

Unit 3: Worksheet

- 1 What is $\left(\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \times \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \right) \times \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$?
- 2 The star Proxima Centauri is a bit more than 4 light years away from us. The brightest star we see in the night sky is **Sirius**. It is 8.6 light years away. The star **Epsilon Eridani** is the closest star for which one has confirmed a planet. It is 10.5 light years away from us. Assume the earth is at $A = (1, 0, 0)$, Proxima Centauri at $B = (4, 3, 0)$ and Sirius at $C = (7, 4, 3)$. Find the plane $ax + by + cz = d$ containing A, B, C .
- 3 What is the distance of Epsilon Eridani, a star at $D = (8, -5, -6)$ to that plane?
- 4 Parametrize the line through D perpendicular to the plane ABC .



Source: Caltech. Artist rendering of asteroid belts in Epsilon Eridani.

¹Hints:

1) $[0, 1, 0]$.

2) Build $\vec{AB} = [3, 3, 0]$ and $\vec{AC} = [6, 4, 3]$. The cross product gives $\vec{n} = [-9, -9, -6] = [a, b, c]$ perpendicular to them. The equation of the plane is $ax + by + cz = -9x - 9y - 6z = d$. To get d plug in a point like $(1, 0, 0)$. We get $d = -9$. 3) Use $|\vec{n} \cdot \vec{AD}|/|\vec{n}| = 18/\sqrt{198}$. 4) $\vec{r}(t) = [8, -5, -6] + t[-9, -9, -6] = [8 - 9t, -5 - 9t, -6 - 6t]$.