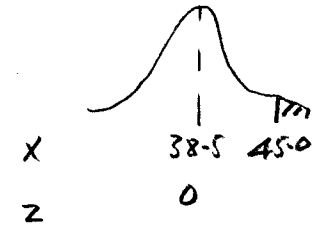
MEI STATISTICS 2 JUNE 2005 Q2 NORMAL

2 i) $X \sim N(38.5, 4.0^2)$ (μ, σ^2)

$P(X > 45.0) = 1 - P(X < 45.0)$



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

$$z = \frac{45.0 - 38.5}{4.0}$$

$$z = 1.625$$

$$1 - P(X < 45.0) = 1 - P(Z < 1.625)$$

$$= 1 - \Phi(1.625)$$

$$= 1 - 0.9479$$

$$= 0.0521$$

---

2 ii)

For 90% exceeding z

$$z = -\Phi^{-1}(0.9)$$

$$z = -1.282$$

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

$$\sigma z + \mu = x$$

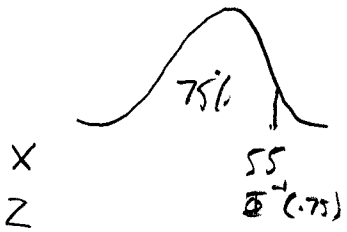
$$4 \times (-1.282) + 38.5 = x$$

$$33.372 = x$$

Quote 33.4 mpg

MEI STATISTICS 2 JUNE 2005 Q2 NORMAL

2iii) $X \sim N(51.2, \sigma^2)$



$X = 55$ when $Z = \Phi^{-1}(0.75)$

$Z = 0.6745$

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

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

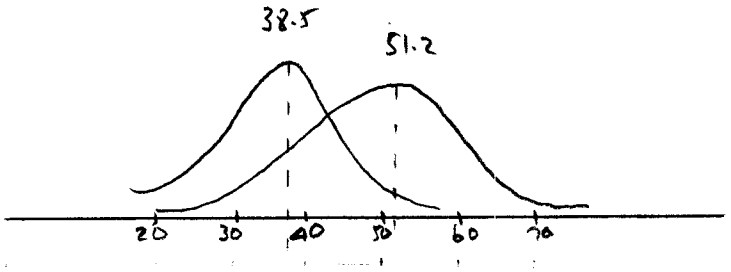
$$\frac{x-\mu}{z} = \sigma$$

$$\frac{55 - 51.2}{0.6745} = \sigma$$

$$\sigma = 5.6338$$

$$\sigma = 5.63 \quad \text{to 3 s.f}$$

2iv)



The 3.85 mean is taller because smaller s.d

Areas under graphs are both 1 so thinner ⇒ taller

MEI STATISTICS 2 JUNE 2005 Q2 NORMAL

2v)

Prob (either Petrol or Diesel or both over 45)

$= 1 - \text{Prob}(\text{both under } 45)$

From (i) $P(\text{Petrol under } 45) = 1 - 0.0521 = 0.9479$

Diesel $X \sim N(51.2, 5.63^2)$

when $X = 45$ $\quad z = \dfrac{45 - 51.2}{5.63}$

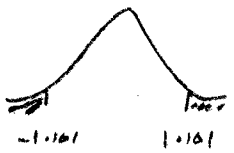
$z = -1.101$

$P(X < 45) = P(Z < -1.101)$

$= 1 - P(Z < 1.101)$

$= 1 - 0.8645$

$= 0.1355$



$\therefore \quad P(\text{Both Petrol and Diesel} < 45) = 0.9479 \times 0.1355$

$= 0.1284$

$\Rightarrow \quad P(\text{either or both} > 45) = 1 - 0.1284$

$= 0.8716$