

Edexcel (U.K.) Pre 2017

Questions By Topic

S1 Chap09 Normal Distribution

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Last updated: February 7, 2026



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6. A scientist found that the time taken, M minutes, to carry out an experiment can be modelled by a normal random variable with mean 155 minutes and standard deviation 3.5 minutes.

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Find

(a) $P(M > 160)$. (3)

(b) $P(150 \leq M \leq 157)$. (4)

(c) the value of m , to 1 decimal place, such that $P(M \leq m) = 0.30$.

5. From experience a high-jumper knows that he can clear a height of at least 1.78 m once in 5 attempts. He also knows that he can clear a height of at least 1.65 m on 7 out of 10 attempts.

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Assuming that the heights the high-jumper can reach follow a Normal distribution,

(a) draw a sketch to illustrate the above information, (3)

(b) find, to 3 decimal places, the mean and the standard deviation of the heights the high-jumper can reach, (6)

(c) calculate the probability that he can jump at least 1.74 m. (3)

7. The measure of intelligence, IQ, of a group of students is assumed to be Normally distributed with mean 100 and standard deviation 15.

(a) Find the probability that a student selected at random has an IQ less than 91.

(4)

The probability that a randomly selected student has an IQ of at least $100 + k$ is 0.2090.

(b) Find, to the nearest integer, the value of k .

(6)

6. The random variable X has a normal distribution with mean 20 and standard deviation 4.

(a) Find $P(X > 25)$. (3)

(b) Find the value of d such that $P(20 < X < d) = 0.4641$ (4)

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6. The weights of bags of popcorn are normally distributed with mean of 200 g and 60% of all bags weighing between 190 g and 210 g.

(a) Write down the median weight of the bags of popcorn.

(1)

(b) Find the standard deviation of the weights of the bags of popcorn.

(5)

A shopkeeper finds that customers will complain if their bag of popcorn weighs less than 180 g.

(c) Find the probability that a customer will complain.

(3)

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7. A packing plant fills bags with cement. The weight X kg of a bag of cement can be modelled by a normal distribution with mean 50kg and standard deviation 2kg.

(a) Find $P(X > 53)$.

(3)

(b) Find the weight that is exceeded by 99% of the bags.

(5)

Three bags are selected at random.

(c) Find the probability that two weigh more than 53 kg and one weighs less than 53 kg.

(4)

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6. The random variable X has a normal distribution with mean 30 and standard deviation 5.

(a) Find $P(X < 39)$.

(2)

(b) Find the value of d such that $P(X < d) = 0.1151$

(4)

(c) Find the value of e such that $P(X > e) = 0.1151$

(2)

(d) Find $P(d < X < e)$.

(2)

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8. The lifetimes of bulbs used in a lamp are normally distributed. A company X sells bulbs with a mean lifetime of 850 hours and a standard deviation of 50 hours.

(a) Find the probability of a bulb, from company X , having a lifetime of less than 830 hours. (3)

(b) In a box of 500 bulbs, from company X , find the expected number having a lifetime of less than 830 hours. (2)

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A rival company Y sells bulbs with a mean lifetime of 860 hours and 20% of these bulbs have a lifetime of less than 818 hours.

(c) Find the standard deviation of the lifetimes of bulbs from company Y . (4)

Both companies sell the bulbs for the same price.

(d) State which company you would recommend. Give reasons for your answer. (2)

7. The heights of a population of women are normally distributed with mean μ cm and standard deviation σ cm. It is known that 30% of the women are taller than 172 cm and 5% are shorter than 154 cm.

(a) Sketch a diagram to show the distribution of heights represented by this information. (3)

(b) Show that $\mu = 154 + 1.6449\sigma$. (3)

(c) Obtain a second equation and hence find the value of μ and the value of σ . (4)

A woman is chosen at random from the population.

(d) Find the probability that she is taller than 160 cm.

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7. The distances travelled to work, D km, by the employees at a large company are normally distributed with $D \sim N(30, 8^2)$.

(a) Find the probability that a randomly selected employee has a journey to work of more than 20 km.

(3)

(b) Find the upper quartile, Q_3 , of D .

(3)

(c) Write down the lower quartile, Q_1 , of D .

(1)

An outlier is defined as any value of D such that $D < h$ or $D > k$ where

$$h = Q_1 - 1.5 \times (Q_3 - Q_1) \quad \text{and} \quad k = Q_3 + 1.5 \times (Q_3 - Q_1)$$

(d) Find the value of h and the value of k .

(2)

An employee is selected at random.

(e) Find the probability that the distance travelled to work by this employee is an outlier.

(3)

8. The weight, X grams, of soup put in a tin by machine A is normally distributed with a mean of 160 g and a standard deviation of 5 g.
A tin is selected at random.

(a) Find the probability that this tin contains more than 168 g.

(3)

The weight stated on the tin is w grams.

(b) Find w such that $P(X < w) = 0.01$

(3)

The weight, Y grams, of soup put into a carton by machine B is normally distributed with mean μ grams and standard deviation σ grams.

(c) Given that $P(Y < 160) = 0.99$ and $P(Y > 152) = 0.90$ find the value of μ and the value of σ .

(6)

4. Past records show that the times, in seconds, taken to run 100 m by children at a school can be modelled by a normal distribution with a mean of 16.12 and a standard deviation of 1.60

A child from the school is selected at random.

