

The Mathematics of Forensic Science

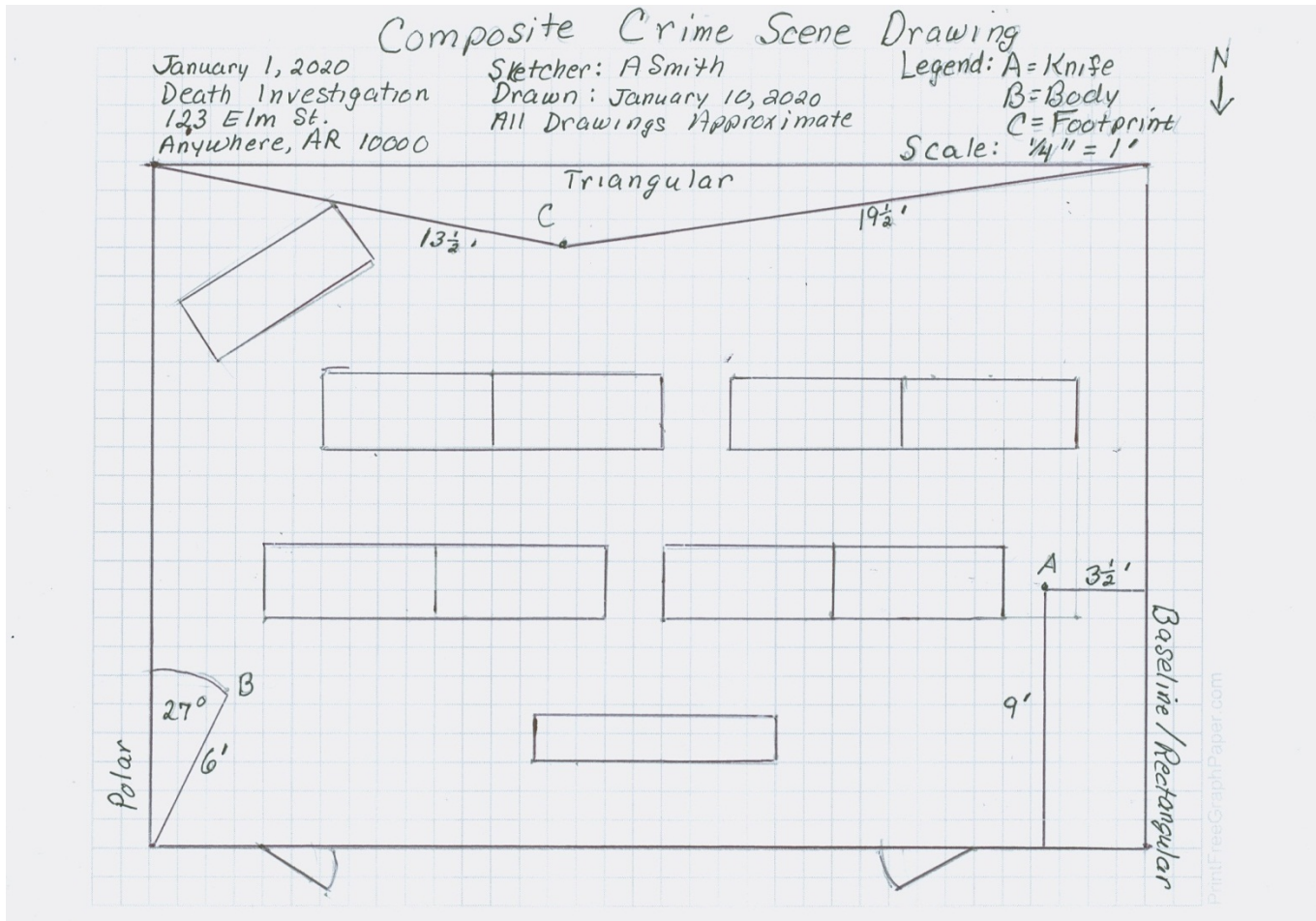
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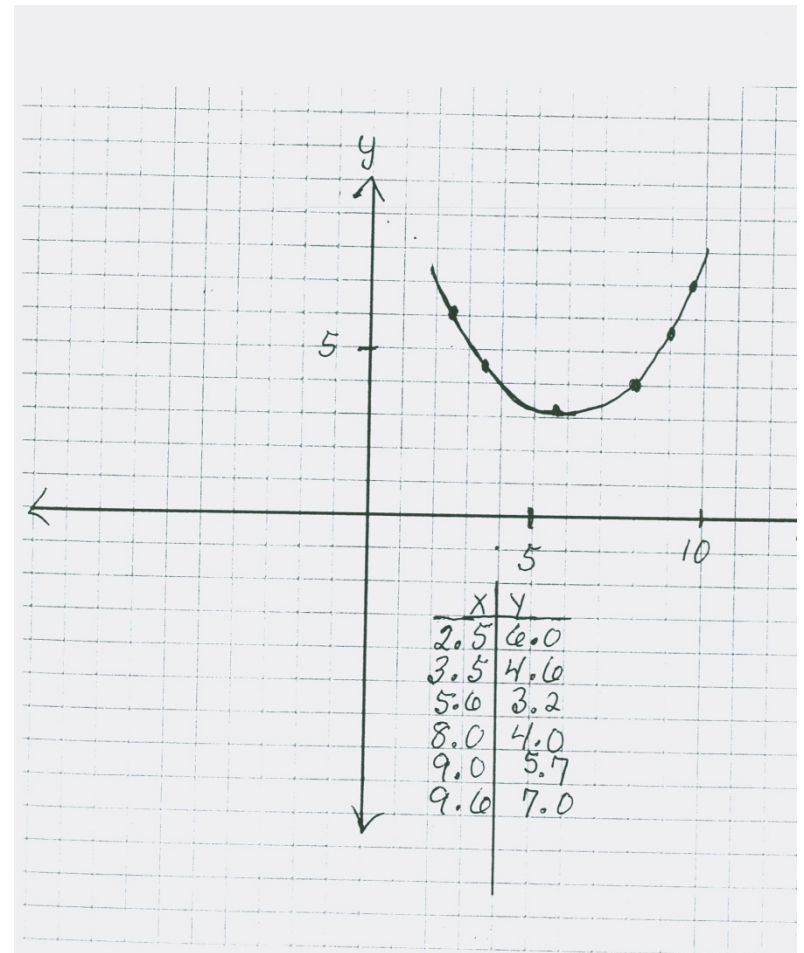
NCTM Denver, April 19, 2013

