FORENSICS

Supplies: notebook, pencil, ruler.

Curriculum (1 hour, 15 minutes)

1. What is Forensic Physical Anthropologist?

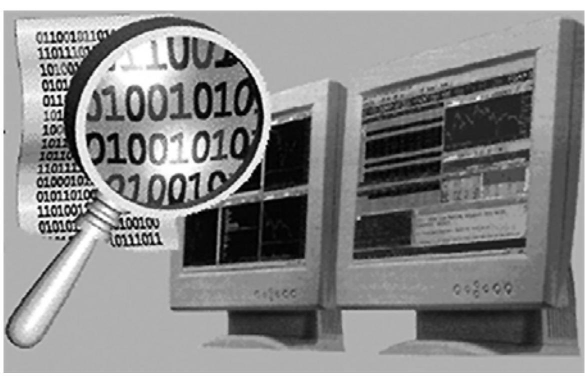
A person best trained to answer questions about just discovered human remains. The next time you read in the newspaper or hear on the radio or TV that a body or skeleton has been found, it is likely that a forensic anthropologist will be contacted to identify it. Forensic anthropologists are also called to identify individuals killed in disasters such as plane crashes, explosions, fires, and other tragedies resulting in the loss of life and mutilation of bodies. Here are some questions about the remains:

- Are they human?
- If so, how many persons they represent?
- Was that person male or female?
- To what ethnic group did that person belong?
- How old, how tall was that person?
- What was the cause of death?
- What was the time of death?

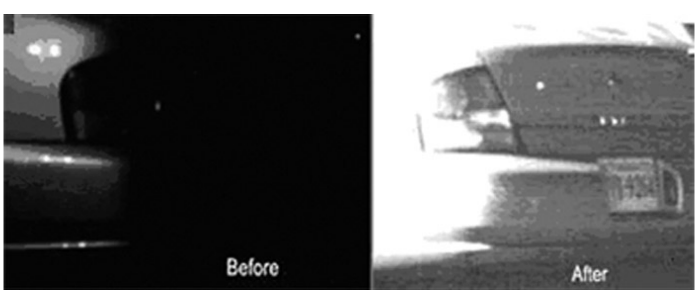
Field Forensic Kit

2. There are other areas of forensic science:

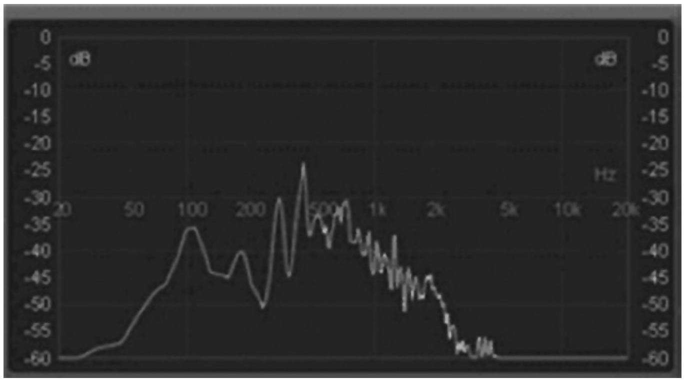
Digital & Multimedia Sciences



Media analysis of a computer can recover deleted files.



Video Analysis to enhance an image.

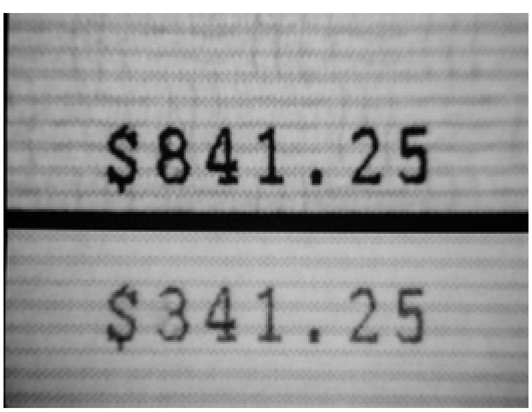


Audio analysis of a sound sample.

