Question 1. (1 point) Given the incoming direction of the light \( L = [1, 3, 2] \) and the surface normal direction \( N = [0, 1, 1] \), what is the mirror reflection direction \( R \)? (You need to normalize \( L \) and \( N \) first.)

Question 2. (3 points) Please use the forward Euler method, the midpoint method, and the trapezoid rule method to compute the integral \( \int_1^2 \frac{1}{t} \, dt \). Which method is the most accurate in this example? (Use the slides or wikipedia as your reference. The exact solution is: 0.69)
Question 3. (1 points) To see why an explicit mass-spring system will cause instability issues, let us consider a single 1D spring. One end of the spring is attached to the origin, and the other end is attached to a particle with mass 1. The spring length is initially 1, so the particle is located at $x = 1$. Suppose the time step $\Delta t$ is 1 and the spring stiffness is 10, we can formulate the whole system as:

$$\begin{align*}
  v^{t+1} &= v^t - 10(x^t - 1) \\
  x^{t+1} &= x^t + v^t
\end{align*}$$

(1)

If we move the particle to $x^0 = 2$ and then release it with no initial velocity ($v^0 = 0$), where is the particle located at time $t = 1$? Where is the particle located at time $t = 2$?

Submission Guideline Please submit your solution either in person or by email to our grader. If you finish it early, you may also give it to the professor after class.