Autumn Scheme of Learning

Year 6

#MathsEveryoneCan

2020-21

White Rose Maths

New for 2020/21

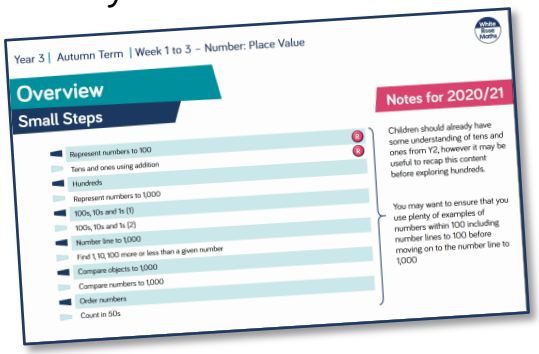
2020 will go down in history. The world has changed for all of us.

We want to do as much as we can to support children, teachers, parents and carers in these very uncertain times.

We have amended our schemes for 2020/21 to:

- ★ highlight key teaching points
- ★ recap essential content that children may have forgotten
- ★ flag any content that you might not have covered during the school closures period.

We hope these changes will add further value to the schemes and save you time.


Year 3 | Autumn Term | Week 1 to 3 – Number: Place Value

Overview

Small Steps

- Represent numbers to 100
- Tens and ones using addition
- Hundreds
- Represent numbers to 1,000
- 100s, 10s and 1s (1)
- 100s, 10s and 1s (2)
- Number line to 1,000
- Find 1, 10, 100 more or less than a given number
- Compare objects to 1,000
- Compare numbers to 1,000
- Order numbers
- Count in 50s

Notes for 2020/21

Children should already have some understanding of tens and ones from Y2, however it may be useful to recap this content before exploring hundreds.

You may want to ensure that you use plenty of examples of numbers within 100 including number lines to 100 before moving on to the number line to 1,000

Lesson-by-lesson overviews

We've always been reluctant to produce lesson-by-lesson overviews as every class is individual and has different needs. However, many of you have said that if blended learning becomes a key feature of school life next year, a weekly plan with linked content and videos could be really useful.

As always, we've listened! We've now produced a complete lesson-by-lesson overview for Y1 to Y9 that schools can use or adapt as they choose. Each lesson will be linked to a free-to-use home learning video, and for premium subscribers, a worksheet. This means that you can easily assign work to your class, whether they are working at home or in school.

Inevitably, this lesson-by-lesson structure won't suit everyone, but if it works for you, then please do make use of this resource as much as you wish.

Teaching for Mastery

These overviews are designed to support a mastery approach to teaching and learning and have been designed to support the aims and objectives of the new National Curriculum.

The overviews:

- have number at their heart. A large proportion of time is spent reinforcing number to build competency
- ensure teachers stay in the required key stage and support the ideal of depth before breadth.
- ensure students have the opportunity to stay together as they work through the schemes as a whole group
- provide plenty of opportunities to build reasoning and problem solving elements into the curriculum.

For more guidance on teaching for mastery, visit the NCETM website:

https://www.ncetm.org.uk/resources/47230

Concrete - Pictorial - Abstract

We believe that all children, when introduced to a new concept, should have the opportunity to build competency by taking this approach.

Concrete – children should have the opportunity to use concrete objects and manipulatives to help them understand what they are doing.

Pictorial – alongside this children should use pictorial representations. These representations can then be used to help reason and solve problems.

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods.

Need some CPD to develop this approach? Visit www.whiterosemaths.com for find a course right for you.

