

Task 1

Kate's Date

Age 11 to 16

The mean mass of five giant dates was 50g.

Kate ate one, and the mean mass of the four remaining dates was 40g.

What was the mass of the date that Kate ate?

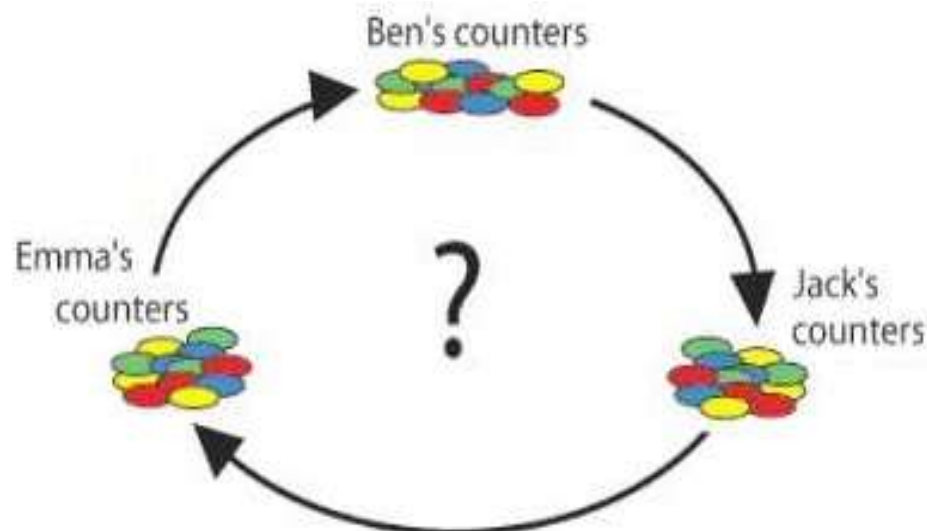
Task 2

Ben's Game

Age 11 to 16

Ben, Jack and Emma were playing a game with a box of 40 counters - they were not using all of them.

They each had a small pile of counters in front of them.



All at the same time, Ben passed a third of his counters to Jack, Jack passed a quarter of his counters to Emma, and Emma passed a fifth of her counters to Ben.

They all passed on more than one counter. After this they all had the same number of counters.

How many could each of them have started with?

Task 3

Fibonacci Surprises

Age 11 to 16

You may have seen this sequence before:

1,1,2,3,5,8,13,21,...

It is called the Fibonacci Sequence, and each term is calculated by adding together the previous two terms in the sequence.



Try adding together any three consecutive Fibonacci numbers.

What do you notice?

Can you explain it?

Choose any four consecutive Fibonacci numbers. Add the first and last, and divide by two.

What do you notice?

Can you explain it?

Add together any six consecutive Fibonacci numbers and divide by four.

What do you notice?

Can you explain it?

Can you discover any Fibonacci Surprises of your own?

Task 4

M, M and M

Age 11 to 16

There are several sets of five positive whole numbers with the following properties:

- Mean = 4
- Median = 3
- Mode = 3

Can you find **all** the different sets of five positive whole numbers that satisfy these conditions?

Can you explain how you know you've found them all?

Task 5

Fair Shares?

Age 14 to 16

Last weekend Mrs Jenkins won £25 and she gave her winnings to her five children.

She gave her first child **£1** plus $\frac{1}{6}$ of the money remaining.

She gave her second child **£2** plus $\frac{1}{6}$ of the money remaining.

She gave her third child **£3** plus $\frac{1}{6}$ of the money remaining, and so on...

Without doing any calculations, which child do you think ended up with the most money?

Work out how much each child received. Are you surprised?

Mrs Hobson also had some money to share with her family.

She gave her first child **£1** plus $\frac{1}{5}$ of the money remaining.

She gave her second child **£2** plus $\frac{1}{5}$ of the money remaining.

She gave her third child **£3** plus $\frac{1}{5}$ of the money remaining, and so on...

How much money did she have to share out if all the children received the same amount?

