Y7 Academic Mathematics Enrichment

These tasks are created to encourage you to problem solve, think creatively and outside the box. You might explore some new areas of mathematics that you may want to research further on the Internet if you wish to. Some tasks will take longer than others and some tasks are open-ended, so you may not complete them "fully", which is perfectly okay. You can attempt the tasks in any order you wish and you don't need to start with Activity 1. See which one you fancy! Please send in any solutions to your Mathematics teacher and ask for help and guidance if you require it. We hope you have fun trying these activities.

Activity 1

Complete the following:

- Using only the digits 3, 4, 6, 7, and 8. (You can repeat digits or not use one)

```
    7  ?
X      ?
-------
4  ?  8
```

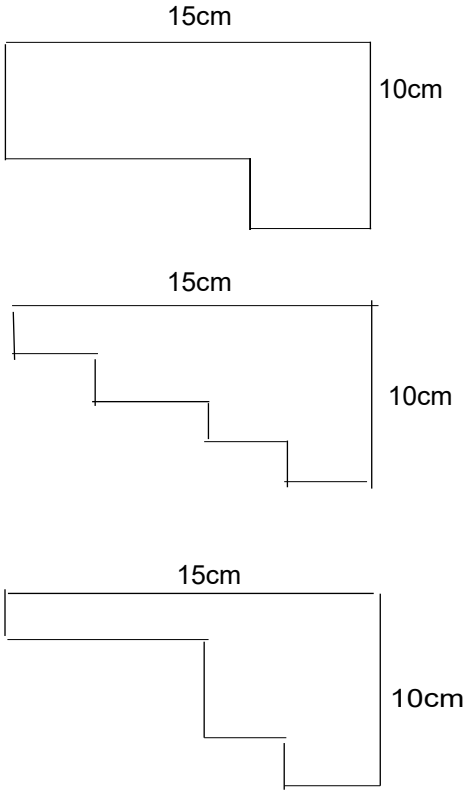
- Using only the digits 1, 2, 3, 4 and 5 (use all digits once)

```
    ?  ?
X      ?
-------
   ?   ?
```

- How many solutions are there? Explain why.
- Using the digits 1, 2, 3, 4, 5, 6, 7 complete:

```
    ?  ?  ?
X         ?
----------
    ?  ?  ?
```

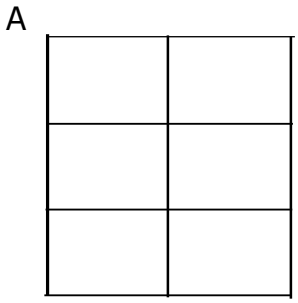
Activity 2



Draw these shapes on squared paper.

- Find the perimeter of the above shapes? Explain what you have done.
- Which of these shapes has the greatest area?

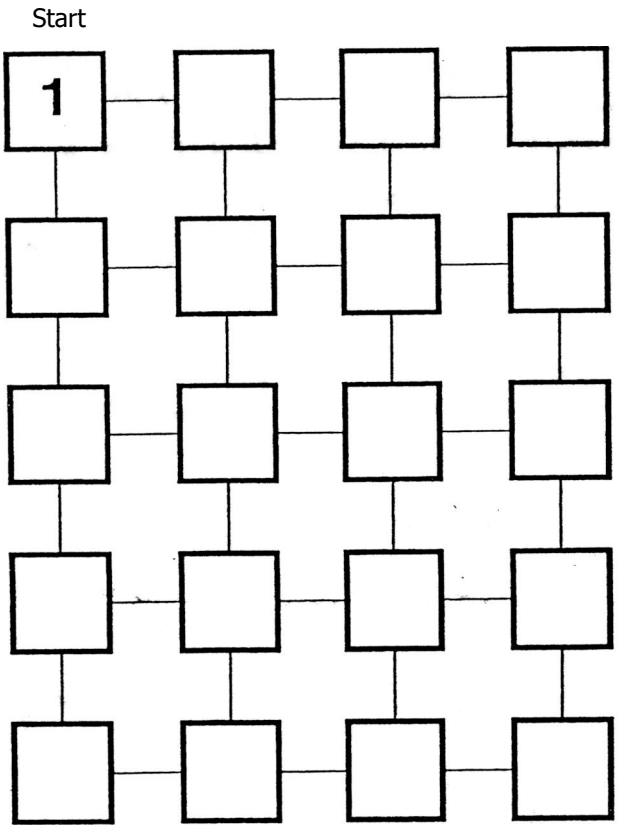
Activity 3



- How many ways can you get from A to B moving only in the following directions: right → or down ↓.
- Can you justify your solution?

