



F09-30min Estimating from Samples (Foundation): 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A sample of 40 shoppers found that 8 used a loyalty card. Write down the proportion of the sample who used a loyalty card, as a decimal.

(Total for Question 1 is 1 mark)

- 2** A film critic recorded the running time, in minutes, of a sample of 25 films. The median running time in the sample was 108 minutes.

A streaming library holds 4000 films in total.

- (a) Write down what a median running time of 108 minutes tells you about the sample of 25 films. (1)

- (b) Use the median to estimate how many of the 4000 films in the library have a running time of more than 108 minutes. (2)

(Total for Question 2 is 3 marks)

3 In a sample of 60 customers, 35% said they had used a shop's app to place an order. The shop has 2450 customers in total.

(a) Work out 35% of 60 to find the number of customers in the sample who used the app. (2)

(b) Use the sample to estimate the number of the shop's 2450 customers who have used the app. Give your answer to the nearest whole number of customers. (2)

(Total for Question 3 is 4 marks)

4 A biologist catches 30 fish from a lake, tags each one, and releases them back into the lake. Later, she catches a second sample of 50 fish, of which 6 are already tagged.

Capture-recapture formula:

estimated population = (number tagged in 1st catch x total in 2nd catch) / (number tagged in 2nd catch)

(Total for Question 4 is 3 marks)

5 Two students each estimate the mean height of trees in the same forest.

Student A measures a sample of 5 trees. Student B measures a sample of 50 trees.

(a) Whose estimate of the mean height is more likely to be reliable? (1)

(b) Give a reason for your answer. (1)

(Total for Question 5 is 2 marks)

- 6** A gym has 1800 members. A sample of 60 members found that 42 attended a class in the last month.

Work out the percentage of the sample who attended a class, and use this to estimate how many of the gym's 1800 members attended a class in the last month.

(Total for Question 6 is 3 marks)

- 7** A conservation officer wants to estimate the number of red squirrels living in a woodland, using the capture-recapture method.

(a) Plan: Give one reason why it would not be practical for the officer to count every red squirrel living in the woodland. (1)

(b) Collect: The officer traps 24 squirrels, tags each one, then releases them back into the woodland. Give two things she should do to make sure the second catch gives an accurate population estimate. (2)

(c) Process: Two weeks later, the officer catches a second sample of 30 squirrels. Of these, 4 are already tagged. Use the capture-recapture method to estimate the number of red squirrels living in the woodland. (3)

(d) Interpret: Give one assumption that must be true for this estimate of 180 to be reliable. (2)

(Total for Question 7 is 8 marks)

- 8** A researcher wants to estimate what proportion of all residents in a town recycle regularly. She stands outside a recycling centre on a Saturday morning and surveys 50 people leaving it. 46 of them say they recycle regularly.

Explain why this sample is unlikely to give a reliable estimate for all town residents, and state whether the estimate is likely to be too high or too low.

(Total for Question 8 is 3 marks)

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- 9** A student is estimating the number of oak trees in a woodland of 8000 trees, using a sample of 40 trees in which 6 are oak. Here is the student's working:

Proportion of oaks in the sample = $6/40 = 0.15$

Estimated number of oaks in the woodland = $0.15 \times 8000 = 1200$

(a) Identify the error in the student's working. (1)

(b) Work out the correct estimate for the number of oak trees in the woodland. (2)

(Total for Question 9 is 3 marks)

Mark scheme · F09-30min Estimating from Samples (Foundation): 30-minute Pack

Question 1

- **B1** 0.2 cao
- **Answer: 0.2**

Question 2

- (a) **B1** half of the sample of films have a running time of 108 minutes or less, and half have a running time of 108 minutes or more, oe
- (a) **Answer: Half the sample runs 108 minutes or less; half runs 108 minutes or more.**
- (b) **M1** 0.5×4000 , oe
- (b) **A1** 2000 cao
- (b) **Answer: 2000**

Question 3

- (a) **M1** 0.35×60 , oe
- (a) **A1** 21 cao
- (a) **Answer: 21**
- (b) **M1** 0.35×2450 (=857.5), oe
- (b) **A1** 858 (awrt), rounded to the nearest whole customer
- (b) **Answer: 858**

Question 4

- **M1** 30×50 (=1500), oe
- **M1** $1500 \div 6$
- **A1** 250 cao
- **Answer: 250**

Question 5

- (a) **B1** Student B cao
- (a) **Answer: Student B**
- (b) **B1** a larger sample is more likely to represent the whole forest / is less affected by one or two unusually tall or short trees, oe
- (b) **Answer: A larger sample is more representative and less affected by unusual values.**

Question 6

- **M1** $42/60$, oe (=0.7 or 70%)
- **M1** 0.7×1800 , oe
- **A1** 1260 cao
- **Answer: 70%; an estimated 1260 members**

Question 7

- (a) **B1** squirrels move around and are difficult to see/find, so counting every one would be very difficult, take a very long time, or be unreliable, oe
- (a) **Answer: Squirrels are mobile and hard to find, so a full count would be impractical.**
- (b) **B1** wait long enough for the tagged squirrels to mix back thoroughly (and randomly) with the rest of the population, oe
- (b) **B1** catch the second sample from the same woodland/area, using a similar method to the first catch, oe (accept: make sure no squirrels have been born, died, or moved in/out between catches)
- (b) **Answer: Allow time for tagged squirrels to mix back in; catch the second sample the same way, from the same area.**
- (c) **M1** $24 \times 30 (=720)$, oe
- (c) **M1** $720 / 4$
- (c) **A1** 180 cao
- (c) **Answer: 180**
- (d) **B1** the population is closed: no squirrels were born, died, or moved into/out of the woodland between the two catches, oe
- (d) **B1** the tagged squirrels mixed back randomly/thoroughly with the rest of the population, so the second catch was a fair, representative sample, oe
- (d) **Answer: The squirrel population must stay unchanged between catches, and tagged squirrels must mix back in randomly.**

Question 8

- **B1** identifies that the sample only includes people already at the recycling centre, who are more likely to recycle than a resident chosen at random, oe (bias identified)
- **B1** states the estimate is likely to be too high, oe
- **B1** explains that residents who do not visit the recycling centre (e.g. non-recyclers) are not represented in the sample, oe
- **Answer: The sample is biased because only recycling-centre visitors were asked; the estimate (92%) is likely too high because residents who do not recycle, or do not visit the centre, are not represented.**

Question 9

- (a) **B1** the student added the proportion and 8000 instead of multiplying them (should be 0.15×8000 , not $0.15 + 8000$), oe
- (a) **Answer: The student added instead of multiplied.**
- (b) **M1** 0.15×8000 , oe
- (b) **A1** 1200 cao
- (b) **Answer: 1200**