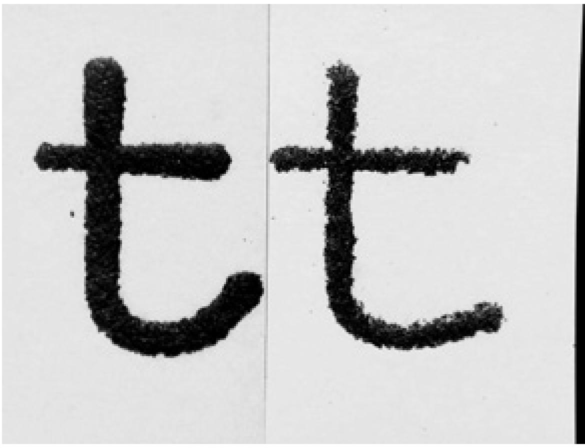
Engineering Sciences

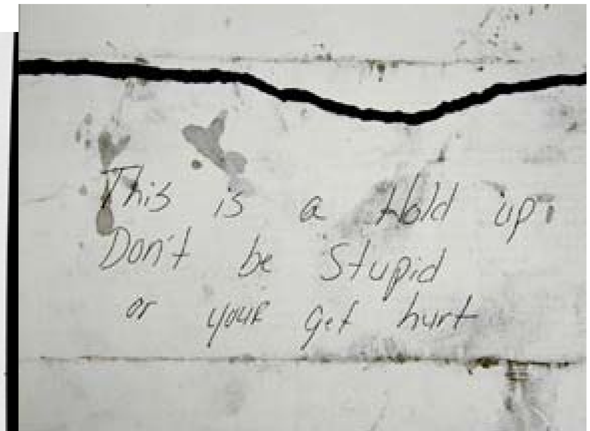

Forensic engineers on-site investigating an accident.

Documents forgery and comparison.



A close-up of the hand-altered area of a check.





A comparison of the differences in typescript examinations.

A physical match of the paper from a robbery note that was left at the scene to a piece of paper found in the suspect's car.

3. The Role of a Forensic Physical Anthropologist

(a) Provide investigators with physical description of a person which then can be compared with missing person reports

(b) Follow up with more detailed dental and medical records

MISSING - <u>POSSIBLY ENDANGERED</u>

SHANE DIVILBISS (AGE 18)

WEST MEMPHIS POL
confidential
COPY TO PROSECUTO
AUGUST 13 1993

LAST SEEN AM OF 2/3/93 SHANE'S CAR IS ALSO MISSING
1983 DELTA 88, BLUISH-GRAY
TENN TAG CMM 134

$200 REWARD FOR INFORMATION LEADING TO HIS WHEREABOUTS.

CALL CARL & SANDRA PERKINS, GRANDPARENTS
(501) MARION AR
DAWN & HENRY BOELCKE, PARENTS
(901) MEMPHIS TN
OR MARION POLICE DEPT (501) 739-3071

