17 Equations That Changed the World

by Ian Stewart

1. Pythagoras's Theorem $a^2 + b^2 = c^2$ — Pythagoras, 530 BC
2. Logarithms $\log xy = \log x + \log y$ — John Napier, 1610
3. Calculus $\frac{df}{dt} = \lim_{h \to 0} \frac{f(t+h) - f(t)}{h}$ — Newton, 1668
4. Low of Gravity $F = G\frac{m_1 m_2}{r^2}$ — Newton, 1667
5. The Square Root of Minus One $i^2 = -1$ — Euler, 1750
6. Euler's Formula for Polyhedra $V - E + F = 2$ — Euler, 1751
7. Normal Distribution $\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{\frac{(x-\rho)^2}{2\rho^2}}$ — G.F. Gauss, 1810
8. Wave Equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ — J. d'Alambert, 1746
9. Fourier Transform $f(\omega) = \int_{-\infty}^{\infty} f(x)\, e^{-2\pi i \omega} dx$ — J. Fourier, 1822
10. Navier-Stokes Equation $\rho(\frac{\partial \mathrm{v}}{\partial \mathrm{t}} + \mathrm{v} \cdot \nabla \mathrm{v}) = -\nabla \mathrm{p} + \nabla \cdot \mathrm{T} + \mathrm{f}$ — C. Navier, G. Stokes, 1845
11. Maxwell's Equations
    $\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$
    $\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}$
    $\nabla \cdot \mathbf{H} = 0$
    $\nabla \times \mathbf{H} = \frac{1}{c}\frac{E}{\partial t}$ — J.C. Maxwell, 1865
12. Second Law of Thermodynamics $\mathrm{d}S \geq 0$ — L. Boltzmann, 1874
13. Relativity $E = mc^2$ — Einstein, 1905
14. Schrodinger's Equation $ih\frac{\partial}{\partial t}\Psi = H\Psi$ — E. Schrodinger, 1927
15. Information Theory $x_{t+1} = kx_t(1 - x_t)$ — C. Shannon, 1949
16. Chaos Theory $x_t + 1 = kx_t(1 - x_t)$ — Robert May, 1975
17. Black-Scholes Equation $\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$ — F. Black, M. Sholes, 1990