Lesson plan: MATHS KS3

ALTERNATIVE VOUCHERS

Making sound decisions about purchases is an essential use of mathematical thinking

In this lesson, students consider pairs of alternative discount vouchers in a restaurant and reason about which one will save them more money. This involves comparing percentage reductions when the total bill is of different sizes, and the answer depends on how much money is being spent. There are opportunities to consolidate understanding of percentages and graphical representations of relationships to make sense of a real-life problem.

Q Which of two discounts saves you more money in different situations?

STARTER ACTIVITY

Q *Suppose you go to eat in a restaurant. You have two discount vouchers, but you can only use one of them. Which one will save you more money? Why?*

MONEY-OFF VOUCHER
£6 off
your entire bill!

DINING VOUCHER
30% off
your entire bill!

Students will realise that as the bill increases the '30% off' will increase as well, and eventually overtake the fixed '£6 off'. So, the thing to work out is where this critical point is:
30% of what amount = £6 ?
This amount is £20. So, if your entire bill is less than £20, use the 'Money-Off' voucher, and, if your entire bill is more than £20, use the 'Dining' voucher. (And if your bill is exactly £20 then it doesn't matter which voucher you use!)

DOWNLOAD
the TASK SHEET for this lesson at
teachwire.net/ks3vouchers

WHY TEACH THIS?

This lesson helps students to make reasoned choices about which option will save them more money.

KEY CURRICULUM LINKS

- extend understanding of the number system; make connections between number relationships, and their algebraic and graphical representations
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- interpret fractions and percentages as operators

A PDF OF ALL THE VOUCHERS USED IN THIS LESSON IS AVAILABLE AT
teachwire.net/ks3vouchers

MAIN ACTIVITY

Q Suppose you go to eat in a restaurant and this time you have the two discount vouchers shown below, but, once again, you can only use one of them. Which one will save you more money this time? Why?

MAIN MEAL VOUCHER
40% off
your main meal!

DINING VOUCHER
30% off
your entire bill!

Before students begin the task, you may need to clarify for them that, for the purposes of this task, 'main meal' means one main course, not including starter or dessert or drinks.

Encourage students to try out different scenarios where different parts of their meal cost different amounts and see what happens when they apply each voucher. You could encourage them to draw graphs showing the saving made by each voucher for different costs of main meal and entire bill.

If students solve this problem quickly, invite them to vary the percentages and see what effect this has. Can they generalise to a% off a main meal versus b% off the entire bill?

They could also invent their own alternative pairs of offers for another student to try.

DISCUSSION

Q *What did you find out? Which voucher would you use when? Why? How did you work it out? What happens for different percentages? What other possible vouchers did you invent? What did you find out?*

Both of these vouchers save you more money the more that you spend, but the balance between main meal and the rest becomes important now.

Although students will probably work numerically, an algebraic solution may be accessible. Algebraically, if the main meal costs £m and the rest of the bill is £r, then, although the blue voucher gives a lower percentage off, as r increases relative to m there will come a point where the two vouchers save you the same amount of money. At this point,

$$0.6\,m + r = 0.7\,(m + r),$$

so $0.3r = 0.1m$, meaning that $m = 3r$. So, if the main costs more than ¾ of the entire bill, then the red voucher will save more money than the blue voucher; otherwise, the blue voucher wins.

In general, for an a% reduction on the red voucher and a b% reduction on the blue voucher, the vouchers will save the same amount when

$$\left(1 - \frac{a}{100}\right) m + r = \left(1 - \frac{b}{100}\right)(m + r)$$

which reduces to $m = \frac{br}{a-b}$, provided that $b < a$. So, the red voucher will save more money than the blue voucher if the main costs more than $\frac{b}{a}$, of the entire bill.

ADDITIONAL RESOURCE

There is a nice percentages task that can be found at **nrich.maths.org/1118**

GOING DEEPER

Confident students could invent their own problems of this kind, where there are multiple alternative restaurant vouchers.

ABOUT OUR EXPERT

Colin Foster is a Reader in Mathematics Education at the Mathematics Education Centre at Loughborough University. He has written many books and articles for mathematics teachers. His website is www.foster77.co.uk, and on Twitter he is @colinfoster77.