

Four hundred years of calculating numbers:

1) Linear measurement

King James I of England and Scotland

Here is the basic information on linear measurement which guides you on the units of measurement that were used in the 1620s, almost 400 years ago.

As we now use a decimal system where everything is based on tens, the system used 400 years ago seems quite strange to us. However, it gives the chance to do some interesting calculation. Yes, a foot was about equal to a man’s foot and a yard was about equal to the length of a man’s belt, (or is it a man’s stride?).

12 inches = 1 foot

3 feet = 1 yard

5 ½ yards = 1 pole (a.k.a. rod or perch)

40 poles = 1 furlong

8 furlongs = 1 mile

Using the information shown above, calculate:

How many feet in 28 yards? \_\_\_\_\_\_\_ feet

How many inches in 12 ½ yards? \_\_\_\_\_\_\_\_ inches

Which of the following statements is CORRECT and which INCORRECT?

Do your calculations on separate paper then write C or I at the end of each sentence

below.

1. 359 inches = 10 yards.
2. 25 feet > 8 ½ yards.
3. 10 ½ yards < 4 poles but > ½ a furlong.
4. 3 ½ furlongs = 770 yards.
5. 1 mile > 1,500 yards, but < 1,750 yards.
6. 1 pole > 5 yards but < 16 ½ feet

Make up one problem of your own using < and /or > and the measurement system. Write it on the line below, then try it out on someone.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



King James I of England and Scotland

Four hundred years of calculating numbers:

2) Money

Just as with linear measurement, money was not a decimal-based system 400 years ago. There were no paper notes; the more valuable coins were gold, the rest were made of silver, even the penny. First the information, then the challenge of some calculations:

12 pennies = 1 shilling

20 shillings = 1 sovereign; ah, so \_\_\_\_\_\_\_ pennies make 1 sovereign.

1 angel = ½ sovereign

1 crown = ½ an angel

1 half crown = ½ crown or ¼ of an angel

1 sixpence = ½ a shilling.

Let’s have some fun with fractions!

1) 3 shillings is what fraction of 1 sovereign? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) 1 shilling is what fraction of one and a half angels? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) What fraction of 1½ angels is one half a crown? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Which of the following statements is CORRECT and which INCORRECT?

Do your calculations on separate paper then write C or I at the end of the sentence.

a. ¼ angel > 3 shillings.

b. 479 pennies = 2 sovereigns.

c. 4 half crowns = 1 angel but > 100 pennies.

d. 12 sixpences > ½ angel.

e. 2 ½ angels > 1 sovereign but < 4 crowns.

f. 420 pennies = one sovereign, one angel and one crown.

Make up one problem of your own including at least one fraction and the money system used in the 1620s. Write it on the line below then try it out on someone.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



 Four hundred years of calculating numbers:

3) Resurfacing the driveway

King James I of England and Scotland

Although there isn’t a driveway at the 1620s House today it is almost certain that there would have been one to allow the Digbys to approach their property in style.

As they will be receiving very important guests, it has been decided to resurface the driveway which has potholes and is rather worn way. That is going to cost quite a bit of money and Katherine Digby will have to choose between two types of surface, one more expensive than the other.

To Help out, you will do the cost calculations for both types of surface so that Katherine Digby can make a choice according to the money available. To be able to do this work you will have to look at the pages on linear measurement and money which give some of the information you need to do the calculations.

The driveway is 40 poles (or 1 furlong) in length.

Resurfacing using the cheaper material will cost 1 shilling per yard.

 How much will that cost in sovereigns and shillings?

 It will cost \_\_\_\_\_ sovereigns or \_\_\_\_\_\_\_\_ shillings.

 The more expensive material will cost 2 shillings and sixpence per yard.

 How much will it cost to use the more expensive material?

 It will cost \_\_\_\_\_\_ sovereigns and \_\_\_\_\_\_ shillings.

What is the difference between the cost of the cheaper and more expensive material?

 The difference between the two costs is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



 Four hundred years of calculating numbers:

4) Instant topiary for the garden

King James I of England and Scotland

You are probably wondering what topiary is and how it can be instant. Topiary means pruning and shaping shrubs and bushes so that they grow to make a particular shape. In this case it is instant because Katherine Digby wants to buy ready-shaped bushes growing in attractive pots to show off her garden. Good topiary was really admired in the 1620s.

There are three basic designs available, pyramids, cones and spirals and their costs reflect how difficult they are to grow. First of all, your challenge will be to work out how much each bush will cost including a terracotta pot for each one. You may well have to refer to the linear measurement and money pages.

