

Brachistochrone problem

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“I, Johann Bernoulli, address the most brilliant mathematicians in the world. Nothing is more attractive to intelligent people than an honest, challenging problem, whose possible solution will bestow fame and remain as a lasting monument. Following the example set by Pascal, Fermat, etc., I hope to gain the gratitude of the whole scientific community by placing before the finest mathematicians of our time a problem which will test their methods and the strength of their intellect. If someone communicates to me the solution of the proposed problem, I shall publicly declare him worthy of praise.”

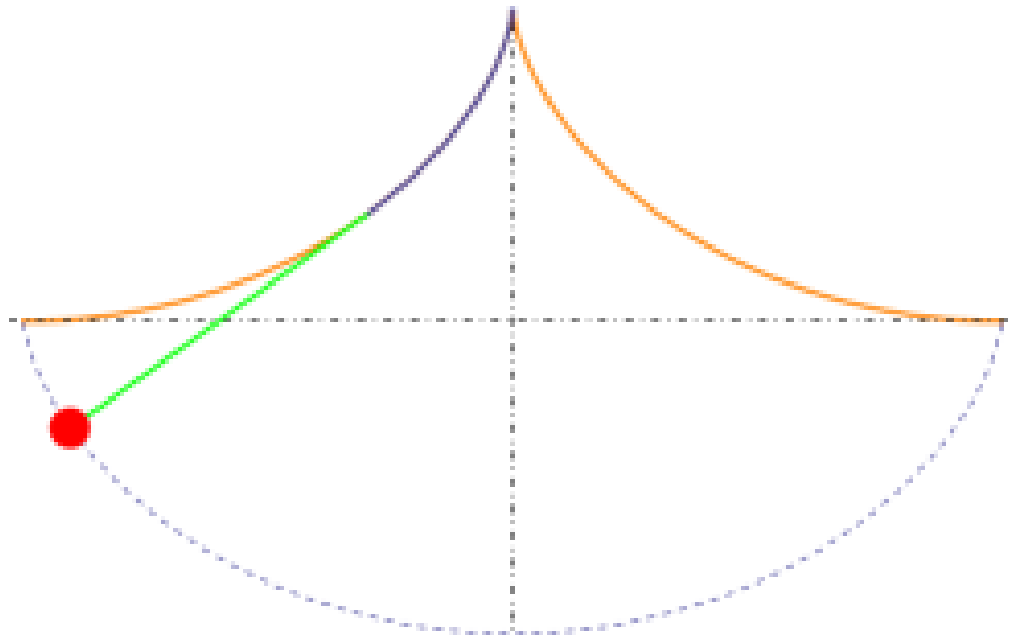
Roller coaster



Ski



Cycloid pendulum



Brachistochrone

<https://www.youtube.com/watch?v=GUcDyEZzcfA>

<https://www.youtube.com/watch?v=BbXBxubKYmU>

Roller coaster:

<https://www.youtube.com/watch?v=Wl-Ap2yUjYQ>

Tautochrone:

<https://www.youtube.com/watch?v=Q2q7e-ReC0A>

Huygens's pendulum

<https://www.youtube.com/watch?v=EI5zwTvfkqA>

Gerolamo Cardano (1501-1576)



- Italian Polymath
 - Mathematician; Physician; Biologist; Physicist; Chemist; Astrologer; Astronomer; Philosopher; Writer; Gambler
- Key figure in the foundations of probability, binomial coefficients, binomial theorem
- Invented combination lock, gimbal,
- First systematic use of negative numbers, solutions of cubic and quartic equations, acknowledged existence of imaginary numbers
- Cardano predicted the exact date of his death and achieved it by committing suicide

Cubic equations

$$x^3 + bx + c = 0$$

Solution to the cubic equation:

$$x = \sqrt[3]{-\frac{c}{2} + \sqrt{\frac{c^2}{4} + \frac{b^3}{27}}} + \sqrt[3]{-\frac{c}{2} - \sqrt{\frac{c^2}{4} + \frac{b^3}{27}}}$$

Example:

$$x^3 - 15x - 4 = 0$$

Solution contains imaginary numbers!

$$x = \sqrt[3]{2 + i11} + \sqrt[3]{2 - i11}$$

Problem

- Two numbers whose sum is 10 and product is 40

$$a \cdot b = 40$$

$$a + b = 10$$

Cardano: Father of probability theory

- Cardano was also an avid and at times compulsive gambler, who squandered a significant part of his life and fortune on games of chance.
- His interest in gambling led to his mathematical study of probability.
- Cardano's book [Liber de Ludo Aleae](#) (The Book on Games of Chance), published after his death in 1663, contained perhaps the first mathematical analysis of gambling.