quiz 3
math228, classical geometry
fall 2021

The quiz is worth 10 points. Justify all your claims rigourously.

Recall that for any triangle ABC, the following holds :
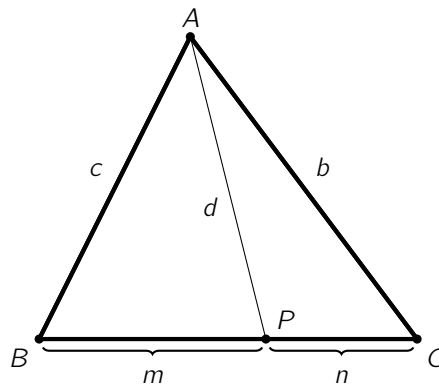
$$|BC|^2 = |AB|^2 + |AC|^2 - 2|AB||AC|\cos(\angle BAC)$$

This previous equation is often referred to as the *cosine law*.

(10 points)   **a.** Consider a triangle ABC and a point P on the segment BC such that

$$|BP| = m, \quad |CP| = n, \quad |AP| = d, \quad |AC| = b, \quad |AB| = c,$$

as pictured in the following figure :

Using the cosine law and the fact that $\cos(180° - \alpha) = -\cos\alpha$ for any angle α, show that

$$b^2 m + c^2 n = (m + n)(d^2 + mn).$$

This result is known as *Stewart's theorem*.

(5 points)   **b.** By applying **a**, show that for any triangle ABC having centroid G,
bonus

$$|AB|^2 + |AC|^2 + |BC|^2 = 3(|AG|^2 + |BG|^2 + |CG|^2).$$