A Matter of Timing

Astronomers who study planets and their satellites often have to work out how often satellites or planets 'line up' in various ways, especially when they are closest together in space.

Figure shows the satellite Dione (Courtesy: NASA/Cassini)

Problem 1 – The two satellites of Tethys and Dione follow circular orbits around Jupiter. Tethys takes about 2 days for one complete orbit while Dione takes about 3 days. If the two satellites started out closest together on July 1, 2008, how many days later will they once again be at 'opposition' with one another?

A) Find the Least Common Multiple between the orbit periods.

B) Draw two concentric circles and work the solution out graphically.

C) What is the relationship between your answer to A and B?

Problem 2 - Two planets have orbit periods of 3 years and 5 years. How long will it take them to return to the same locations that they started at?

Answer Key

Problem 1 - A) The Least Common Multiple between 2 and 3 is 6, so it will take 6 days for the two moons to return to their original positions. B) The figure below shows the progression in elapsed days, with the moons moving counterclockwise. C) The LCF between the orbit periods tells you how long it will take for the two bodies to return to their same locations when they started.

Problem 2 - Two planets have orbit periods of 3 years and 5 years. How long will it take them to return to the same locations that they started at?
Answer;   The LCM for 3 and 5 is found by forming the multiples of 3 and 5 and finding the first number they share in common.

For 3:   3, 6, 9, 12, **15,** 18, 21, 24, 27, 30, 33, 36, ….
For 5:   5, 10, **15,** 20, 25, 30, …

The smallest common multiple is '15', so it will take the two planets 15 years to return to the positions they started with.