Newnham Croft Maths workshop

Reasoning and Problem Solving

Mathematics Policy

Our mathematics curriculum aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason** mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

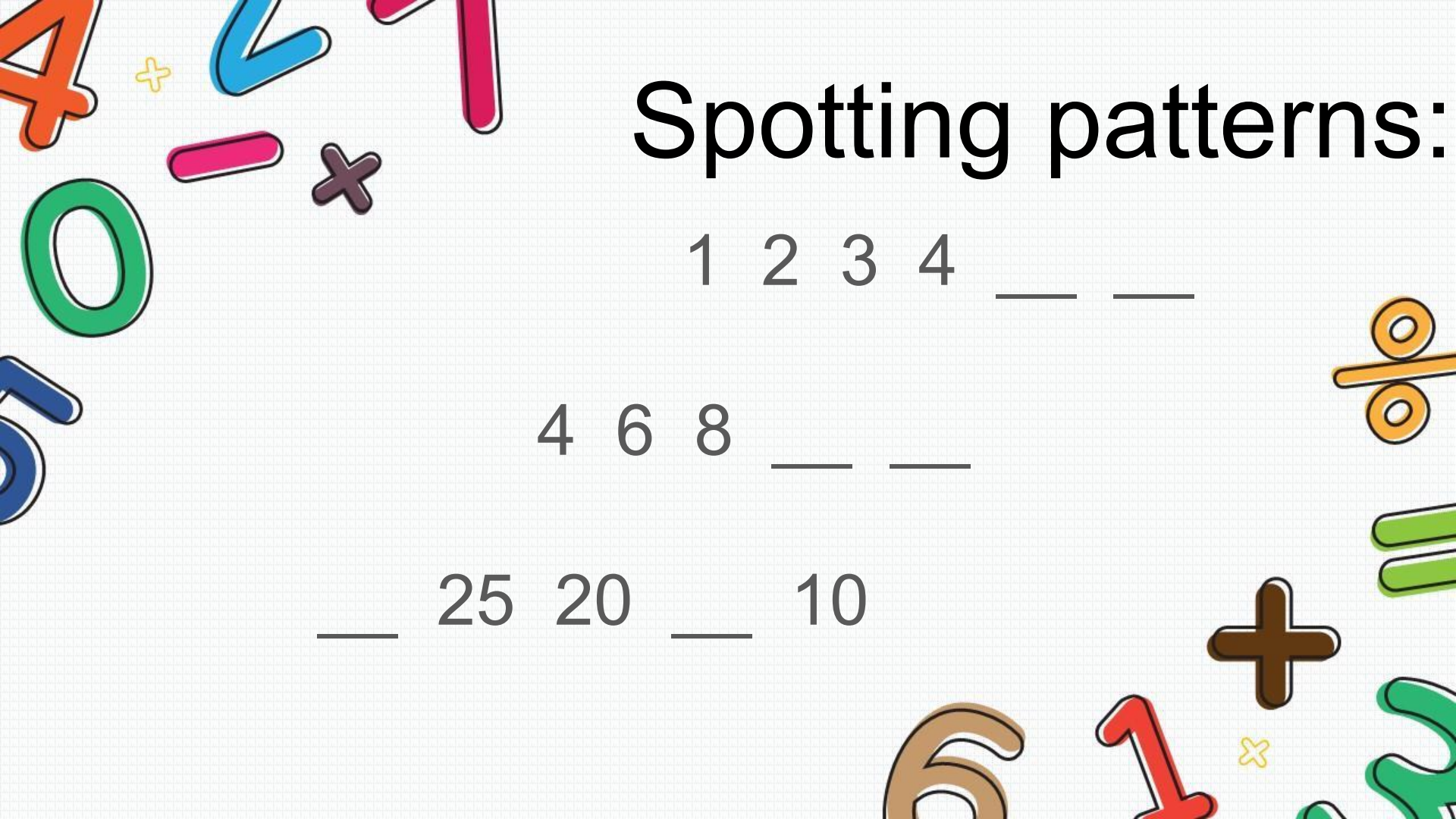
Some examples of reasoning…

Spotting patterns:

1 2 3 4 __ __

4 6 8 __ __

__ 25 20 __ 10



Y1

Which numbers have 4 tens?

40 41 42 43 44 45 46 47 48 49

My number has 4 tens. One more than my number would make the tens digit change.

