Jet Propulsion Laboratory
California Institute of Technology

π IN THE SKY 3

Just like NASA's science and engineering pros, use pi to help guide a spacecraft into orbit around the gas giant Jupiter.

Discover more "π in the sky" math problems at:
jpl.nasa.gov/edu/nasapidaychallenge

GRAVITY GRAB

The Juno spacecraft is hurtling toward Jupiter. At closest approach, it will reach a velocity of 57.98 km per second relative to the planet. To get into orbit around Jupiter, Juno will have to brake at just the right time to be pulled in by Jupiter's gravity or miss its target completely.

By how much does Juno need to change its velocity relative to Jupiter to get into a 53.5-day orbit around the planet?

Use these equations to approximate a solution assuming Juno could instantaneously decelerate at perijove:

$$T = 2\pi\sqrt{\left(\frac{a^3}{\mu}\right)}$$

$$E = \frac{-\mu}{2a} = \frac{v^2}{2} - \frac{\mu}{r}$$

T = orbital period (in seconds)
E = total orbital energy
a = semi-major axis of the orbit (in km)
μ = gravitational parameter for Jupiter ($126{,}686{,}536\ km^3 / sec^2$)
v = velocity of Juno relative to Jupiter after deceleration
r = radius of Juno at perijove (76,006 km)

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