Name:

Problem 1: Consider $\mathcal{P}_2$, the set of polynomials of degree less than or equal to 2:

$$\mathcal{P}_2 = \{a_0 + a_1 x + a_2 x^2 : a_0, a_1, a_2 \in \mathbb{R}\}.$$

Give a basis for this vector space.

Must any basis of $\mathcal{P}_2$ contain a constant polynomial, a polynomial of degree 1 and a polynomial of degree 2? Please give a one-sentence explanation of your answer.