The Second Law of Motion and The Law of Gravitation

Sir Isaac Newton (1642-1727) established the scientific laws that govern 99% or more of our everyday experiences. He also explained our relationship to the Universe through his Laws of Motion and his universal theory of gravitation - which are considered by many to be the most important laws of all physical science.

Newton was the first to see that such apparently diverse phenomena as a satellite moving near the Earth's surface and the planets orbiting the Sun operate by the same principle: Force equals mass multiplied by acceleration, or F=ma.

Our everyday lives are influenced by different forces. As you know, the Earth exerts a force on us that we call gravity. We feel the force required to lift an object from the floor to a table. We can see and feel a magnet's pull on a pile of metal paper clips. But exactly how does Newton's Second Law of Motion relate to gravity? To understand Newton's theories, you must first know about the nature of force and acceleration when applied to circular motion, rather than motion in a straight line.

Newton's First Law of Motion tells us that, without the interaction of some sort of force, everything travels in a straight line forever. This means that an object traveling in a circular path must be influenced by a net (outside) force. The circulating object has a velocity that is constantly changing, not because its speed is changing but because its direction is changing. A change in velocity is called an acceleration. Newton's Second Law explains it this way: A net force changes the velocity of an object by changing either its speed or its direction.

Therefore, an object moving in a circle is undergoing an acceleration. The direction of the acceleration is toward the center of the circle. The magnitude of the acceleration is equal to, where "v" is the constant speed along the circular path and "r" is the radius of the circular path. This acceleration is called centripetal

(literally, “center-seeking”) acceleration. The force needed to produce the centripetal acceleration is called the centripetal force , which is equal to “ma” according to Newton’s Second Law (F=ma). But since “a” is , the centripetal force is equal to .