

Stats 1 - January 2013

① a) When $x_c = 0$, I would expect $a = 30$

b) i) From calc: $a = 31$ (intercept)
 $b = -0.64$ (gradient)

$$\rightarrow y = 31 - 0.64x_c$$

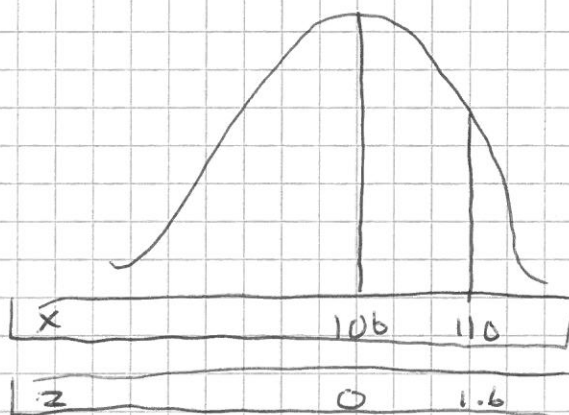
ii) Each hour the length of the candle reduces by 0.64 cm

iii) $x_c = 50 \rightarrow y = 31 - 0.64(50)$
 $= -1$

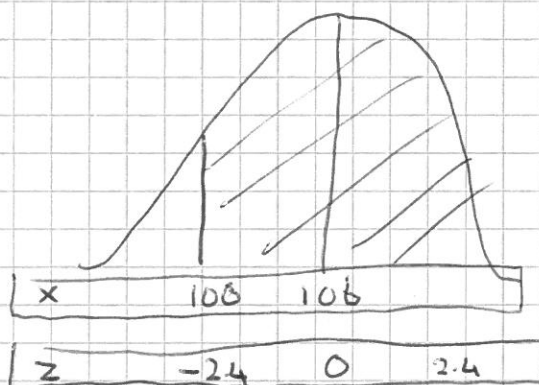
Impossible to have negative height, so claim appears invalid.

② $X \sim N(106, 2.5^2)$

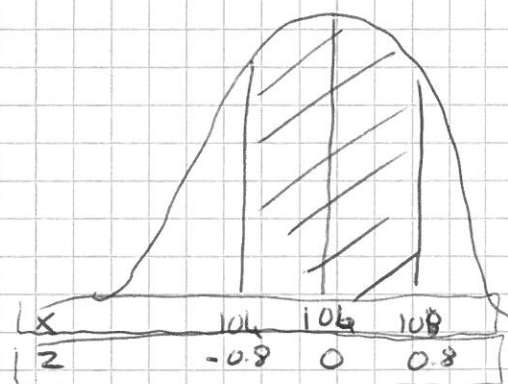
a) $P(X < 110)$
 $= P(Z < \frac{110 - 106}{2.5})$
 $= P(Z < 1.6)$
 $= 0.94520$



b) $P(X > 100)$
 $= P(Z > \frac{100 - 106}{2.5})$
 $= P(Z > -2.4)$
 $= P(Z < 2.4)$
 $= 0.99186$



c) $P(104 < X < 108)$
 $= P(\frac{104 - 106}{2.5} < Z < \frac{108 - 106}{2.5})$
 $= P(-0.8 < Z < 0.8)$
 $= P(Z < 0.8) - P(Z < -0.8)$



$$= P(Z < 0.8) - (1 - P(Z < 0.8))$$

$$= 0.78914 - (1 - 0.78914)$$

$$= 0.57828$$

$$d) P(X = 106) = 0$$

$$\therefore P(X \neq 106) = 1$$

$$(3) a) E \sim B(40, 0.3)$$

$$i) P(E \leq 10) = 0.3087 \quad (\text{from tables})$$

$$ii) P(E \geq 15) = 1 - P(E \leq 14)$$

$$= 1 - 0.8074 = 0.1926$$

$$iii) P(E = 12) = \binom{40}{12} \times 0.3^{12} \times 0.7^{28}$$

$$= 0.1366$$

$$b) B(16, 0.2): \text{MEAN} = np = 16 \times 0.2 = 3.2$$

$$\text{VAR} = np(1-p) = 16 \times 0.2 \times 0.8 = 2.56$$

$$B(16, 0.125): \text{MEAN} = np = 16 \times 0.125 = 2$$

$$\text{VAR} = np(1-p) = 16 \times 0.125 \times 0.875 = 1.75$$

$$c) i) \text{ From calc: } \Sigma x = 24$$

$$\bar{x} = 2$$

$$s = 1.59544... \rightarrow s^2 = 2.54545...$$

$$ii) B(16, 0.25): \text{Different mean, although variance is similar}$$

$$B(16, 0.125): \text{Same mean, but variance is a lot different.}$$

$\therefore$ Neither model likely to be appropriate.