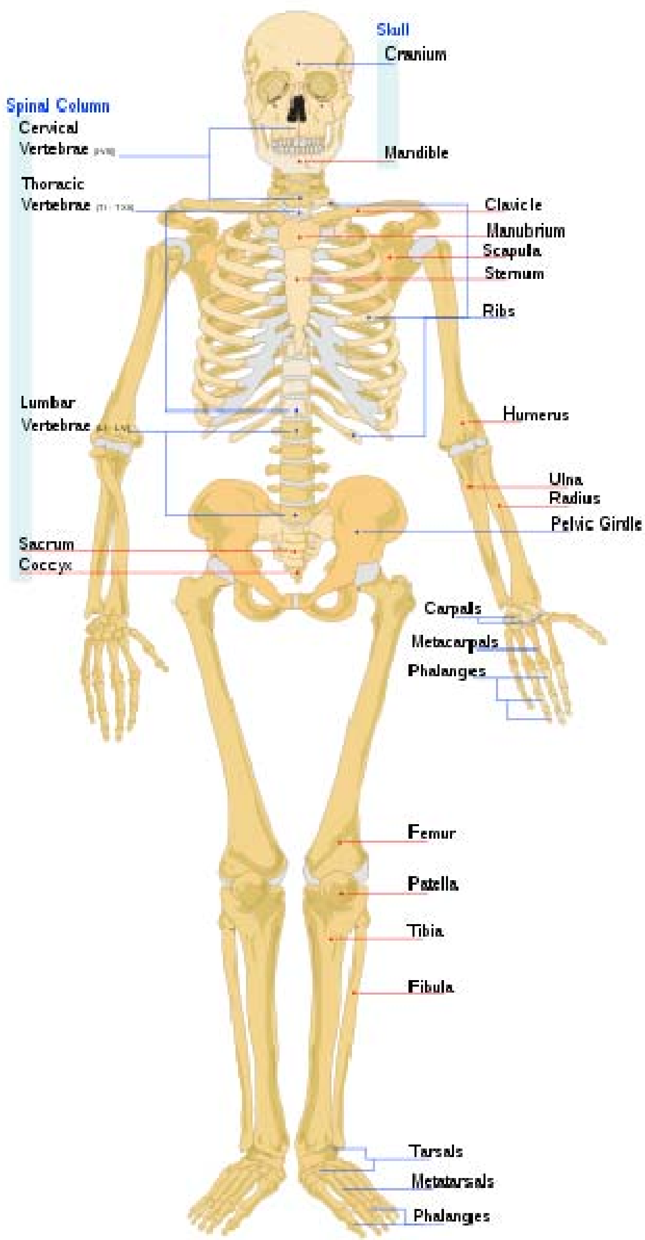
PLEASE INCLUDE SHANE AND HIS FAMILY IN YOUR PRAYERS

4. Is it a Human Bone?
    (a) Medical examiners are usually accurate
    (b) The most frequent offender? Skinned bear paws.

5. What gender was the person?
6. What race?
7. What height? Weight?
8. The short and narrow scapula indicates that the subject is a female, with 99.1 certainty.
9. The small round ends of the humerus increases the chance of gender determination to 99.9%.
10. The statistical analysis of the size ratios of bones helps determine the race with 66% certainty.
11. Analysis of lengths of femur, tibia, and other bones can determine the height of the subject with 95% certainty.

All the above steps help reduce the pool of subjects on which a DNA test would have to be run from thousands to only a few.

