

## Lesson Element – 5.02b Inverse Proportion

### Instructions and answers for teachers

These instructions should accompany the OCR resource ‘Lesson Element 5.02b Inverse Proportion’ activity which supports OCR GCSE (9–1) Mathematics.

May 2015

#### Foxes and Rabbits

Arrange the cards into sets containing:

- One graph
- One set of data points
- One equation
- One proportional relationship

Write each proportionality sentence in algebraic notation using the  $\propto$  symbol.

Work out the value of  $k$  for each model.

Identify the model most likely to represent the real relationship between fox and rabbit numbers.

Does it have any limitations?

GCSE (9–1)  
MATHEMATICS

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Oxford Cambridge and RSA

#### The Activity:

This resource comprises of 1 task.



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

#### Associated materials:

‘Lesson Element 5.02b Inverse Proportion’ Lesson Element learner activity sheet.

#### Suggested timings:

**Task 1:** 20–30 minutes



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## Rationale

All learners at GCSE are expected to be able to solve more formal problems involving quantities in inverse proportion i.e. where  $y \propto \frac{1}{x}$ , so it is important that they not only understand the concept of inverse proportion, but are also familiar with the notation.

## Assumed Knowledge

This activity assumes that learners can:

- Read graphs and identify graphs from their shape.
- Write a proportionality statement using the proportionality symbol  $\propto$ .
- Substitute values into expressions and solve to find a variable.

## Possible Misconceptions

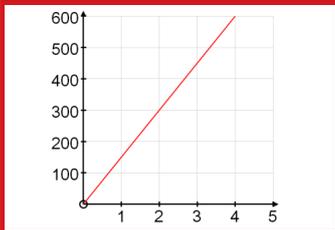
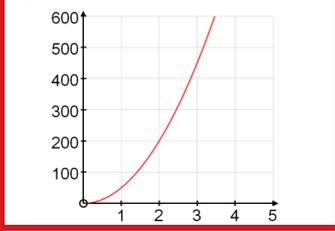
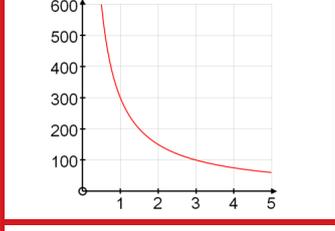
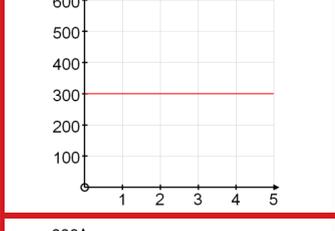
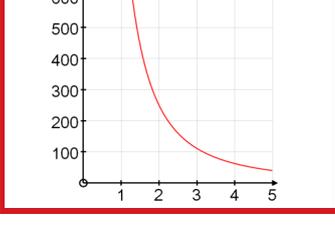
- Learners often have difficulty in determining when to use the symbols  $\propto$  or  $=$ . After expressing  $y \propto \frac{1}{x}$  some learners will write  $y \propto \frac{k}{x}$  instead of  $y = \frac{k}{x}$ . Alternatively, if the value of  $k$  is found to be 24, learners may write  $y \propto \frac{24}{x}$  instead of  $y = \frac{24}{x}$ .
- Given an equation of the form  $y = \frac{k}{x}$  and asked to find  $y$ , learners experience difficulties when dividing by a decimal, e.g. when  $x = 0.3$ . When attempting to find  $y$ , given  $x$ , learners are sometimes confused, for example, dividing  $y$  by  $k$ .



## Task 1 – Foxes and Rabbits Card Sort

The aim of this activity is to help learners develop a conceptual understanding of the meaning of ‘inverse proportionality’ in relation to other forms of proportionality with which they may be more familiar.

Give learners the individual cards from the PowerPoint ‘Foxes and Rabbits Card Sort’. Ask them to sort them into sets of four containing: one graph, one set of data points, one equation and one proportional relationship. The correct order is shown below, but the ‘student sheet’ is randomised so can be given to learners to cut up themselves.

|   |  |   |                     |
|---|--|---|---------------------|
|    | <ul style="list-style-type: none"> <li>When there are 2 foxes, there are 300 rabbits</li> <li>When there are 4 foxes, there are 600 rabbits</li> </ul> | <p><math>y</math> is directly proportional to <math>x</math></p>    | $y = kx$            |
|   | <ul style="list-style-type: none"> <li>When there are 2 foxes, there are 200 rabbits</li> <li>When there are 3 foxes, there are 450 rabbits</li> </ul> | <p><math>y</math> is proportional to <math>x^2</math></p>           | $y = kx^2$          |
|  | <ul style="list-style-type: none"> <li>When there are 2 foxes, there are 150 rabbits</li> <li>When there are 4 foxes, there are 75 rabbits</li> </ul>  | <p><math>y</math> is inversely proportional to <math>x</math></p>   | $y = \frac{k}{x}$   |
|  | <p>Regardless of the number of foxes, the number of rabbits stays constant</p>   | <p><math>y</math> is constant</p>                                   | $y = k$             |
|  | <ul style="list-style-type: none"> <li>When there are 2 foxes, there are 250 rabbits</li> <li>When there are 5 foxes, there are 40 rabbits</li> </ul>  | <p><math>y</math> is inversely proportional to <math>x^2</math></p> | $y = \frac{k}{x^2}$ |



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Once complete, instruct learners to write the sentence algebraically using the proportion symbol. Next, either ask the learners to find the value of  $k$  in each case, or if learners are working in groups, each could be assigned a single 'set of cards' to work out, and then present their solution to the rest of the class. Correct answers are given in the table below:

|               |                 |                         |                 |                           |
|---------------|-----------------|-------------------------|-----------------|---------------------------|
| $y \propto x$ | $y \propto x^2$ | $y \propto \frac{1}{x}$ | $y$ is constant | $y \propto \frac{1}{x^2}$ |
| $k = 150$     | $k = 50$        | $k = 300$               | $k = 300$       | $k = 1000$                |

There are opportunities here to discuss suitable models based on learners own insight into the relationship between predator and prey. Learners could be asked to identify which of the models are sensible/ridiculous and encouraged to give clear reasons. Learners could also be asked to consider the long term accuracy of the model e.g. what might happen to the population of foxes once the rabbit numbers have fallen significantly?

Teachers may also choose to select a model and ask learners to find the number of foxes given a particular number of rabbits or vice versa. This is a good opportunity to use mini whiteboards to quickly assess learners' level of understanding.

At this point learners should have four 'model solutions' for these kind of proportion questions and can be directed to textbook exercises either focusing on inverse proportion questions, or on areas identified as needing work based on the activity.



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