Given three points \( P_1(2, 1, 5) \), \( P_2(-1, 3, 4) \), \( P_3(3, 0, 6) \):

a) Find the area of the triangle \( \triangle P_1P_2P_3 \).

b) Find the magnitude \( |\vec{P}_1\vec{P}_2| \) of the vector \( \vec{P}_1\vec{P}_2 \).

c) Find the scalar projection of \( \vec{P}_1\vec{P}_2 \) along \( \vec{P}_1\vec{P}_3 \).

d) Evaluate the quantity \( |\vec{P}_1\vec{P}_2 \times \vec{P}_1\vec{P}_3| = |\vec{P}_1\vec{P}_2 \times \vec{P}_1\vec{P}_3| / |\vec{P}_1\vec{P}_3| \), which is the scalar projection of \( \vec{P}_1\vec{P}_2 \) perpendicular to \( \vec{P}_1\vec{P}_3 \).

e) Confirm that the square of b) equals the sum of the squares of c) and d).

f) OPTIONAL: Draw a suggestive diagram illustrating this problem, taking into account the sign of c).

► solution