Whitney

What is Whitney's number? 49

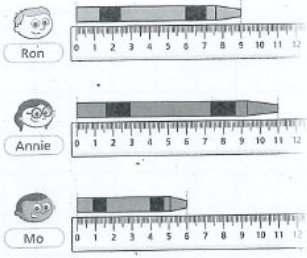
My number is one more than forty-five.

Dexter

What is Dexter's number? 46

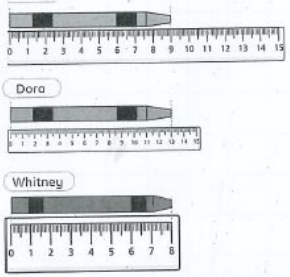
Who has the greater number? whitney

LO: We are learning to order lengths – 17.03.22



a. Who has the shortest crayon? Mo ✓

b. Who has the longest crayon? Annie ✓

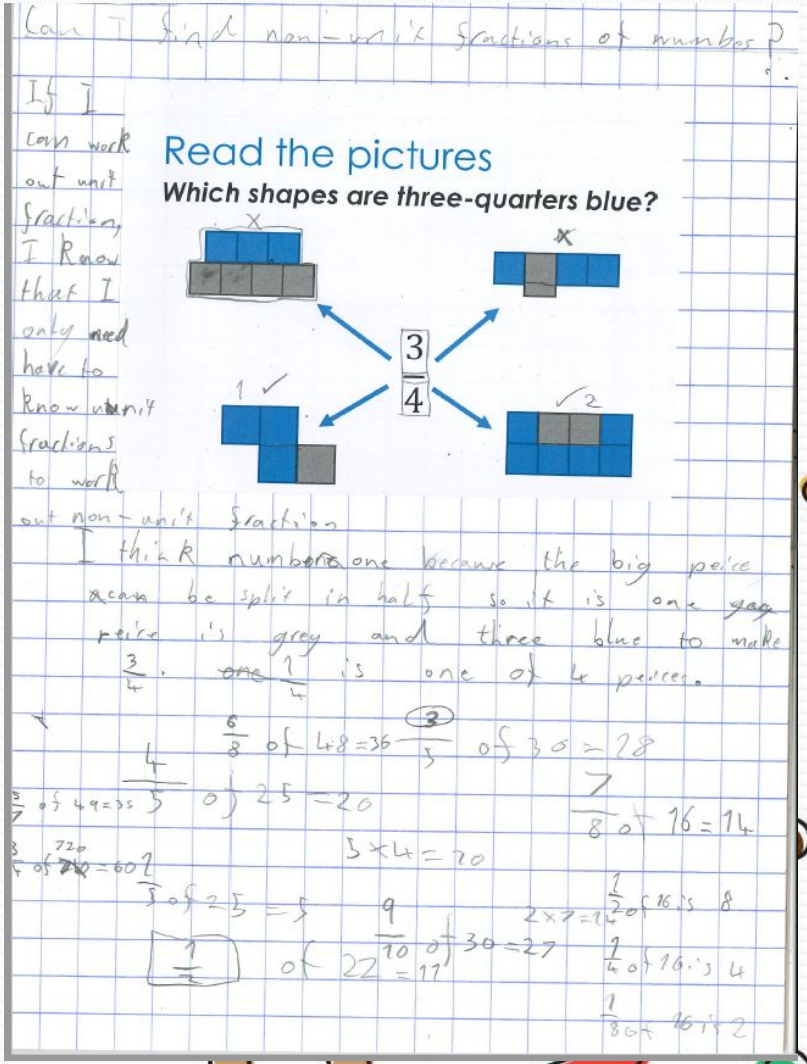


How long is Dora's Crayon? 13 cm ✓

Whitney thinks she has the longest crayon because it goes to the end of the ruler. Why is she wrong? She is wrong because Her ruler is smaller. it has smaller Numbers

Y2

Y3


Can I find non-unit fractions of numbers?
If I can work out unit fractions, I know that I only need have to know unit fractions to work out non-unit fractions
Read the pictures
Which shapes are three-quarters blue?
3/4
I think number one because the big peice can be split in half so it is one grey peice and three blue to make 3/4. 1/4 is one of 4 peices.
6/8 of 48 = 36
3/5 of 30 = 28
4/5 of 25 = 20
7/8 of 16 = 14
5 x 4 = 70
1/2 of 25 = 5
9/10 of 30 = 27
2 x 7 = 14
1/2 of 16 is 8
1/4 of 16 is 4
1/8 of 16 is 2
1/2 of 22 = 11

HOT

7a. Sofia is buying sweets to share with her friends. The total number of sweets has these two factors, it is less than 100 but greater than 60.

