St Joseph's Catholic Primary School

Calculation Policy

Agreed by the Governing Body on	
Review Date	
Review Schedule	
Person(s) Responsible	

MISSION STATEMENT

In the St. Joseph's family, learning together through Jesus, we aim to develop to the fullest possible extent the whole person, socially, emotionally, creatively, academically, physically and spiritually.

Outlining our clear and progressive teaching in calculations for all four operations.

Enabling children to manipulate numbers with confidence using secure mental and written methods.

The four operations:

÷ × - +

- From Nursery to Year 6, our school places emphasis on children's own recordings to support calculation. Children are given time and space to express a calculation in their own way. This is as valid as a more formal method when it gives them the correct answer, but does not act as a replacement for their grasp of more formal calculations.
- In order to successfully calculate at higher levels, it is vital that children are able to complete mental calculations efficiently. They should be capable of drawing on known number facts such as doubles, halves, number bonds to multiples of 10 and their times tables.
- Skills should be taught progressively and breadth of experience in using and applying these skills should be encouraged before children are extended.
- It is important to give children a purpose for their maths where possible and the time to explore their emergent grasp of new concepts.
- To become successful mathematicians children will need a firm understanding of place value, familiarity with a range of mathematical vocabulary and a sound interpretation of mathematical symbols.

ADDITION

Mental Calculations (ongoing)

A ***selection*** of mental calculation strategies:

To add successfully, children need to be able to:

- Count forwards from many starting points including negative numbers, numbers in the thousands and tens of thousands, decimals and fractions.
- Say what number comes immediately after any whole number and decimal number, and near multiples of 10, 100, 100

  e.g. what number comes before 1999? 3,499? 4,529? 1.4?
- Recall all addition pairs to 9 + 9 and complements in 10.
- Mental recall of number bonds

  6 + 4 = 10 ☒ + 3 = 10
  25 + 75 = 100 19 + ☒ = 20
- Use near doubles

  To calculate 6 + 7 → double 6 + 1 = 13
- Add mentally a series of one-digit numbers, such as 5 + 8 + 4
- Add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value
- Add the nearest multiple of 10, 100 and 1000 and adjust
- Build up children's mental imagery of the number line.

- For some calculations, they can then use this mental image to work out the answer in their heads.

  24 + 19 = 24 + 20 – 1 = 43
  458 + 71 = 458 + 70 + 1 = 529

- Partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways

- Addition using partitioning and recombining

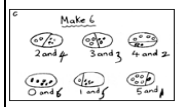
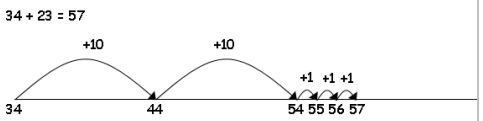
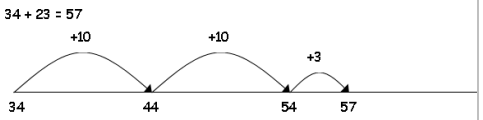
  34 + 45 = (30 + 40) + (4 + 5) = 79

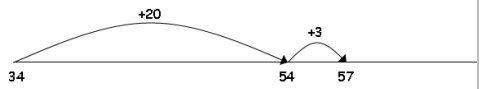
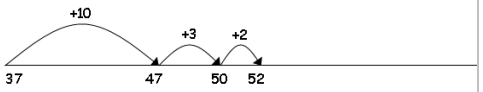
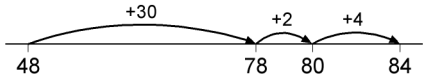
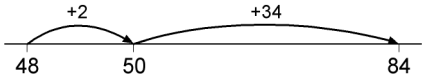
- Use the relationship between addition and subtraction

  36 + 19 = 55 19 + 36 = 55
  55 – 19 = 36 55 – 36 = 19

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for addition.

