

Past-paper walk-through

The normal distribution ■ 5.5

eXercise

Questions in this set

- 9709/51 N25 Q6 ■ 9 marks
- 9709/52 N25 Q3 ■ 7 marks
- 9709/52 N25 Q6 ■ 9 marks
- 9709/51 J25 Q1 ■ 3 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 6

9709/51 N25 ■ Q6 ■ 9 marks

A factory produces chocolate bars. The weights of the bars are normally distributed with mean 155 g and standard deviation 6 g. A random sample of 350 of these bars is chosen.

- (a)** How many of these 350 bars would you expect to weigh between 148 g and 160 g? **[4]**
- (b)** A second factory also produces chocolate bars whose weights are normally distributed with mean μ g and standard deviation σ g. Tests show that 8

Solution 6

(a)

Mark scheme

- $P(148 < X < 160) = \Phi(0.8333) + \Phi(1.1667) - 1 = 0.6759$; expected number $= 0.6759 \times 350 \approx 237$ (accept 236).

Solution 6

(b)

Mark scheme

- $\frac{114 - \mu}{\sigma} = 1.405$ and $\frac{99.5 - \mu}{\sigma} = -0.842$; solving simultaneously gives $\mu = 105, \sigma = 6.45$.

Question 3

9709/52 N25 ■ Q3 ■ 7 marks

- (a)** The heights of the 124 Senior members of the Giraffes basketball club are normally distributed with mean 187.4 cm and standard deviation 6.4 cm. How many members of the club would you expect to have heights within 5 cm of the mean? [4]
- (b)** The heights of the Junior members of the Giraffes club are normally distributed with mean 172.7 cm and standard deviation σ cm. 23% of these members have height less than 170.3 cm. Find the value of σ . [3]

Solution 3

(a)

Mark scheme

- $P(|Z| < \frac{5}{6.4}) = 2\Phi(0.781) - 1 = 0.565$; expected number = $124 \times 0.565 \approx 70$.

Solution 3

(b)

Mark scheme

■ $\Phi^{-1}(0.23) = -0.739$, so $\frac{170.3 - 172.7}{\sigma} = -0.739 \Rightarrow \sigma = \frac{2.4}{0.739} = 3.25$.

Question 6

9709/52 N25 ■ Q6 ■ 9 marks

For a randomly chosen person, their next birthday is equally likely to occur on any day of the week, independently of any other person's birthday.

- (a)** Find the probability that, out of 10 randomly chosen people, none of them will have their next birthday on a Saturday or Sunday. **[1]**
- (b)** Find the probability that, out of 10 randomly chosen people, fewer than 3 will have their next birthday on a Wednesday. **[3]**
- (c)** Use a suitable approximation to find the probability that, out of 392 randomly chosen people, more than 65 will have their next birthday on a Friday. **[5]**

Solution 6

(a)

Mark scheme

- $P(\text{neither Sat nor Sun}) = \frac{5}{7}$, so $\left(\frac{5}{7}\right)^{10} = 0.0346$.

Solution 6

(b)

Mark scheme

■ $X \sim B(10, \frac{1}{7})$: $P(X < 3) = \left(\frac{6}{7}\right)^{10} + 10 \cdot \frac{1}{7} \left(\frac{6}{7}\right)^9 + 45 \left(\frac{1}{7}\right)^2 \left(\frac{6}{7}\right)^8 = 0.838.$

Solution 6

(c)

Mark scheme

- $X \sim B(392, \frac{1}{7})$, approximated by $N(56, 48)$.

$$P(X > 65) \approx P\left(Z > \frac{65.5-56}{\sqrt{48}}\right) = P(Z > 1.371) = 0.0852.$$

Question 1

9709/51 J25 ■ Q1 ■ 3 marks

The masses of the bags of rice made by a company are normally distributed with mean μ kg and standard deviation 0.14 kg. The probability that the mass of a randomly chosen bag of this rice is less than 1.48 kg is 0.22. Find the value of μ . **[3]**

Solution 1

Mark scheme

$$\blacksquare P\left(Z < \frac{1.48 - \mu}{0.14}\right) = 0.22 \Rightarrow \frac{1.48 - \mu}{0.14} = -0.772 \Rightarrow \mu = 1.59.$$