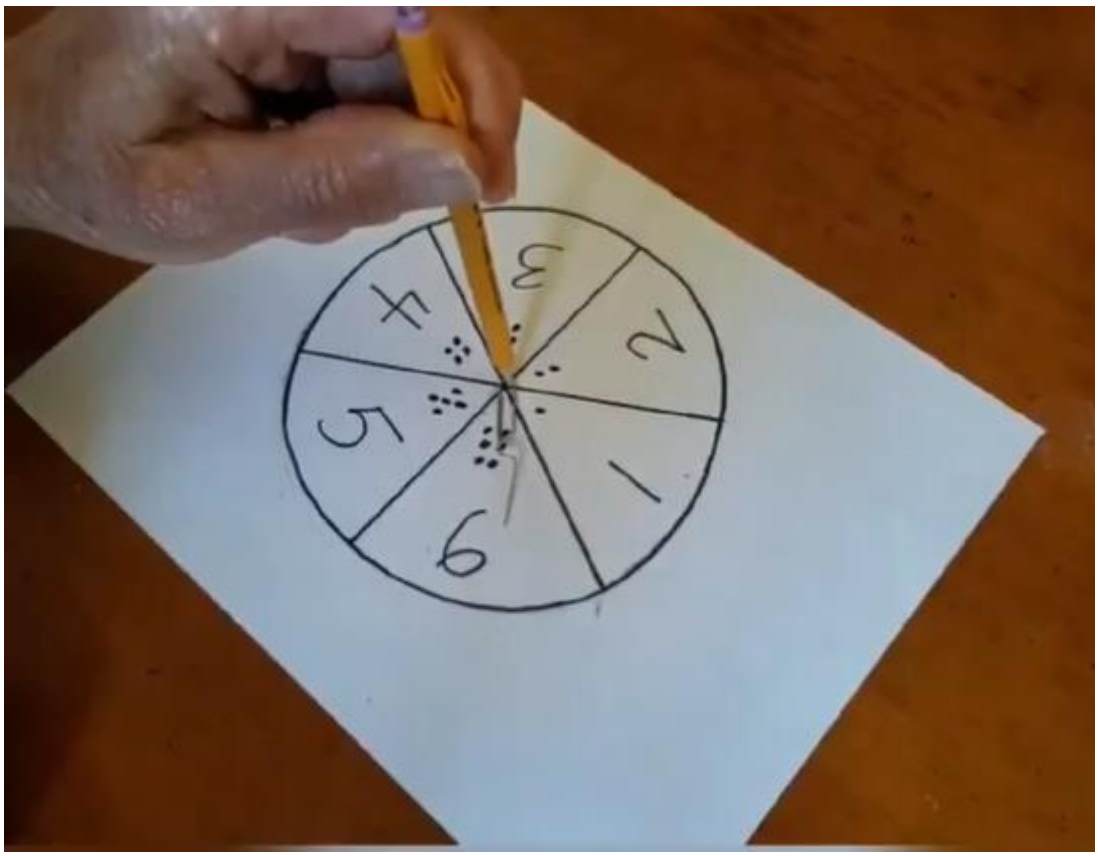
Dice Week – Additive and Multiplicative Reasoning Y5/6

For this week you will need:

- Two six-sided dice or a spinner.
- If you don't have any dice at home you can find dice on the internet at: https://www.random.org/dice/
- Or you can make an easy spinner. Trace a plate to make a spinner face, use a pencil & a paper clip, place the pencil point inside the paper clip in the centre of the spinner and spin the paper clip.



- Pencil and paper

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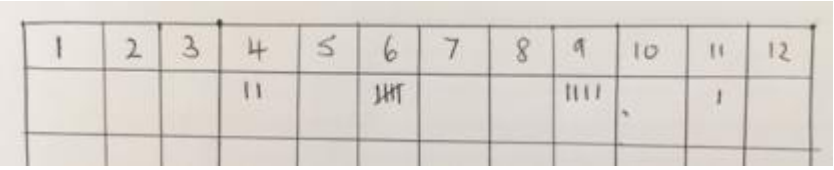
Day 1

- Write the numbers 1 to 12 in a simple table.
- Throw two dice (or spin twice) and add the numbers together to find the total. Mark the total on the table.
- Throw the two dice again and total them. Mark the total on the table. Do this at least 20 times, marking your totals on the table each time.



- Look at your totals. Which numbers came up most often? Why do you think this is?
- What do you think would happen if you did another 20 throws?
- Now throw two dice (or spin twice) and add the numbers together to get the total. Then throw one dice again and subtract the number from your total and record your answer. Watch out for negative numbers; for example if you throw 1 and 1 first and then throw a 6 you will need to work out 2 – 6 which equals -4.
- Repeat this at least 20 times. (You might find it useful to create a table to keep track of your answers.)
- Look at the numbers you've recorded. Which numbers came up most often and why? What are all the possible numbers you could get?

