(2)

(III) Falso.

Seja $T: \mathbb{R}^2 \to \mathbb{R}^2$ tal que

$$A = [T]_{can} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}.$$

Neste caso $A^2 = 0$ e o operador $T^2 + I = I$ e 1 é autovalor de $I + T^2$.

Q2)

$$W = \{ p \mid p(1) + p'(0) = 0 \}$$

$$p(t) = t^2 + at + b \in W^{\perp}$$

$$q(t) = \alpha t^2 + \beta t + \gamma \in W$$

$$q(1) = \alpha + \beta + \gamma$$

$$q'(t) = 2\alpha t + \beta$$

$$q'(0) = \beta$$

$$q(1) + q'(0) = \alpha + \beta + \gamma + \beta = 0$$

$$\Rightarrow \alpha = -2\beta - \gamma$$

$$q(t) \in W \iff W = [-2t^2 + t, 1 - t^2]$$

(i) $\langle p, -2t^2 + t \rangle = (1 - a + b)(-2 - 1) + b \cdot 0 + (1 + a + b)(-2 + 1)$

$= -4 + 2a - 4b = 0$

(ii) $\langle p, 1 - t^2 \rangle = 0 + b \cdot 1 + 0 = 0 \Rightarrow b = 0$

$$2a = 4$$

$$\boxed{a = 2}$$