Katherine Digby wants each bush to be one yard high, but the grower charges by the inch.

Pyramids are 3 pennies per inch, cones 4 pennies per inch and spirals 6 pennies per inch.

The large decorated terracotta pots costs 2 shillings each. (12 inches = 1 foot, 3 feet = 1 yard).

You could say that there are 36 inches in one yard, (12 x 3 = 36). Multiply the cost per inch by 36 which will give the cost in pennies. Then you will have to divide by \_\_\_\_\_ for cost in shillings. Don’t forget that each terracotta pot costs an extra 2 shillings, they don’t give them away!

Q1 What is the total cost in shillings of one:

Pyramid-shaped bush in a pot: The cost is \_\_\_\_\_\_\_\_\_\_shillings.

Cone-shaped bush in a pot: The cost is \_\_\_\_\_\_\_\_\_\_ shillings.

Spiral-shaped bush in a pot: The cost is \_\_\_\_\_\_\_\_\_\_ shillings.

Now for some interesting calculating… Katherine Digby has a budget of 18 sovereigns for the topiary which she will not exceed. One third of the budget must be spent on spiral bushes and she would like to buy as close as possible to an equal number of pyramid and cone bushes. Also, try and spend as close to the total budget of 18 sovereigns as possible. There may some money left over.

It may be easiest to work in shillings, but there are other ways, over to you.

(Please go on to the next page)

Q2 How many spiral bushes will be bought and what is their total cost in shillings?

1. I can buy \_\_\_\_ spiral bushes at a total cost of \_\_\_\_\_ shillings which = \_\_\_\_\_\_ sovereigns.

Remembering to try and ‘buy’ as close to an equal number of pyramid and cone bushes as you can and to spend a total which is as close to 18 sovereigns as possible….

1. How many pyramid-shaped bushes did you buy? I was able to buy \_\_\_\_\_\_\_

What was their total cost? Their total cost was \_\_\_\_\_\_\_\_\_ shillings.

1. How many cone-shaped bushes were you able to buy? I was able to buy \_\_\_\_\_\_\_\_\_\_

 What was their total cost in shillings? Their total cost was \_\_\_\_\_\_\_\_\_\_\_shillings.

Did you work out that one spiral-shaped bush would cost a total of 20 shillings which is one sovereign? If the total budget is 18 sovereigns, one third of 18 is 6. Therefore, 12 sovereigns which = 240 shillings is available to spend on the other two, shaped bushes.

Q3 Adding together all the bushes and pots bought, how close to the budget of 18 sovereigns did you get? Please show your evidence below.

The six spiral bushes cost \_\_\_\_\_\_ shillings.

The \_\_\_\_\_ pyramid bushes cost \_\_\_\_\_\_ shillings.

The \_\_\_\_\_\_ cone bushes cost \_\_\_\_\_\_ shillings.

The total money available was 18 x 20 = 360 shillings.

I spent \_\_\_\_\_ shillings so that leaves \_\_\_\_\_\_ shillings unspent.



Four hundred years of calculating numbers:

 5) Sundial and statues

King James I of England and Scotland

Just two more bits of ‘bling’ are needed for the garden. The good news for Katherine Digby is that only one thing will have to be bought new and that is the sundial.

In the 1620s clocks were very rare and expensive, so sundials were useful and popular.

**Q1**, can you think of two situations in which a sundial would not be of much use?

1

2

The face of the sundial to be made is circular and two feet in diameter. It will stand on a stone column four and a half feet high. In addition to the usual writing on the face, the sundial will be inscribed with the words: ‘GOD SAVE THE KING’.

Master Brown, a stone mason, will charge 6 pennies per inch for the sundial face and 6 pennies per letter for the inscription about the King, while there is no charge for the stone column.

Master Grey, another stonemason, will charge 4 pennies per inch for the sundial face, 2 shillings per foot for the stone column and 1 shilling and sixpence for the whole inscription about the King.

**Q2** Work out which stonemason will charge less for the same job and explain your answer.

I think that Master\_\_\_\_\_\_\_\_\_\_\_\_ will charge less for making the sundial.

I think that because his total cost will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ while the more expensive sundial will cost\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The statues that Katherine also wants will be borrowed from the Digby’s other house in Rutland. They just have to pay a carter for bringing and returning them.

The distance each way is 27.5 miles which is a long day’s travel on bad roads. The carter charges one shilling per mile including a bed for the night and food.

