HW 1 Solutions

1. 
   a. Because there are 4 control points, this needs to be a 3rd degree polynomial (or cubic splines). $C^1$ continuity.
   b. Same reasoning as above with 6 control points, so 5th degree polynomial. Gives $C^2$ continuity.

2. Dot product is distributive. So $a(b - \alpha a) = |a|(|b| \cos \theta - \alpha |a|)$
   a. General case: $\alpha = ab/|a|$
   b. $|a| = 0$, then any value of $\alpha$ works
   c. $|a| = 1$, then $\alpha = ab$.

3. $f_(A \cup B) = \min(f_A, f_B)$;
   $f_(A \cap B) = \max(f_A, f_B)$;
   $f_A \text{ complement} = -f_A$

4. Let’s order the points as follows: A(1, -1), B(1, -3), C(4, -1)
   a. Use the constraints $\alpha A + \beta B + \gamma C = P$, and $\alpha + \beta + \gamma = 1$;
   b. $(2,2) : (\alpha, \beta, \gamma) = (13/6, -3/2, 1/3)$
   c. $(2,2) : (\alpha, \beta, \gamma) = (8/3, -2, 1/3)$
   d. It’s outside because $\alpha, \beta, \gamma$ all need to be within the range (0,1).

5. 
   2 0 0
   a. 0 1 0
   0 0 1
   1 1 0
   b. 0 1 0
   0 0 1

   1/2 -1/2 0
   c. 1/2 1/2 0 (rotation and scale)
   0 0 1