The normal distribution– 2023 AS Mathematics 9709

1. Nov/2023/Paper_9709/51/No.3

A farmer sells eggs. The weights, in grams, of the eggs can be modelled by a normal distribution with mean 80.5 and standard deviation 6.6. Eggs are classified as small, medium or large according to their weight. A small egg weighs less than 76 grams and 40% of the eggs are classified as medium.

(a) Find the percentage of eggs that are classified as small. [3]

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(b) Find the least possible weight of an egg classified as large. [3]

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150 of the eggs for sale last week were weighed.

(c) Use an approximation to find the probability that more than 68 of these eggs were classified as medium. [5]

2. Nov/2023/Paper_9709/52/No.3

A factory produces a certain type of electrical component. It is known that 15% of the components produced are faulty. A random sample of 200 components is chosen.

Use an approximation to find the probability that more than 40 of these components are faulty. [5]

3. Nov/2023/Paper_9709/52/No.5

(a) The heights of the members of a club are normally distributed with mean 166 cm and standard deviation 10 cm.

(i) Find the probability that a randomly chosen member of the club has height less than 170 cm. [2]

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(ii) Given that 40% of the members have heights greater than h cm, find the value of h correct to 2 decimal places. [3]

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(b) The random variable X is normally distributed with mean μ and standard deviation σ.

Given that $\sigma = \frac{2}{3}\mu$, find the probability that a randomly chosen value of X is positive. [3]

4. Nov/2023/Paper_9709/53/No.2

The weights of large bags of pasta produced by a company are normally distributed with mean 1.5 kg and standard deviation 0.05 kg.

(a) Find the probability that a randomly chosen large bag of pasta weighs between 1.42 kg and 1.52 kg. [3]

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The weights of small bags of pasta produced by the company are normally distributed with mean 0.75 kg and standard deviation σ kg. It is found that 68% of these small bags have weight less than 0.9 kg.

(b) Find the value of σ. [3]

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5. Nov/2023/Paper_9709/53/No.5

The probability that a driver passes an advanced driving test is 0.3 on any given attempt.

(a) Dipak keeps taking the test until he passes. The random variable X denotes the number of attempts required for Dipak to pass the test.

(i) Find $P(2 \leqslant X \leqslant 6)$. [2]

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(ii) Find $E(X)$. [1]

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Five friends will each take their advanced driving test tomorrow.

(b) Find the probability that at least three of them will pass tomorrow. [3]

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75 people will take their advanced driving test next week.

(c) Use an approximation to find the probability that more than 20 of them will pass next week. [5]

6. March/2023/Paper_9709/52/No.6

In a cycling event the times taken to complete a course are modelled by a normal distribution with mean 62.3 minutes and standard deviation 8.4 minutes.

(a) Find the probability that a randomly chosen cyclist has a time less than 74 minutes. [2]

(b) Find the probability that 4 randomly chosen cyclists all have times between 50 and 74 minutes. [4]

In a different cycling event, the times can also be modelled by a normal distribution. 23% of the cyclists have times less than 36 minutes and 10% of the cyclists have times greater than 54 minutes.

(c) Find estimates for the mean and standard deviation of this distribution. [5]