**Q3** How much less than three sovereigns will the carter charge for both journeys?

The carter will charge \_\_\_\_\_\_\_\_\_\_\_ which is \_\_\_\_\_\_\_\_ < than three sovereigns.



 Four hundred years of calculating numbers:

6) Tapestries for the wall

King James I of England and Scotland

The walls are looking rather bare in the Great Hall in the 1620s House. Tapestries were regarded as a sign of high status and they would impress visitors, so Katherine Digby has decided that she would like to buy four tapestries each one showing a different scene from the Bible. The tapestries will come from the Mortlake Company in London which was established in 1619 at the suggestion of King James.

Each tapestry will measure 12 feet long by 9 feet wide and they come in two different qualities.

The cheaper one costs 3 shillings and sixpence per square yard, the more expensive one, one crown per square yard.

Can you think of one thing that might make a tapestry more expensive? Write it on the line below:

The tapestries have been measured in feet, but the price for them is in square yards.

**Q1** Can you work out a link between feet which is a linear measurement and square yards which is a measure of area?

Once you have sorted that out you can work out the cost of the two types of tapestry.

**Q2** One tapestry measuring 12 feet by 9 feet costing 3 shillings and sixpence a square yard will cost: \_\_\_\_\_\_\_\_\_\_\_\_ shillings.

**Q3** Four of those tapestries will cost a total of \_\_\_\_\_\_\_shillings; or \_\_\_\_\_\_ sovereigns and \_\_\_\_\_shillings.

Q4 One tapestry measuring 12 feet by 9 feet costing one crown per square yard will cost:

\_\_\_\_\_\_\_\_\_\_ shillings.

Q5 Four of those tapestries will cost \_\_\_\_\_\_ shillings; or \_\_\_\_\_\_\_ sovereigns and \_\_\_\_\_\_ shillings.

Q6 How much cheaper are the four less expensive tapestries?

The four less expensive ones are \_\_\_\_\_\_ sovereigns and \_\_\_\_\_\_ shillings cheaper.



 Four hundred years of calculating numbers:

7) New dining furniture

King James I of England and Scotland

With 10 people to seat at the table, the dining table in the Great Hall is really not big enough. Also, the chairs are not a matching set, (not very impressive!). Luckily the table’s legs and under stretchers are big and strong enough to take a larger top, so that is all that is required. Katherine Digby has heard that walnut is replacing oak as a fashionable timber and she would like to use that to impress her guests. However, unlike oak, walnut has to be imported from France and is more expensive.

The new table top needs to measure 12 feet long by 4 feet wide.

The new table top will also require a tablecloth which will have to hang down by 12 inches on all the sides of the table.

An oak table top will cost 1 shilling and four pennies per square foot, while one made from imported walnut will cost 3 shillings per square foot.

**Q1** Calculate the cost of a new table top in oak.

 The oak table top will cost \_\_\_\_\_ shillings or \_\_\_\_\_ sovereigns and \_\_\_\_\_ shillings

**Q2** Calculate the cost of a new table top in walnut.

 The walnut table top will cost \_\_\_\_\_ shillings or \_\_\_\_\_ sovereigns.

**Q3** What is the difference in cost between the two table tops in sovereigns?

 The difference in cost is \_\_\_\_\_\_\_ shillings or \_\_\_\_\_\_\_\_ sovereigns.

Now for the table cloth which will cost 6 pennies per square foot. (Remember that the cloth is quite a bit larger than the table top).

Q4 The new table cloth will cost \_\_\_\_\_\_\_ sovereigns and \_\_\_\_\_\_ shillings.

Q5 Finally, calculate the cost of the ten new chairs, two of which will have arms, costing three crowns each while the other eight will be without and will cost one angel each.

Will six sovereigns be enough to pay for the chairs? YES / NO.

If YES, how much money will be left from seven sovereigns? There will be \_\_\_\_\_\_\_\_\_\_\_\_



 Four hundred years of calculating numbers:

8) New tableware for the dining table

King James I of England and Scotland

The guests would expect to eat their food off plates made from pewter which is a metal alloy, so it is a mixture of metals, in this case, mainly tin plus some copper, lead and antimony. In case you are asking yourself about lead being poisonous…. Yes it was and yes it did sometimes make the users ill, or worse, depending on how much lead was in the pewter, what they ate and how they ate it.

Ten large and ten medium plates are required but pewter was bought by weight, so your calculations will involve the units of weight used in the 1620s.

