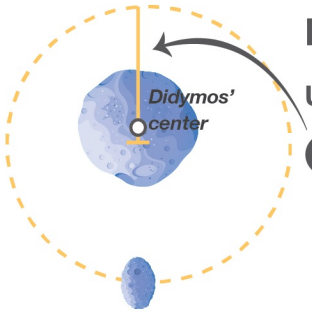
π IN THE SKY 11

ANSWER KEY



DARING DEFLECTION

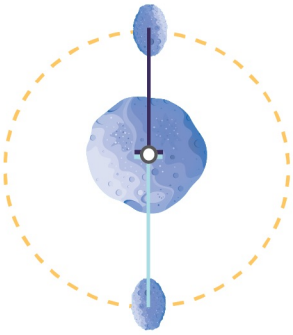
Use Kepler's third law to calculate the semi-major axis (a) of the new orbit.

1. **Rearrange Kepler's third law equation to solve for the semi-major axis.**

$$a = \sqrt[3]{(T / 2\pi)^2 \bullet GM}$$

$$a = \sqrt[3]{(40{,}980 \text{ sec} / 2\pi)^2 \bullet ((6.674 \bullet 10^{-11} \text{ N} \bullet \text{m}^2/\text{kg}^2) \bullet (5.643 \bullet 10^{11} \text{kg}))}$$

$$a \approx \text{1,170 meters}$$

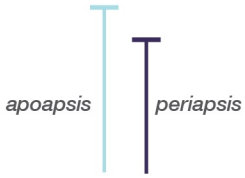


Calculate Dimorphos' apoapsis and periapsis.

1. **Plug in the given value for e and the calculated value for a.**

apoapsis ≈ 1,170 m (1 + 0.02) ≈ **1,193 meters**

periapsis ≈ 1,170 m (1 - 0.02) ≈ **1,147 meters**

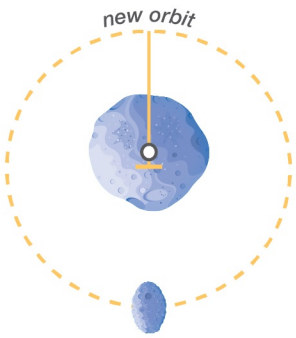


Compare the new elliptical orbit to the circular orbit.

1. **Convert the distances in meters to kilometers and compare the orbits' measurements.**

apoapsis: 1,193 m ≈ 1.19 km

periapsis: 1,147 m ≈ 1.15 km



All points on the original circular orbit are equidistant from the central mass. Dimorphos' new elliptical orbit puts it at different distances from Didymos throughout its orbit, as shown by the apoapsis and periapsis calculations.