Kettlethorpe
HIGH SCHOOL

MATHS

Year 11 | Theta

Name:

Set:

Unit	Topic	Complete
1	Collecting data	
2	Averages	
3	Vectors	
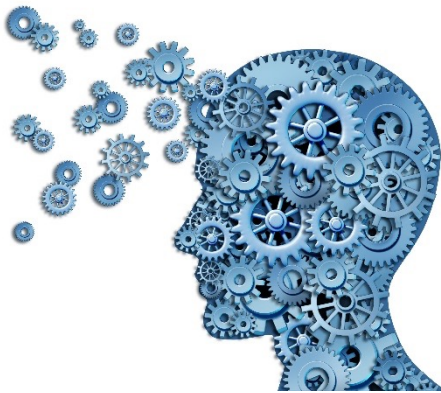
Theta Unit 1: Collecting Data

Essential knowledge:
- Use sampling to estimate population sizes (capture-recapture method)
- Identify Bias

Key Words:
Sample, population, fraction, decimal, percentage, bias, stratified sample, random, box plot, histogram, frequency density, frequency, mean, median, mode, range, lower quartile, upper quartile, interquartile range, spread, comparison, outlier

Prior Knowledge:
- Equivalent fractions e.g.
$$\frac{5}{20} = \frac{30}{x}$$

$$x = \frac{30}{5} \times 20 = 120$$

- Know the difference between discrete and continuous data

- Know what bias is

- Know how to reduce bias in sampling and questionnaires

- Know that a larger sample produces more reliable results

Sampling (capture-recapture)

The capture-recapture method is used to estimate a **population** size from a **sample** size, by assuming that the sample size is in the same proportion as to the population size

Example
A man catches 20 fish in a lake, he marks them with a cross, he puts the fish back in the lake. The next day the man catches 30 fish and 5 of them have a cross on them. Estimate how many fish are in the lake.

Currently $\frac{5}{30}$ are marked, we know 20 are marked altogether.

So $\frac{5}{30} = \frac{20}{x}$ As they are in the same proportion, x = the population size. To calculate 30 x (20÷5) = 120.

Example
Gary wants to have a party for his 300 friends, he asks 30 of them what their favourite crisps are and they give the following results

Salt & Vinegar	Ready Salted	Cheese & Onion	Prawn Cocktail
10	7	8	5

How many of each flavour should Gary order?

Gary sampled 30 out of 300, so the multiplier is 300÷30 = 10. So for each flavour we multiply by 10

Salt & Vinegar	Ready Salted	Cheese & Onion	Prawn Cocktail
10 x 10 = 100	7 x 10 = 70	8 x 10 = 80	5 x 10 = 50

Caution
We have made assumptions for the above questions

We have assumed that the sample is representative of the population.

LITERACY

Write the definition of Random

Use the word random within a sentence

REASONING

Stephen traps 30 deer in the forest, tags them and releases them. A week later he traps 50 and 15 are tagged. He uses capture/recapture to estimate the total number of deer as 100. Write down 3 assumptions he must make.

FLUENCY

1) There are 477 people at a concert.

	Male	Female
Adult	57	83
Child	114	223

Eric wants to pick a sample of 80 stratified by gender and age.

i)   Work out the number of adult males in the sample.

ii) Work out the number of female children in the sample.

2) Taymar wants to estimate the number of fish in a lake.
She catches 60 fish from the lake and marks them with a dye. She then releases the fish back in to the lake.
The next day, Taymar catches 70 fish from the lake, 8 of the fish have been marked with the dye..
Work out an estimate for the number of fish in the lake.

PROBLEM SOLVING

There are 2480 people in a town.

	Men	Women	Children	Total
Number in town	1260			2480
Number in sample	63	22		

The stratified sample is selected with Men, Women and Children being the 3 strata.
Complete the table.

Theta Unit 2: Averages

Essential knowledge:

Calculate the mean from a table or tables
Compare two data sets using averages and ranges

Key Words:

Mean, median, mode, range, average, discrete, continuous, estimate

Prior Knowledge:

Calculate the basic averages

Mode – The number which appears the most

Median – The middle value when the values are in size order

Mean – The value calculated when they are added together and divide by the number of values in the data set.

Calculate measures of spread for consistency

Range – The difference between the smallest and largest values

To be able to read and plot Stem and Leaf diagrams

Median and Mode from frequency table

Here is a table showing the number of goals scored in 10 football matches

Number of goals	Frequency
0	2
1	2
2	5
3	1

Mode = 2 (the class with highest frequency)

The **median** is the class containing the 5,5th data point

Number of goals	Frequency	Cumulative
0	2	2
1	2	2+2 = 4
2	5	4 + 5 = 9
3	1	9 + 1 = 10

The 5.5th data is set is the category for 2, therefore the median is 2

Mean from frequency table

To find the mean, you need to find the total number of goals scored

Number of goals, g	Frequency, f	F x g
0	2	0
1	2	2
2	5	10
3	1	3

Total goals 0 + 2 + 10 + 3 = 15

Mean = 15/10 = 1.5 goals per game

Remember
When the data is grouped like below, we estimate the mean using the midpoint for the classes

Mass (m grams)	Frequency	Midpoint
10<m≤20	10	15
20<m≤40	30	30
40<m≤50	20	45

Comparing data sets

In order to compare data sets, make 2 comparisons:

Compare an Average: Use the median, mode or mean to show which is higher/lower

Compare the range: A smaller range means that the data is more consistent.

