



The figure above shows the orbits of many of Jupiter's numerous satellites. Each of these 'moons' orbits Jupiter in a different number of days. The image to the right shows the appearance of one of Jupiter's moons Callisto. The orbit periods of many of the moons have simple relationships between them.

When Jupiter's moon Ganymede orbits 1/2 way around Jupiter, Jupiter's moon Europa orbits Jupiter once. When Jupiter's moon Leda orbits Jupiter once, Ganymede orbits Jupiter 34 times. When Jupiter's moon Leda orbits Jupiter five times, the more distant moon Thelxinoe orbits Jupiter twice. When Leda orbits Jupiter three times, the moon Kalyke orbits Jupiter once.

Example: $1/2 \times \text{Ganymede} = 1 \times \text{Europa}$, so in the time it takes Europa to go once around Jupiter, Ganymede goes only $1/2$ way around in its orbit.

Problem 1 - How many times does Ganymede orbit Jupiter in the time it takes Europa to orbit six times?

Problem 2 – How many times does Leda orbit Jupiter in the time it takes Ganymede to orbit Jupiter 6 times?

Problem 3 - How many orbits will Thelxinoe have to complete around Jupiter before Kalyke orbits exactly five times?

Problem 1 - How many times does Ganymede orbit Jupiter in the time it takes Europa to orbit six times?

Answer: The information says that Europa orbits once when Ganymede orbits $1/2$ times, so $1 \times \text{Europa} = 1/2 \times \text{Ganymede}$ and so $2 \times \text{Europa} = 1 \times \text{Ganymede}$. If Europa orbits 6 times, then $3 \times (2 \times \text{Europa}) = 3 \times (1 \times \text{Ganymede})$, and so **Ganymede orbits 3 times.**

Problem 2 - How many times does Leda orbit Jupiter in the time it takes Ganymede to orbit Jupiter 6 times?

Answer: Leda orbits once when Ganymede orbits 34 times, so $1 \times \text{Leda} = 34 \times \text{Ganymede}$, so $1 \times \text{Ganymede} = 1/34 \times \text{Leda}$. So $6 \times (1 \times \text{Ganymede}) = 6 \times (1/34 \times \text{Leda})$ so Leda goes only $6/34$ or **$3/17$** of the way around its orbit in the time it takes Ganymede to go 6 times around in its orbit.

Problem 3 - How many orbits will Thelxinoe have to orbit Jupiter before Kalyke orbits exactly five times?

Answer: $5 \times \text{Leda} = 2 \times \text{Thelxinoe}$
so $\text{Leda} = 2/5 \text{ Thelxinoe}$

also $3 \times \text{Leda} = 1 \times \text{Kalyke}$
so $\text{Leda} = 1/3 \text{ Kalyke}$,

then in the same orbit time as for Leda, $2/5 \text{ Thelxinoe} = 1/3 \text{ Kalyke}$,
and $\text{Thelxinoe} = (5/2 \times 1/3) \text{ Kalyke}$
so $\text{Thelxinoe} = 5/6 \text{ Kalyke}$,

and so $6 \times \text{Thelxinoe} = 5 \times \text{Kalyke}$
then if Kalyke orbits 5 times, **Thelxinoe orbits 6 times.**