Linear Algebra and Geometry 1

Systems of equations, matrices, vectors, and geometry

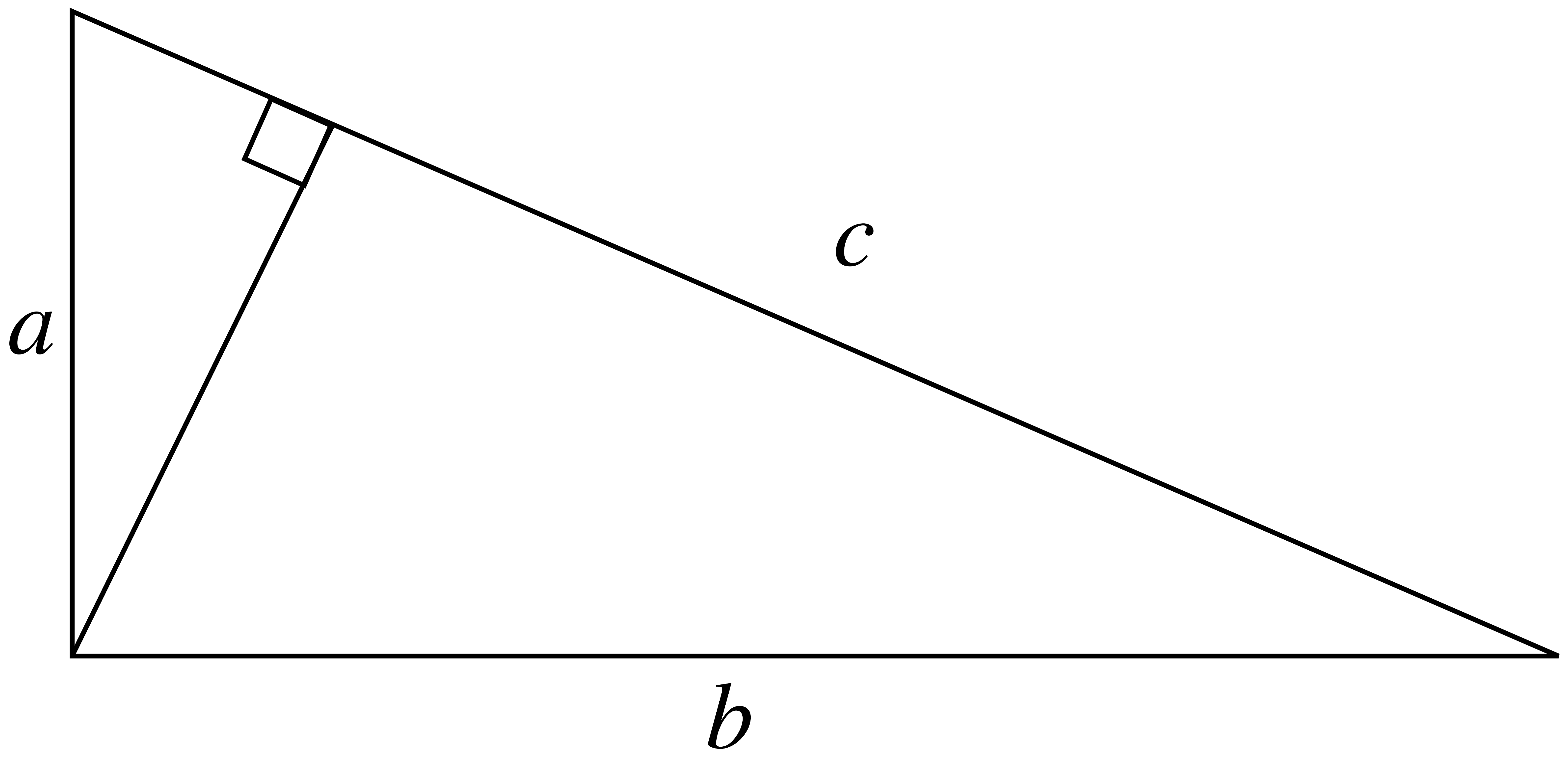
Pythagorean Theorem and distance between points

Hania Uscka-Wehlou, Ph.D. (2009, Uppsala University: Mathematics)

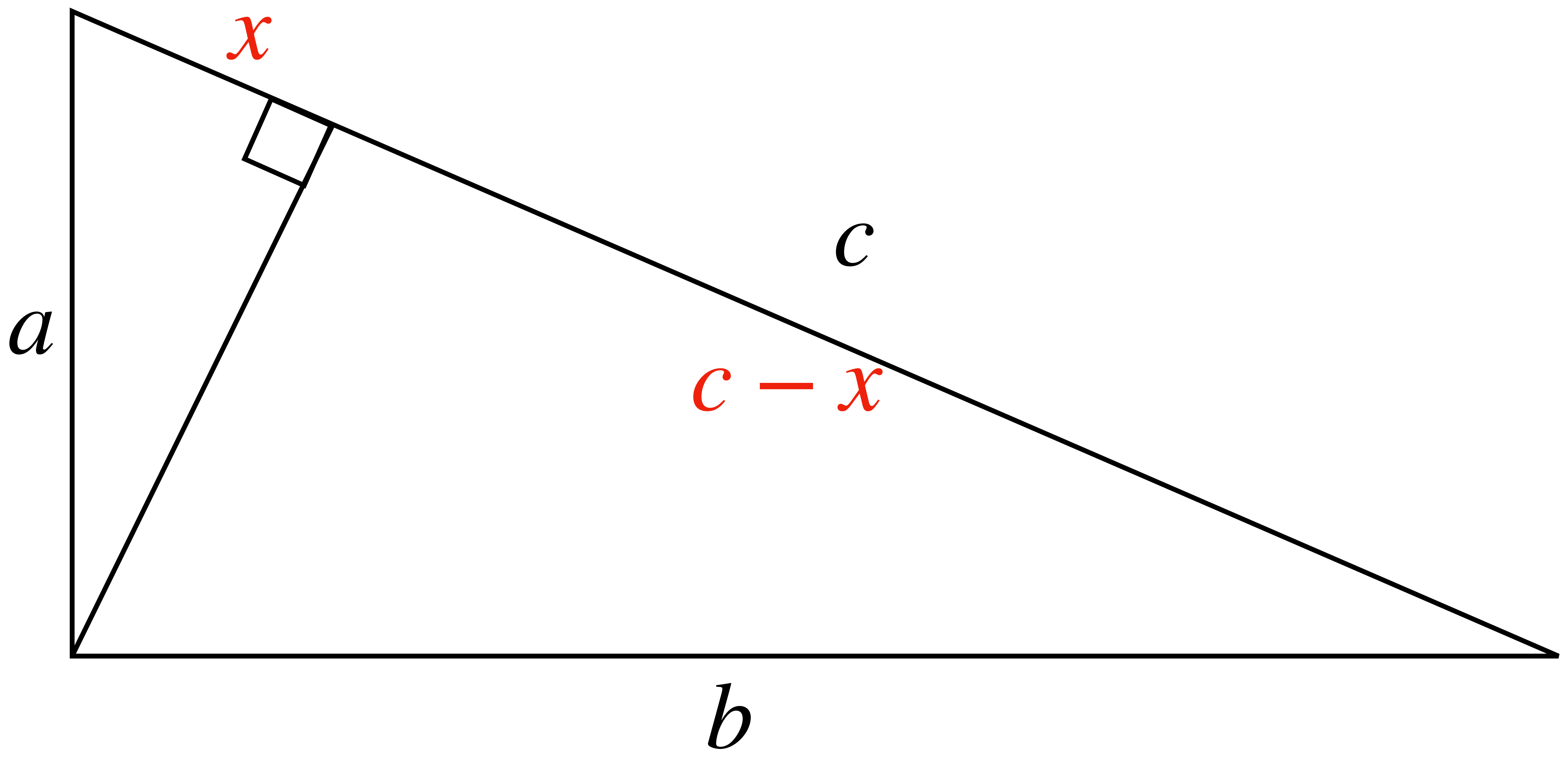
University teacher in mathematics (Associate Professor / Senior Lecturer) at Mälardalen University, Sweden

