



### Activity description

This activity requires students to complete data tables, then draw, read and interpret linear graphs where the intercept on the  $y$  axis is not zero. Interpretation includes finding where two linear graphs meet.

The last part of the activity requires the use of a spreadsheet – this could be omitted if computers are not available.

For level 2, the work could be refocused to introduce algebraic graphs.

### Suitability

Level 1 (Foundation), Level 2 (Intermediate/Higher) introductory.

### Time

2 hours

### Resources

Student information sheet

*Optional:* slideshow

### Equipment

Graph paper, rulers, calculators, computers.

### Key mathematical language

Line graph, axis, scale, points,

For second questions page: percentage, intercept, gradient, direct proportion.

### Notes on the activity

The activity can be introduced using the slideshow. This would help you to explain the plumber's information and graph.

Ensure that students:

- know how to plot and read points accurately
- know how to use a line graph to read off points (both ways)
- can scale axes appropriately for drawing their own graphs.

Emphasise that having a start-up amount means that direct proportionality no longer applies.

The last part of the activity requires a spreadsheet. This could be demonstrated with a data projector if individual computers are not available, or deleted from the activity if you wish.

## During the activity

The questions increase in difficulty, and less able students may not complete them all.

## Points for discussion

When introducing the plumber's graph, students can be asked to work out the missing values for the table. Also discuss why the graph does not start at (0, 0). You could ask students to suggest similar situations where there is a fixed charge and a variable charge.

When students are working on question 2 (mobile phone tariffs) you could discuss why the first tariff is direct proportion, but the second is not.

At the end of the activity, check that students appreciate why the plumber's charges are not directly proportional to the time worked, and how you can tell this from the graph.

Also discuss the significance of the intercept and gradient of the graph.

Ask about the advantages and disadvantages of using a graph (once drawn, the graph is quick to use, but less accurate than calculating each charge separately).

## Extensions

The last question requires students to be able to calculate basic percentages and to use appropriate spreadsheet formulae. Level 2 students could be encouraged to express the rules for each question in the form  $y = mx + c$ .

## Answers

**1a** £ 120, **b**  $3\frac{3}{4}$  hours

**2c** 1000 minutes costs the same on both tariffs.

**2d** Lo-user is cheaper for less than 1000 minutes, and Chatterbox for more than 1000 minutes.

**3b ii** £11.20 **b iii**  $1\frac{3}{4}$  miles **c iii**  $\text{£}8.80 - \text{£}6.85 = \text{£}1.95$

**3c iv** Both have a fixed starting price, and the further you go the more it costs. Night Rate and Sunday has a greater fixed starting price and is steeper (larger gradient) because the cost per mile is more.

**4b ii** £2000 in sales **iii** earns £200 basic wage without any sales

**4d iii** Gradient =  $\frac{1}{5}$  or 0.2 which are equivalent to 20%

**4d iv** Earnings are the same for £2000 sales.

The new 20% scheme is better for the reps if they can sell more than £2000 worth of goods.