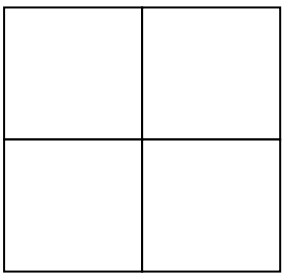
Investigation 1 - Adding squares to a hundred

Here is a grid made out of 4 squares



Step 1 - Choose 4 digits from the numbers 1 to 9 – this is any four digits from 1, 2, 3, 4, 5, 6, 7, 8, or 9.

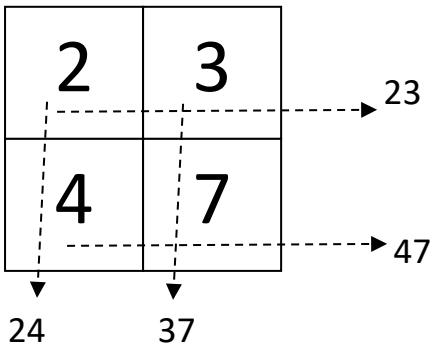
Write each digit in a different square on the grid.

Step 2 Use your grid to create four 2-digit numbers.

Step 3 – Add the 2-digit numbers together to get your total.

Example

I have decided to use the digits 2, 3, 4 and 7.



My four 2-digit numbers are 23, 47, 24 and 37.

$$\begin{array}{r} 23 \\ +\ 47 \\ +\ 24 \\ +\ 37 \\ \hline 131 \end{array}$$

In this case **my total is 131.**

For the following tasks, you can use the grids on the page 3 or draw your own grids.

The bronze task is the easiest. Everybody should try it.

The silver task is harder – have a go if you feel confident that you did well on the bronze task.

The gold task is the hardest – can you meet the challenge?

BRONZE TASK

1. Choose your own four digits and work out your total.
2. Use the same digits in a different order. Did you get the same total?
3. Keep trying the same digits in different orders. How many different totals can you get from the four different digits that you chose?
4. Choose other sets of four digits. Is there a quick way to see if the total will be even or odd?.

SILVER TASK

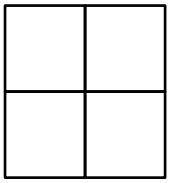
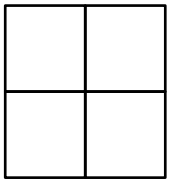
1. Your challenge is to find **four different digits** which give four 2-digit numbers **that add up to 100.**
2. How many different ways can you make 100?
3. What strategies did you use to help you?

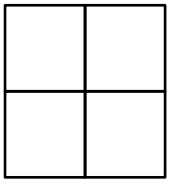
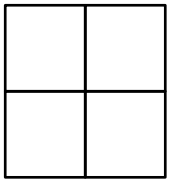
GOLD TASK

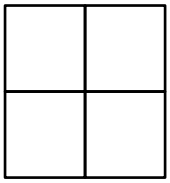
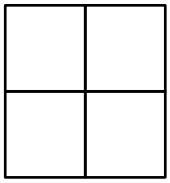
If we use four 0s, the total is 0.

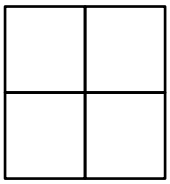
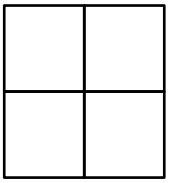
If we use four 9s, the total is 396.

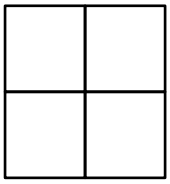
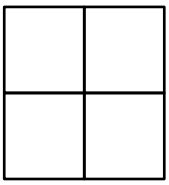
Which numbers between 0 and 396 is it possible to make?

Investigation 2 - Factors and Multiples

For this investigation, we use a 5 by 5 number grid and four shaded squares. You may find it easier to cut out the four shaded squares.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

You have to put the shaded squares on top of a one of the numbers in the grid.
You can only do this if:

- The shaded square is a multiple of the number on the grid, or
- The shaded square is a factor of the number on the grid.

Example

3	2	3	4	5
6	21	8	9	2
1	12	13	14	15
16	17	18	19	20
21	22	23	24	25

In this example:

3 has been placed on top of the number 1, because 3 is a multiple of 1 *(for example, 3 is in the 1 times table).*

21 has been placed on top of the number 7, because 21 is a multiple of 7. *(for example, 21 is in the 7 times table).*

2 has been placed on top of the number 10, because 2 is a factor of 10. *This means that 2 divides into 10 without a remainder.*

1 has been placed on top of the number 11, because 1 is a factor of 11.

For the following tasks, you can use the 5 by 5 grid at the top of page 5 and cut out the shaded squares. Or you can draw your own grids.

The bronze task is the easiest. Everybody should try it. If you struggle, there are some clues on page 6.

The silver task is harder – have a go if you feel confident that you did well on the bronze task.

The gold task is the hardest – can you meet the challenge?

BRONZE TASK

1. Try putting the number 21 onto the grid.
2. How many different places can you put the number 21 onto the grid?
3. Try putting the number 3 onto the grid.
4. How many different places can you put the number 3 onto the grid?
5. Try to put all the shaded squares onto the grid.
6. Find five different ways of putting the shaded squares onto the grid.