How many sweets might she have? 70, 84

Investigate how many possible answers you can find.

9a. True or false?

Odd numbers have more factor pairs than even numbers.

Do you agree? Explain your answer.

No, it depends on the number

→ Why?

9b. Draw lines to match the factor pairs.

Factor pairs of 96

1 3 4 16 8 2

48 12 96 6 32 24

Factor pairs of 72

72 9 36 3 12 4

1 18 24 6 8 2

Factor pairs of 80

80 4 8 16 14 40

2 5 1 20 7 10

Factor pairs of 76

8 76 6 19 9 38

2 18 4 17 1 12

10b. Find a way to sort these factor pairs.

43 x 3 12 x 8 18 x 8

1 x 92 23 x 4 2 x 46

17 x 8 4 x 23 33 x 3

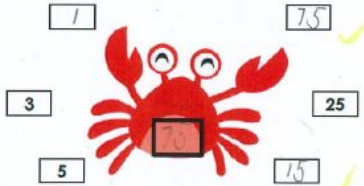
1x92 2x46 3x33 3x43

4x23 8x12 8x17 8x18

11b. Explore methodically the factors of 84.

84	
1 2 4 8	84 42 21

12b. Complete the factor crab.



Y4

Y5

13.1.22

Can I write rules explaining if a number is divisible by 2, 4, 5 and 10?

1. A number that is divisible by 2 is ~~6 + 224 and 6+5~~ a number that is even. For example:

2	12
4	14
6	16
8	18
10	20

and all the other tens are also in the 2 times table.

2. A number is divisible by ten if it always has a 0 in the ones column for example:

10	60
20	70
30	80
40	90
50	100

3. A number is divisible by 5 if it always end in a 5 or a 0 in the ones column for example:

5	25
10	30
15	35
20	40

4.

9	
18	
27	
36	
45	
54	
63	
72	
81	

In the 9 times table it always goes up in 1, 2, 3, 4, 5, 6, 7 and 8 in the ~~tens~~ ones column and in the ones column it goes ~~down~~ counts down from 9. For example: If My friend Natilie

14.1.22

Con't

5.) A number is divisible by 3 if because whe you lay it out you can add up the tens and the ones to make 3, 6, 9 and then back to three again. For example: ~~If~~ ~~3~~

	10	= 9
	21	= 3
3 =	142	2+4 = 6
6 =	135	2+7 = 9

__ + 2 = 8

Y6

Can I use function machines? P.94

1) First, they times it by 10, then add 2

n × 10 + 2 = 10n + 2

~~a)~~ 4 × 10 +

4		40			42
10	×10	100		+2	102
50		500			502
6		60			62
2		20			22

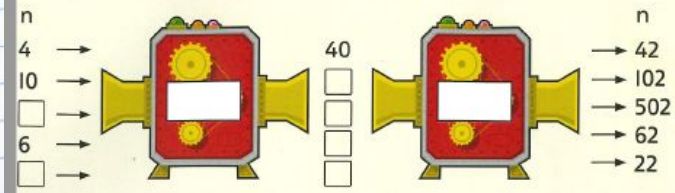
2) Times it by ~~10~~ 7, then take away 3.

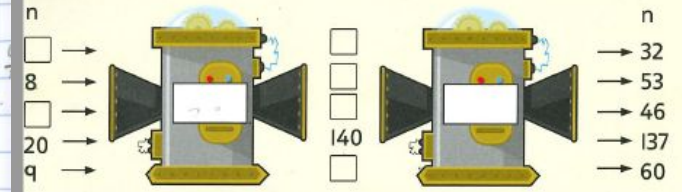
n × 7 − 3 = 7n − 3

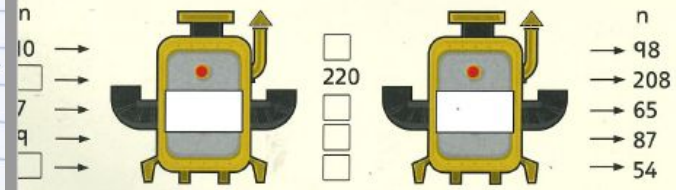
5		35			32
8		56			53
7	× 7	49		−3	46
20		140			137
9		63			60

6 +11 17 76 −2 75 8

scribe what each pair of function machines is doing, first words and then using *n*. Then fill in the missing steps.



