Assuming a uniform relative velocity $\vec{v}$, the relative trajectory is $\vec{r}(t) = \vec{r_2} + \vec{v}\,t$ $(\blacksquare)$, where $\vec{r_2}$ is the location at $t=0$; $\vec{r_1}$ is the location at time Δt before $t=0$.

Then: $$\vec{v} = \frac{\vec{r_2} - \vec{r_1}}{|\Delta t|}$$

- Convert ranges and angles into Cartesian coordinates (x, y, z):
  $\vec{r_1} = (x_1, y_1, z_1)$ and $\vec{r_2} = (x_2, y_2, z_2)$

- Calculate Cartesian components of velocity:
  $$V_x = \frac{x_2 - x_1}{|\Delta t|}, \quad V_y = \frac{y_2 - y_1}{|\Delta t|}, \quad V_z = \frac{z_2 - z_1}{|\Delta t|}$$

CPA occurs at time $t = T$, when distance $s(t) = |\vec{r}(t)|$ is minimum.

Since $$|\vec{r}(t)| = \sqrt{(x_2 + V_x t)^2 + (y_2 + V_y t)^2 + (z_2 + V_z t)^2} \quad (\blacktriangle)$$

which is minimum when $\left.\dfrac{d\,|\vec{r}(t)|}{dt}\right|_{t=T} = 0$, we solve a linear equation for $t = T$, the time of CPA

$$(x_2 + V_x T)\,V_x + (y_2 + V_y T)\,V_y + (z_2 + V_z T)\,V_z = 0$$

- Find time T (since observing $\vec{r_2}$):
  $$T = -\frac{x_2 V_x + y_2 V_y + z_2 V_z}{V_x^2 + V_y^2 + V_z^2}$$

- Plug the solution for T into Equation $(\blacktriangle)$ to get range at CPA.

- Plug the solution for T into Equation $(\blacksquare)$ and use it to find the direction at CPA. In 2-D that's one angle, in 3-D that will be 2 angles.