ADDITION

Stage 1 1 more using concrete material (EYFS)	Stage 2 Number line (by beg of Y1)	Stage3 The Empty Number Line (by the end of year 2)	Stage 4 Partitioning (beg year 2)	Stage 5 Partitioning under each other (by the end of year 3)	Stage 6 Expanded method in columns (by the end of year 4)	Stage 7 Column Method (by beg of year 5)
• Counting on fingers • Count on one digit from a given number • Extend to more than one number using concrete material if children are ready • To use informal recording e.g pictures of what they have done. 	Continue developing ways of recording calculations using pictures.  Use number lines to support calculation and teachers *demonstrate* the use of the number line. Begin by using the number line moving forward one number at a time .e.g 4+3= Begin at 4	**NOTE-Before children can begin to use an empty number line, they need to have had lots of experience of counting on and back using numbered lines, bead strings and partly numbered lines.** **Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.** ✓ **First counting on in tens and ones.**  ✓ **Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).** 	**Record steps in addition using partitioning:** 47 + 72 = 40 + 70 + 7 + 2 = 110 + 9 = 119	**Partitioned numbers are then written under one another:** 47 = 40 + 7 +76 = 70 + 6 110 + 13	✓ **Move on to a layout showing the addition of tens to the tens and the ones to the ones separately.** ✓ **Practical apparatus to be used when learning carrying and exchanging** Write the numbers in columns. Adding the ones first: 47 + 76 13 110 123 ✓ **Discuss how adding the ones first gives the same answer as adding the tens first and reason for adding from smallest to largest.**	✓ **Column addition remains efficient when used with larger whole numbers and decimals. Once learned, the method is quick and reliable.** ✓ **Carry digits are recorded below the line, using the words 'carry ten' or 'carry one hundred', not 'carry one'.** 47 + 76 = 123 (1 1) 258 + 87 = 345 (1 1) 366 + 458 = 824 (1 1) ✓ **Later extend to adding three digit numbers, two digit numbers and numbers with different number of digits.**

	and then jump one number at a time three times. Once children are able confident to do that independently to work out problem then extend them to simply doing 1 jump of 3. Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.	✓ **Followed by adding the tens in one jump and the units in one jump.** 34 + 23 = 57  ✓ **Bridging through ten can help children become more efficient.** 37 + 15 = 52  ✓ **Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.** 8 + 7 = 15  48 + 36 = 84  or:  				

SUBTRACTION

Mental Calculations (ongoing)

These are a **selection** of mental calculation strategies:

To subtract successfully, children need to be able to:

- Count backwards from many starting points including negative numbers, numbers in the thousands and tens of thousands, decimals and fractions.
- Say what number comes immediately before any whole number and decimal number, and near multiples of 10, 100, 100

  e.g. what number comes before 3000? 2,500? 4,530? 13.0?
- Recall all addition and subtraction facts to 20; e.g. 10 – 6 = 4

  17 - ☒ = 11

  20 - 17 = 3 10 - ☒ = 2
- Find a small difference by counting up
- Subtract multiples of 10 (such as 160 – 70) using the related subtraction fact,16 – 7, and their knowledge of place value;
- Counting on or back in repeated steps of 1, 10, 100, 1000

  86 - 52 = 34 (by counting back in tens and then in ones)

  460 - 300 = 160 (by counting back in hundreds)
- Subtract the nearest multiple of 10, 100 and 1000 and adjust

  24 - 19 = 24 - 20 + 1 = 5

458 - 71 = 458 - 70 - 1 = 387

- Partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

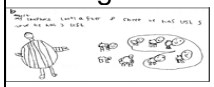
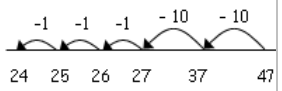
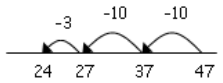
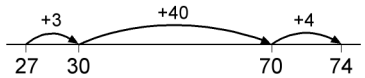
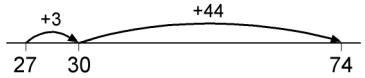
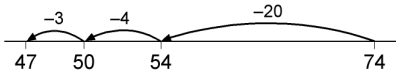
- Use the relationship between addition and subtraction

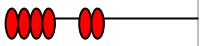
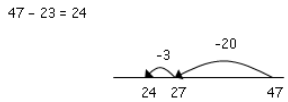
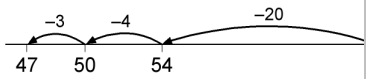
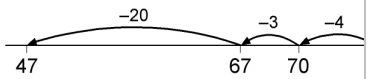
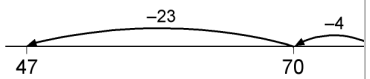
36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for subtraction.

