MATHEMATICAL PERIODS

with some major contributions and contributors

(many dates are approximate)

EGYPTIAN AND BABYLONIAN (3000 B.C. to A.D. 260)	GREEK (600 B.C. to A.D. 450)	CHINESE (1030 B.C. to A.D. 1644)	HINDU (200 B.C. to A.D. 1250)
Essentially empirical, or inductive, mathematics. Introduction of early numeral systems (decimal and sexagesimal). Simple arithmetic, practical geometry. Mathematical tables, collections of mathematical problems. Chief primary sources: Moscow (1850 B.C.), Rhind (1650 B.C.), and other Egyptian papyri; Babylonian cuneiform tablets (2100 B.C. to 1600 B.C. and 600 B.C. to A.D. 300).	Significant introduction, then development, of deductive geometry (Thales, 600 B.C.; Pythagoras, 540 B.C.). Start of number theory (Pythagorean School, 540 B.C.). Discovery of incommensurable magnitudes (Pythagorean School, before 340 B.C.). Systematization of deductive logic (Aristotle, 340 B.C.). Axiomatic development of geometry (Euclid, 300 B.C.). Germs of the integral calculus (Archimedes, 225 B.C.). Geometry of conic sections (Apollonius, 225 B.C.). Practical geometry (Heron, A.D. 75?). Trigonometry (Hipparchus, 140 B.C.; Menelaus, A.D. 100; Ptolemy, A.D. 150). Number theory, syncopation of algebra (Diophantus, A.D. 250?).	Largely isolated from the mainstream of mathematical development. Decimal numeral system, rod numerals magic squares (from earliest time). *Chou-peï,* oldest of Chinese mathematical classics (300 B.C.?). *Arithmetic in Nine Sections* (100 B.C.?). Horner's method (Ch'in Kiu-Shoo, 1247). Pascal's arithmetic triangle, binomial theorem (Chu Shǐ-kié, 1303). Jesuit missionaries infiltrated China in early 1600s.	Introduction of Hindu-Arabic numeral system (before A.D. 250). Negative numbers and invention of zero symbol (early centuries A.D.). Development of early computing algorithms (A.D. 900 − 1000). Syncopated algebra, indeterminate equations. (Brahmagupta, A.D. 628; Bhāskara, A.D. 1150). **ARABIAN** (A.D. 650 to 1200) Preservers of Hindu arithmetic and Greek geometry (encouraged by caliph patrons of learning, such as Harun al-Rashid, A.D. 790). Influential treatise on algebra and a book on the Hindu numerals (Al-Khowârizmî, A.D. 820). Trigonometric tables (Abû'l Wefâ, A.D. 980; Ulugh Beg, A.D. 1435). Geometric solution of cubic equations (Omar Khayyam, A.D. 1100).

DARK AGES (A.D. 450 to 1120)	MODERN (first half, A.D. 1450 to 1700)	MODERN (second half, A.D. 1700 to present)
A sterile period for all learning in Western Europe. Slender thread of Greek and Latin learning preserved in monasteries.	**Early trigonometry** (Regiomontanus, 1464; Copernicus, 1530; Rhaeticus, 1550). **Early arithmetics** (Borghi, 1484; Widman, 1489; Pacioli, 1494; Köbel, 1512; Riese, 1518; Tonstall, 1522; Buteo, 1525). **Beginnings of algebraic symbolism** (Recorde, 1557; Bombelli, 1572; Viète, 1579; Oughtred, 1631).	**Applied calculus** (Jakob and Johann Bernoulli, 1700; Clairaut, 1743; d'Alembert, 1743; Euler, 1750; Lagrange, 1788; Laplace, 1805; Fourier, 1822; Legendre, 1825; Green, 1828; Poisson, 1831). **Infinite series** (Taylor, 1715; Maclaurin, 1742; Fourier, 1822). **Non-Euclidean geometry** (Saccheri, 1733; Lambert, 1770; Legendre, 1794; Gauss, 1800; Lobachevski, 1829; J. Bolyai, 1832).
PERIOD OF TRANSMISSION (A.D. 950 to 1500)	**Algebraic solution of cubic and quartic equations** (Tartaglia, Cardano, Ferrari, 1545). **Development of classical algebra** (Viète, 1580; Harriot, 1631).	**Topology** (Euler, 1736; Gauss, 1799; Listing, 1847; Riemann, 1851; Möbius, 1865; Poincaré, 1895). **Advanced analytic geometry** (Monge, 1795; Plücker, 1826; Möbius, 1827).
Learning preserved by the Arabs slowly transmitted to Western Europe. **Translation of Arabic works** (Plato of Tivoli, A.D. 1120; Robert of Chester, A.D. 1140; Adelhard of Bath, A.D. 1142; Gherardo of Cremona, A.D. 1150; Campanus, A.D. 1260). **Advocacy of Hindu-Arabic numeral system** (Fibonacci, A.D. 1202). **Fourteenth century, the century of the Black Death.** **First printed edition of Euclid's *Elements*** (Campanus' translation, A.D. 1482).	**Decimal fractions** (Stevin, 1585). **Boost from science** (Galileo, 1600; Kepler, 1609). **Logarithms** (Napier, 1614; Briggs, 1615). **Modern number theory** (Fermat, 1635). **Analytic geometry** (Fermat, 1629; Descartes, 1637). **Start of projective geometry** (Desargues, 1639; Pascal, 1648). **Mathematical probability** (Fermat and Pascal, 1654). **Calculus** (Fermat, 1629; Cavalieri, 1635; Barrow, 1669; Leibniz, 1684; Newton, 1687).	**Analysis** (Lagrange, 1797; Abel, 1826; Cauchy, 1827; Riemann, 1851; Dedekind, 1872; Weierstrass, 1874; Lebesgue, 1903). **Projective geometry** (Poncelet, 1822; Gergonne, 1826; Steiner, 1834; Von Staudt, 1847; Clifford, 1878). **Modern computing machines** (Babbage, 1823; ASCC, 1944; ENIAC, 1945; SSEC; EDVAC; MANIAC; UNIVAC). **Rise of abstract algebra** (Galois, 1832; Hamilton, 1843; Grassmann, 1844; Cayley, 1857). **Mathematical logic** (Boole, 1847; De Morgan, 1847; Schröder, 1890; Peano, 1894; Whitehead and Russell, 1910; Lukasiewicz, 1921). **Set theory** (Cantor, 1874; Hausdorff, 1914). **Foundations and philosophy of mathematics** (Frege, 1884-1903; Hilbert, 1899; Brouwer, 1907; Whitehead and Russell, 1910; Gödel, 1931). **Abstract spaces** (Fréchet, 1906; Hausdorff, 1914; Banach, 1923).