MiTM

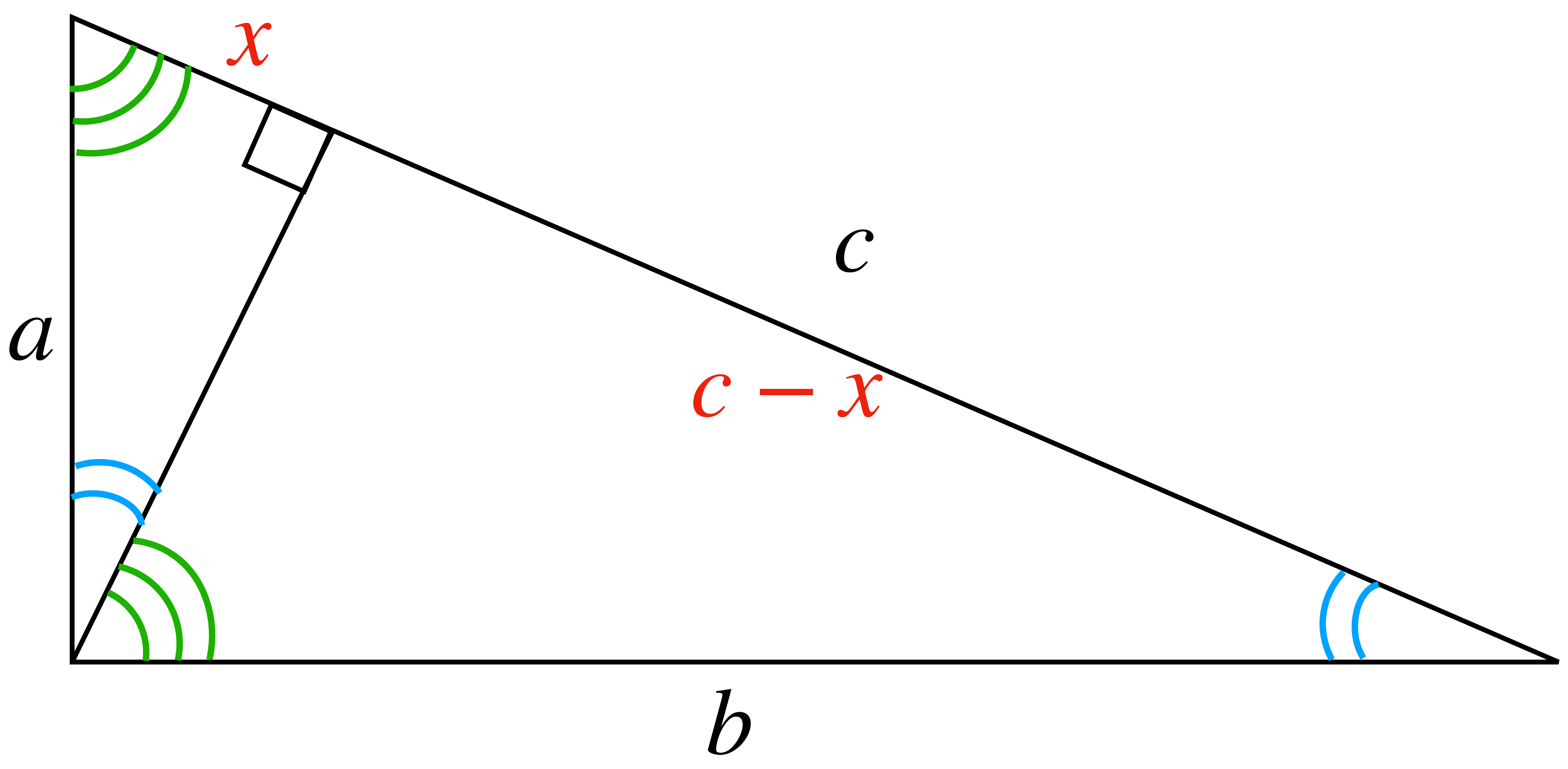
Man in The Middle AB



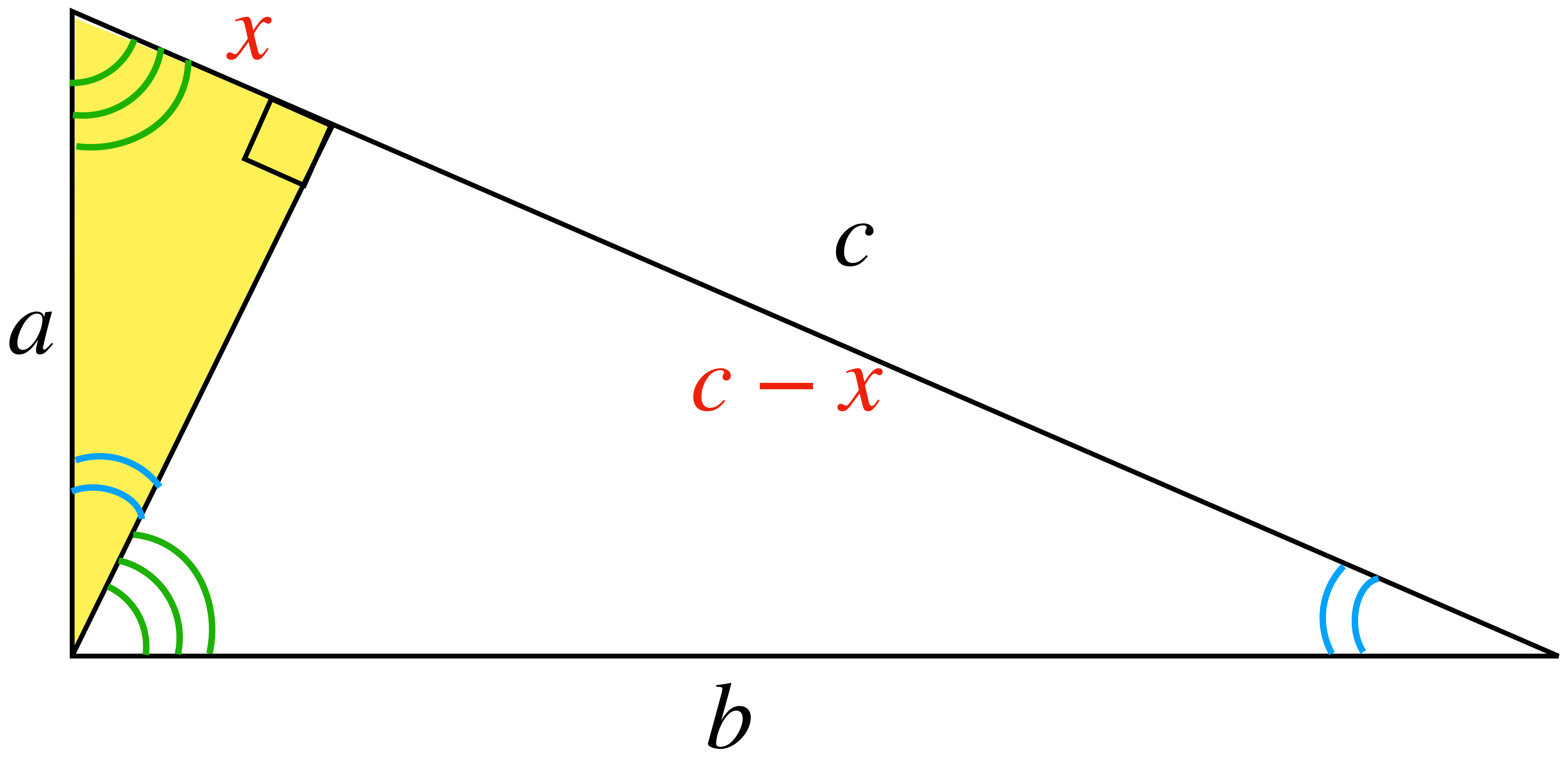
$$a^2 + b^2 = c^2$$



$$a^2 + b^2 = c^2$$

