

## Applications of Mathematics in Forensic Science

- Anthropology – Linear Equations, Angle Measurements, Linear Measurements, Vernier Calipers/micrometers. Example: Subpublic angle on pelvis  $> 90^\circ = \text{Female}$ ;  $< 90^\circ = \text{Male}$ .
- Blood Pattern Analysis – Geometry, Trigonometry, Measuring Skills
- Blood/Fluids – Chance, Percentages. Example: Punnett Squares

	B	O
A	AB	AO
O	AO	OO

- Blood Pattern Analysis – Trigonometry, Asymptotes. Examples: Angle of Incidence, Point of Origin, Diameter of drop vs. height from which it is dropped.
- Crime Scene Sketches – Measuring, Geometry
- DNA – Find the number of possible combinations using Adenine (A), Guanine (G), Cytosine (C), and Thymine (T) bases to form amino acids. Codons three at a time, e.g., GAC .
- Engineering – Equations, Change of Base, Calculus  
Example: Young's Modulus  
Hexadecimal storage of data in vehicle Event Data Recorder (black box)
- Entomology – Temperature data to determine rate of developing insects species. Compare to weather station nearby; use regression analysis.
- Fingerprints – Counting, Ratios. Henry Number – fingers are assigned different powers of 2; ratio of sum of evens + 1 over sum of odds + 1.
- Fire and Explosives – Rational Equations (Gas Laws)
- Firearms – Measuring, Quadratic Equations, Trigonometry, Geometry Example: Caliber, Range of Projectile

- Footprints/Tiretread – Geometry, Patterns Example: Radius of tires, shoe tread patterns
- Odontology – Counting, Quadratic Equations
- Questioned Documents – Ratios - Rf value for paper chromatography
- Taphonomy – Calculus Example: Newton's Law of Cooling (Roughly, nude body in 18°-20° C cools at a rate of 1.5° C for the first 8 h.) Glaister Equation:  $98.4^{\circ}\text{F} - \text{internal temperature}/1.5 = \text{hours elapsed since death (Algor Mortis)}$
- Toxicology – Percentages, Algebraic Equations for Concentration, ppm Example: Blood alcohol (or drug) concentration ng or  $\mu\text{g}$  per ml. Trace – Multiplication Example: Magnification of Microscope
- Trace – Ratios and Proportions. Examples: Index of Refraction of Glass
- Vehicle Accident Analysis – Edheads online crash scene investigation [http://edheads.org/activities/crash\\_scene/](http://edheads.org/activities/crash_scene/) Others: Friction, Braking Distance, Position-Displacement-Velocity-Acceleration Equations
- Overall – Chance, Error Analysis. Example: Blood patterns B = 10%, PGM 1-2+ = 4.7%, EAP B = 39.5%, Hp 2-1 = 47.9%. Probability of a person with all of these characteristics in the population is the product.