SILVER TASK

1. How many different places can you put the shaded number 1 onto the grid?
2. Put the shaded numbers 2, 3 and 21 onto some correct places on the grid. *Now,* how many different places can you put the shaded number 1 onto the grid? Is this always the case?
3. How many different places can you put the shaded number 2 onto the grid?
4. Put the shaded numbers 1, 3 and 21 onto some correct places on the grid. *Now,* how many different places can you put the shaded number 2 onto the grid? Is this always the case?

GOLD TASK

How many different ways can you put the shaded numbers onto the 5 by 5 grid?

Investigation 2 - **CLUES**

Only read these clues if you are struggling with the bronze, silver or gold challenges.

Clue 1: The factors of 21 are 1, 3, 7 and 21.
These are all of the whole numbers that divide into 21 without a remainder.

Clue 2: The factors of 3 are 1 and 3.
These are all of the whole numbers that divide into 3 without a remainder. (3 is a prime number because it has exactly two factors).

Clue 3: The factors of 2 are 1 and 2.
These are all of the whole numbers that divide into 2 without a remainder. (2 is a prime number because it has exactly two factors).

Clue 4: The only factor of 1 is 1.
1 is not a prime number because it has does not have exactly two factors.

Clue 5: The multiples of 3 on the grid are 3, 6, 9, 12, 15, 18, 21 and 24.

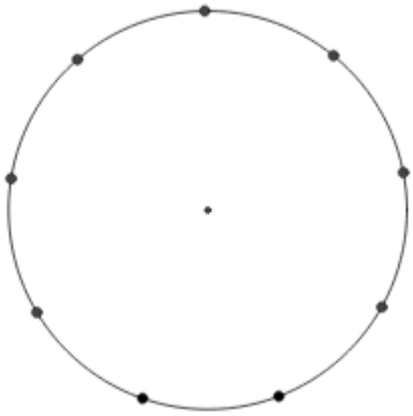
Clue 6: The multiples of 2 on the grid are 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24.

Clue 7: The only multiple of 21 on the grid is 21.

Clue 8: All whole numbers are multiples of 1.

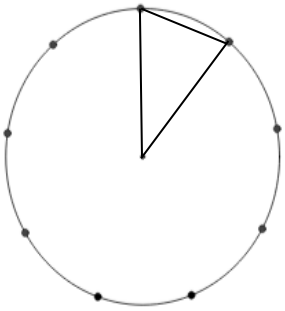
Investigation 3 - Triangles in Circles

This circle has 9 equally spaced points marked on its circumference.



This task involves joining 2 dots on the circumference to the centre of the circle using straight lines to make a triangle.

Example.



You can make a number of different triangles in the same way.

To make sure that the triangles are different, you may wish to use tracing paper to compare them (or cut one out to see if it fits on top of one of the other triangles).

For the following tasks, you can use circles on page 9. Or you can draw your own.

The bronze task is the easiest. Everybody should try it.

The silver task is harder – have a go if you feel confident that you did well on the bronze task.

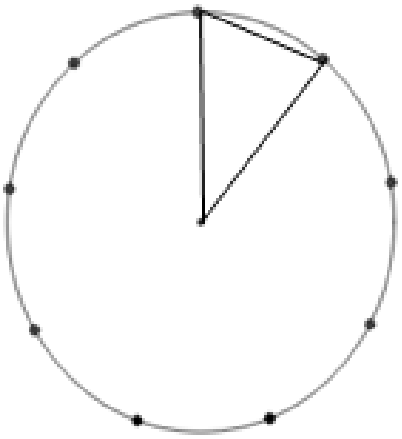
The gold task is the hardest – can you meet the challenge?

BRONZE TASK

Use the circles on page 9 to join 2 dots on the circumference to the centre of the circle using straight lines to make a triangle.

How many different triangles can you make?

SILVER TASK



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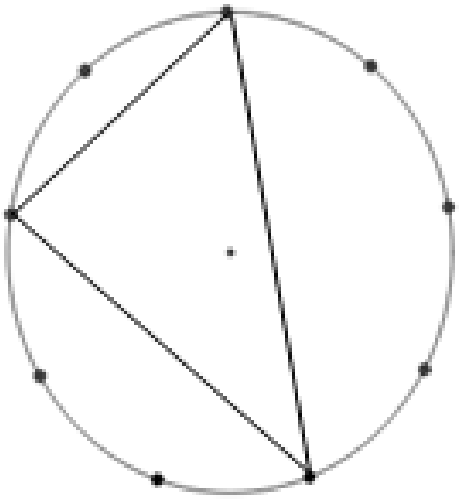
Look at the example to the left.

1. Can you work out the size of the three angles in the triangle?

There are some clues on page 10. Only use the clues one at a time if you are finding it difficult to get started.

2. Work out the sizes of the angles in your other triangles.

GOLD TASK



Look at the new example to the left.

