1. A matrix exponential can be used to solve all linear time **invariant** ODE's of the form $\dot{z} = Az$.

   (a) true
   (b) false

   Solution: True, see recitation 1. The differential equation $\dot{x} = Ax$ can be solved exactly with $x(t) = e^{At}x(0)$.

2. A matrix exponential can be used to solve all linear time **varying** ODE's of the form $\dot{z} = A(t)z$.

   (a) true
   (b) false

   Solution: False, only time invariant ODE's.

3. You should use a matrix exponential to discretize a nonlinear system after it has been linearized, since differentiating through an explicit integrator is a bad idea.

   (a) true
   (b) false

   Solution: False. Differentiating through an explicit integrator is required for a true 1st order Taylor series of the discrete time dynamics function. Not only is it the only correct way to do this, but differentiating through an explicit integrator with modern automatic differentiation is significantly faster than computing a matrix exponential.

4. Quaternions and rotation matrices have **all** of the same operations: a multiplication operation, an identity, inverse/conjugation.

   (a) true
   (b) false

   Solution: True.

5. All quaternion-specific math operations (multiplication, conjugation, etc.) can be computed with standard matrix/vector multiplication after defining the matrix functions $L(q)$ and $R(q)$, as well as the matrices H and T.

   (a) true
   (b) false

   Solution: True.

6. $L(q_1)q_2 = R(q_2)q_1$

   (a) true
   (b) false

   Solution: True.

7. $L(q)^T L(q) = I$

   (a) true
   (b) false

   Solution: True, L and R are both orthogonal.

8. $L(q_1)^T q_2 = TR(q_2)q_1$

   (a) true

(b) false

Solution: False.

9. $L(q_1)^T q_2 = R(q_2) T q_1$

   (a) true

   (b) false

   Solution: True.