Crime Scene Sketching



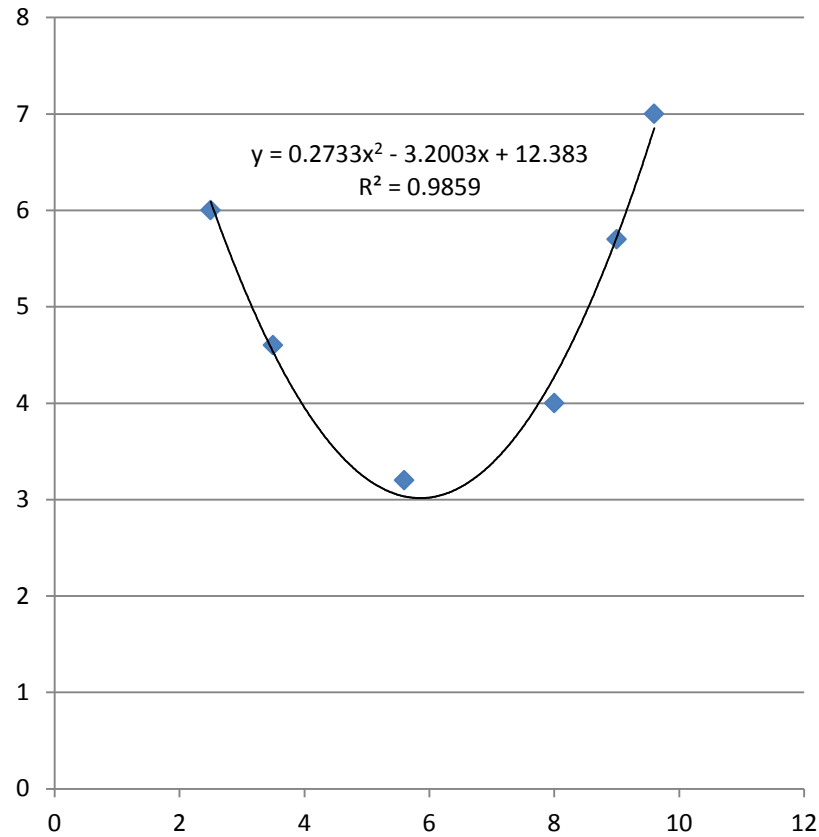
Modeling Bite Marks

- Produce Bite Mark
- Trend Line with Marker
- Trace on Graph Paper
- Label 6-8 Points
- Produce Regression Equation