How many children were there in the family?

In a family with 8 children, the mother wants to give each child a lump sum plus a fraction of the remainder, in the same way that Mrs Jenkins and Mrs Hobson did.

How much money will she share out, and what fraction will she use each time, in order to share the money equally?

Extension

Imagine someone had n children.

How much money do you think you would need, in order to give every child an equal share using the method above?

Can you show that the first child will receive $\frac{1}{n}$ of the total?

Can you show that the second child will also receive $\frac{1}{n}$ of the total?

What about the third? The fourth? The k th child? ...

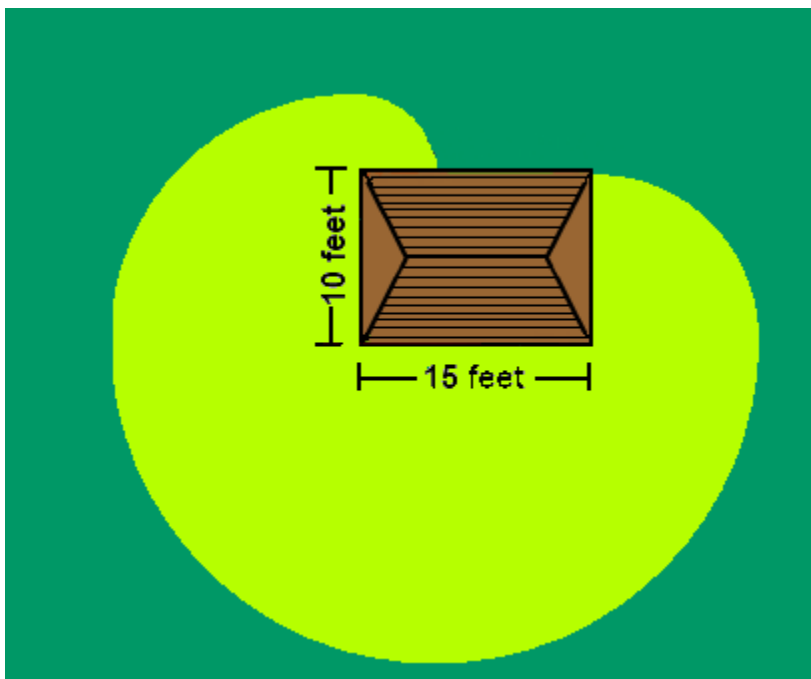
Task 6

An Unusual Shape

Age 11 to 14

Stuart tethered his goat to one end of a 20-foot length of rope and attached the other end of the rope to a hook fixed to the side of his shed.

When he came back the goat had eaten all the grass within its reach. Here is a picture showing the region eaten by the goat:



Where did Stuart fix the rope?

What was the area grazed by the goat?

Could the goat have eaten more grass if the rope had been attached to a different point on the shed?

Experiment with different lengths of rope. Where should the hook be positioned each time to allow the goat to eat the maximum amount of grass?

Task 7

Shopping Basket

Age 11 to 16

A mathematician goes into a supermarket and buys three items.

It has been a while since she has used a calculator and she multiplies the cost (in pounds, using the decimal point for the pence) instead of adding them.

At the checkout she says, "So that's £5.88" and the checkout attendant, correctly adding the items, agrees.

Can you find the values of the three items?

I wonder if the same can happen with other values?

Alison wrote a computer program, and found three values that add together and multiply together to give £5.49.

Can you find them?

Alison's program also found three values that add together and multiply together to give £5.55. Can you find these?

You may wish to write a program of your own - if you do, we would love to hear about it. Remember, if you send us a solution to any of these problems, be sure to explain your thinking!

Extension

A mathematician goes into a supermarket and buys four items.

It has been a while since she has used a calculator and she multiplies the cost (in pounds, using the decimal point for the pence) instead of adding them.

At the checkout she says, "So that's £7.11" and the checkout attendant, correctly adding the items, agrees.

Find four possible prices of the items.

Very Challenging Extension: Prove that the costs giving rise to £7.11 are unique.