Problem 1. State the factoring formula for each of the following expressions (2 points).
$A^2 - B^2 = (A+B)(A-B)$
$A^3 - B^3 = (A-B)(A^2 + AB + B^2)$

Problem 2. Factor the following expressions (2 points).
$4x^2 - y^2 = (2x+y)(2x-y)$
$8x^3 - y^3 = (2x-y)(4x^2 + 2xy + y^2)$

Problem 3. Simplify the following expression completely (1 point).
$$\frac{4x^2 - y^2}{8x^3 - y^3} = \frac{(2x+y)(2x-y)}{(2x-y)(4x^2+2xy+y^2)} = \frac{2x+y}{4x^2+2xy+y^2}$$

Problem 4. Simplify the following expression completely, and rationalize the denominator (5 points).

$$
\begin{aligned}
& \frac{\dfrac{4x^2 - y^2}{8x^3 - y^3} - \dfrac{yz}{4x^2z + 2xyz + y^2z}}{\dfrac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}} \\
= & \left(\frac{4x^2 - y^2}{8x^3 - y^3} - \frac{yz}{4x^2z + 2xyz + y^2z}\right) \div \left(\frac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}\right) \\
= & \left(\frac{(2x+y)(2x-y)}{(2x-y)(4x^2+2xy+y^2)} - \frac{z \cdot y}{z(4x^2+2xy+y^2)}\right) \div \left(\frac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}\right) \\
= & \left(\frac{2x+y}{4x^2+2xy+y^2} - \frac{y}{4x^2+2xy+y^2}\right) \div \left(\frac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}\right) \\
= & \frac{2x+y-y}{4x^2+2xy+y^2} \div \left(\frac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}\right) \\
= & \frac{2x}{4x^2+2xy+y^2} \div \left(\frac{8\sqrt[3]{x^5}}{8x^2 + 4xy + 2y^2}\right) \\
= & \frac{2x}{4x^2+2xy+y^2} \div \left(\frac{2 \cdot 4\sqrt[3]{x^5}}{2(4x^2 + 2xy + y^2)}\right) \\
= & \frac{2x}{4x^2+2xy+y^2} \div \frac{4\sqrt[3]{x^5}}{4x^2 + 2xy + y^2} \\
= & \frac{2x}{4x^2+2xy+y^2} \times \frac{4x^2 + 2xy + y^2}{4\sqrt[3]{x^5}} \\
= & \frac{x}{2\sqrt[3]{x^5}} \\
= & \frac{x}{2\sqrt[3]{x^5}} \times \frac{\sqrt[3]{x}}{\sqrt[3]{x}} \\
= & \frac{x\sqrt[3]{x}}{2x^2} \\
= & \frac{\sqrt[3]{x}}{2x}
\end{aligned}
$$