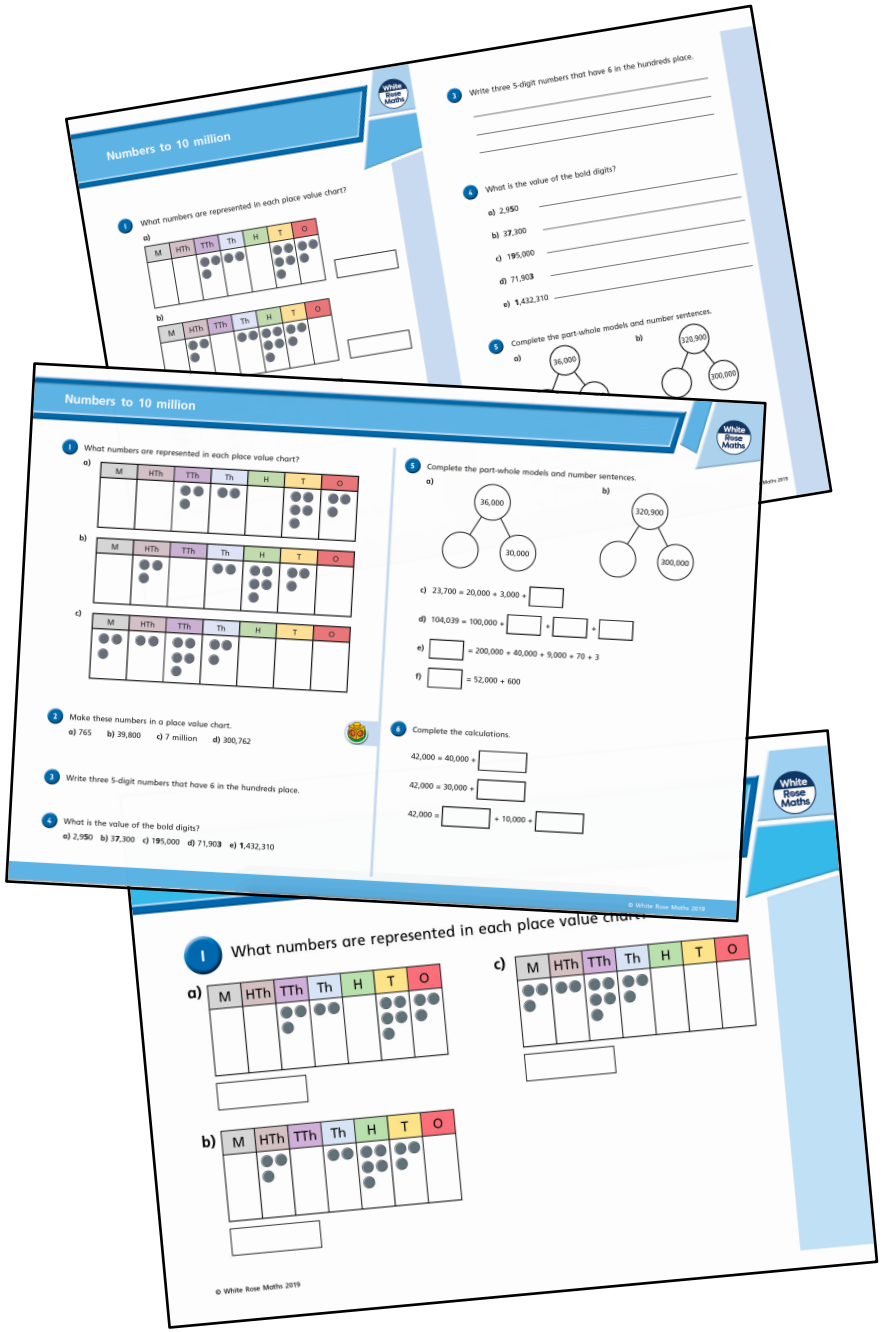
Supporting resources

We have produced supporting resources for every small step from Year 1 to Year 11.

The worksheets are provided in three different formats:

- Write on worksheet – ideal for children to use the ready made models, images and stem sentences.
- Display version – great for schools who want to cut down on photocopying.
- PowerPoint version – one question per slide. Perfect for whole class teaching or mixing questions to make your own bespoke lesson.

For more information visit our online training and resources centre resources.whiterosemaths.com or email us directly at support@whiterosemaths.com



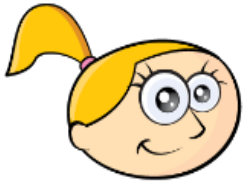
Meet the Characters

Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who's your favourite?


Teddy


Rosie


Mo


Eva


Alex


Jack


Whitney


Amir


Dora


Tommy


Dexter


Ron


Annie

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number: Place Value		Number: Addition, Subtraction, Multiplication and Division				Number: Fractions					Geometry: Position and Direction
Spring	Number: Decimals		Number: Percentages		Number: Algebra		Measurement: Converting Units	Measurement: Perimeter, Area and Volume		Number: Ratio		Statistics
Summer	Geometry: Properties of Shape			Consolidation or SATs preparation		Consolidation, investigations and preparations for KS3						

White Rose Maths

Autumn - Block 1

Place Value

Overview

Small Steps

- Numbers to 10,000 (R)
- Numbers to 100,000 (R)
- Numbers to a million (R)
- Numbers to ten million
- Compare and order any number
- Round numbers to 10, 100 and 1,000 (R)
- Round any number
- Negative numbers

Notes for 2020/21

Many children may struggle to work immediately with numbers to 10,000,000 so we are suggesting that this might build up from smaller numbers.

