**Exercise 1:** Consider two laser beams, one shining along the ray \( \mathbf{r}_1(t) = (1, 2, 4) + t(2, 1, -1) \), the other other along the ray \( \mathbf{r}_2(t) = (6, 3, -1) + t(-5, 2, c) \). For what value(s) of \( c \) do the two laser lines intersect?

**Exercise 2:** Consider the cylinder \( x^2 + y^2 = 1 \) and the sphere \( x^2 + y^2 + z^2 = r^2 \) in \( \mathbb{R}^3 \). Describe the intersection of the sphere and cylinder if (a) \( r > 1 \), (b) \( r = 1 \), and (c) \( 0 < r < 1 \).

**Exercise 3: Viviani’s Curve** Find the intersection of a cylinder (radius \( r \)) tangent to a sphere (radius \( R > r \)). The equation of the sphere is

\[
x^2 + y^2 + z^2 = R^2,
\]

and the cylinder is

\[
y^2 + (x - (R - r))^2 = r^2.
\]

*Hint:* Points on the intersection satisfy the equations of both surfaces. Writing \( y \) and \( z \) in terms of \( x \) (or any two variables in terms of the third) is a complete description of the intersection.

**Exercise 4:** Use the properties of the dot product to prove the triangle inequality,

\[
||\mathbf{v} + \mathbf{w}|| \leq ||\mathbf{v}|| + ||\mathbf{w}||.
\]

*Hint:* Consider \((||\mathbf{v} + \mathbf{w}||)^2\) and \((||\mathbf{v}|| + ||\mathbf{w}||)^2\) separately.