

## Normal Distribution

► from the Formula Booklet – SL & HL ◀

standardized normal variable  $z = \frac{x - \mu}{\sigma}$

**Exercises** – calculator allowed on all questions

[answers included]

- A machine fills plastic bottles with mineral water. The volume of mineral water that the machine pours into each bottle follows a normal distribution with a mean of 498 ml and a standard deviation of 3.4 ml. Each can has a maximum capacity of 506 ml. On the label of each bottle is printed the statement: **Contents 500 ml**  
Find the probability that a bottle chosen by random
  - has a volume less than 500 ml;
  - has a volume between 500 ml and 506 ml;
  - is completely full, i.e. has a volume of 506 ml
- The length of a certain skateboard model is advertised to be 81 cm. The actual length,  $X$  metres, follows a normal distribution with a mean of 81.04 cm and a standard deviation of 1.2 cm.
  - Find:
    - $P(X < 80)$
    - $P(80 < X < 82)$
  - Given that the value of the standard deviation does not change, find the mean length necessary to guarantee that only 1% of skateboards have lengths less than 80 cm. Give your answer accurate to four significant figures.
- The weights of a certain animal are normally distributed with a mean of 36.4 kg and a standard deviation of 4.7 kg. Find the probability that when one of these animals is chosen at random it will have a weight that is:
  - 40.0 kg or less;
  - more than 45.0 kg;
  - between 32.0 kg and 41.0 kg.
- The random variable  $X$  represents the annual consumption, in cubic metres, of water by households in the town of Hippersburg.  $X$  is normally distributed with mean  $\mu$  and standard deviation  $\sigma$ . Given that 30% of households use more than 200 cubic metres annually and 20% of households use less than 120 cubic metres annually, find the value of  $\mu$  and the value of  $\sigma$ .
- Adult male customers for t-shirts have chest measurements which may be modelled by a normal distribution with mean 101 cm and standard deviation 5 cm. T-shirts to fit customers with chest measurements less than 98 cm are classified as ‘small’. Find the median chest measurement of customers requiring ‘small’ t-shirts.