Notes for adults working with groups of children

- Help the children to create a table and make sure they record their total each time.

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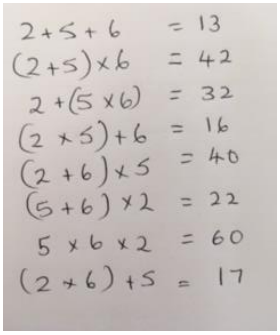
Day 2

- Throw a dice three times and write down the numbers that appear.
- Using addition and/or multiplication, with or without brackets, how many different numbers can you make? For example, if you throw 2, 6 and 5 you could make eight different numbers:



- Do this again. Do you think you will always get eight different numbers? Why?
- With 2, 6 and 5 (above) the largest number was made by multiplying the three numbers (5 x 6 x 2 = 60). Will multiplying all three numbers from the three dice throws always make the largest number? How do you know?

Notes for adults working with groups of children

- Help the children to find all the possibilities systematically. It might help to have the numbers and the +, x, ( ) symbols written on separate pieces of paper for the children to move around as they consider different possibilities. One way to be systematic is to start with the numbers written in an order and consider all the numbers that can be found keeping that order and changing the symbols. For example add all 2 + 5 + 6, then change the second addition 2 + 5 x 6, then put brackets around the addition (2 + 5) x 6 etc.
- This is a good opportunity to talk about when you do need brackets and when you don't, asking 'Does adding brackets change the calculation?'
- In many cases multiplying the three numbers will make the largest total but not if the numbers include a 1. Support the children to recognise and understand why this is different.

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Day 3

- Throw the dice three times (or spin three times) and write down the numbers.
- Use your numbers to make a two-digit number and a one-digit number and multiply these numbers. For example with 2, 6 and 5 you can do 65 x 2, 26 x 5, 25 x 6 etc.
- How many different answers can you make?
- Which multiplication makes the largest number?
- Which one makes the smallest number?
- What do you notice?
- Throw the dice three times again to make another set of two-digit by one-digit multiplications.
- Can you explain how to make the largest number? Will this always work?

Notes for adults working with groups of children

- Help the children to find all the possibilities systematically. It might help to have the numbers on separate pieces of paper for the children to move around as they consider different possibilities. One way to be systematic is to keep the one-digit number the same and change the two-digit number. Another way is to keep the tens part of the two-digit number the same and swap the other digits.
- Encourage the children to explain what they notice about the multiplications that make the biggest product and record this as a 'rule'.

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Day 4

- Throw the dice three times (or spin three times) and write down the numbers.
- Using your three numbers write down all the two digit numbers you can make. For example with 2, 6 and 5 you could make 26, 65, 25, 52, 62 and 56.
- Choose one of the numbers. If it is a multiple of 2 (you can divide it by 2 without a remainder) you score two points.
- If it is a multiple of 3 you score 3 points.
- If it is a multiple of 4 you score 4 points and so on…
  For example I choose 25:
    - 25 is a multiple of 5 scoring 5 points
    - 25 is a multiple of 25 scoring 25 points
    - This means 25 scores 30 points in total (5 + 25).
- Find the total of your points. Which of your six numbers will give you the highest score?
- Which two-digit number would give you the highest score of all possible two-digit numbers formed using dice?

Notes for adults working with groups of children

- Help the children to work and record systematically. Start with considering if it is a multiple of 2, then 3 then 4 etc.
- Encourage the children to look for links between numbers. For example, 24 will score all the points that 12 scores plus additional points because 24 is a multiple of 12.

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Day 5

- Throw 2 dice (or spin twice). Add the scores together to make a number. Write it down. Repeat this three more times so that you have four numbers. For example I throw:
    - 4 and 2 and write down 6 (4 + 2 = 6)
    - 3 and 3 and write down 6 (3 + 3 = 6)
    - 1 and 2 and write down 3 (1 + 2 = 3)
    - 5 and 4 and write down 9 (5 + 4 = 9)
- Using your four numbers and any combination of operations (addition, subtraction, multiplication or division) try to make 24. For example with 6, 6, 3 and 9 I can find two ways to make 24:
    - 6 + 6 + 3 + 9 = 24
    - 6 ÷ 3 x 9 + 6 = 24 (6 ÷ 3 = 2, 2 x 9 = 18 and 18 + 6 = 24)
- Try again and see if you can find more ways to make 24 with your new numbers.
- Which would be the best numbers to start with if you want to find the most ways to make 24?

Notes for adults working with groups of children

- Encourage learners to explore all the possible operations and different combinations of operations, changing the order where it makes a difference

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