

The Gravitational Theories of  
**Isaac Newton**

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# The life of Isaac Newton

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**Isaac Newton**



**BA degree 1665**

- Isaac Newton was born on Christmas Day, 25 December 1642 "an hour or two after midnight" in the county of Lincolnshire, UK.
- In June 1661, he was admitted to Trinity College, Cambridge, on the recommendation of his uncle Rev William Ayscough, who had studied there.
- Soon after Newton had obtained his BA degree in August 1665, the university temporarily closed as a precaution against the Great Plague. Although he had been undistinguished as a Cambridge student, Newton's private studies at his home in Woolsthorpe over the subsequent two years saw the development of his theories on the law of gravitation.
- Newton died in his sleep in London on 20 March 1727

# Where it all began

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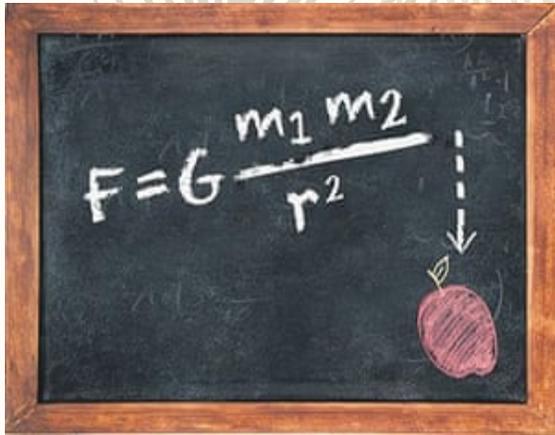
- It was 1666, during the time of the plague epidemic, when Isaac Newton sat under an apple tree in his mother's garden in Lincolnshire, wondering about the movement of planets. It was while he sat that an apple fell from the tree under which he was sitting and struck him on the head. It was in this instant, through observing the fall of an apple, that Isaac Newton came up with his revolutionary theory of gravity.



# What is Gravity?

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- Gravity is the force that keeps us from floating off into space. It literally keeps our feet on the ground!
- We feel the effects of gravity every second of our lives (unless we're astronauts), but most of us don't give it a second thought.
- Gravity is, quite simply, **a force of attraction between objects**. An object is 'attracted' to – pulled towards – the Earth.



# What is Gravity?

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## GRAVITY

GRAVITY IS THE EARTH'S GRAVITATIONAL PULL ON A BODY, LYING ON NEAR THE SURFACE OF EARTH.

- Thanks to Isaac Newton, we know that:
  - *The more mass an object has, the bigger the force of attraction.*
- And ...
  - *The closer something is, the bigger the force of attraction.*
- The Earth, having a very large mass, and being very close, exerts a strong pull on anything in its vicinity, including:
  - a stone when you drop it,
  - your body when you fall over,
  - and something large and round flying above your head ...
  - ... The moon!

# An example:

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- Here's a question:
- *If I had a 1kg weight in one hand, and a 100g weight in the other hand, and dropped them at exactly the same time, which would fall the fastest and therefore land first?*
- The answer is that they would both fall at the same speed (or, more specifically, with the same acceleration), and both would hit the ground at the same time.



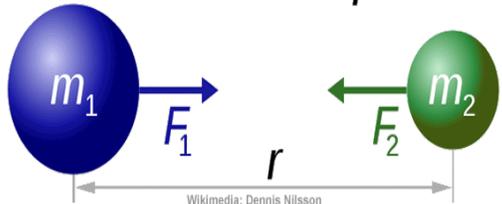
# Newton's Law of Universal Gravitation

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- Newton's law of universal gravitation, published in 1687 states that **'any two bodies in the universe attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them'**.
- Newton's work show us that gravity is a force of attraction between objects, and is dependent both on the masses of the objects involved, and on the distance they are from each other.

## Newton's Law of Universal Gravitation

$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$



# Newton's Theory explained

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- Using Newton's laws, we can find out why two objects of different mass fall with the same acceleration.
- Basically, if the mass of an object is doubled, the gravitational force is doubled, but the rate of acceleration remains the same meaning that they will both hit the ground at the same time!