All you need to know here is that 16 ounces make 1 pound in weight. That is on what is called the avoirdupois scale. (French for ‘to have some weight’).

The large, 14 inches in diameter plates weigh 2 ½ pounds each.

You need 10 of each size.

The medium, 9 inches in diameter plates weigh 1 ½ pounds each.

Each pound in weight will cost 11 pennies.

Q1 what is the total weight in pewter required? \_\_\_\_\_\_\_ pounds.

Q2 At 9 pennies per pound that will make a total of \_\_\_\_\_\_\_\_ pennies?

Q3 Written as sovereigns and pennies that makes \_\_\_\_\_ sovereigns and \_\_\_\_\_\_\_ pennies?.

Four plain, but solid silver serving dishes must also be bought. That is also bought by weight, but not on the avoirdupois scale but on the ‘troy’ scale in which 12 troy ounces = 1 troy pound.

Each silver serving dish weighs 1 ¾ troy pounds and four are required.

Q4 What is their total weigh in troy pounds? \_\_\_\_\_\_.

Each troy pound of silver costs one crown

Q5 If two sovereigns are given to pay for the silver, how much change is given? \_\_\_\_\_\_\_\_\_\_

The guests will drink out of beautiful glasses made in Venice. Coming all the way from the east coast of what is now Italy, they are not cheap…. In fact at 3 shillings and sixpence each, that’s dear!

So ten glasses required each costing three shillings and sixpence cost \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Will one sovereign one angel and one crown pay for the glasses? YES/NO



 Four hundred years of calculating numbers:

9) The ten bird roast

 King James 1 of England and Scotland

Katherine and her cook have planned something really special as part of the first course of the dinner. You may have heard of people eating a five bird roast, especially at Christmas time? The idea is that five birds, each of a different size are plucked and dressed, ready for cooking. Often, only the breast meat of the smaller birds is selected. The idea then is that the five birds are stuffed inside the largest bird and they are cooked together.

A quick question; when stuffing the birds into the largest bird, do you think it would matter in which order the birds were put in?

I think\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The birds included in ascending order from the smallest are:

Skylark, thrush, pigeon, quail, partridge, pheasant, duck, goose, swan and heron.

The tiny skylark weighs one ounce, the thrush two ounces and each successive bird weighs double the one before in the order. Calculation time:

What is the total weight in ounces of all ten birds?

The ten birds weigh a total of \_\_\_\_\_\_\_\_ ounces.

In pounds and ounces that is \_\_\_\_\_\_ pounds and \_\_\_\_\_\_\_ ounces.

Which of the birds have a weight which is equal to a square number?

What do you notice about the total weight of all the birds and double the weight of the heaviest bird?, the heron which weighs 512ounces?

I notice that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



 Four hundred years of calculating numbers:

10) Special fruit for the banquet

 King James 1 of England and Wales

In Elizabethan and Jacobean times when people talked about a banquet they meant the sweet, pudding or dessert course. Katherine Digby has managed to buy some special fruit to impress her guests, especially the Spanish Ambassador. Yes, we can get the sort of fruits listed below at almost any time because it is so easy to transport them around the world. In the 1620s it would have been very difficult and expensive to provide fruit like that. It would have impressed the guests!

There are six different fruits:

Pineapple, orange, lemon, peach, nectarine and pomegranate, cut into portions.

The ten people attending the dinner are Catholics and the number three is important to them. So the rule for the banquet course is that each person can select one of each of three out of the six fruits. So someone might choose pineapple, orange and lemon; one each of three different fruit.

Here comes the first calculation:

There are six different fruit and the guests have to choose three different fruit out of the six.

 How many possible different choices under those rules are possible? Hint, it might be easier if you give each fruit a number rather than writing down the name each time. Try and find a methodical way so that you don’t repeat any of the combinations. Another hint, the answer is > 10 but < 30. Please show your working out in the space below.

1, 2, 3.

1, 2, 4.

1, 2, 5. And so on (yes?)

1, 2, 6

 I found that the number of different combinations of three is \_\_\_\_\_\_\_\_\_ ‘combinations’.

Last challenge, really. In case all ten people want the same three items of fruit, how many portions of fruit must be provided to make sure that can happen when it isn’t known which three they will choose until they choose them? (Yes the number is well clear of 100).

 I think that \_\_\_\_\_\_\_ portions will have to be provided.

Well, thank you for all your help with these calculations. Mistress Katherine will be most pleased and can now start spending the money to make the house and gardens look splendid for our guests.