LITERACY

Explain the following words:

Estimated mean-

Modal class interval-

REASONING

A football team played six games.

Here are the number of goals they scored in each game:

6   0   3   2   2   5

The football team play one more game.
The mean number of goals scored increases to 4.

(c) Work out the number of goals scored in the seventh game.

FLUENCY

4.   Timothy asked 30 people how long it takes them to get to school.

The table shows some information about his results.

Time (t minutes)	Frequency
0 < t ≤ 10	2
10 < t ≤ 20	8
20 < t ≤ 30	12
30 < t ≤ 40	7
40 < t ≤ 50	1

Work out an estimate for the mean time taken.

..........................minutes

PROBLEM SOLVING

Shown below are five cards which are arranged in order from smallest to largest

5				

The range of the cards is 4.
The median of the cards is 8.
The mean of the cards is 7.

Work out the 4 missing numbers.

Theta Unit 3: Vectors

Essential knowledge:

- Write and draw column Vectors
- Identify parallel column vectors
- Add column vectors

Key Words:

Vector, magnitude, column, scalar, direction, parallel, ratio, combined

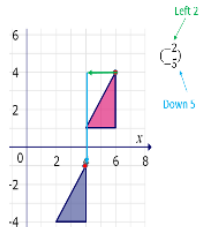## Prior Knowledge:

- Understand the notation of column vectors

$$\binom{3}{4}$$

Means 3 left, 4 up

The top number means left (+) and right (-)
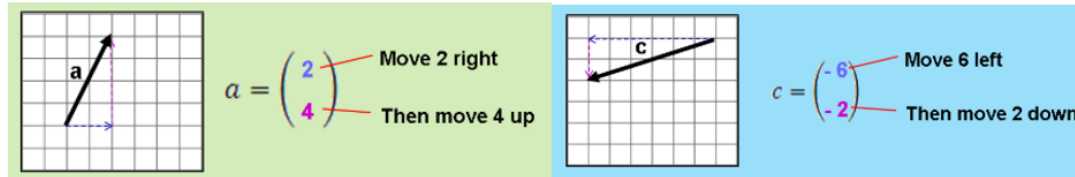
The bottom number represents up (+) and down (-)

- Perform translations using column vectors

- Understand what parallel means

Writing and drawing vectors

Vectors have direction and magnitude. They can be visually represented as a line, like below.

$a = \binom{2}{4}$ — Move 2 right, Then move 4 up

$c = \binom{-6}{-2}$ — Move 6 left, Then move 2 down

You may be asked, either to write the column vector, or draw the corresponding vector on a grid. Remember you need to lace an arrow to show the direction of the vector.

Parallel vectors

Parallel vectors are ones which have the same direction.

Two Vectors are parallel if one is a multiple of the other.

E.g.

$A = \binom{2}{3}$ and $B = \binom{6}{9}$ are parallel as $B = 3A$

Here's some more parallel vectors

$A = \binom{1}{3}$ and $B = \binom{2}{6}$ are parallel, so is $C = \binom{-4}{-12}$

Combining vectors

Tw vectors can be combined to give a single vector

E.g.

$A = \binom{2}{3}$ and $B = \binom{1}{4}$, $A + B = \binom{2+1}{3+4} = \binom{3}{7}$

You can also add multiples of vectors

$A = \binom{3}{4}$ and $B = \binom{2}{-4}$ Find $2A + 3B$

$2A = \binom{6}{8}$ and $3B = \binom{6}{-12}$ $2A + 3B = \binom{6+6}{8 \pm 12} = \binom{12}{-4}$

LITERACY

Give an example to explain what a "column vector" is.

REASONING

A shape is translated by the vector $\begin{pmatrix} 0 \\ 4 \end{pmatrix}$
In which direction does the shape move: up/down/left/right?
Give a reason for your answer.

FLUENCY

Here are two column vectors f = $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and g = $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Work out

(a) f + g

(b) f – g

(c) 2f + g

(d) 3f + 2g

(e) 4f – 3g

(f) ½ (f + g)

PROBLEM SOLVING

ACD is a straight line.
(a) Write down the vector $\overrightarrow{AC}$
in terms of x and y.

(b) AC : CD = 2 : 1.
Work out the vector $\overrightarrow{AD}$
in terms of x and y.
Give your answer as simply as possible.