SUBTRACTION

Stage 1 Counting on and back EYFS/Y1	Stage 2 Number line Y1	Stage 3 The Empty Number Line End of Y2	Stage 4 The Counting Up Method (end of Y3)	Stage 5 Partitioning (end of Y4)	Stage 6 Expanded method in columns leading to column method (stage 7) (end of y6)
• Counting back from a larger number • One less, two less • Counting on from a smaller number • Find the difference by counting up important to use visual images 	Counting back using a number line. Finding the difference between two numbers using the number line to assist 'how many number between' They use number lines and practical resources to support calculation. Teachers *demonstrate* the use of the number line. Bead strings or bead bars can be used to illustrate subtraction as taking away.	Children will begin to use empty number lines to support calculations. **Counting back:** ✓ **First counting back in tens and ones.** 47 – 23 = 24  ✓ **Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).** 47 – 23 = 24  ✓ **Subtracting the tens in one jump and the units in one jump.**	Where the numbers involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.  74 – 27 3 → 30 40 → 70 4 → 74 47 or:  74 – 27 3 → 30 44 → 74 47 *Children should:* ✓ *be able to subtract numbers with different numbers of digits;*	Subtraction can be recorded using partitioning: 74 – 27 = 74 – 20 – 7 = 54 – 7 = 47 This requires children to subtract a single-digit number or a multiple of 10 from a two-digit number mentally. The method of recording links to counting back on the number line.  	**Practical apparatus to be used when learning carrying and exchanging** Partitioned numbers are then written under one another: Example: 74 – 27 70 + 4 – 20 + 7 ~~60~~ ~~70~~ + ~~14~~ ~~4~~ – 20 + 7 = 40 + 7 ~~6~~ ~~7~~ ~~14~~ ~~4~~ – 2 7 = 4 7 Example: 741 – 367 700 + 40 + 1 – 300 + 60 + 7 ~~600~~ ~~700~~ + ~~130~~ ~~40~~ + ~~11~~ ~~1~~ – 300 + 60 + 7 = 300 + 70 + 4 ~~6~~ ~~7~~ ~~13~~ ~~4~~ ~~11~~ ~~1~~ – 3 6 7 = 3 7 4 The expanded method leads children to the more compact method so that they understand its structure and efficiency. The amount of time that should be spent teaching and practising the expanded method will depend on how secure the children are in their recall of number facts and in their understanding of place value.

	 6-2=4 The number line should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.	 The steps may be recorded in a different order. Steps in subtraction can be recorded on a number line. The steps often bridge through a multiple of 10. 15 – 7 = 8  74 – 27 = 47 worked by counting back:  The steps may be recorded in a different order:  or combined:  Children need to be able to partition numbers in ways other than into tens and ones to help them	✓ *begin to find the difference between two decimal fractions with up to three digits and the* ✓ *same number of decimal places;* ✓ *know that decimal points should line up under each other.*		

		make multiples of ten by adding in steps.			

MULTIPLICATION

Mental Calculations (ongoing)

To multiply successfully, children need to be able to:

- Count forwards in groups from many starting points including numbers in the thousands and tens of thousands, decimals and fractions.

  e.g. 2,4,6,8,10 0.3, 0.6, 0.9, 1.2, 1.5, 1.8, 2.12/10 4/10 6/10 8/10 1 1,2/10 1,4/10

- Recall all multiplication facts to 10 × 10
- Double and halve
- Apply the knowledge of doubles and halves to known facts.

  e.g. 8 x 4 is double 4 x 4

- Partition numbers into multiples of one hundred, ten and one
- Use related facts and their knowledge of place value
- Work out products such as 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value; e.g. If I know 3 x 7 = 21, what else do I know?