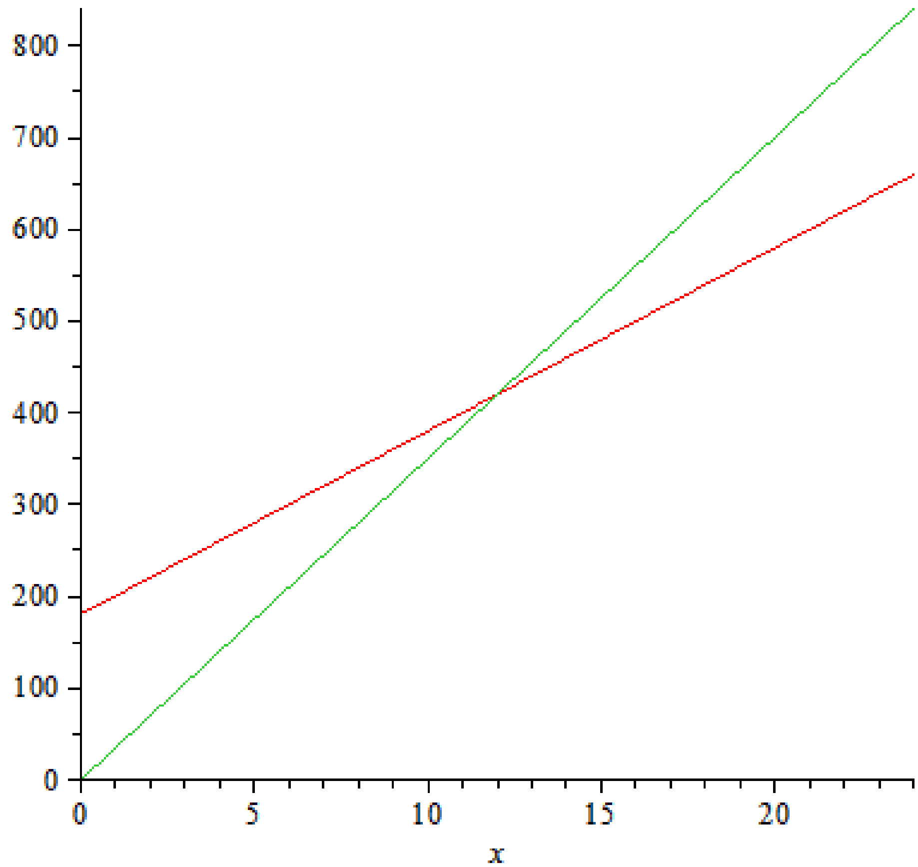
Human Skeleton



12. Cell phone deals - straight line to the rescue!

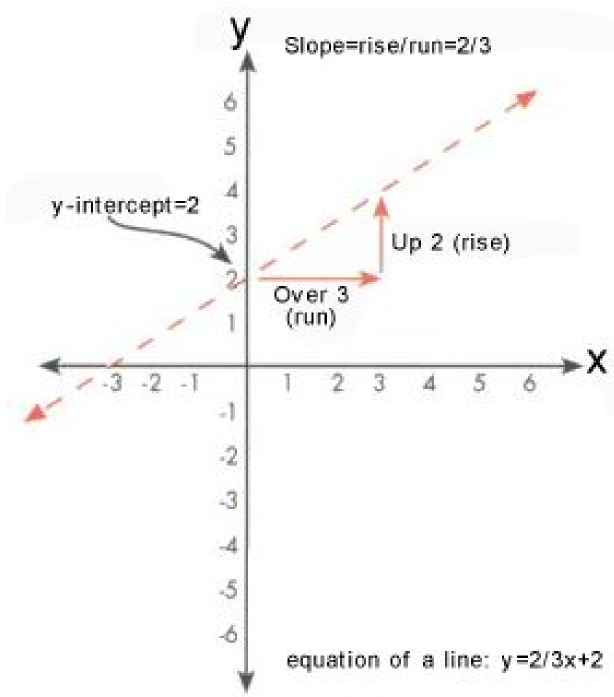
Plan 1: $180 for the cell phone + $20 monthly fee.

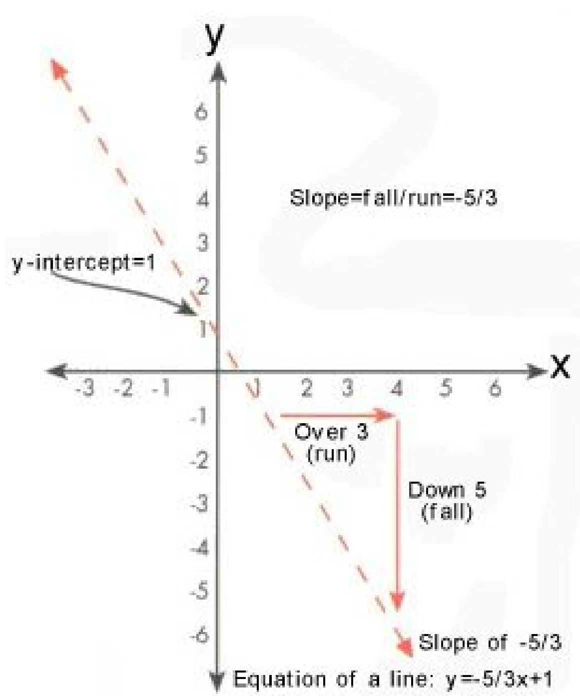
Plan 2: Free phone + $35 monthly fee.



