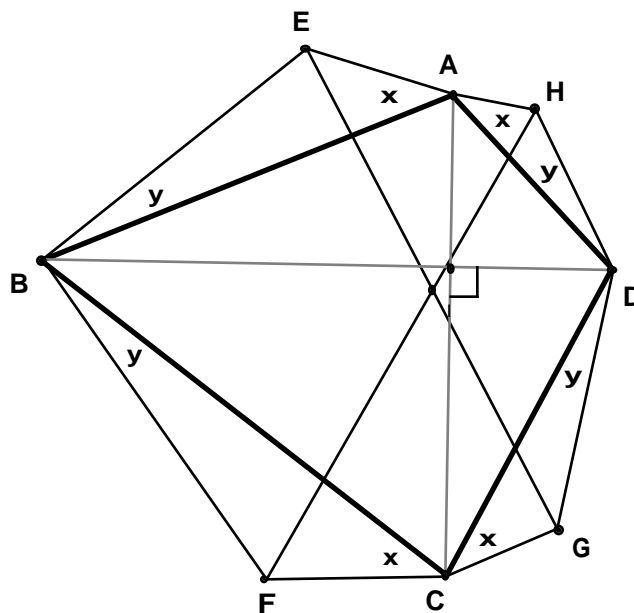


Reader Investigations, 2005

1. The difference between the positive integers 13 and 7 is exactly one-twentieth of the difference between their squares, e.g. $13 - 7 = 6$ and $13^2 - 7^2 = 120$. How many other pairs of positive integers can you find whose difference is exactly one-twentieth the difference of their squares?
2. The following delightful puzzle was invented by Steven Landsberg (University of Illinois, Urbana-Champaign) and posed in the March 2005 *Math e-Newsletter*: Ten pirates have got their hands on a hoard of 100 gold pieces, and wish to divide the loot between them. They are democratic pirates, in their own way, and divide as follows. The fiercest pirate makes a proposal about the division, and everybody votes - one vote each including the proposer. If 50% or more are in favour, the proposal passes and is implemented forthwith. Otherwise the proposer is thrown overboard and the procedure is repeated with next fiercest pirate. Which proposal will maximise the fiercest pirate's gain? (*Hint*: work backwards).
3. The following was posed in the April 2005 *Math e-Newsletter*: Consider the corresponding analogues of perpendicular bisectors, angle bisectors, altitudes and medians of a triangle for a tetrahedron, and investigate which of these are also concurrent for a tetrahedron. If true, prove it; if not, provide a counter-example.



4. Given any quadrilateral $ABCD$ with $AC \perp BD$ and similar triangles constructed on the sides as shown above, prove that $EG = FH$.

The n kg chicken

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(From *Mathematics Teaching*, March 2006, p. 33, published by the ATM)

I was visiting a secondary school in Nottingham to observe one of my students. As I glanced round the room one student seemed detached from the rest of the group – literally (she was sitting on her own at the back) and through a lack of engagement with what the rest of the class were doing. So I sat next to her; we'll call her Simone.

She engaged with me immediately: "I'm not supposed to be in this group – I've been sent down here for messing about."

She was working her way through a booklet that the rest of her peers in her 'normal' group were following, so I asked her what she was doing. "It's stupid – look, I've got to work out how long to cook a chicken that weighs n kg. What's a chicken that weighs n kg?"

I looked at the page – it told us that we had to cook chickens for 20 minutes per kg + 20 minutes.

So I asked Simone, "How long would you have to cook a 3 kg chicken for?"

Simone looked at me frustrated, tutted very loudly and the following conversation ensued:

Simone: "It isn't a 3 kg chicken – it's an n kg chicken!"

Tony: "But say it was 3 kg; how long would you cook it for?"

Simone: "Well that's easy – 1 hour 20 minutes."

Tony: "Ok – and how long would you cook a 5 kg chicken for?"

Simone (increasingly frustrated): "it isn't a 5 kg chicken – it's an n kg chicken!"

Tony: (trying to remain calm, aware of irritated glances from the rest of the class) No – but say it was 5kg.

Simone (very quickly): 2 hours.

Tony: So how are you working it out?

Simone: You just add up the 20 minutes for each kg and then add on an extra one.

Tony: So how many 20s for 3 kg?

Simone: 3 and another one.

Tony: And for 5?

Simone: 5 and another one.

Tony: (writing) So if I wrote n lots of 20 and another 20 like this: $n \times 20 + 20$, what does that mean?

Simone: Well I suppose that's the answer – but there isn't such a thing as an n kg chicken.

I left later wondering how often we give tasks to mathematics learners that they can already do but the task somehow manages to convince them that maths is hard and confusing and worst of all doesn't make any sense in their real world. So thanks, Simone, for teaching me that there is no such thing as an n kg chicken.

"Idealism increases in direct proportion to one's distance from the problem." - John Galsworthy, Nobel Laureate in
Literature

"Education is what is left over when you forget all the facts that your teacher made you memorize when you were in school." - Mark Twain