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 $\Phi\left(x\right) = \frac{1}{\sqrt{2\pi}\rho} e^{\frac{(x-\rho)^2}{2\rho^2}}$ 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 $f(\omega) = \int_{-\infty}^{\infty} f\left(x\right) e^{-2\pi i \omega} dx$ 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