Red line: y= 180 + 20x ; Green line: y = 35x ; y= cost at x months
180 + (20)(12) = 420; (35)(12) = 420 same cost at 12 months

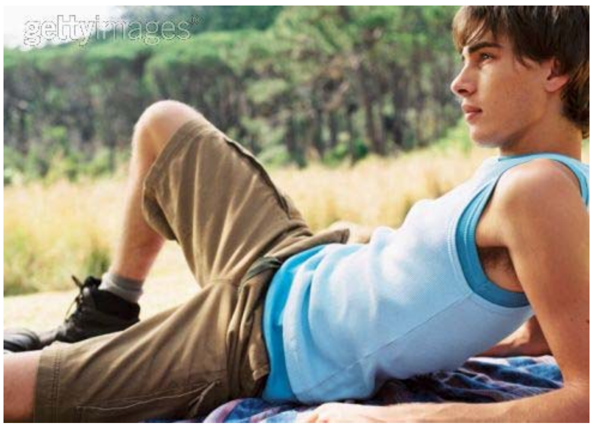
13. We use straight line to determine the value of a dependent variable, usually y, from the value of the independent variable, usually x.





14. Here is a story we want to investigate.

A robber brakes into a house but is scared away by the returning owners. He/She jumps from the window and falls on soft ground leaving imprints of his lower arm and upper leg. Just like this:



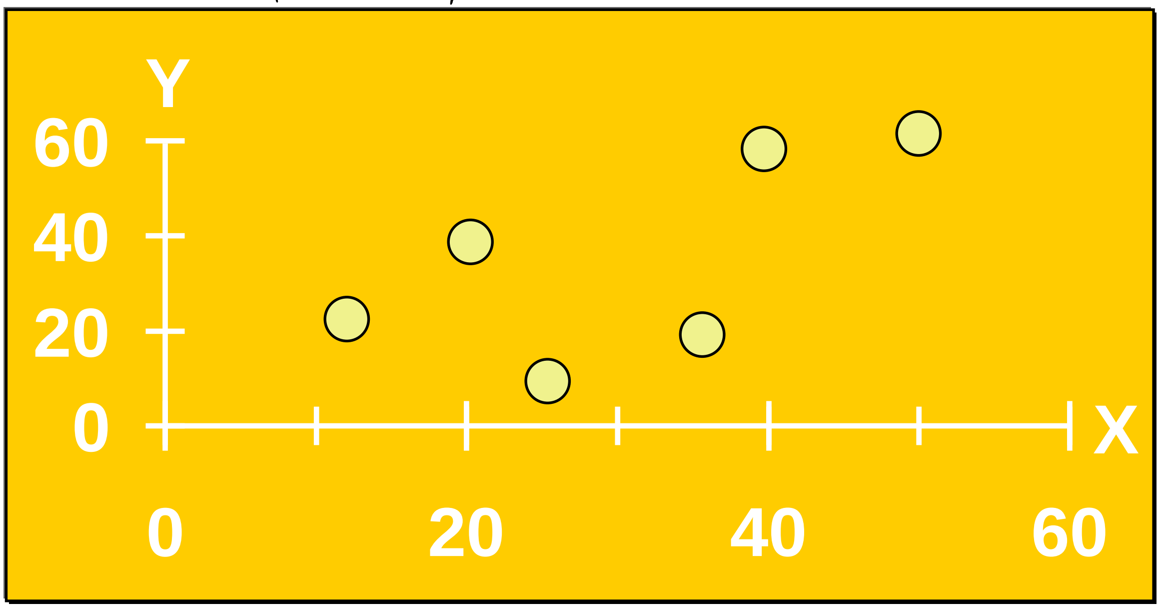
Can we help the police to establish description of the perpetrator?

