MEI STATISTICS 2 JUNE 2006 Q2 NORMAL

2 i) $X \sim N(49.7,\ 1.6^2)$

A)

$P(X > 51.5)$

$= P(Z > 1.125)$

$= 1 - P(Z < 1.125)$

$= 1 - 0.8696$

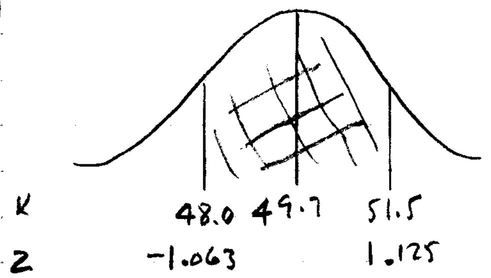
$= 0.1304$

$Z = \dfrac{x - \mu}{\sigma}$

$z = \dfrac{51.5 - 49.7}{1.6}$

$z = 1.125$

B)



$z = \dfrac{x - \mu}{\sigma}$

When $x = 51.5$ $\quad z = \dfrac{51.5 - 49.7}{1.6}$

$z = 1.125$

when $x = 48.0$ $\quad z = \dfrac{48.0 - 49.7}{1.6}$

$z = -1.063$

$P(48.0 < X < 51.5)$

$= P(-1.063 < z < 1.125)$

$= \Phi(1.125) - (1 - \Phi(1.063))$

$= \Phi(1.125) + \Phi(1.063) - 1$

$= 0.8696 + 0.8561 - 1$

$= 0.7257$

---

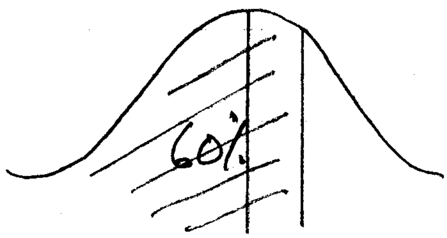
2 ii) $4 \times 0.7257^1 \times 0.2743^3$

$= 0.0599$

(0.2743 is prob not in required range $1 - 0.7257$)

MEI STATISTICS 2 JUNE 2006 Q2 NORMAL

2 iii) $X \sim N(\mu, \sigma^2)$

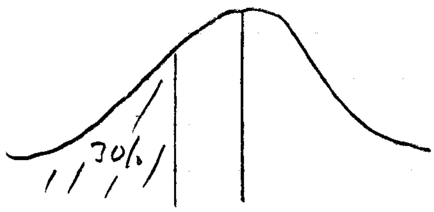


x	μ 49.0
z	$\Phi^{-1}(0.6)$
z	0.2533

$$z = \frac{x - \mu}{\sigma}$$

$$\sigma z = x - \mu$$

$$0.2533\sigma = 49 - \mu \quad ①$$



x	47.5 μ
z	$-\Phi^{-1}(0.7)$
z	-0.5244

$$\sigma z = x - \mu$$

$$-0.5244\sigma = 47.5 - \mu \quad ②$$

① - ② $\quad 0.7777\sigma = 1.5$

$$\sigma = \frac{1.5}{0.7777} = 1.929$$

Sub in ① $\quad 1.929 \times 0.2533 = 49 - \mu$

$$\mu = 49 - 1.929 \times 0.2533 = 48.51$$

$$\mu = 48.51 \qquad \sigma = 1.929$$

MEI STATISTICS 2 JUNE 2006 Q2 NORMAL

2 iv) $H_0 : \mu = 49.7\text{cm}$

$H_1 : \mu > 49.7\text{ cm}$

where μ is mean circumference of entire population of organically fed 3 year-old boys

$$X \sim N\left(\mu, \left(\frac{\sigma}{\sqrt{n}}\right)^2\right)$$

$$X \sim N\left(49.7, \left(\frac{1.6}{\sqrt{10}}\right)^2\right)$$

$$X = 50.45$$

$$z = \frac{50.45 - 49.7}{\frac{1.6}{\sqrt{10}}}$$

$$z = 1.482$$

For 10% significance level

critical z value is $\Phi^{-1}(0.9) = 1.282$

Since $1.482 > 1.282$

reject H_0 and accept H_1

These is sufficient evidence to suggest 3-year-old boys fed on a special organic diet will have a mean head circumference greater than 49.7 cm