Plumbers' prices

The charges made by two plumbers include a basic call-out charge plus an hourly rate:

Pete Basic charge of £33 plus £25.75 per hour

Lauren: Basic charge of £19.80 plus £32 per hour

This activity shows how to use a graph to find out which plumber gives the best deal.

Information sheet

A Using a spreadsheet to work out Pete and Lauren's prices

Think about

Pete's total charge in £ for h hours of work is given by: $C = 33 + 25.75h$
Can you explain this formula?

1 Using C and h again, write a similar formula for Lauren's total charge in £.

The formulae are now written as a pair of equations involving two variables, C and h. Two equations with two unknowns are called ***simultaneous equations***. They can be solved using a graph.

2 Use the formulae to set up a spreadsheet table using three columns.

Put a heading h (for number of hours) at the top of column A.

Put C (Pete) at the top of column B for Pete's total charge in £.

and C (Lauren) at the top of column C for Lauren's total charge in £.

The formulae you need are given below.

To use 0 as the first value of h, enter 0 in cell A2.

Write a spreadsheet formula in cell B2 to calculate Pete's total charge.

Write a spreadsheet formula in cell C2 to calculate Lauren's total charge.

Write a spreadsheet formula in cell A3 to calculate the next value of h.

	A	B	C
1	h	C (Pete)	C (Lauren)
2	0		
3	1		

Numerical values

	A	B	C
1	h	C (Pete)	C (Lauren)
2	0	=33 + 25.75*A2	=19.8 + 32*A2
3	=A2+1		

Formulae

3 Use 'fill down' to complete the table as far as $h = 8$.
Check that your results are as shown below:

	A	B	C
1	h	C (Pete)	C (Lauren)
2	0	33	19.8
3	1	58.75	51.8
4	2	84.5	83.8
5	3	110.25	115.8
6	4	136	147.8
7	5	161.75	179.8
8	6	187.5	211.8
9	7	213.25	243.8
10	8	239	275.8

Numerical values

	A	B	C
1	h	C (Pete)	C (Lauren)
2	0	=33 + 25.75*A2	=19.8 + 32*A2
3	=A2+1	=33 + 25.75*A3	=19.8 + 32*A3
4	=A3+1	=33 + 25.75*A4	=19.8 + 32*A4
5	=A4+1	=33 + 25.75*A5	=19.8 + 32*A5
6	=A5+1	=33 + 25.75*A6	=19.8 + 32*A6
7	=A6+1	=33 + 25.75*A7	=19.8 + 32*A7
8	=A7+1	=33 + 25.75*A8	=19.8 + 32*A8
9	=A8+1	=33 + 25.75*A9	=19.8 + 32*A9
10	=A9+1	=33 +25.75*A10	=19.8 + 32*A10

Formulae

Think about

Compare the prices in the table.
For what times does Pete charge more?
For what times does Lauren charge more?
How much more does Lauren charge than Pete for 6 hours work?