$$(4) a) i) \text{ From calc: } r = -0.32569...$$

$$ii) \text{ Weak negative linear correlation between marks in Paper I and Paper II}$$

$$b) ① \text{ Identify non-linear relationships.}$$

$$② \text{ Identify any outliers.}$$

b) i) See Mark Scheme.

ii) Seems to be TWO separate correlated cons:
A to F & G to I

c) $\boxed{A \text{ to } F} \quad r = 0.9$

$\boxed{G \text{ to } L} \quad r = -0.75$

⑤ a) i) $P(F \cap C) = 0.3$

ii) $P(G \cup S) = 0.3 + 0.15 = 0.45$

iii) $P(C|F) = \frac{0.3}{0.55} = 6/11 \text{ or } 0.5454...$

iv) $P(R'|D) = \frac{0.25}{0.3} = 5/6 \text{ or } 0.8333...$

v) $P(F|C') = \frac{0.25}{0.6} = 5/12 \text{ or } 0.41666...$

b) $P(F \cap C) = 0.3$, $\therefore$ Both Days = 0.3^2

$P(F \cap G) = 0.25$, $\therefore$ Both Days = 0.25^2

$\therefore$ Total Probability = $0.3^2 + 0.25^2 = 0.1525$

⑥ a) $L \sim N(1005, 15^2)$

$\bar{L} \sim N(1005, 15^2/12)$

$P(\bar{L} < 1000)$

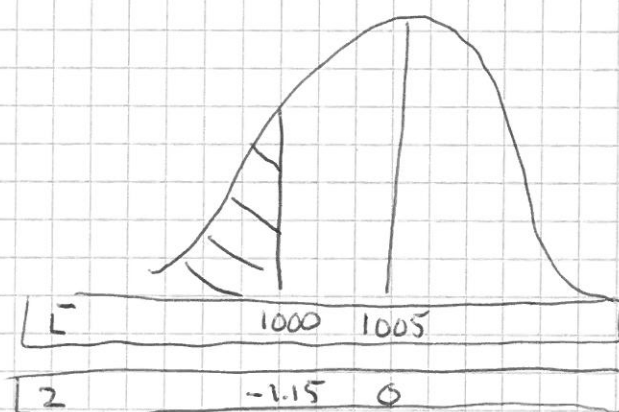
$= P(Z < \frac{1000 - 1005}{15/\sqrt{12}})$

$= P(Z < -1.1547)$

$= P(Z < -1.15)$

$= 1 - P(Z < 1.15)$

$= 1 - 0.87493 = 0.12507$



b) $\bar{x} = 4.65$, $s = 0.15$, $n = 24$

99% Z multiplier (2 tailed) = 2.5758

$\mu = \bar{x} \pm Z \times s/\sqrt{n}$

$\mu = 4.65 \pm 2.5758 \times 0.15/\sqrt{24}$

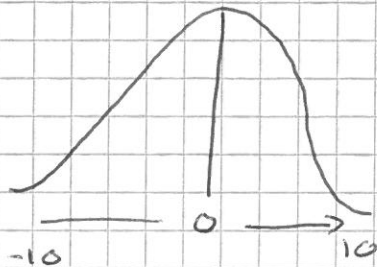
$$\mu = 4.65 \pm 0.07886...$$

$$\mu = (4.5711, 4.7289)$$

b) 4.5 lies outside the confidence interval and below the lower bound.

$\therefore$ Agree with manufacturer's claim.

⑦ a)



Expect vast majority of data to be within 3 SDs, of mean.

$$\therefore \text{area } \sigma = 10/3 = 3\frac{1}{3}$$

b) **MEAN** 391 is sample mean

As machine is set to 415, this implies this is population mean.

These 2 values should be same/similar.

$\therefore$ Claim likely to be wrong.

SD 95.5g is sample SD

We have estimated population SD of $3\frac{1}{3}$

$\therefore$ claim also likely to be wrong.

c) Population mean = 820

$$\text{mean } \bar{y} = \frac{\sum y}{n} = \frac{8210.0}{10} = 821$$

$\therefore$ close to population mean

$$\text{Population variance} = 3.3^2 = 10.89$$

$$s^2 = \frac{\sum (y - \bar{y})^2}{n-1} = \frac{110}{9} = 12.222...$$

$\therefore$ close to population variance.