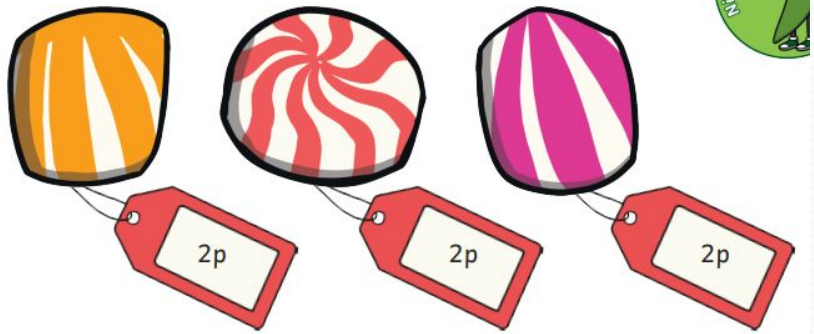




rite three more inputs and outputs for each machine.

INK Draw your own pair of function machines with three inputs and outputs and describe what they do using *n*.

And a couple of examples of problem solving…



Money Muddles

What is the total cost of the sweets?

Rec

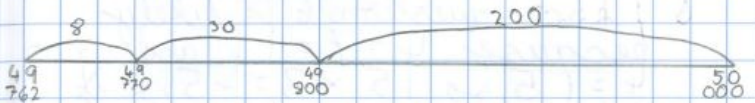
9.3.2022

Can I solve word problems?

5 Jon uses a cycling app. It tells him that he has been on 1774 rides and that he rides, on average, 28 km per ride. What is the overall distance of all his rides and how much further has he got to go to have cycled 50 000 km?

1774 × 28 = 49,672 km ✓

50,000 − 49,672 = 238 km ×



He has ridden 49,672 km and to get to 50,000km he has got to ride 238 km.

6 Ahmed is a boat painter. In one week he uses 4.36 l of blue paint. He uses 7.28 l more white paint than blue paint. If the blue and white paint costs £3 per litre, how much did he spend on paint?

4.36l + 7.28l = 11.64l

11.64 + 4.36 = 16.00l

16 × 3 = £48 ✓

30 → 48, 18 ↓

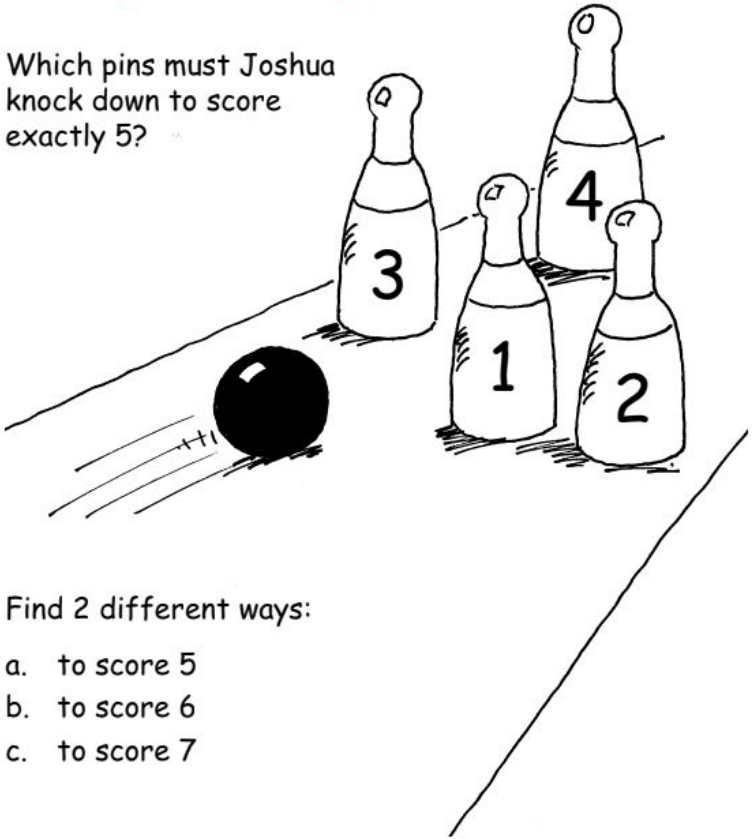
He spend £48 on paint

Y6


I wondered why ...
I started by ...
I checked by ...
I used the inverse of ...
The pattern I noticed was ...
I was systematic because I ...