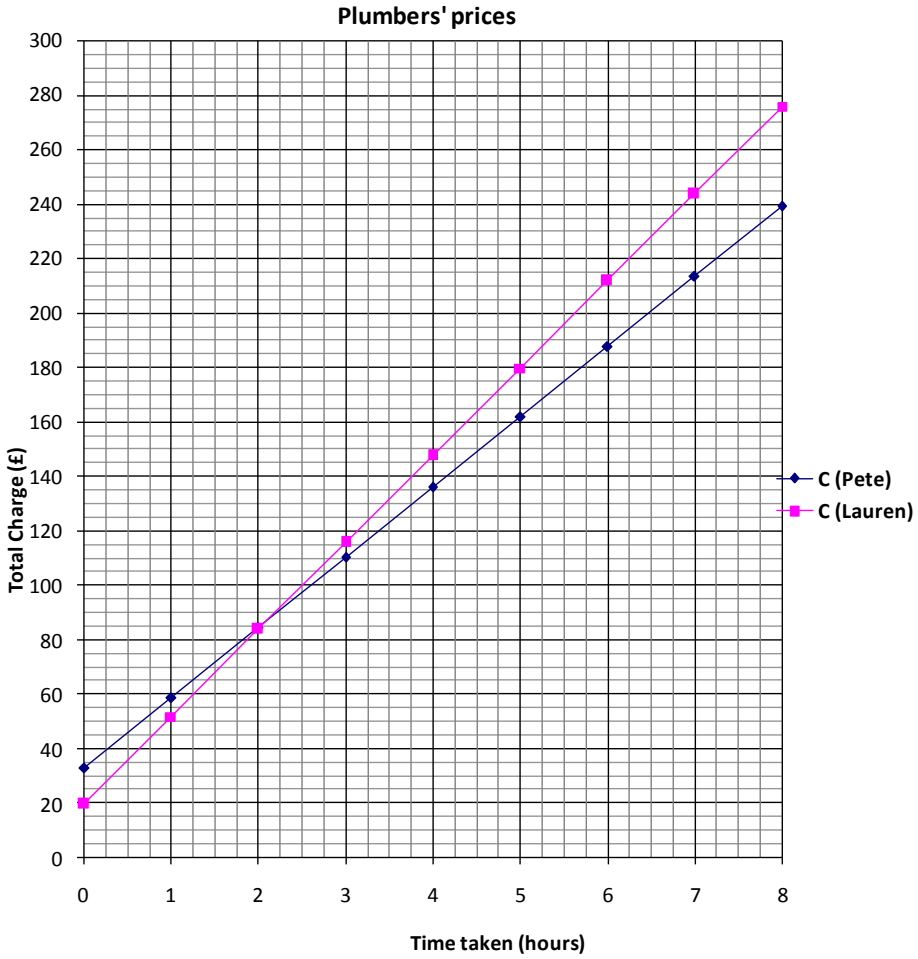
B Using a graph to compare Pete's and Lauren's prices

1 Highlight the values in columns A, B and C and ***draw a scatter graph*** – use the points joined with lines option.

2 Format your graph so that the gridlines enable you to read values easily.

If you wish use the scales on the graph below:

- 1 square on the horizontal axis represents $\frac{1}{4}$ hour
- 1 square on the vertical axis represents £5.



Think about

Whose basic charge is the greatest? How can you tell this from the graph?

Whose hourly charge is the greatest? How can you tell this from the graph?

Who charges the least for jobs that take a short time?

Who charges the least for jobs that take a long time?

Why is the point where the lines cross important?

3 Print your graph and use it to complete the following:

a For 5 hours of work:
Pete charges …… and Lauren charges ……

b For $1\frac{1}{2}$ hours of work:
Pete charges …… and Lauren charges ……

c) For $7\frac{1}{4}$ hours of work:
Pete charges …… and Lauren charges ……

d Pete and Lauren charge exactly the same for …… hours of work.
The charge for this work is ……

Invitations

Information

A shop sells ready-made invitation cards costing 5 pence each.

It also gives customers the option of creating their own design of cards. This option costs £4.50 plus 3 pence per card.

A graph can be drawn to compare prices.

Try this

1 Write down a formula for the price, £P, of n ready-made cards.

P = ……

Write down another formula to give the price, £P, of n customer-designed cards.

P = ……

You will now have a pair of equations involving two variables, n and P.

2 Use ***spreadsheet formulae*** to draw up a table like the one started below.

Extend your table to give prices of cards at intervals of 50 cards, up to a maximum of 500 cards.

The numbers at the beginning of your table should be as shown below.

	A	B	C
1	***n***	**£*P* (Ready-made)**	**£*P* (Customer designed)**
2	0	0	4.5
3	50	2.5	6
3	…	…..	…..

Numerical values

3 Draw a ***scatter graph*** (choose the line with points) to illustrate the prices.

Format the graph so that values can be read from it easily.

4 Print your graph then use it to complete the following.

a 120 ready-made cards cost ……

and 120 customer-designed cards cost …….

b 370 ready-made cards cost ……

and 370 customer-designed cards cost …….

c Estimate the number of cards for which the cost is the same whether you buy ready-made or customer-designed cards

…… cards.

The estimated cost for this number of cards is ……

At the end of the activity

When you use a graph to compare prices made up from fixed and variable charges:

- how can you tell which is the greatest basic charge?
- how can you tell which is the greatest variable charge?
- what information is given by the point of intersection of the lines on the graph?

Optional extension

Use algebraic equations to find:

- the number of hours' work for which the two plumbers charge the same amount
- how many invitation cards cost the same in both price schemes.