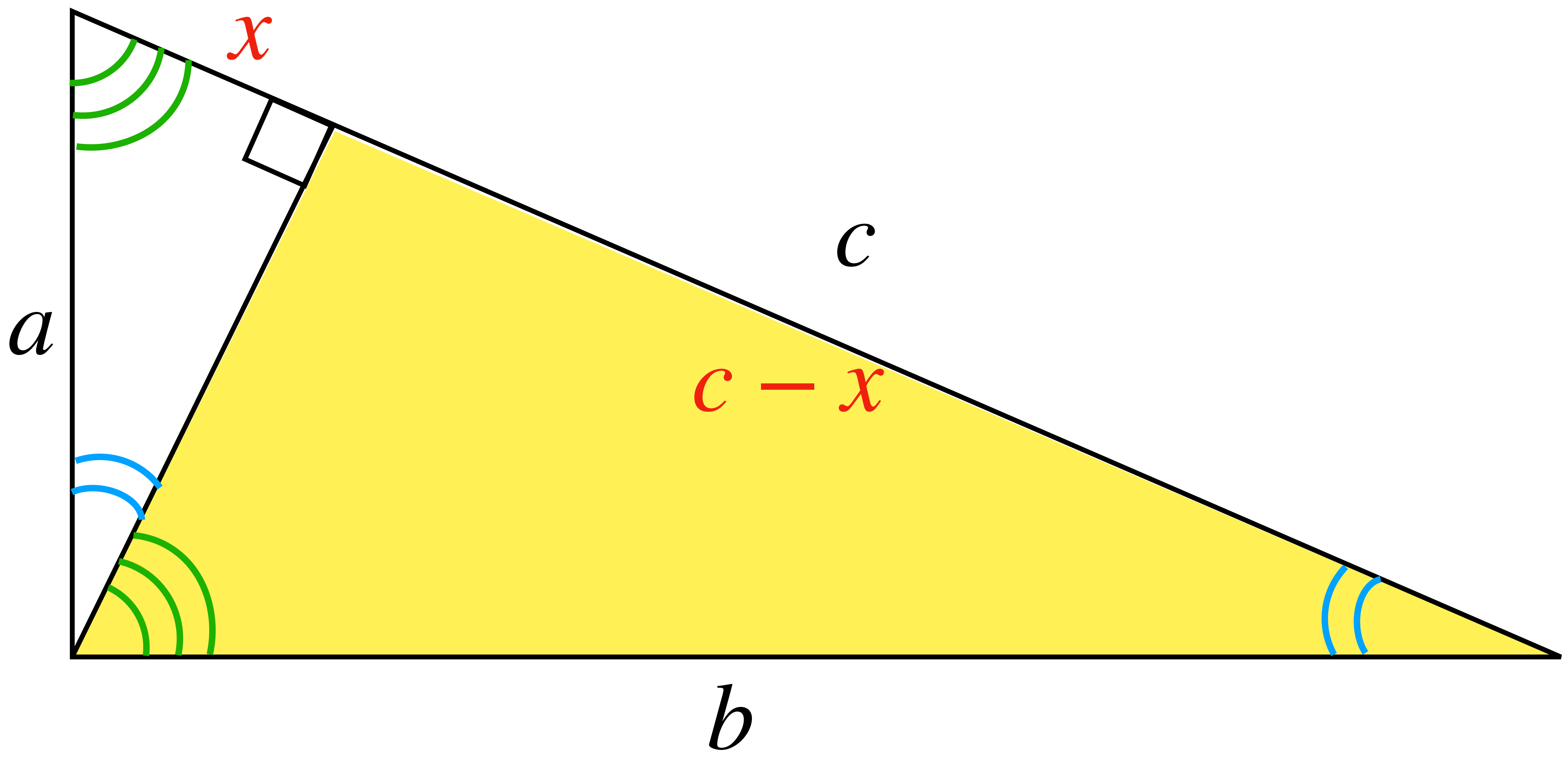


$$a^2 + b^2 = c^2$$



$$a^2 + b^2 = c^2$$

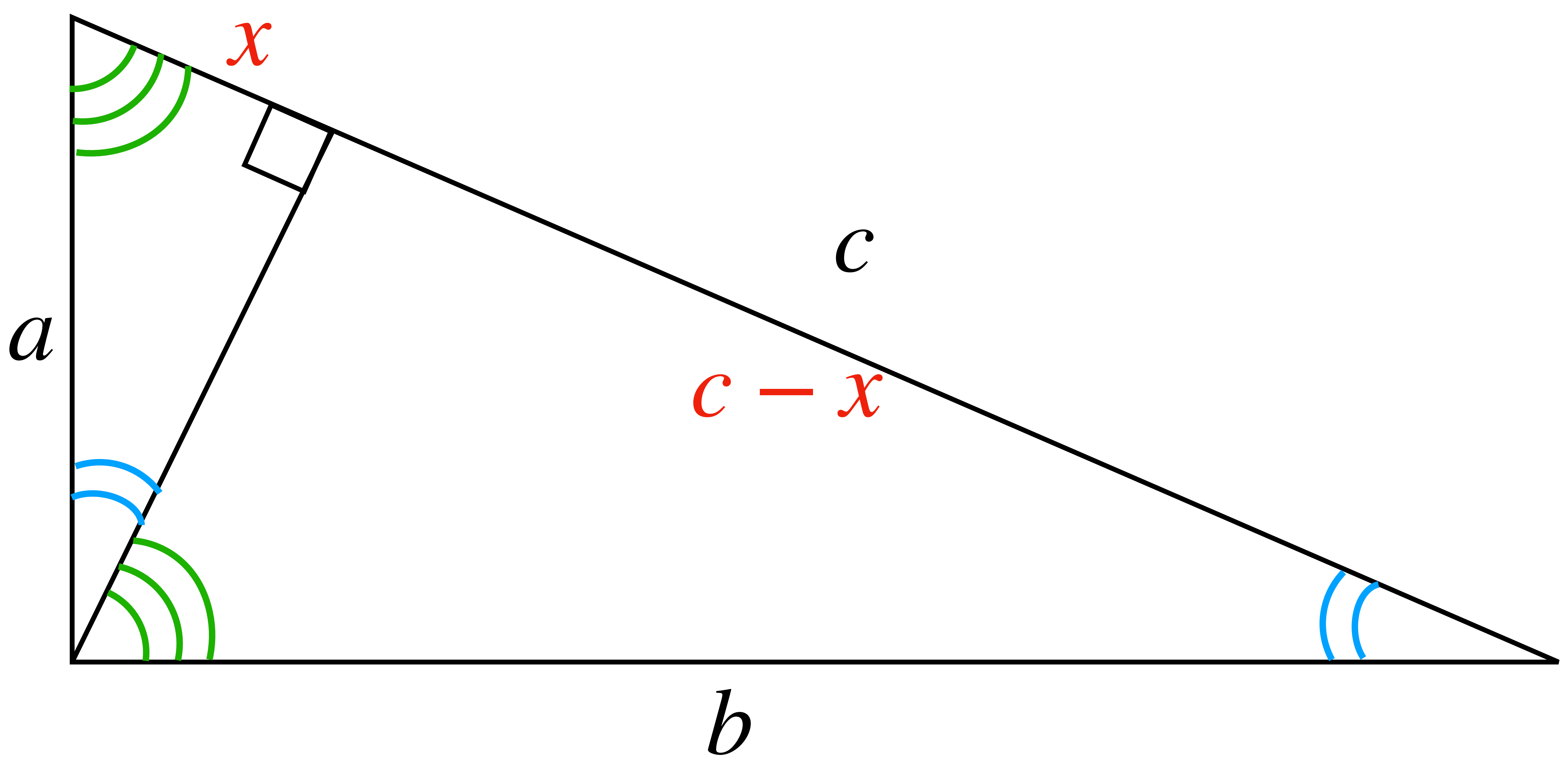
$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad a^2 = xc$$