Four-pin bowling

Which pins must Joshua knock down to score exactly 5?



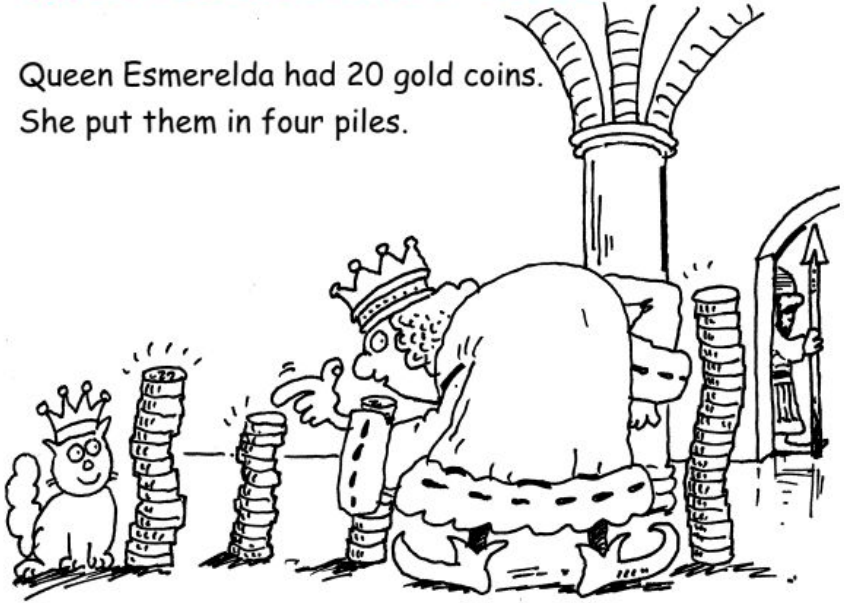
Find 2 different ways:

a. to score 5
b. to score 6
c. to score 7

KS1

Queen Esmerelda's coins

Queen Esmerelda had 20 gold coins.
She put them in four piles.



- The first pile had four more coins than the second.
- The second pile had one less coin than the third.
- The fourth pile had twice as many coins as the second.

How many gold coins did Esmerelda put in each pile?

LKS2

Investigate

Make a 3-digit number.
Each digit must be different.

Make another 3-digit number.
Use the same digits.

Make the difference between the numbers as large as possible.

LKS2

Example

Number 1: **2** **5** **7** Number 2: **7** **2** **5**

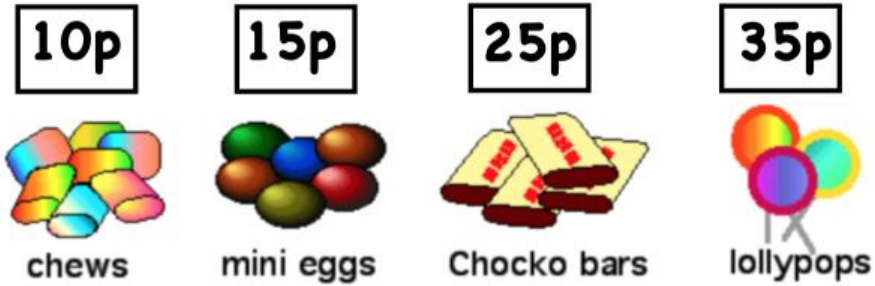
The difference between 257 and 725 is 468.

The New Puzzling Sweet Shop

Age 7 to 11
Challenge Level ★★

Rosie went into the sweet shop with 50p to spend.

There were chews for 10p, mini eggs for 15p, Chocko bars for 25p and lollypops for 35p.



What could she buy if she wanted to spend all her money?

Alice, James, Katie and Henry went into the shop too. They each had 100p to spend and they all spent all of their money.

Alice bought at least one of each kind of sweet. Which one did she have two of?

James spent his money on just one kind of sweet, but he does not like chews. Which sweets did he buy?

Katie bought the same number of sweets as James but she had 3 different kinds. Which sweets did she buy?

Henry chose 8 sweets. What could he have bought?

LKS2

The sum of the digits for a whole-number is 6.

All the digits are different.

What is the smallest that the number could be?
What is the largest that the number could be?

Example: the sum of the digits for 214 is 7 (2 + 1 + 4 = 7)

UKS2

UKS2

SUPPORT

Examples:

24 is a 2-digit number. The sum of the digits is 6 *(2 + 4 = 6)*.

204 is a 3-digit number. The sum of the digits is 6 *(2 + 0 + 4 = 6)*.