15. We have data on bone measurements and people heights, let's build a straight line model.

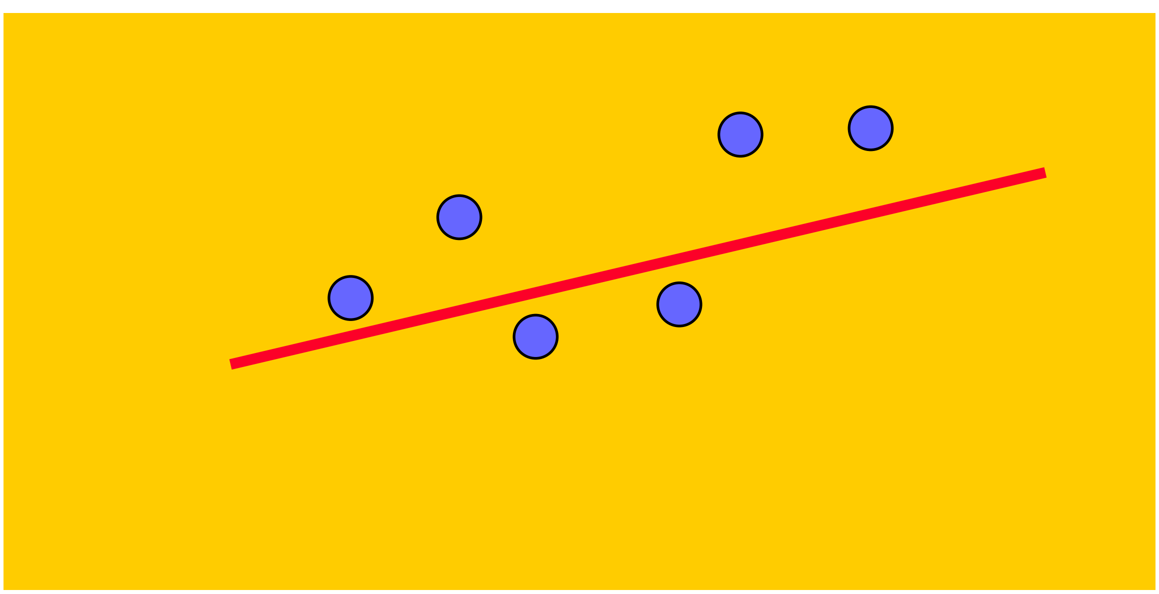
16. How to fit a straight line to data?

Scattergram

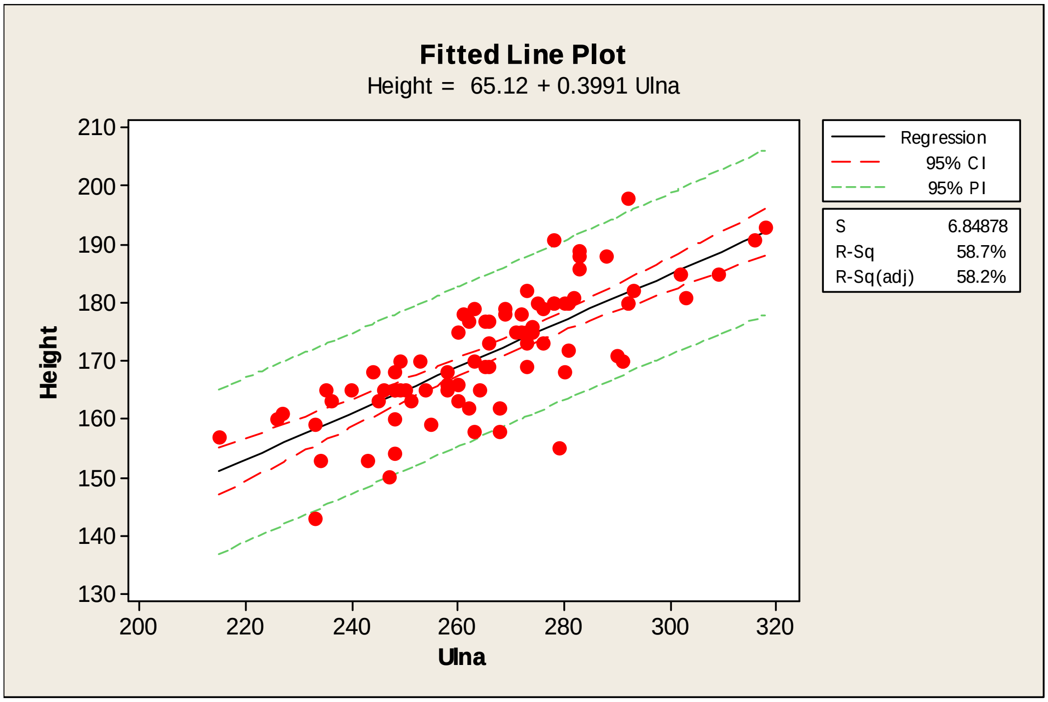
- Suggests How Well Model Will Fit
- Plot of All (X_i, Y_i) Pairs

