Sampling and population size

Worked solutions

GCSE science calculations

This topic online

1 Hamza places 10 quadrats at random on a school field. He counts the daisies in each one.

Quadrat	1	2	3	4	5	6	7	8	9	10
Daisies	4	7	2	0	5	6	3	8	1	4

Calculate the mean number of daisies per quadrat. (2 marks)

Mean = sum of values ÷ number of values

sum = 4 + 7 + 2 + 0 + 5 + 6 + 3 + 8 + 1 + 4 = 40

The 0 still counts as a quadrat

mean = 40 ÷ 10

4

2 Zainab counts the snails in 11 quadrats in a woodland.

2, 6, 3, 6, 1, 4, 8, 6, 5, 0, 3

a. Find the median number of snails.

b. Find the mode. (2 marks)

a)

Put the values in order

0, 1, 2, 3, 3, 4, 5, 6, 6, 6, 8

11 values, so the middle one is the 6th

4

b)

Mode = the most common value

6 appears 3 times

6

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3 A meadow has an area of 400 m^2. Jessica uses 12 quadrats, each with an area of 1 m^2. She finds a mean of 3.5 buttercups per quadrat.

Estimate the number of buttercups in the meadow. (2 marks)

The 12 quadrats are not needed: the mean is already given

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$\text{population} = 3.5 \times \frac{400}{1}$$

$$\text{population} = 3.5 \times 400$$

1400

4 A park lawn has an area of 600 m^2. Oscar uses a square quadrat with sides of 50 cm. He finds a mean of 2.4 dandelions per quadrat.

Estimate the number of dandelions on the lawn. (3 marks)

Same units first: 100 cm = 1 m

$$50 \text{ cm} = 0.5 \text{ m}$$

Area of quadrat = side × side

$$\text{quadrat area} = 0.5 \times 0.5 = 0.25 \text{ m}^2$$

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$\text{population} = 2.4 \times \frac{600}{0.25}$$

$$\text{population} = 2.4 \times 2400$$

5760

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5 A rectangular field is 30 m long and 45 m wide. Leah places six quadrats, each 0.5 m by 0.5 m, and counts the clover plants.

5, 3, 0, 4, 2, 4

Estimate the number of clover plants in the field.

Show your working.

(4 marks)

Mean = sum of values ÷ number of values

sum = 5 + 3 + 0 + 4 + 2 + 4 = 18

mean = 18 ÷ 6 = 3

Area of a rectangle = length × width

field area = 30 × 45 = 1350 m^2

quadrat area = 0.5 × 0.5 = 0.25 m^2

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$\text{population} = 3 \times \frac{1350}{0.25}$$

population = 3 × 5400

16200

6 Lucas places a square quadrat with sides of 50 cm on a lawn. Moss covers 600 cm^2 of the area inside the quadrat.

Calculate the percentage cover of moss in this quadrat.

(3 marks)

Area of quadrat = side × side

quadrat area = 50 × 50 = 2500 cm^2

Percentage cover = area covered ÷ area of quadrat × 100

$$\text{percentage cover} = \frac{600}{2500} \times 100$$

24%

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7 A nature reserve warden estimates there are 3000 orchids in a 1500 m^2 meadow. She used 1 m^2 quadrats.

Calculate the mean number of orchids per quadrat she must have found. (2 marks)

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$3000 = \text{mean} \times \frac{1500}{1}$$

$$3000 = \text{mean} \times 1500$$

Divide both sides by 1500

$$\text{mean} = 3000 \div 1500$$

2

8 A council ecologist estimates there are 4500 bluebells in a woodland clearing. She found a mean of 1.8 bluebells per quadrat, and each quadrat has an area of 0.25 m^2.

Calculate the area of the clearing. (3 marks)

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$4500 = 1.8 \times \frac{\text{area}}{0.25}$$

Divide both sides by 1.8

$$\frac{\text{area}}{0.25} = 4500 \div 1.8 = 2500$$

Multiply both sides by 0.25

$$\text{area} = 2500 \times 0.25$$

625 m^2

9 Jun places 20 quadrats, each 0.25 m^2, on a 250 m^2 bank beside a canal. He counts 64 primrose plants altogether.

Estimate the number of primrose plants on the bank.

Show your working. (3 marks)

64 is the total in 20 quadrats, not the mean

$$\text{mean} = 64 \div 20 = 3.2$$

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$\text{population} = 3.2 \times \frac{250}{0.25}$$

$$\text{population} = 3.2 \times 1000$$

3200

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10 A Year 10 class compares the number of daisies in an open area and a shaded area of a school field. Each area is 80 m^2. They use quadrats measuring 0.5 m by 0.5 m.

Quadrat	1	2	3	4	5
Open area	6	9	7	8	10
Shaded area	2	3	1	4	0

a. Estimate the number of daisies in the open area.

b. Estimate the number of daisies in the shaded area.

c. Calculate how many more daisies there are in the open area than the shaded area.

Show your working. (5 marks)

Area of quadrat = side x side

quadrat area = $0.5 \times 0.5 = 0.25\ m^2$

Number of quadrats that fit in each area = total area ÷ area of one quadrat

$$\frac{80}{0.25} = 320$$

Estimated population = mean per quadrat x 320

a)

mean = $(6 + 9 + 7 + 8 + 10) \div 5 = 40 \div 5 = 8$

population = 8×320

2560

b)

mean = $(2 + 3 + 1 + 4 + 0) \div 5 = 10 \div 5 = 2$

population = 2×320

640

c)

$2560 - 640 = 1920$

1920

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11 A sports field is 60 m by 35 m. Nadia uses a small square quadrat with sides of 25 cm to count self-heal plants. Her counts from 10 quadrats are:

1, 0, 3, 2, 0, 1, 4, 2, 1, 2

Estimate the number of self-heal plants on the field. Give your answer to 2 significant figures.

Show your working.

(5 marks)

Mean = sum of values ÷ number of values

mean = 16 ÷ 10 = 1.6

Same units first: 25 cm = 0.25 m

quadrat area = 0.25 × 0.25 = 0.0625 m^2

field area = 60 × 35 = 2100 m^2

Estimated population = mean per quadrat × total area ÷ area of one quadrat

$$\text{population} = 1.6 \times \frac{2100}{0.0625}$$

population = 1.6 × 33 600

population = 53 760

54000

12 Ethan estimates how much of a 1200 m^2 grazing field is covered by thistles. He records the percentage cover of thistles in five quadrats.

Quadrat	1	2	3	4	5
Percentage cover	12	18	9	15	21

a. Calculate the mean percentage cover.

b. Estimate the area of the field covered by thistles.

Show your working.

(4 marks)

a)

Mean = sum of values ÷ number of values

mean = (12 + 18 + 9 + 15 + 21) ÷ 5

mean = 75 ÷ 5

15%

b)

15% of the whole field

$$\text{area} = \frac{15}{100} \times 1200$$

180 m^2

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