MARKS

5

7. A farmer has found over the years that the daily amount of milk she obtains from her favourite cow Clarabelle can be modelled by a normal distribution with a mean of 3.50 litres. If the farmer has also observed that Clarabelle's daily output exceeds 4.00 litres 30% of the time, find the standard deviation of the normal model for Clarabelle's daily milk output.

Let the random variable Y represent Clarabelle's milk output (in litres) on a day selected equiprobably ('at random');
we use the model: $Y \sim N(3.50, \sigma)$,
where σ is the standard deviation we want to find.

We are told that: $\Pr(Y > 4.0) = 0.30$,

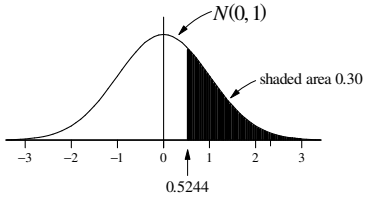
$$\therefore \quad \Pr\left(\frac{Y-\mu}{\sigma} > \frac{4.00-3.50}{\sigma}\right) = 0.30 \qquad \text{(standardizing)},$$

i.e., $\Pr[N(0,1) > \frac{0.5}{\sigma}] = 0.30.$

Then, from the $N(0,1)$ table: $\frac{0.5}{\sigma} = 0.5244,$

so that: $\sigma = \frac{0.5}{0.5244} = 0.953\,471;$

that is, the required standard deviation is $\sigma \simeq 0.953$ litres.



0.953 litres

Standard deviation