

\[
= 20x^2 - 12x - 5x + 3 \\
= (20x^2 - 5x) - (12x - 3) \\
= 5x(4x - 1) - 3(4x - 1) \\
= (4x - 1)(5x - 3) \\
= 20 \cdot 3 = 60. \\
= (-12, -5)
(1) Factor the following polynomial.

\[6x^4y + 9x^3 - 12x^3y\]

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

(2) Consider the following polynomial

\[4y^{11} - y^{12} + 1 + 6y^8\]

1. Express the polynomial in descending order

\[-y^{12} + 4y^{11} + 6y^8 + 1\]

2. Degree?

12

3. Leading coefficient

-1