The Sum of Cubes Factoring Formula is:
\[ x^3 + y^3 = (x + y)(x^2 - xy + y^2) \]

The Difference of Cubes Factoring Formula is:
\[ x^3 - y^3 = (x - y)(x^2 + xy + y^2) \]

Factor: \( 8a^3 + b^3 \)

Factor: \( 8a^3 - b^3 \)

Factor: \( 8a^3 + 27b^3 \)

Factor: \( 64x^3 - 27y^3 \)

Factor: \( 24a^4 + 3ax^3 \)
Factor: $8a^3 + b^3$

We begin by rewriting each term as a cube and use the sum of cubes formula as a guide.

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

\[
8a^3 + b^3 = (2a)^3 + (b)^3 = (2a + b)((2a)^2 - (2a)(b) + (b)^2)
\]

So simplifying the right hand side we get:

\[
8a^3 + b^3 = (2a + b)(4a^2 - 2ab + b^2) \leftarrow \text{Answer}
\]

Factor: $8a^3 - b^3$

We begin by rewriting each term as a cube and use the difference of cubes formula as a guide.

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

\[
8a^3 - b^3 = (2a)^3 - (b)^3 = (2a - b)((2a)^2 + (2a)(b) + (b)^2)
\]

So simplifying the right hand side we get:

\[
8a^3 - b^3 = (2a - b)(4a^2 + 2ab + b^2) \leftarrow \text{Answer}
\]

Factor: $8a^3 + 27b^3$

We begin by rewriting each term as a cube and use the sum of cubes formula as a guide.

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

\[
8a^3 + 27b^3 = (2a)^3 + (3b)^3 = (2a + 3b)((2a)^2 - (2a)(3b) + (3b)^2)
\]

So simplifying the right hand side we get:

\[
8a^3 + 27b^3 = (2a + 3b)(4a^2 - 6ab + 9b^2) \leftarrow \text{Answer}
\]
Factor: $64x^3 - 27y^3$

We begin by rewriting each term as a cube and use the difference of cubes formula as a guide.

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

\[
64x^3 - 27y^3 = (4x)^3 - (3y)^3 = (4x - 3y)((4x)^2 + (4x)(3y) + (3y)^2)
\]

So simplifying the right hand side we get:

\[
64x^3 - 27y^3 = (4x - 3y)(16x^2 + 12xy + 9y^2) \leftarrow \text{Answer}
\]

Factor: $24a^4 + 3ax^3$

This problem doesn’t even look like a sum or difference of cubes problem. However, there is a common factor in each of the two terms. It is $3a$. So we can write:

\[
24a^4 + 3ax^3 = 3a(8a^3 + x^3)
\]

Now notice that the factor in parentheses is a sum of two cubes and except for the $x$ it is the same expression that was factored in the first exercise on this sheet. So we can write:

\[
24a^4 + 3ax^3 = 3a(8a^3 + x^3) = 3a(2a + x)(4a^2 - 2ax + x^2) \leftarrow \text{Answer}
\]