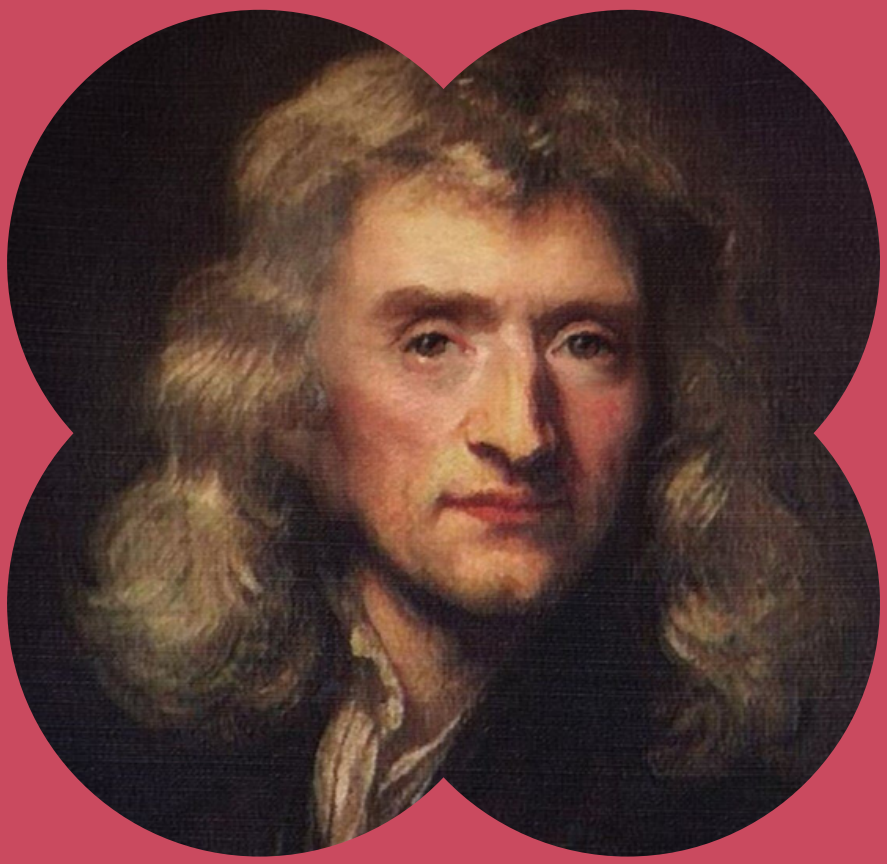
# Activity and discussion guide



# Isaac Newton

History Science Theatre ON DEMAND
A production of Matheatre

# Isaac Newton

Dear Teacher,

Thank you for bringing Matheatre's *History Science Theatre ON DEMAND* into your classroom or home learning curriculum. Matheatre's mission is to use live theatre to tell stories that inspire excitement about math and science. We hope that the personal storytelling and character interpretations in this video series will make the many faces of science relatable and alive for modern students.

In this guide you will find:

- A brief biography of the historical figure
- A summary of key concepts presented in the video story
- Suggested discussion questions
- Suggested activities
- Suggested reading

We believe that *stories* hold immense power to engage the imagination, foster empathy, encourage creative and critical thinking, and educate by way of entertainment. We hope the stories in this series inspire lively conversation, exploration, experimentation, curiosity, and perspective for each of your students as they make history in their own way.

Sadie Bowman
Co-founder, Managing Director
Matheatre

# Who was Isaac Newton?

**SIR ISAAC NEWTON (1643-1727)** was a mathematician, physicist, astronomer, and one of the world's most influential scientists. His laws of motion are widely viewed as the basis for modern physics. His mathematical work established that the motion of celestial bodies and the motion of objects on earth are explained and accounted for by the same principles--a huge paradigm shift at the time. He also worked extensively in optics and light, and is credited, along with German mathetmatician Gottfried Leibniz, with developing the vocabulary of the branch of mathematics we now call Calculus.

For all of Newton's contributions to science, he was a complicated figure. Bullied as a child, he was purported by contemporary accounts to be petty, childish and a bit of a bully himself. While there is no doubt that Newton is a crucial figure in the history of math and physics, it's important to note, as he did himself, that he has seen far "by standing on the shoulders of giants." Math does not happen in a vaccuum and Newton's important work was a coalescence of ideas that had been swirling around for centuries and continue to evolve today!

