Had a look ☐ Nearly there ☐ Nailed it! ☐

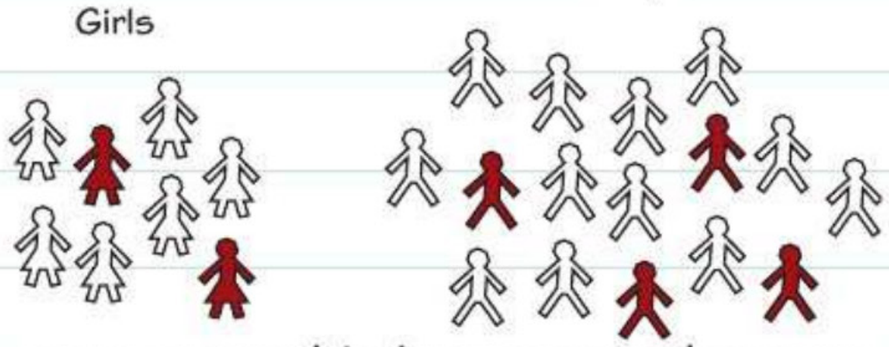
Tricky Topic

Stratified sampling

What is stratified sampling?

A stratified sample is one in which the population is split into groups. The number of members selected from each group for the sample is proportional to the size of that group.

There are twice as many boys as girls in this population...



... so you need twice as many boys as girls in a stratified sample.

Sampling fraction

Use this rule to find the sampling fraction for a stratified sample.

$$\text{Sampling fraction} = \frac{\text{Sample size}}{\text{Population size}}$$

You multiply the sampling fraction by the size of each group to work out how many members to select from that group.

In the example on the left the sampling fraction is $\frac{6}{24}$. So you need $8 \times \frac{6}{24} = 2$ girls and $16 \times \frac{6}{24} = 4$ boys in your stratified sample.

Worked example

Target grade 5

The table below gives information about the members of a tennis club.

	Male	Female	Total
18 or over	74	66	140
Under 18	22	42	64
Total	96	108	204

Malik is carrying out a customer satisfaction survey. He chooses a sample of 30 members, stratified by age group and gender.

Work out the number of females under 18 he should include in his sample. **(3 marks)**

$42 \times \frac{30}{204} = 6.176...$

Malik should include 6 females under 18 in his sample.

There's a lot of information given so read the whole question carefully.
Start by calculating the sampling fraction.
The population size is the total in the bottom right of the table.

$$\text{Sampling fraction} = \frac{\text{Sample size}}{\text{Population size}}$$

$$= \frac{30}{204}$$

You need to use this in your calculation so you can leave it in this form.
Remember that you can only select a **whole number** of students from each group, so you should round your answer to the nearest whole number.

Now try this

Target grade 5

This table shows the number of employees at a large department store. The human resources manager wants to select a random sample of 40 employees, stratified by gender.

(a) How many male employees should she select for her sample? **(3 marks)**

(b) Suggest **one** method she could use to select a random sample. **(1 mark)**

	Full-time	Part-time	Total
Male	80	36	116
Female	105	19	124
Total	185	55	240

Look at page 115 for methods of random sampling.

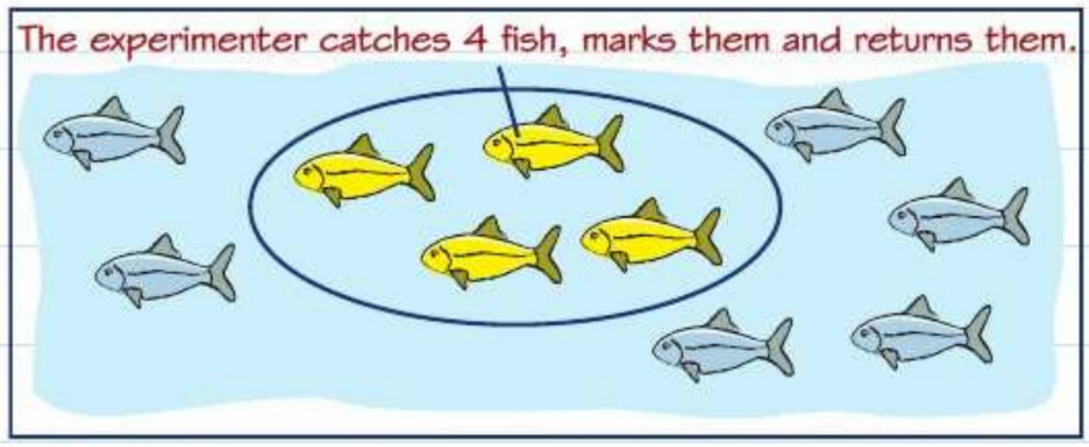
Had a look ☐ Nearly there ☐ Nailed it! ☐