  30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

- Multiply by 10 or 100

  Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

  Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

- Use closely related facts already known

  13 x 11 = (13 x 10) + (13 x 1)

= 130 + 13

= 143

- Partition

  23 x 4 = (20 x 4) + (3 x 4)

  = 80 + 12

  = 102

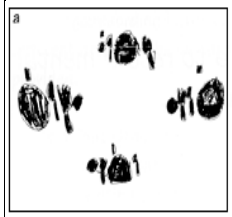
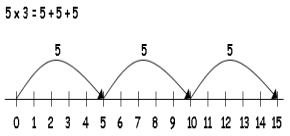
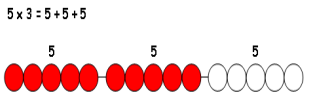
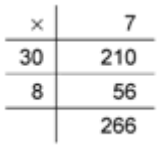
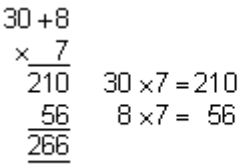
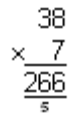
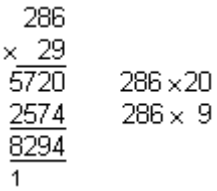
- Use factors

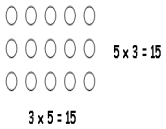
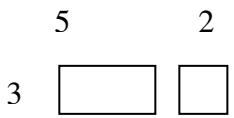
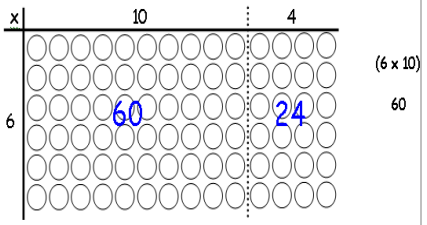
  8 x 12 = 8 x 4 x 3

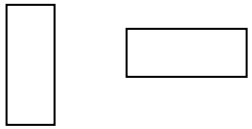
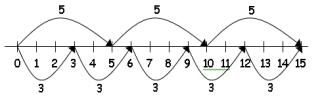
- Use of the empty array as a visual to support mental multiplication of larger numbers in the later stages of KS2

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for multiplication.

MULTIPLICATION

Stage 1 Experience equal groups of objects. EYFS-Y1	Counting in sets. End of Rec	Stage 3 Repeated Addition, Arrays, Double Number Lines, Commutativity (Introduced y2)	Stage 4 Partitioning. (Introduced Y3)	Stage 5 The Grid Method (Introduced in y4 and taught throughout.)	Stage 6 Expanded multiplication for any number. Double number lines for ratios and fractions. (Y5)	Stage 7 Short/Long Multiplication (Y6- once chn are confident and are using expanded multiplication well.)
Children will experience equal groups of objects. They will work on practical problem solving activities involving equal sets or groups.  Y1- chn will develop further recording strategies e.g. drawings.	They will count in 2s and 10s and begin to count in 5s. orally and begin to play games and complete practical activities to support counting in sets. (talk through maths good resource for activities to help) They will continue to work on practical problem solving activities involving equal sets or groups.	Children will develop their understanding of multiplication and use jottings to support calculation: ✓ **Repeated addition** 3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x3 Repeated addition can be shown easily on a number line:  and on a bead bar:  	Continue to record multiplication as a double number line ✓ **Partitioning** 38 x 5 = (30 x 5) + (8 x 5) = 150 + 40 = 190 Children will continue to use arrays where appropriate leading into the grid method of multiplication. At first they partition numbers to 10 e.g. in 3 x 7 7 can be partitioned into a 5 and 2:	✓ **Grid method (all numbers)** **For example, TU X U** 38 × 7 = (30 × 7) + (8 × 7) = 210 + 56 = 266  	Children will approximate first ✓ **Expanded method (all numbers)** For example, 38 x 7  56 × 27 is approximately 60 × 30 = 1800.	✓ **Short multiplication**  Children will approximate first ✓ **Long multiplication** 286 × 29 is approximately 300 × 30 = 9000. 