# Key lesson concepts:

**Force**

**Laws of motion**

**Orbital motion**

**Experimentation**

*Possibly a drawing of Isaac Newton as a child*

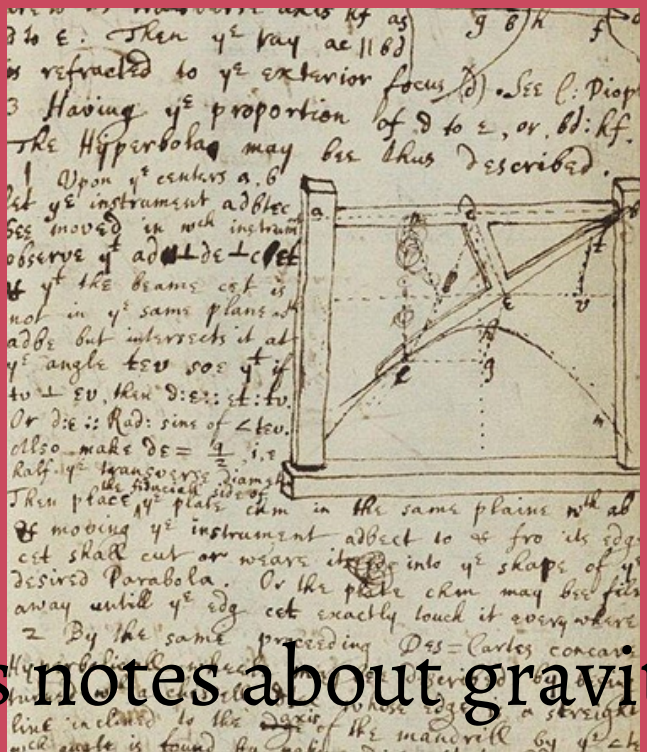
## Suggested discussion questions

- Isaac loves math because it lets us take a big problem and break it down into small pieces. What do you like about math?
- Isaac describes being bullied as a young student. Have you ever been bullied, and how did it feel? What did you do about it?
- Isaac tested his idea about gravity by throwing the apple five times and observing that it came down five times–meaning 100% of the times he threw the apple, the apple fell down. Why is it important to test and verify ideas with experiments? *(for more about the scientific method, see our History Science Theatre ON DEMAND program on Marie Curie!)*

*Woolsthorpe Manor: the house where Isaac sheltered from the plague*

# Suggested activities

- **Try Isaac's orbiting water trick! Fill a plastic or otherwise unbreakable cup with water, and take it outside (with your adult's permission and help if needed). Experiment with spinning the cup at arm's length over your head and see how speed affects the action of the water!**
- **Isaac writes down all his questions about the universe in a notebook. Start a list of your own questions about the universe. You can keep adding to this list as you have more questions!**



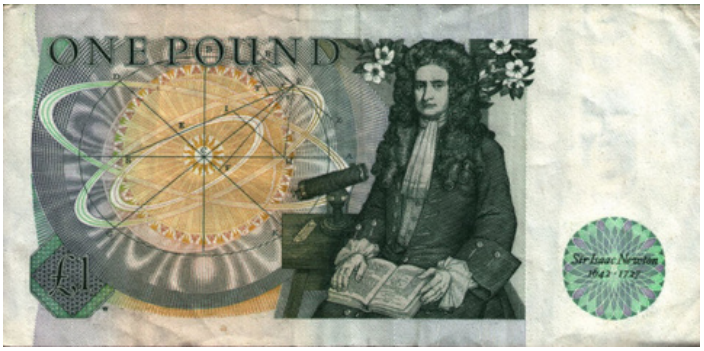
Isaac's notes about gravity!

# Suggested discussion questions

- How can you tell if your body is being affected by gravity?

- Isaac talks about three Laws of Motion: an object at rest will stay at rest/an object in motion will stay in motion, force is equal to mass times acceleration, and for every action there is an equal and opposite reaction. How would life on Earth be different if any of these laws were not true?

- Isaac called the year and a half he had to stay home from school his "Wonder Year" because he made so many important discoveries. Have you experienced anything special in the time you had to stay home from school?




*Isaac's picture on a Bank of England note*

# Suggested activities

- **Use marbles to experiment with the 3rd law of motion (For every action, there is an equal and opposite reaction). Choose two marbles and set one marble at the end of a flat surface. Push the second marble into the first marble (at the end of the surface). Observe what happens when the two marbles collide—notice the reaction to the collision. What happens with a greater force? What happens with a weaker force?**

- **Isaac talks about the effect of gravity on the moon's orbit around the Earth. Imagine that gravity did not affect the orbit of moons around planets, and planets around the sun. Draw a picture of what you think the solar system would look like without gravity!**

# Suggested reading

| *Isaac Newton and Physics for Kids: His Life and Ideas with 21 Activities* | *Gravity* | *Isaac Newton and the Laws of Motion* | *Motion: Push and Pull, Fast and Slow* |
|---|---|---|---|
| BY KERRIE LOGAN HOLLIHAN | BY JASON CHIN | BY ANDREA GIANAPOULOS | BY DARLENE RUTH STILLE |

HISTORY SCIENCE THEATRE ON DEMAND

# Modern day Isaac Newtons!

Mathematicians and scientists are still asking questions and finding out answers, just like Isaac Newton! Can you think of some big questions that might be answered with math?

It's hard to know what Isaac Newton would be up to if he were around today, but many, many people are expanding on his work in math, physics, optics, and astronomy.

Choreographers like Darnell, pictured here, use math and physics every day. Dance uses rhythm and patterns (math!), and motion (physics!) to express ideas and emotions. Darnell says *"I love to dance because it's a language everyone can speak. It knows no boundaries and has no restrictions...except for the challenges that gravity throws our way! We find joy in the moments of suspense when gravity reminds us that it's still there!"*

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