$$a^2 + b^2 = c^2$$

$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad a^2 = xc$$

$$\frac{c-x}{b} = \frac{b}{c} \quad \Rightarrow \quad b^2 = c(c-x)$$

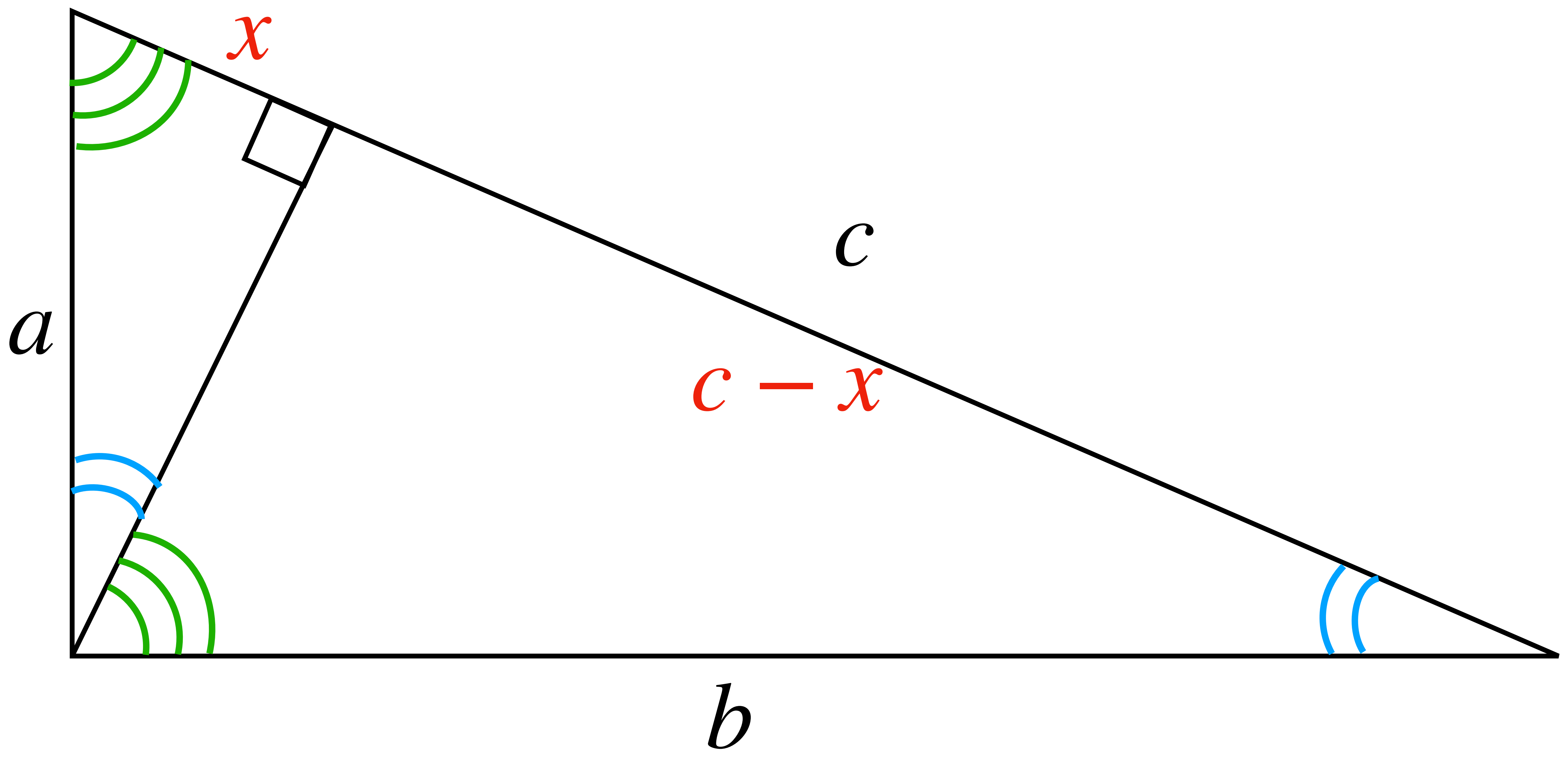


$$a^2 + b^2 = c^2$$

$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad \boxed{a^2 = xc}$$

$$\frac{c-x}{b} = \frac{b}{c} \quad \Rightarrow \quad \boxed{b^2 = c(c-x)}$$

$$\boxed{a^2 + b^2} =$$