		Record multiplication as a double number line as beneath: Counting in 2s: 1 2 3 4 5 6 2 4 6 8 10 12 ✓ **Arrays** Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.  They will produce and cut out their own arrays making connections between multiplications e.g. 3 x 8 and 8 x 3	 And later they can apply this t o partitioning whole numbers into tens and units and then the grid method. The grid method:  		56 × 27 1000 50×20 = 1000 120 6×20 = 120 350 50×7 = 350 42 6×7 = 42 1512 1 <u>Children will approximate first</u> <u>Children will approximate first</u> ✓ **Expanded short multiplication** 38 x 7 30 + 8 × 7 210 30×7 = 210 56 8×7 = 56 266 <u>Children will approximate first</u> ✓ **Expanded long multiplication** 56 x 27	

		 ✓ **Commutativity** Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line. 			56 × 27 1000 50×20 = 1000 120 6×20 = 120 350 50×7 = 350 42 6×7 = 42 1512 1 Children will link ratios to their previous visual use of the double number line e.g. a ratio of 1:2 is the same as a ratio of 2:4 Double number line: 1 2 3 4 5 6 2 4 6 8 10 12 This will also be linked to equivalent fractions ½ is the same as 2/4 and 3/6 etc.	

DIVISION

Mental Calculations (ongoing)

These are a **selection** of mental calculation strategies:

To divide successfully in their heads, children need to be able to:

- Double and halve

  Knowing that halving is dividing by 2

- Count backwards in groups from many starting points including numbers in the thousands and tens of thousands, decimals.

  e.g. 2,4,6,8,10 0.3, 0.6, 0.9, 1.2, 1.5, 1.8, 2.1 516, 512, 508, 504, 500, 496, 492, 488, 484, 480

- Recall multiplication and division facts to 10 × 10, recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value

- Divide by 10 or 100

  Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

  Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

- Children should be able to utilise their tables knowledge to derive other facts.

  e.g. If I know 3 x 7 = 21, what else do I know? 30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

- Partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways

- Know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5

- Understand and use multiplication and division as inverse operations

- Use factors

- Use partitioning e.g. 72 ÷ 3 = [ ]

NOTE: to carry out short division of a two- digit number, children need to be confident with multiplication and division facts and with subtracting multiples of 10 mentally, and whose place value is sound.

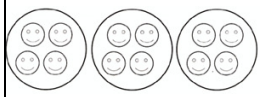
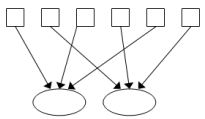
For most children this will be in Year 5.

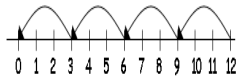
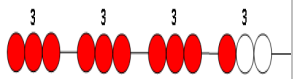
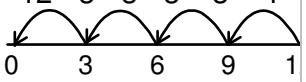
To carry out written methods of division successful, children also need to be able to:

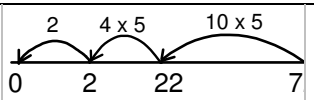
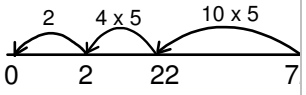
- understand division as repeated subtraction;
- estimate how many times one number divides into another – for example, how many sixes there are in 47, or how many 23s there are in 92;
- multiply a two-digit number by a single-digit number mentally
- subtract numbers using the column method.

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for division.

