HW06 Hints

1. This problem showcases a situation in which EVD enables an economical computation of A^k. The relevant slide, therefore, is p. 20. As for Horner's methods, see Problem 12(b) of Module 2 practice problem set. With a simple modification to the code, it can be used for both scalar and vector inputs.

   Note. If you want to test your code (the problem does not require any testing), use `polyval` for cases where `x` is a scalar or a vector and `polyvalm` for cases where `x` is a square matrix. Do recall that MATLAB uses a different convention in arranging polynomial coefficients, so you need to use `flip` accordingly; see, for instance, p. 31 of Module 2 or p. 9 of Module 3.

2. Use Theorem 5 on p. 36. Since A in the problem is a real matrix, $A^* = A^{\mathrm{T}}$. It is your job to determine which one of $A^{\mathrm{T}}A$ or AA^{T} to use. *Hint.* The problem demands a 2×2 eigenvalue problem.

3. (a) Let $A = U\Sigma V^{\mathrm{T}}$ be the SVD of A. Then

   $$A^{\mathrm{T}} = \left(U\Sigma V^{\mathrm{T}}\right)^{\mathrm{T}} = V\Sigma^{\mathrm{T}}U^{\mathrm{T}}.$$

   What kind of matrix is Σ^{T} and what does it equal?

   (b) Along with the previous part, Theorem 4 on p. 34 of Module 4 is useful.

4. I hope by now that everyone is comfortable creating a Vandermonde-type matrix; see also Problem 3 of HW5. The semi-log plot for part (b) should plot singular values (vertical axis) against integers $1, \ldots, 25$ (horizontal axis). The vertical axis need to be in log scale, so use `semilogy`, *e.g.*,

```
semilogy( <indices>, <singular values> )
```