What about a 3 by 4 grid - how many ways are there of crossing this?

The same rules apply: moving only in the following directions right → or down ↓.



- Can you fill in all the boxes?
- How many ways are there of crossing a 5 by 6 grid?

Do you notice anything about the numbers?

Activity 4

Recurring Number Magic

Effect: You write down the following 8 digit number on a piece of paper:

1 2 3 4 5 6 7 9

Then ask a friend to circle one of the digits. Say that they circle number 7.

You then ask your friend to multiply the 8 digit number by 63, and magically the result ends up being:

```
  1 2 3 4 5 6 7 9
X           6 3
 7 7 7 7 7 7 7 7 7
```

with the answer as a row of the chosen number 7.

How would it work with the other numbers?

What would you have to multiply 12345679 by to get 111111111, 222222222, 33333333, etc.?

Digit-Sum Spirals

What is a spiral? Can you draw a spiral on a squared grid?

Start by finding some **digit-sums:**

24 > 2+4 = **6**

47 > 4+7 = 11 > 1+1 = **2**

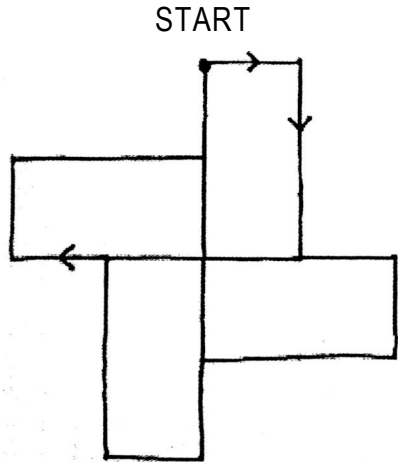
149 > 1+4+9 = 14 > 1+4 = **5**

So the digit sum of 149 is 5

Now create a **digit-sum spiral for multiples of 3:**

1. Write out multiples of 3 in a column (up to 15 x 3?)Write the **digit-sum** alongside each number. (3,6,9,3,6,9,3,6,9,3 ...)
2. Discuss any patterns that can be seen in the sequence of digit sums.
3. Start to draw the spiral (0.25 cm squared paper is recommended) :
4. Starting point is at the top of the page, in the centre.
5. First line : RIGHT **3** squares
6. Turn clockwise 90 degrees, then DOWN **6** squares
7. Turn clockwise 90 degrees, then LEFT **9** squares..
8. Turn clockwise 90 degrees, then UP **3** squares...
9. Continue turning and using the **digit sums** until the **starting point** is reached: the 'spiral' is now complete!

It is perfectly OK to draw over part of a line that has already been drawn:



Digit-sum spiral for multiples of 3

Now try using multiples of other numbers:

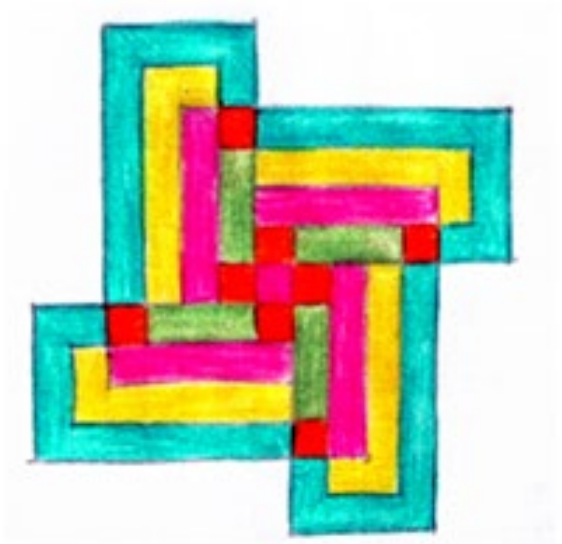
1,2,6,7,8,9 are straightforward; 4 and 5 are slightly trickier.

You will need to experiment to find a good starting point so that the spiral doesn't go off the paper.

Compare results:

Do any numbers have **similar** digit-sum spirals?

What about multiples of 10? 11? 12?..... Can you make any **generalized statements?**



Activity 6

- Take any quadrilateral and mark the midpoints of all four sides. Join the midpoints to form a quadrilateral. What shape is your new quadrilateral?

- Try for different types of quadrilateral and summarise your findings — attempt to explain any of your findings.

- If I tell you the quadrilateral I found by following the above instructions, is it possible for you to work out which quadrilateral I started with? Why?