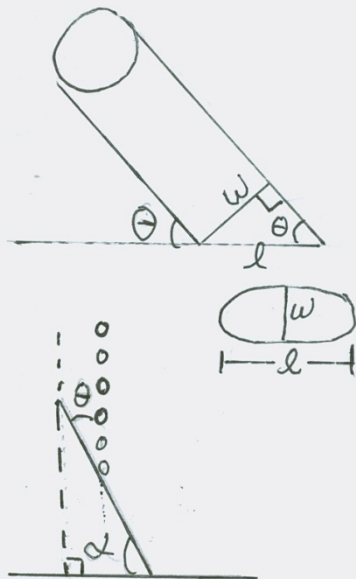
Modeling Bite Marks

Teeth Pattern



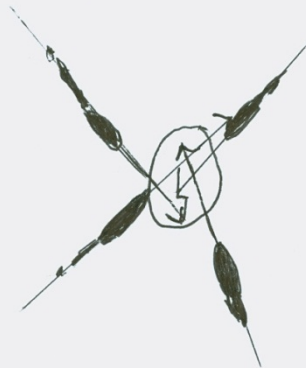
Blood Pattern Analysis

Angle of Impact

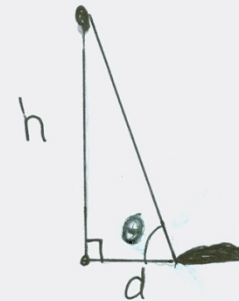


$$\Theta = \sin^{-1}(w/l)$$

Area of Convergence



Point of Origin



$$h = d \tan \Theta$$

Height (cm) Based on Femur Length (cm)

	Male	Female
Caucasoid	$H = 2.32 F + 65.53 \pm 3.94$	$H = 2.47 F + 54.20 \pm 3.72$
Mongoloid	$H = 2.15 F + 72.57 \pm 3.80$	$H = 2.38 F + 56.93 \pm 3.57$
Negroid	$H = 2.10 F + 72.22 \pm 3.91$	$H = 2.28 F + 59.76 \pm 3.41$

Taphonomy

- Newton's Law of Cooling

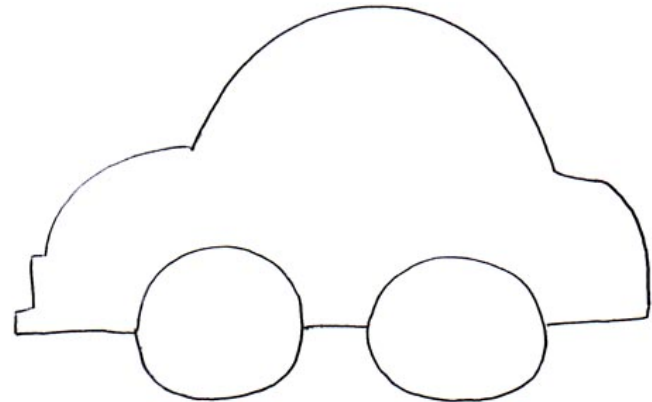
The rate of change of the temperature of an object is proportional to the difference between its own temperature and the ambient temperature.

$$\frac{\Delta T}{\Delta t} \propto (T - T_a)$$



Crash Scene Investigation

- TI Life in the Fast Lane
- Determine coefficient of friction with force probe. Rearrange velocity equation to solve for braking distance. Compare suspect V.
- $\mu = F_f/F_N$
- $V = \sqrt{2g\mu d}$
- TI Hit and Run
- Use motion detector probe to model stopping car.
- Compare graphs to stories of suspects.



Selected Areas of Forensic Science



- Anthropology
- Blood/Fluids
- Blood Pattern Analysis
- Crime Scene Sketching
- DNA
- Engineering
- Entomology
- Fingerprint/Personal Identification
- Fire and Explosives

Areas of Forensic Science contd

- Firearms/Ballistics
- Footprints/Tire Tread
- Odontology
- Questioned Documents
- Taphonomy
- Toxicology
- Trace
- Vehicle Accident Analysis

Teacher Resources



- TI Technology Data Investigations
http://education.ti.com/en/us/activities/explorations-series-books/activitybook_forensics
- American Academy of Forensic Sciences. Educational Conferences www.aafs.org
- Forensic Teacher Magazine
www.theforensicteacher.com

Teacher Resources (contd)

- Selected Suppliers

Ward Science <https://wardsci.com/>

Flinn Scientific <http://www.flinnsci.com/>

Sierchie <http://www.sirchie.com/>

Lynn Peavey

<https://www.lynnpeavey.com//>



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