DIVISION

Stage 1 Grouping and sharing into equal groups.	Stage 2 Counting in groups	Stage 3 Sharing equally/ grouping leading to repeated subtraction. Introduce Y2	Stage 4 Partitioning	Stage 5 Expanded Method- Chunking	Stage 6 Short division Any number by a single digit.	Stage 7 Long Division ONLY USE THIS IF CHN ARE READY AND IT'S APPROPRIATE!
Children will understand equal groups and share items out in play and problem solving.  Division as Grouping and sharing A bag of 6 sweets, how many children can have 2 sweets each. The division sign (÷) 'divided into groups of' Division as Sharing Share equally Share a bag of 6 sweets between 2 children – one for you, one for me…	Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s. Counting in multiples Use hands: How many groups of 5 in 15? How many 5s have been counted? How many more 5s do we need to reach 25? 9)97 −90 9×10 7 Answer: 10 R7	Children will develop their understanding of division and use jottings to support calculation ✓ **Sharing equally** 6 sweets shared between 2 people, how many do they each get?  ✓ **Grouping or repeated subtraction** There are 6 sweets, how many people can have 2 sweets each? 	Mental methods for devising TU÷ U can be based on partitioning and on the distributive law of division over addition.(dividing into groups) Partition TU into a multiple of the divisor plus the remaining ones, then divide each part separately. Informal recording may look like this : 84 70 + 14 ÷7 ↓ ↓ 10 + 2 = 12 Ensure that chn are being taught division	Chunking using a number line 110 ÷ 3 = 10 + 10 + 10 + 5 + 1 = 36 r 2 I know that 10 x 3 = 30 I know that 5 x 3 = 15 So: Leading to simple chunking E.g. 72 ÷ 6 = 10 + 2 = 12 6 | 72 - 60 (10 x 6) 12 - 12 (2 x 6) 00 **Chunking using**	The short division method is recorded like this: $3\overline{)290+1} = 3\overline{)270+21}^{90+7}$ This is then shortened to: $3\overline{)2\,9^{2}1}^{9\,7}$	**Long division HTU ÷ TU** 972 ÷ 36 27 36) 972 - 720 (20x) 252 - 252 (7x) 0 Answer: 27 Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other. Where appropriate, remainders should be shown as - - Decimals - Fractions i.e. if the children were dividing 32 by 10, the answer should

	$6\overline{)196}$ $-\ 60$ 6×10 136 $-\ 60$ 6×10 76 $-\ 60$ 6×10 16 $-\ 12$ 6×2 4 32 Answer: 32 R 4 In effect, the recording above is the long division method, though conventionally the digits of the answer are recorded above the line as shown below. $24\overline{)560}$ 23 -480 80 -72 8 Answer: 23 R 8 How many packs of 24 can we make from 560 biscuits? Start by multiplying 24 by multiples of 10 to get an	✓ **Repeated subtraction using a number line or bead bar** 12 ÷ 3 = 4   The bead bar will help children with interpreting division calcula many 5s make 10?' ✓ **Using a number line** 12 ÷ 3 = 4 12 - 3 - 3 - 3 = 4  72 ÷ 5 Can we subtract 10 lots of 5? How many other lots of 5 can we subtract?	problems at this stage that will have remainders. Remainders after division can be recorded similarly. 96÷7= 96 80 + 16 80÷7=11 r3 16÷7= 2 r2 11+3= 13 3+2=5 =11 r 5	**larger numbers:** 256 ÷ 7 256 ÷ 7 7 | 25 6 - 14 (20 x 7) 0 116 - 70 (10 x 7) 46 - 42 (6 x 7) 4 We have subtracted 36 groups of 7, with 4 remaining The answer is 36 r4		be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in it's lowest terms

	estimate. As 24 × 20 = 480 and 24 × 30 = 720, we know the answer lies between 20 and 30 packs. We start by subtracting 480 from 560. $24\overline{)560}$ $20 - \underline{480}$ $\quad 24\times 20$ $\quad 80$ $3 \quad \underline{72}$ $\quad 24\times 3$ $\quad 8$ Answer: 23 R 8	 Can we subtract 10 lots of 5? How many other lots of 5 can we subtract?  Turn number line around				

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