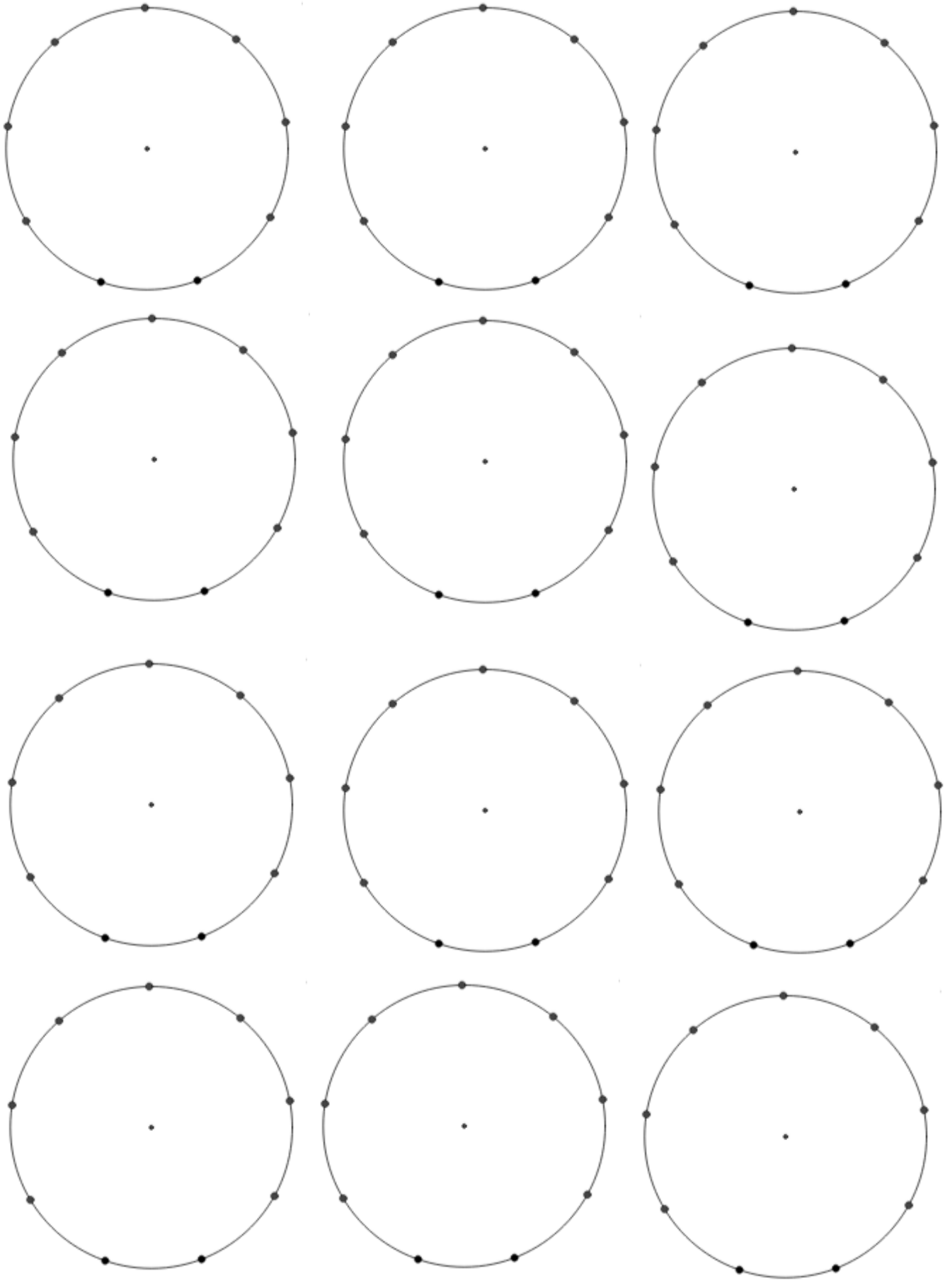
Now, you should join three dots on the circumference to make a triangle.

1. How many different triangles can you make by joining three points on the circumference?

2. Work out the sizes of the angles in the triangle on the left.

There are some clues on page 10. Only use the clues one at a time if you are finding it difficult to get started.

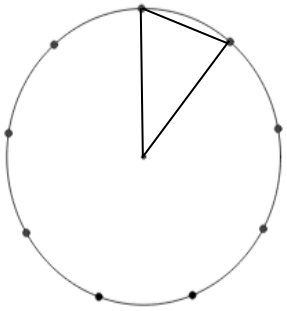
3. Work out the angles in each of your triangles.



Investigation 3 - **CLUES**

Only read these clues if you are struggling with the silver or gold challenges.

SILVER CHALLENGE CLUES



Clue 1: The total of all angles at the centre of a circle is 360°**.**

Clue 2: 9 of these triangles fit into the full circle.

Clue 3: To work out the angle of the triangle near to the centre of The circle, divide 360°**.**

Clue 4 : This is an isosceles triangle.

Clue 5 : The three angles in a triangle add up to 180°.

Clue 6: Two of the angles in an isosceles triangle are the same.

GOLD CHALLENGE CLUES

Clue: The big triangle can be split into three smaller triangles. These three triangles can be found in the silver challenge.