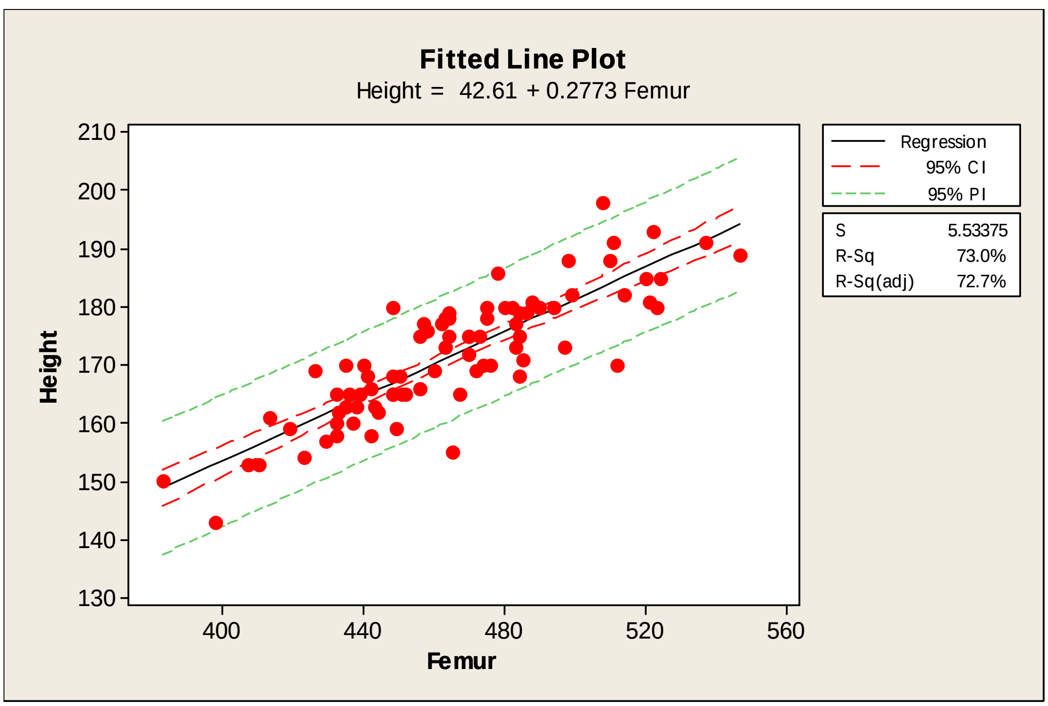


How would you draw a line through the points? How do you determine which line 'fits best'?