(a) Find the probability that this child runs 100 m in less than 15 s.

(3)

On sports day the school awards certificates to the fastest 30% of the children in the 100 m race.

(b) Estimate, to 2 decimal places, the slowest time taken to run 100 m for which a child will be awarded a certificate.

(4)

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7. A manufacturer fills jars with coffee. The weight of coffee, W grams, in a jar can be modelled by a normal distribution with mean 232 grams and standard deviation 5 grams.

(a) Find $P(W < 224)$.

(3)

(b) Find the value of w such that $P(232 < W < w) = 0.20$

(4)

Two jars of coffee are selected at random.

(c) Find the probability that only one of the jars contains between 232 grams and w grams of coffee.

(3)

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6. The heights of an adult female population are normally distributed with mean 162 cm and standard deviation 7.5 cm.

(a) Find the probability that a randomly chosen adult female is taller than 150 cm.

(3)

Sarah is a young girl. She visits her doctor and is told that she is at the 60th percentile for height.

(b) Assuming that Sarah remains at the 60th percentile, estimate her height as an adult. (3)

The heights of an adult male population are normally distributed with standard deviation 9.0 cm.

Given that 90% of adult males are taller than the mean height of adult females,

(c) find the mean height of an adult male.

(4)

4. The length of time, L hours, that a phone will work before it needs charging is normally distributed with a mean of 100 hours and a standard deviation of 15 hours.

(a) Find $P(L > 127)$.

(3)

(b) Find the value of d such that $P(L < d) = 0.10$

(3)

Alice is about to go on a 6 hour journey.

Given that it is 127 hours since Alice last charged her phone,

(c) find the probability that her phone will not need charging before her journey is completed.

(4)

6. The weight, in grams, of beans in a tin is normally distributed with mean μ and standard deviation 7.8

Given that 10% of tins contain less than 200 g, find

(a) the value of μ (3)

(b) the percentage of tins that contain more than 225 g of beans. (3)

The machine settings are adjusted so that the weight, in grams, of beans in a tin is normally distributed with mean 205 and standard deviation σ .

(c) Given that 98% of tins contain between 200 g and 210 g find the value of σ . (4)

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4. The time, in minutes, taken to fly from London to Malaga has a normal distribution with mean 150 minutes and standard deviation 10 minutes.

(a) Find the probability that the next flight from London to Malaga takes less than 145 minutes. (3)

The time taken to fly from London to Berlin has a normal distribution with mean 100 minutes and standard deviation d minutes.

Given that 15% of the flights from London to Berlin take longer than 115 minutes,

(b) find the value of the standard deviation d . (4)

The time, X minutes, taken to fly from London to another city has a normal distribution with mean μ minutes.

Given that $P(X < \mu - 15) = 0.35$

(c) find $P(X > \mu + 15 \mid X > \mu - 15)$. (3)

7. The heights of adult females are normally distributed with mean 160 cm and standard deviation 8 cm.

(a) Find the probability that a randomly selected adult female has a height greater than 170 cm.

(3)

Any adult female whose height is greater than 170 cm is defined as tall.

An adult female is chosen at random. Given that she is tall,

(b) find the probability that she has a height greater than 180 cm.

(4)

Half of tall adult females have a height greater than h cm.

(c) Find the value of h .

(5)

6. The time taken, in minutes, by children to complete a mathematical puzzle is assumed to be normally distributed with mean μ and standard deviation σ . The puzzle can be completed in less than 24 minutes by 80% of the children. For 5% of the children it takes more than 28 minutes to complete the puzzle.

(a) Show this information on the Normal curve below.

(2)

(b) Write down the percentage of children who take between 24 minutes and 28 minutes to complete the puzzle.

(1)

(c) (i) Find two equations in μ and σ .

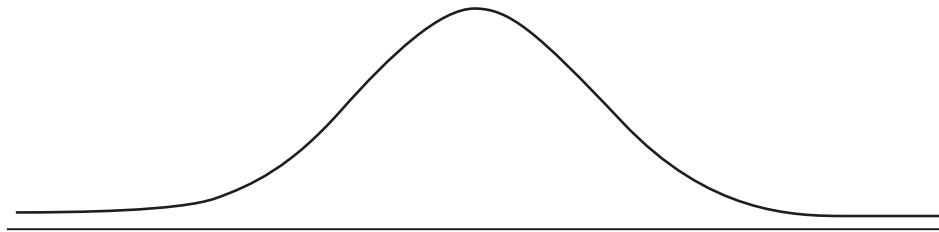
(ii) Hence find, to 3 significant figures, the value of μ and the value of σ .

(7)

A child is selected at random.

(d) Find the probability that the child takes less than 12 minutes to complete the puzzle.

(3)



6. The random variable $Z \sim N(0, 1)$

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A is the event $Z > 1.1$

B is the event $Z > -1.9$

C is the event $-1.5 < Z < 1.5$

(a) Find

(i) $P(A)$

(ii) $P(B)$

(iii) $P(C)$

(iv) $P(A \cup C)$

(6)

The random variable X has a normal distribution with mean 21 and standard deviation 5

(b) Find the value of w such that $P(X > w \mid X > 28) = 0.625$

(6)