



ANSWER BOOK

The normal distribution

Statistics · Year 12–13

6 questions · 20 marks

NAVY EDITION

SECTION A · Warm-up

- A1** A single symmetric peak at the mean, falling away identically on both sides. About 68% of values lie within one standard deviation and about 95% within two: the rule-of-thumb numbers that catch wildly wrong calculator answers.
- A2** Standardise: $z = (70 - 60)/5 = 2$, so $P(X \leq 70) = P(Z \leq 2) = 0.977$. Two standard deviations above the mean leaves only the ~2.3% upper tail beyond it, so the answer sits just below 1, as the sketch predicts. [3]

SECTION B · Standard

- B1** $z = (75 - 60)/10 = 1.5$, and $P(Z > 1.5) = 0.0668$. A sketch with the tail shaded is worth [4] drawing every time: it fixes whether the answer should be a small tail or a large body, which is the error the calculator cannot catch for you.
- B2** The top 5% starts at $z = 1.6449$ on the standard normal. So $(46 - 40)/\sigma = 1.6449$, giving $\sigma = 6/1.6449 = 3.65$. The check forwards: 46 is then about 1.64 standard deviations above the mean, cutting off 5%, as given.
- B3** A probability of 0.975 below 50 puts 50 at $z = +1.96$: $(50 - \mu)/4 = 1.96$, so $\mu = 50 - 7.84 = 42.16$. The value 50 sits above the mean, not below it: reading 0.975 as a lower-tail area is what keeps the sign of z honest.

SECTION C · Stretch

- C1** Standardise both: $z = 1.5$ on the first paper, $z = (69 - 60)/5 = 1.8$ on the second. The 69 is the stronger performance: fewer candidates reach 1.8 standard deviations above the mean than 1.5. Raw marks cannot be compared across different distributions; z-scores put them on one ruler.