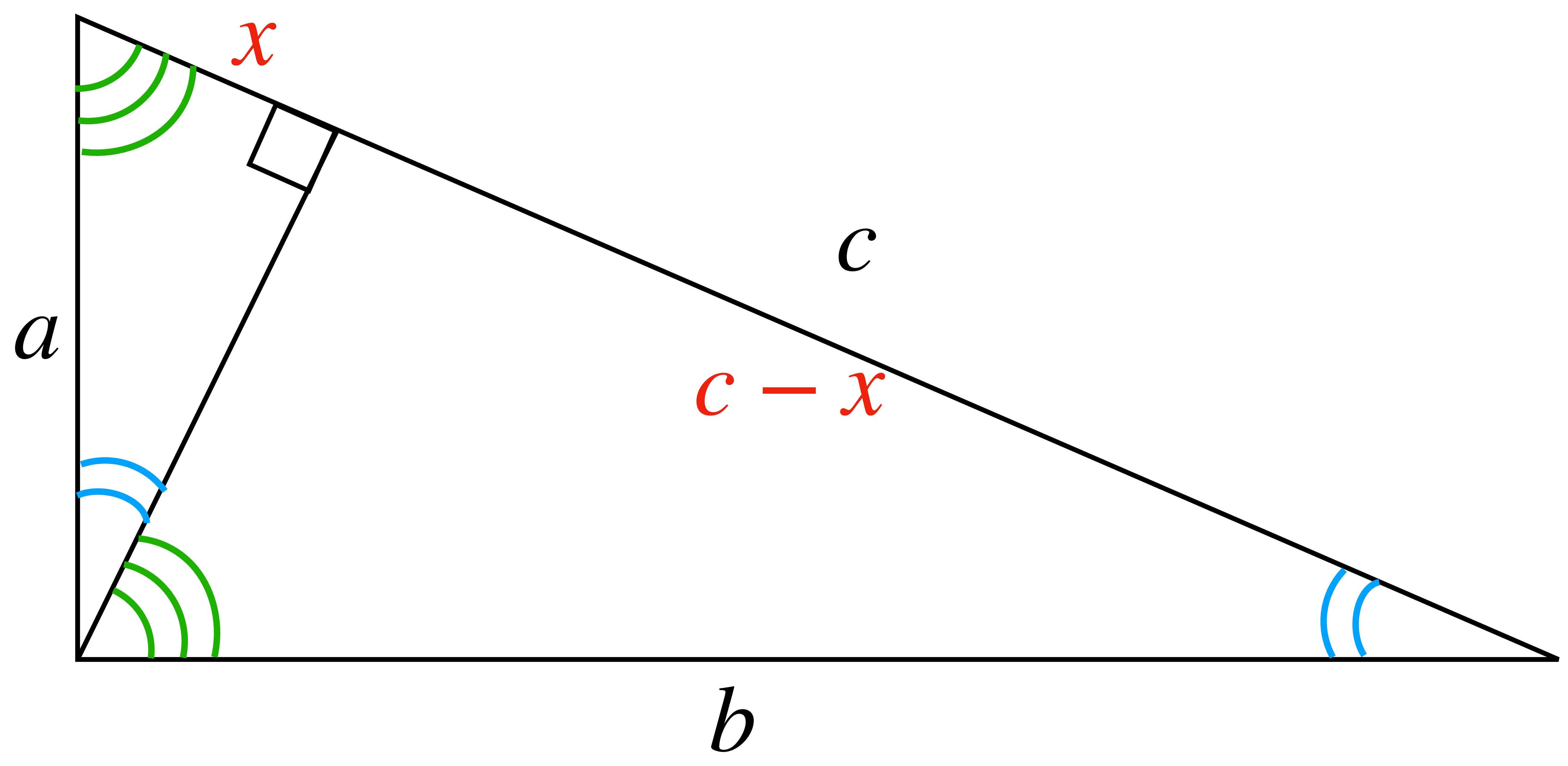


$$a^2 + b^2 = c^2$$

$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad \boxed{a^2 = xc}$$

$$\frac{c-x}{b} = \frac{b}{c} \quad \Rightarrow \quad \boxed{b^2 = c(c-x)}$$

$$\boxed{a^2 + b^2} = xc + c(c-x)$$

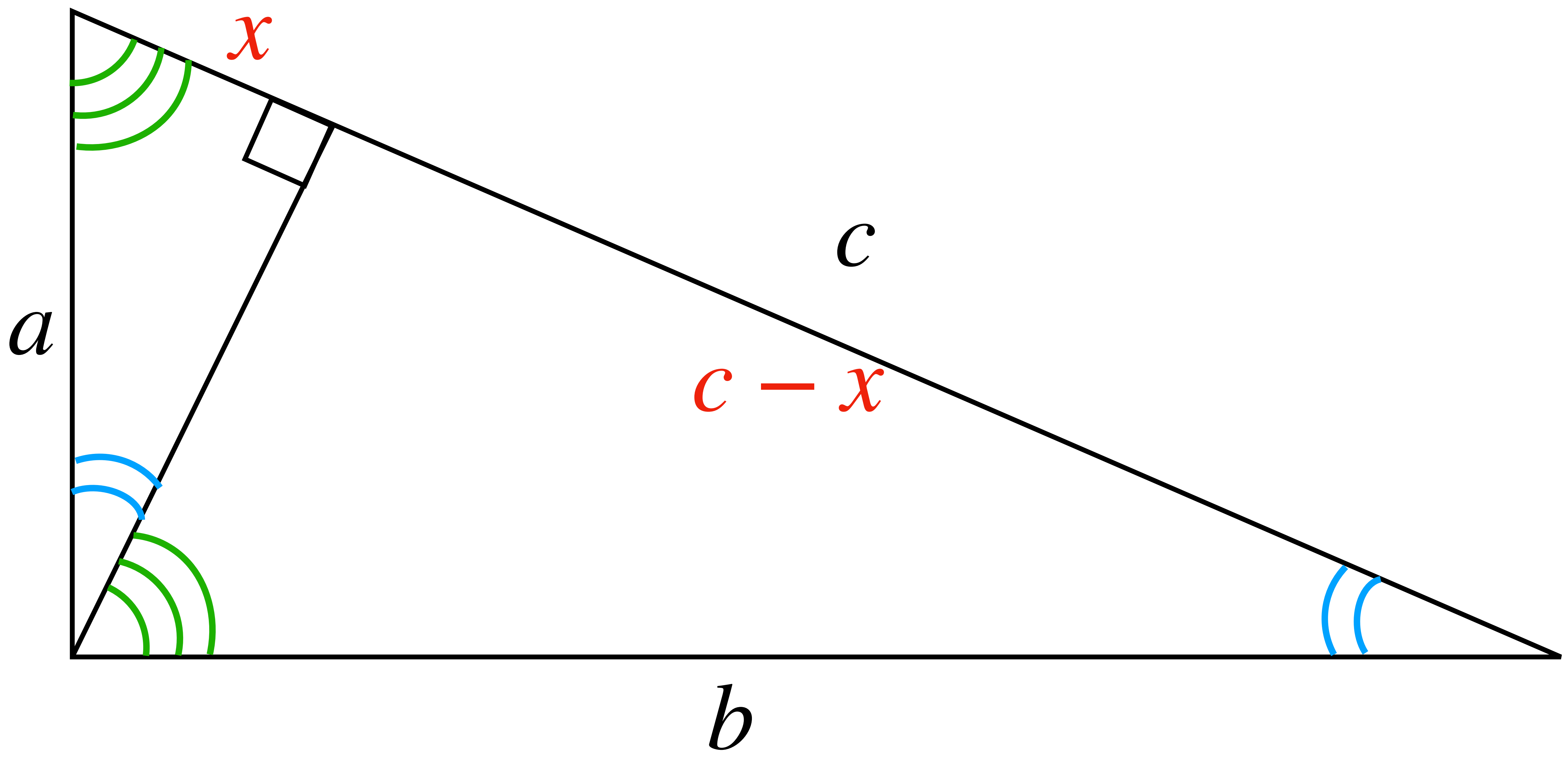


$$a^2 + b^2 = c^2$$

$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad \boxed{a^2 = xc}$$