Tip for making the largest number: *It's possible to make a 4-digit number where the sum of the digits is 6* ***if you use small digits.***

EXPLAIN

Agree or disagree:

'To make a large number when the sum of the digits is 6, you need to use a 5.'

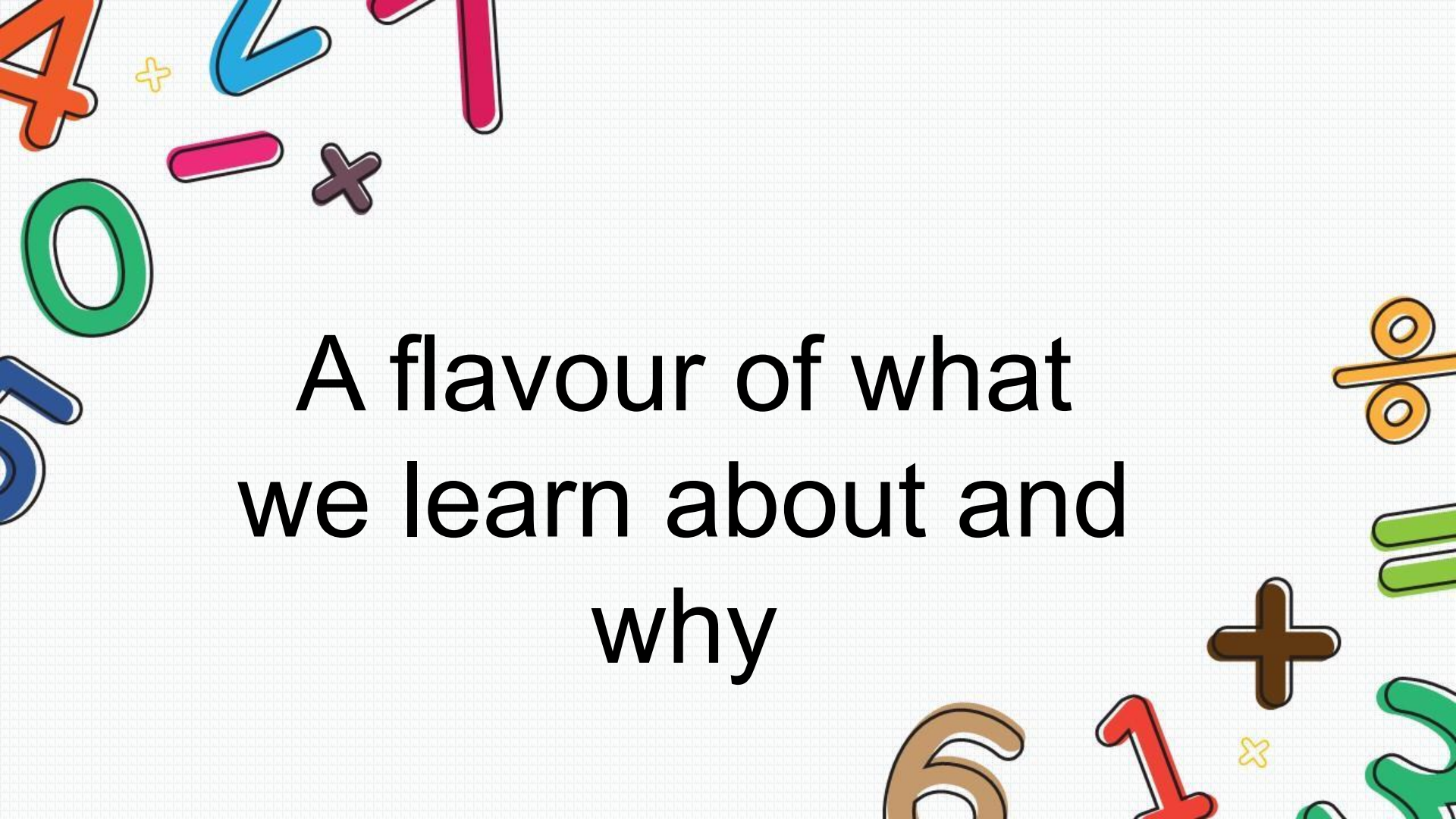
'To make a large number where the sum of the digits is 6, use as many digits as possible.'

EXTEND

The sum of the digits for a whole-number is 11.

All the digits are different.

What is the largest that the number could be?
What is the smallest that the number could be?


A flavour of what we learn about and why