Here is our model:



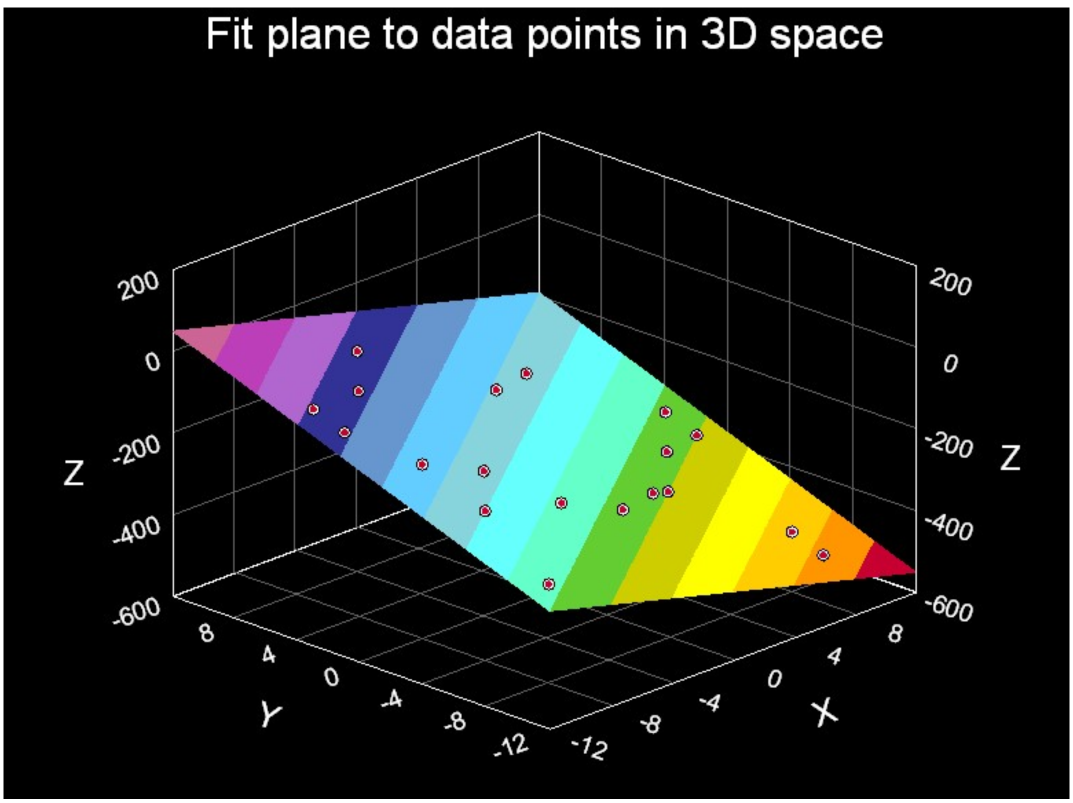


The imprints were: lower arm: 220 mm; upper leg 405 mm. What do we tell the police?

$$\text{Height} = 65.12 + 0.3991 \times 220 = 152{,}9220 \approx 153 \text{ cm}$$
$$\text{Height} = 42.61 + 0.2773 \times 405 = 154.9165 \approx 155 \text{ cm}$$

17. Can we do better and use all the information together?

From fitting the data to a plane



$$\text{Height} = 40.5 + 0.0876 \text{ Ulna} + 0.232 \text{ Femur}$$
$$= 40.5 + 0.0876 \times 220 + 0.232 \times 405 = 153.7320$$
$$\approx 154 \text{cm}$$

18. Activity: let's record our heights, lower arm and upper leg measurements and build a model just for 5^{th} and 6^{th} graders.
19. Activity: give examples where one measurement depends on one or more other measurements.
20. Here is my example: March Madness is coming soon!

What wins a basketball game?

The data presented are for Boston Celtics points = 0.882 fga + 0.992 fga3 + 0.900 fta + 0.368 dreb - 1.15 oreb + 0.406 stl - 0.132 to

Activity: Understanding the model

Perhaps this is a better model:

points = 0.573 fga + 1.07 fga3 + 0.778 fta + 0.550 dreb + 0.554 stl - 0.176 to

NOTE: NEXT MEETING OF KINAWA MATH CIRCLE WILL BE ON THE LAST MONDAY IN JANUARY, JANUARY 31, 2011.

Happy holiday to all