$$\frac{c-x}{b} = \frac{b}{c} \quad \Rightarrow \quad \boxed{b^2 = c(c-x)}$$

$$\boxed{a^2 + b^2} = xc + c(c - x) = xc + c^2 - xc$$



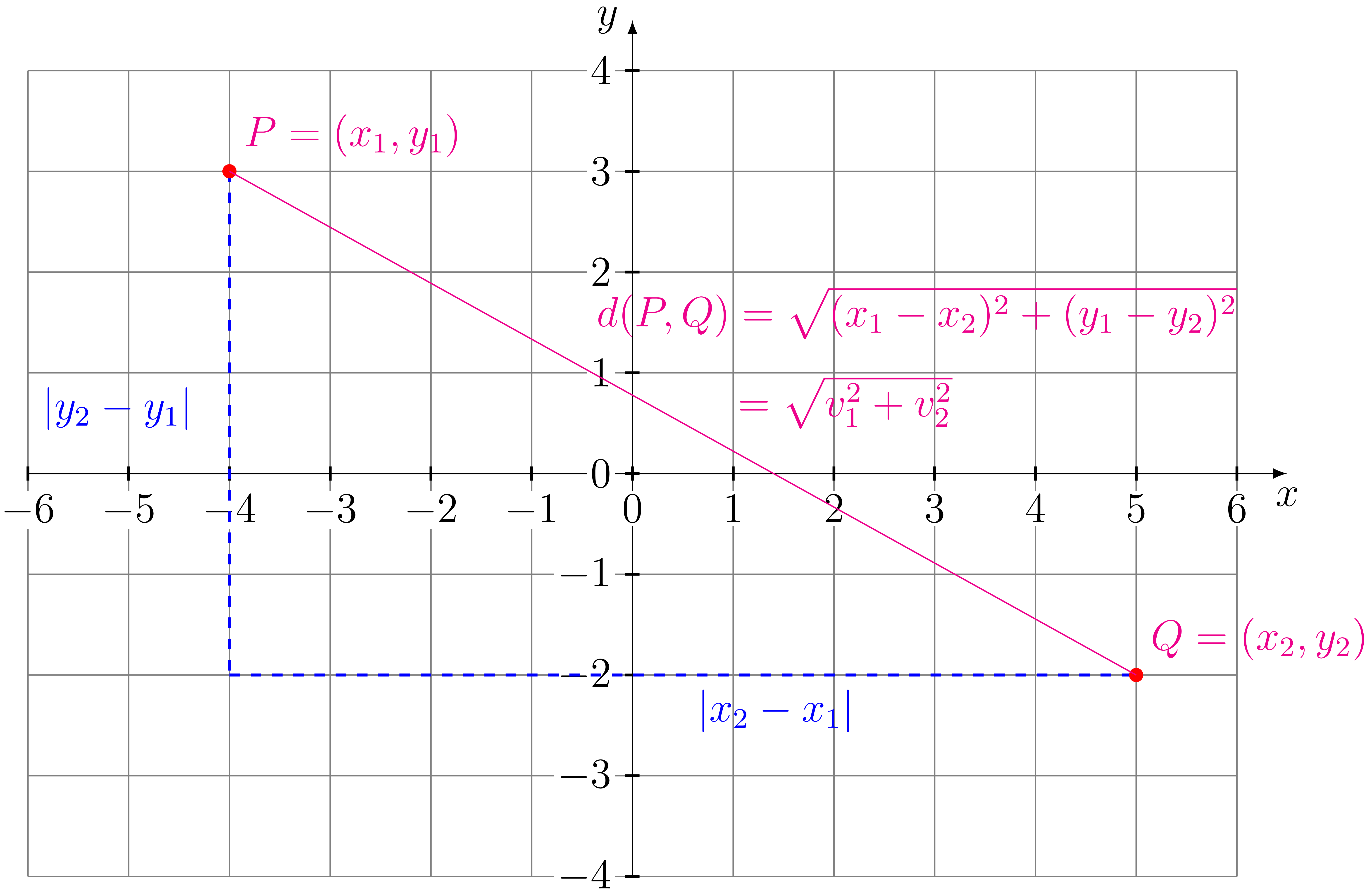
$$a^2 + b^2 = c^2$$

$$\frac{x}{a} = \frac{a}{c} \quad \Rightarrow \quad \boxed{a^2 = xc}$$

$$\frac{c-x}{b} = \frac{b}{c} \quad \Rightarrow \quad \boxed{b^2 = c(c-x)}$$

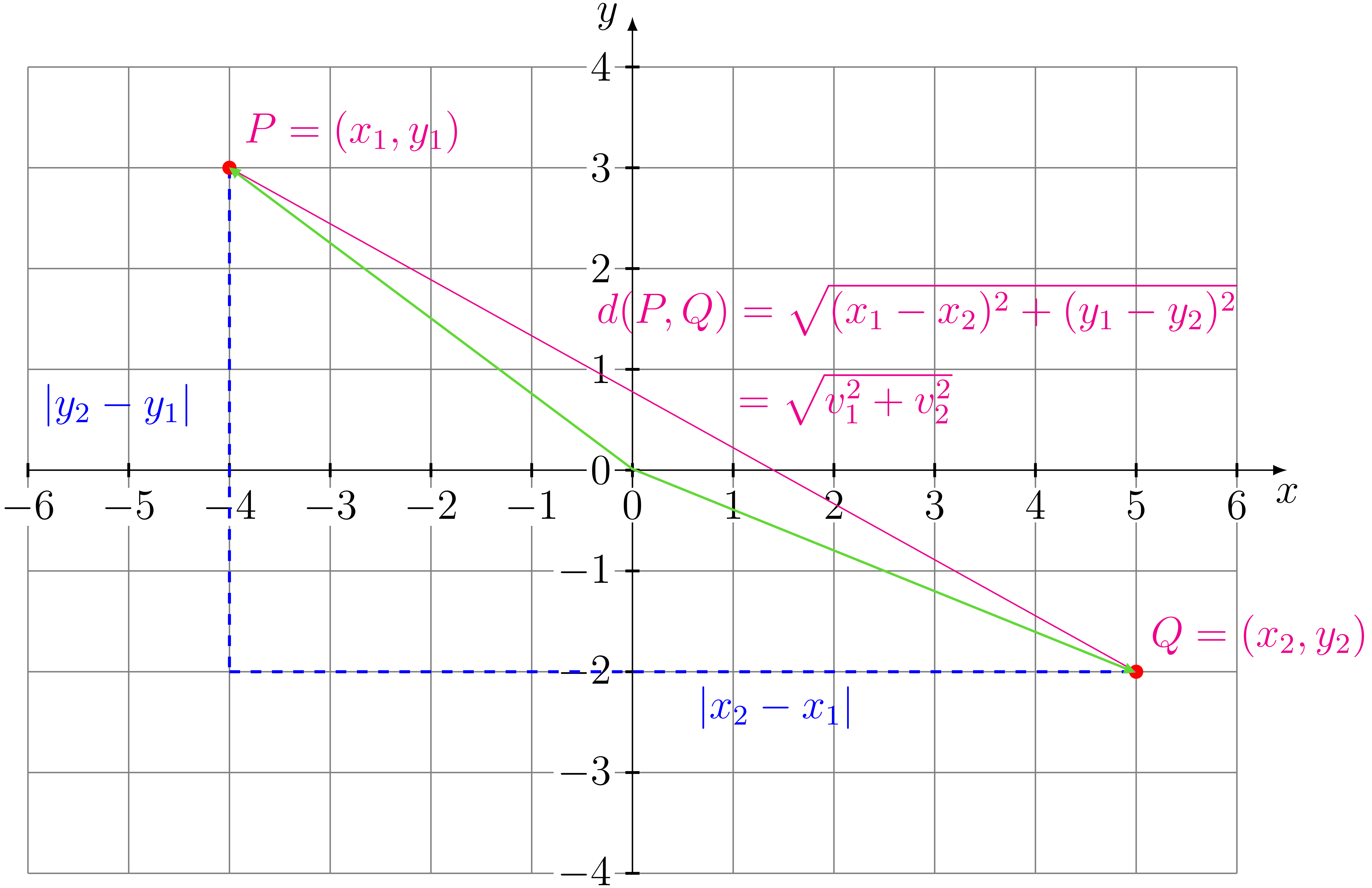
$$\boxed{a^2 + b^2} = xc + c(c-x) = xc + c^2 - xc = \boxed{c^2}$$

