Please stick the barcode label here.

TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

MATHEMATICS Extended Part Module M1
PAPER

Question-Answer Book

Candidate Number

TUTGATHER
PRACTICE PAPER · NOT AN OFFICIAL HKEAA PAPER

1 hour 5 minutes

This paper must be answered in English

Topic practice: Sampling Distribution

INSTRUCTIONS

(1) This paper consists of THREE sections, A(1), A(2) and B.

(2) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins.

(3) Unless otherwise specified, all working must be clearly shown.

(4) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

(5) The diagrams in this paper are not necessarily drawn to scale.

(6) Calculators and mathematical drawing instruments may be used.

(7) The marks for each question are shown in brackets.

(8) No extra time will be given after the 'Time is up' announcement.

TUTGATHER

SECTION A(1) (16 marks)

1. A random sample of 5 observations is taken from a large population and the values are **(3 marks)**

$$4, \quad 7, \quad 9, \quad 12, \quad 18.$$

(a) Find the sample mean $\bar{x}$.
(b) Find the sample standard deviation s (using the divisor $n - 1$).

2. The weights of apples in an orchard have mean 150 g and standard deviation 24 g. A random sample of 64 apples is taken. State the mean and the standard deviation of the sampling distribution of the sample mean $\bar{X}$, and name the theorem that justifies using a normal distribution here. **(3 marks)**

3. A population has mean 80 and standard deviation 20. A random sample of size $n = 100$ is taken. **(4 marks)**
(a) By the central limit theorem, state the approximate distribution of $\bar{X}$.
(b) Find $P(\bar{X} > 83)$.
(c) Find $P(77 < \bar{X} < 83)$.

Answers written in the margins will not be marked.
Answers written in the margins will not be marked.
TUTGATHER

4. The following data are the waiting times (in minutes) of a random sample of 8 customers at a bank: **(6 marks)**

2.1, 3.4, 1.8, 5.2, 4.0, 2.6, 3.0, 6.3.

(a) Find the sample mean and the sample standard deviation (divisor $n - 1$).

(b) Find the median and the interquartile range of the sample.

(c) State, with a reason, whether the sample mean or the median is the better measure of centre for these data.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

TUTGATHER

SECTION A(2) (24 marks)

5. The lifetimes of a brand of light bulb have mean 1200 hours and standard deviation 90 hours. A random sample of 36 bulbs is taken. **(7 marks)**

(a) Find the probability that the sample mean lifetime exceeds 1230 hours.

(b) Find the probability that the sample mean lifetime lies within 25 hours of the population mean.

(c) The manufacturer claims that the probability in (a) is at most 0.05. Using the same population mean and standard deviation, find the smallest sample size n for which $P(\bar{X} > 1230) \leq 0.05$.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

TUTGATHER

6. A machine fills bottles with soft drink. The volume dispensed has a skewed distribution with mean 500 mL and standard deviation 8 mL. A random sample of 100 bottles is taken and the sample mean volume $\bar{X}$ is calculated. **(8 marks)**

(a) Explain why the distribution of $\bar{X}$ may be taken as approximately normal, even though individual volumes are skewed.

(b) Find $P(498.5 < \bar{X} < 501.5)$.

(c) Find the value k such that $P(\bar{X} > k) = 0.10$.

(d) A second sample of only 4 bottles is taken. Explain why the normal approximation for $\bar{X}$ may not be reliable in this case.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

TUTGATHER

7. A random sample of 10 batteries gave the following lifetimes (in hours): **(9 marks)**

48, 52, 45, 61, 50, 47, 55, 49, 53, 60.

(a) Find the sample mean $\bar{x}$ and the sample standard deviation s (divisor $n - 1$).

(b) A second sample of 10 batteries from another batch has mean 54.0 hours and standard deviation 6.0 hours. The two samples are combined. Find the mean and the standard deviation of the combined sample of 20 batteries.

(c) Comment on which batch appears to have more consistent lifetimes.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

TUTGATHER

SECTION B (10 marks)

8. The masses of parcels handled by a courier have mean 2.4 kg and standard deviation 0.9 kg. A random sample of n parcels is taken and the sample mean mass is $\bar{X}$. **(10 marks)**

(a) Write down $E(\bar{X})$ and $\text{Var}(\bar{X})$ in terms of n.

(b) Find the least n such that $P(|\bar{X} - 2.4| < 0.2) \geq 0.95$.

(c) Using the value of n found in (b), find $P(\bar{X} < 2.3)$.

(d) A supervisor claims that if n is doubled, the probability in (b) becomes at least 0.99. Determine whether this claim is true.

END OF PAPER

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

TUTGATHER