

1. Let $ABCD$ be a parallelogram. Suppose that E is on line DC such that C lies on segment ED . Then say lines AE and BD intersect at X and lines CX intersects AB at F . If $AB = 7$, $BC = 13$, and $CE = 91$, then find $\frac{AF}{FB}$.

2. The unit square $ABCD$ has E as midpoint of AD and a circle of radius r tangent to AB , BC , and CE . Determine r .

3. The permutohedron of order 3 is the hexagon determined by points $(1, 2, 3)$, $(1, 3, 2)$, $(2, 1, 3)$, $(2, 3, 1)$, $(3, 1, 2)$, and $(3, 2, 1)$. The pyramid determined by these six points and the origin has a unique inscribed sphere of maximal volume. Determine its radius.