Distance between points = length of a vector



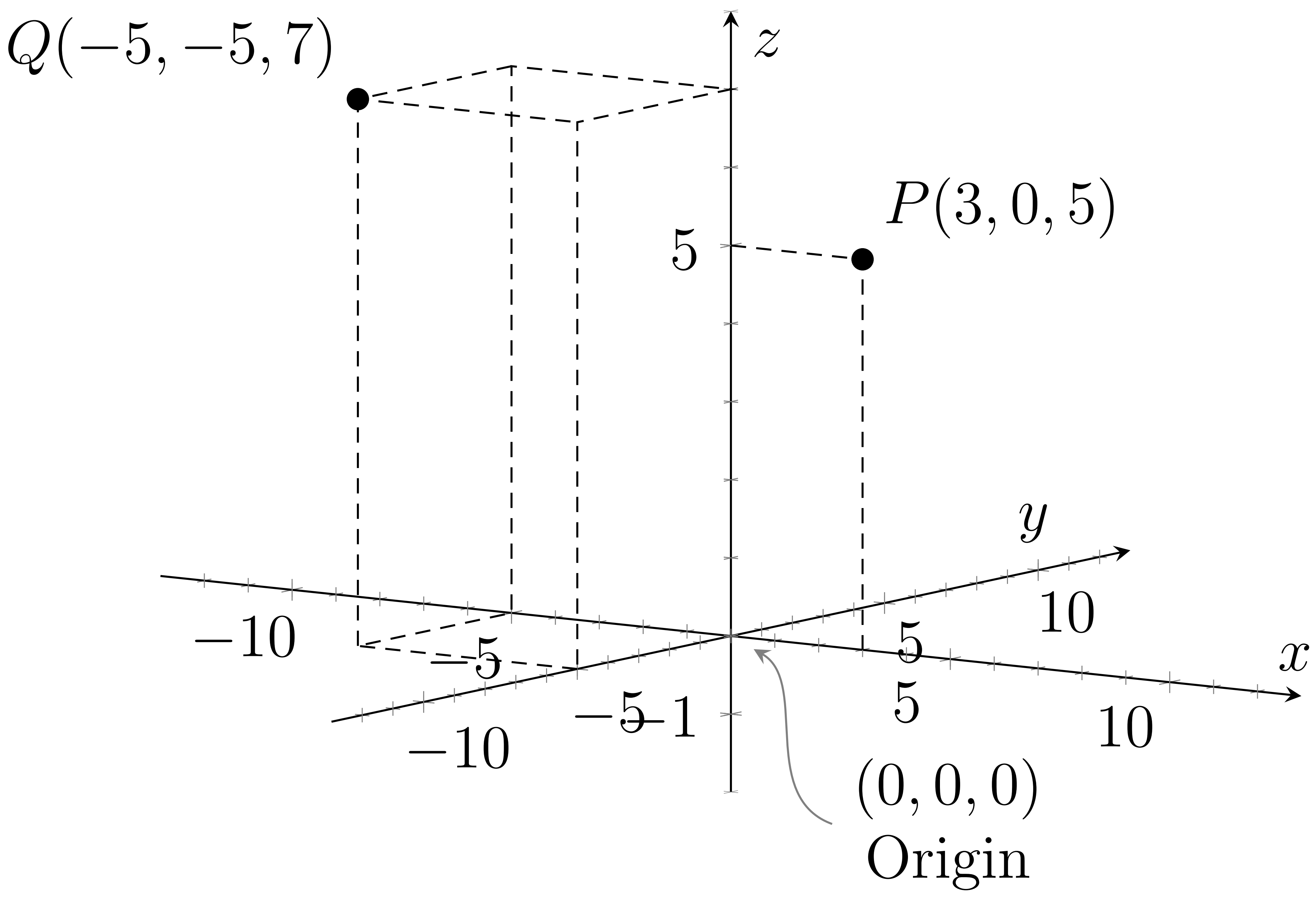
Pythagorean theorem

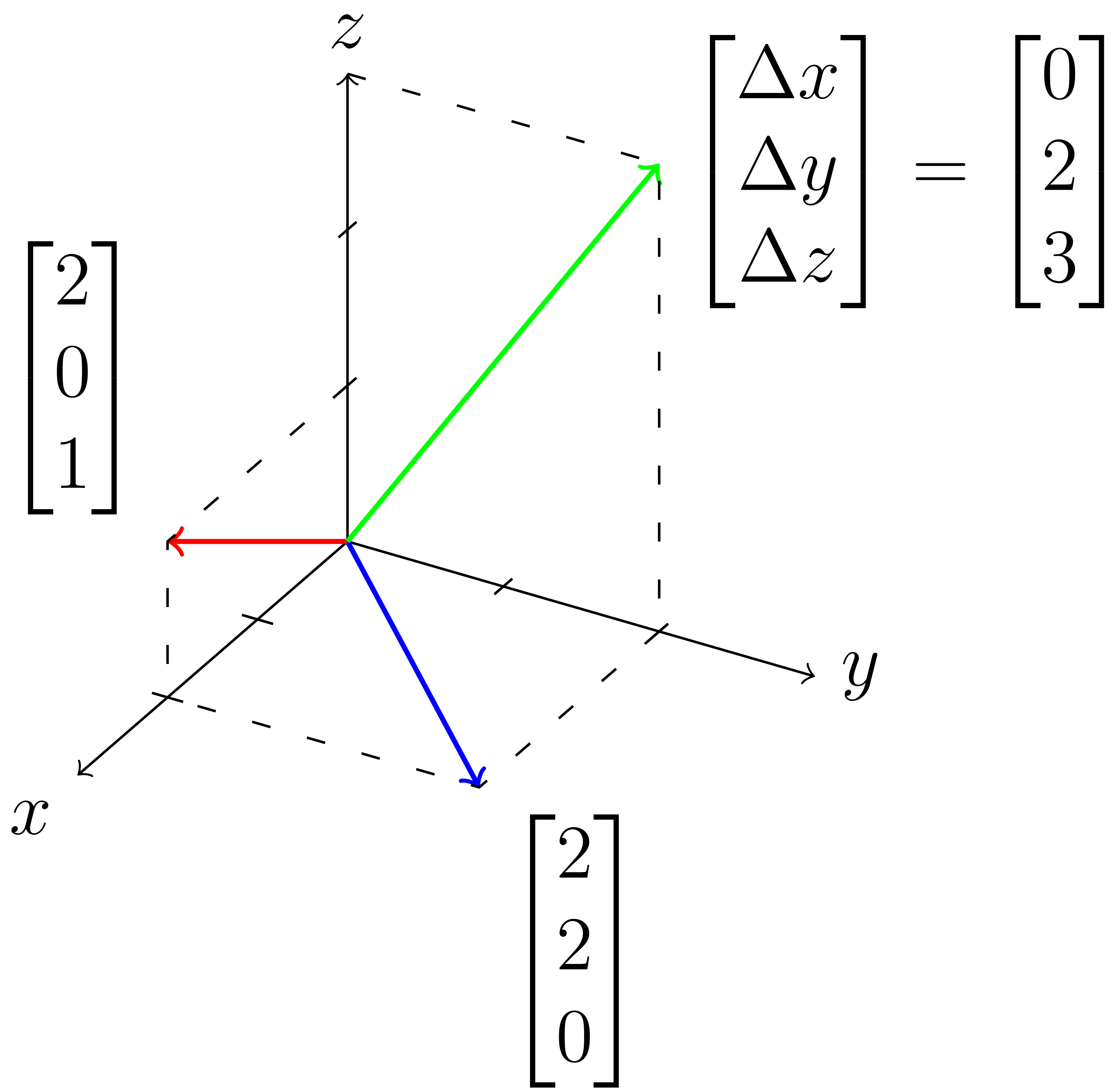
Distance between points = length of a vector



$$d(P,Q) = \| \overrightarrow{PQ} \| = \| \overrightarrow{OQ} - \overrightarrow{OP} \|$$

Cartesian coordinate system

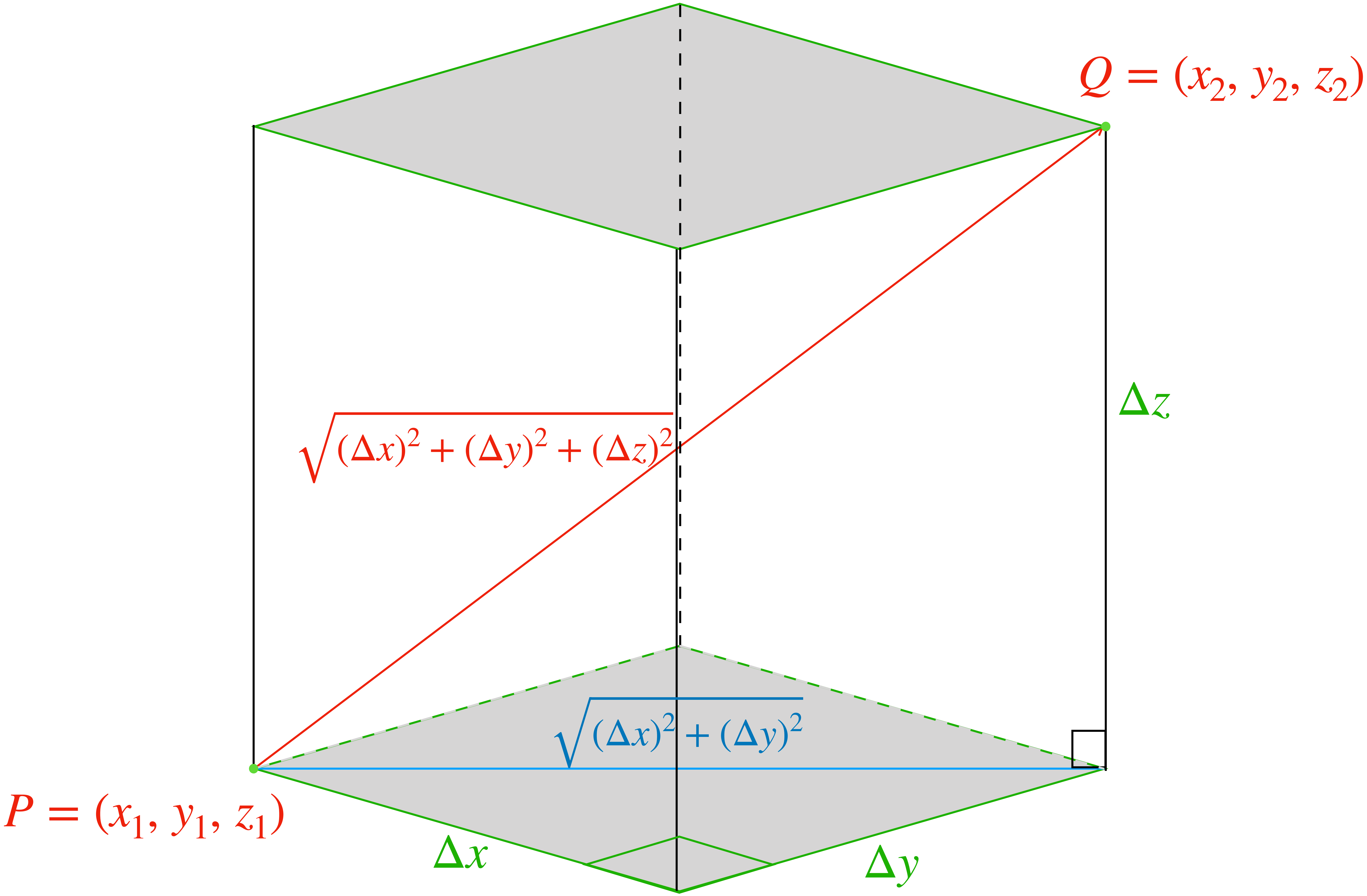




Distance between points = length of a vector

$$P = (x_1, y_1, z_1), \quad Q = (x_2, y_2, z_2)$$

$$d(P, Q) = |\overrightarrow{PQ}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$



$Q = (x_2, y_2, z_2)$
Δz
$\sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}$
$\sqrt{(\Delta x)^2 + (\Delta y)^2}$
$P = (x_1, y_1, z_1)$
Δx
Δy

Length / Norm

$$|\overrightarrow{v}| \qquad |\mathbf{v}|$$

$$\|\overrightarrow{v}\| \qquad \|\mathbf{v}\|$$

$$\mathbb{R}^n$$

$$\mathbf{x} = (x_1, x_2, \ \ldots, x_n)$$

$$\mathbf{y} = (y_1, y_2, \ \ldots, y_n)$$

$$\mathrm{d}(\mathbf{x}, \mathbf{y}) = \sqrt{(y_1 - x_1)^2 + (y_2 - x_2)^2 + \ \ldots + (y_n - x_n)^2}$$