Tricky Topic

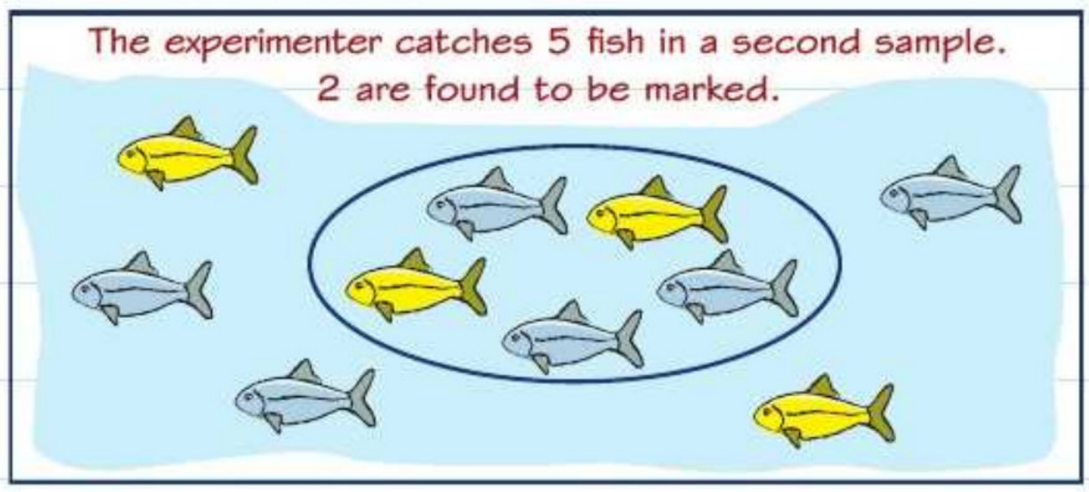
Capture–recapture

You can estimate the size of a large animal population using the **Petersen capture–recapture** method. This is sometimes called the **mark and recapture** method. The diagrams below show how you could use it to estimate the number of fish in a lake.

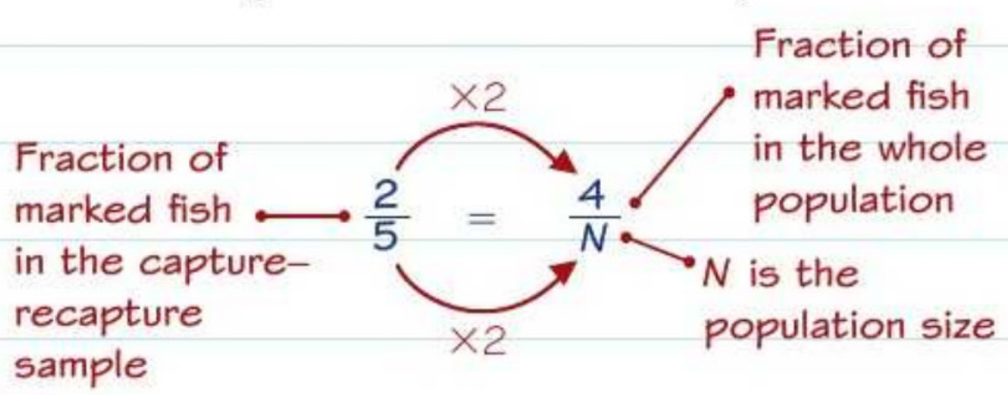
1 Catch a sample of fish from the lake and mark them. Return the marked fish to the lake.



2 Later, catch a second sample of fish. Count how many of this sample are marked.



You can use equivalent fractions to estimate the size of the population. You **assume** that the following two fractions are equivalent.



Using a formula

You can use this formula to estimate the population size N.

$$N = \frac{Mn}{m}$$

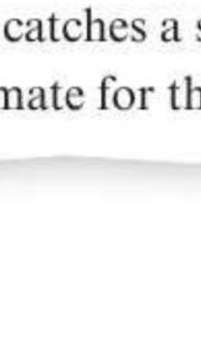
LEARN IT!

M = number of fish marked then released

n = size of recapture sample

m = number of marked fish in recapture sample

Problem solved! If you can't remember the formula for capture–recapture you can answer this question using equivalent fractions:



Always check that your answer makes sense. The estimate must be larger than the number of owls captured.

Worked example

Target grade 7

A conservation charity wants to estimate the number of owls in an area of woodland. A scientist captures 12 owls, marks them with a tag, and releases them. One month later she captures 15 owls. She finds that 4 of the owls are tagged. Estimate the total size of the owl population in this area. **(3 marks)**

$$N = \frac{Mn}{m}$$

$$= \frac{12 \times 15}{4} = 45$$

Now try this

Target grade 7

Ravina wants to find an estimate for the number of eagles in a sanctuary. She catches a sample of 70 eagles in the sanctuary and tags each of them. These birds are then released back into the sanctuary.

The next day she catches a sample of 60 eagles in the sanctuary. 12 of these eagles are tagged.

Work out an estimate for the total number of eagles in the sanctuary. **(3 marks)**