

Normal Distribution 2

Q1.

In Scotland, in November, on average 80% of days are cloudy. Assume that the weather on any one day is independent of the weather on other days.

- (i) Use a normal approximation to find the probability of there being fewer than 25 cloudy days in Scotland in November (30 days). [4]
 - (ii) Give a reason why the use of a normal approximation is justified. [1]
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Q2.

The lengths, in centimetres, of drinking straws produced in a factory have a normal distribution with mean μ and variance 0.64. It is given that 10% of the straws are shorter than 20 cm.

- (i) Find the value of μ . [3]
 - (ii) Find the probability that, of 4 straws chosen at random, fewer than 2 will have a length between 21.5 cm and 22.5 cm. [6]
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Q3.

The random variable X is normally distributed with mean μ and standard deviation $\frac{1}{4}\mu$. It is given that $P(X > 20) = 0.04$.

- (i) Find μ . [3]
 - (ii) Find $P(10 < X < 20)$. [3]
 - (iii) 250 independent observations of X are taken. Find the probability that at least 235 of them are less than 20. [5]
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Q4.

When a butternut squash seed is sown the probability that it will germinate is 0.86, independently of any other seeds. A market gardener sows 250 of these seeds. Use a suitable approximation to find the probability that more than 210 germinate. [5]

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Q5.

The weights of letters posted by a certain business are normally distributed with mean 20 g. It is found that the weights of 94% of the letters are within 12 g of the mean.

- (i) Find the standard deviation of the weights of the letters. [3]
 - (ii) Find the probability that a randomly chosen letter weighs more than 13 g. [3]
 - (iii) Find the probability that at least 2 of a random sample of 7 letters have weights which are more than 12 g above the mean. [3]
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Q6.

A triangular spinner has one red side, one blue side and one green side. The red side is weighted so that the spinner is four times more likely to land on the red side than on the blue side. The green side is weighted so that the spinner is three times more likely to land on the green side than on the blue side.

- (i) Show that the probability that the spinner lands on the blue side is $\frac{1}{8}$. [1]
 - (ii) The spinner is spun 3 times. Find the probability that it lands on a different coloured side each time. [3]
 - (iii) The spinner is spun 136 times. Use a suitable approximation to find the probability that it lands on the blue side fewer than 20 times. [5]
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Q7.

- (i) In a certain country, the daily minimum temperature, in $^{\circ}\text{C}$, in winter has the distribution $N(8, 24)$. Find the probability that a randomly chosen winter day in this country has a minimum temperature between 7°C and 12°C . [3]

The daily minimum temperature, in $^{\circ}\text{C}$, in another country in winter has a normal distribution with mean μ and standard deviation 2μ .

- (ii) Find the proportion of winter days on which the minimum temperature is below zero. [2]
 - (iii) 70 winter days are chosen at random. Find how many of these would be expected to have a minimum temperature which is more than three times the mean. [3]
 - (iv) The probability of the minimum temperature being above 6°C on any winter day is 0.0735. Find the value of μ . [3]
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Q8.

The random variable X is normally distributed and is such that the mean μ is three times the standard deviation σ . It is given that $P(X < 25) = 0.648$.

- (i) Find the values of μ and σ . [4]
 - (ii) Find the probability that, from 6 random values of X , exactly 4 are greater than 25. [2]
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Q9.

It is given that $X \sim N(28.3, 4.5)$. Find the probability that a randomly chosen value of X lies between 25 and 30. [3]

Q10.

The lengths of body feathers of a particular species of bird are modelled by a normal distribution. A researcher measures the lengths of a random sample of 600 body feathers from birds of this species and finds that 63 are less than 6 cm long and 155 are more than 12 cm long.

- (i) Find estimates of the mean and standard deviation of the lengths of body feathers of birds of this species. [5]
 - (ii) In a random sample of 1000 body feathers from birds of this species, how many would the researcher expect to find with lengths more than 1 standard deviation from the mean? [4]
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