Leonardo da Vinci's Discovery

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1 Gravitation

The gravitation observation made by Leonardo da Vinci permits exact solution through a differential equation. Differential equation was not known then, and da Vinci made mathematical mistakes. However, the physics he discovered is correct. We solve the differential equation here.

Let $f(t)$ be the vertical distance travelled by a free-falling object from the stationary state. We have the following differential equation.

$$f(t_1) - f(t_0) - f'(t_0)(t_1 - t_0) = f(t_1 - t_0)$$

Differentiate with respect to t_1.

$$f'(t_1) - f'(t_0) = f'(t_1 - t_0)$$

Divide by $t_1 - t_0$ and notice that $f'(0) = 0$.

$$\frac{f'(t_1) - f'(t_0)}{t_1 - t_0} = \frac{f'(t_1 - t_0) - f'(0)}{t_1 - t_0}$$

Let $t_1 \to t_0$. We obtain

$$f''(t_0) = f''(0) \equiv g$$

Since t_0 is arbitrary, we recover the classical gravitational law.