Y9 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

This is a 51 digit number:

999999999999999999999999M 888888888888888888888888

The above number is divisible by 7.
- What value(s) could M take?
- Suggest different approaches to this problem?
- Research tests for divisibility by 7.

Activity 2

Investigation on a 10 x 10 grid

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	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	45	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- Highlight any block of 4 for example

1	2
1	12

- Add numbers on the diagonals
  e.g. 1 + 12 = 13
       2 + 11 = 13

- Repeat with two more blocks of 4.
- What do you notice?
- Can you be sure this is always true?
- Why?

(Introduce letters instead of numbers)
- Apply the rule. Does it still work?

- Repeat the above but:
  o   Change the size of the grid
  o   Change the size of the block e.g. 3x3
  o   Use a calculator
  o   Use a grid or multiples rather than consecutive numbers e.g

2	4	6			
3	6	9			

Activity 3 - Puzzles

1. Brothers and sisters

Each child in a family has at least 3 brothers and 2 sisters. What is the smallest number of children the family might have?

2. The Circle

A number of children are standing in a circle. They are evenly spaced and the 6th child is directly opposite the 16th child. How many children are there altogether?

3. The Pole

There is a pole in a lake. One-half of the pole is in the ground, another one-third of it is covered by water, and 9 ft is out of the water. What is the total length of the pole in ft?

4. The River

A man has to get a fox, a chicken, and a sack of corn across a river. He has a rowboat, and it can only carry him and one other thing. If the fox and the chicken are left together, the fox will eat the chicken. If the chicken and the corn are left together, the chicken will eat the corn. How does the man do it?

5. The Portrait

A man on a park bench is looking at a small portrait. You ask him, "Who is that in the picture?"
The man says, "Brothers and sisters, I have none, but that man's father, is my father's son."
Can you tell what person is in the picture?

6. Making 100

Using the numerals 1,7,7,7,7 create the number 100. As well as the five numerals you can use the usual mathematical operations +, -, x, ÷ and brackets ().

7. Cards

On your travels you come to an old man on the side of the road holding three cards from a standard deck face down. Trying to make conversation you ask him what the three cards are. He tells you, "To the left of the queen, are one or two jacks. To the right of the jack, are one or two jacks. To the right of the club, are one or two diamonds. To the left of the diamond, are one or two diamonds." What are the three cards?

Tell a student you are going to read their mind. Without anyone seeing you doing it, write down the number 1089 and give it to someone for safekeeping.
Ask them to:

Write 3 different non zero digits e.g.   413
Reverse the digits   314 -

Subtract the smaller number from the larger   099 (first total)

                    (Put in a zero if there is no digit there)

Reverse this new number and add it to the first total and add
                                     990
                                     099 +

                                   1089

Ask them to reveal their number before revealing yours and Hey Presto!

Dice trick

Give a 'spectator' three dice. Ask them to roll the 3 dice and record the numbers without revealing them to you. Ask them to

- Multiply the number on the first dice by 2
- Add 5 to the answer
- Multiply the result by 5
- Add this to the number showing on the second dice
- Multiply the answer by 10
- Add on the number on the third dice
- Tell you their total

You can now tell them the numbers they rolled

e.g. 2,3,4

$2 \times 2 = 4$

$4 + 5 = 9$

$9 \times 5 = 4\ 5$

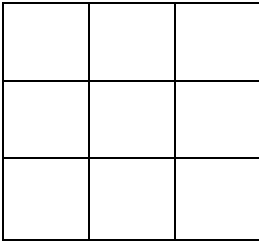$45 + 3 = 48$

$48 \times 10 = 480$

$480 + 4 = 484$

Subtract 250 from this total and the 3 digits of the answer are the numbers rolled

$484 - 250 = 234$ boom boom! **WHY DO THESE TRICKS WORK?**

Activity 5

How many squares can you find?
How many rectangles can you find?

Repeat these questions for a 4 x 4 square
5 x 5 square
20 x 20 square

How many cubes and cuboids are there in a 3 x 3 x 3 cube?

a 4 x 4 x 4 cube?

a 10 x 10 x 10 cube?