II. Finding $p(D)$

**Quiz:** Suppose $W(s) = \frac{s}{s^2 + 1}$. Find $p(D)$ so that $W(s)$ is the transfer function for the system $p(D)x = f(t)$.

**Choices:**

a) $\cos(t)$  
b) $D^2 + I$  
c) $D + 1/D$  
d) It doesn’t exist  
e) Can’t be found with the data given

**Answer:** (d)  
The system $p(D)x = f(t)$ has transfer function $1/p(s)$. Since $W(s)$ is not one over a polynomial there is no such polynomial.

Note that $W(s)$ is the transfer function for the system $\dot{x} + x = \dot{y}$, where we consider $y$ to be the input.