1) Check if the only solution to the eqn

$$c_1 (1,2,3) + c_2 (4,5,6) + c_3 (7,8,9) = (0,0,0)$$

is

$$c_1 = c_2 = c_3 = 0$$

$$c_1 + 4c_2 + 7c_3 = 0$$
$$2c_1 + 5c_2 + 8c_3 = 0$$
$$3c_1 + 6c_2 + 9c_3 = 0$$

2.)

Standard basis: $\{1, x, x^2\}$

for $P^2 \in S$ it should be expressed as a linear combination

$$c_1 (2) + c_2 (x-1) + c_3 (x^2 - x) = a + bx + cx^2$$

$$2c_1 + c_2 x - c_2 + c_3 x^2 - c_3 x = a + bx + cx^2$$
$$(2c_1 - c_2) + (c_2 - c_3) x + c_3 x^2 = a + bx + cx^2$$

$$2c_1 - c_2 = a$$
$$c_2 - c_3 = b$$
$$c_3 = c$$