It's vital that children have that understanding/recap of place value to ensure they are going to be successful with later number work.

Numbers to 10,000

Notes and Guidance

Children use concrete manipulatives and pictorial representations to recap representing numbers up to 10,000

Within this step, children must revise adding and subtracting 10, 100 and 1,000

They discuss what is happening to the place value columns, when carrying out each addition or subtraction.

Mathematical Talk

Can you show me 8,045 (any number) in three different ways?

Which representation is the odd one out? Explain your reasoning.

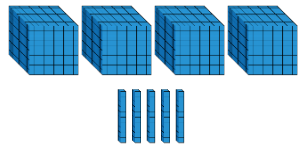
What number could the arrow be pointing to?

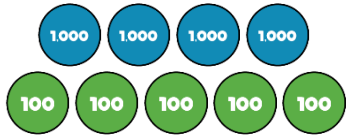
Which column(s) change when adding 10, 100, 1,000 to 2,506?

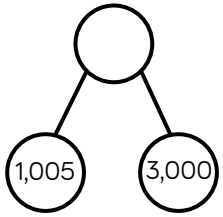
Varied Fluency

R

Match the diagram to the number.

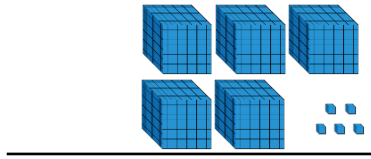


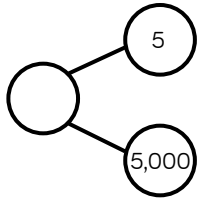


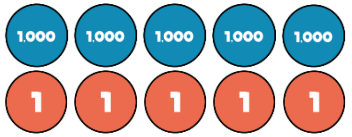


4,005 | 4,500 | 4,050

Which diagram is the odd one out?







Complete the table.

	Add 10	Add 100	Add 1,000
2,506			
7,999			
		6,070	

Numbers to 10,000

Reasoning and Problem Solving

R

Dora has made five numbers, using the digits 1, 2, 3 and 4

She has changed each number into a letter.

Her numbers are

aabcd
acdbc
dcaba
cdadc
bdaab

Here are three clues to work out her numbers:

- The first number in her list is the greatest number.
- The digits in the fourth number total 12
- The third number in the list is the smallest number.

44,213
43,123
13,424
31,413
21,442

Tommy says he can order the following numbers by only looking at the first three digits.

12,516 12,832 12,679 12,538 12,794

Is he correct?

Explain your answer.

He is incorrect because two of the numbers start with twelve thousand, five hundred therefore you need to look at the tens to compare and order.

Numbers to 100,000

Notes and Guidance

Children focus on numbers up to 100,000
They represent numbers on a place value grid, read and write numbers and place them on a number line to 100,000

Using a number line, they find numbers between two points, place a number and estimate where larger numbers will be.

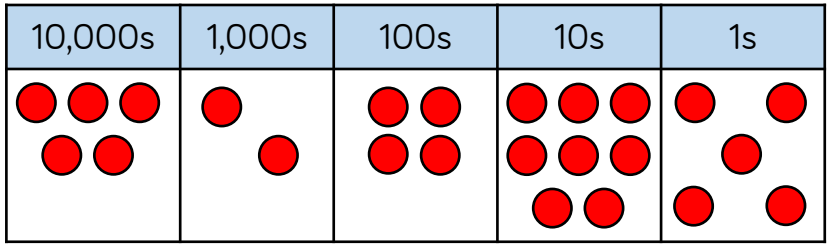
Mathematical Talk

How can the place value grid help you to add 10, 100 or 1,000 to any number?
How many digits change when you add 10, 100 or 1,000? Is it always the same number of digits that change?
How can we represent 65,048 on a number line?
How can we estimate a number on a number line if there are no divisions?
Do you need to count forwards and backwards to find out if a number is in a number sequence? Explain.

Varied Fluency

R

A number is shown in the place value grid.

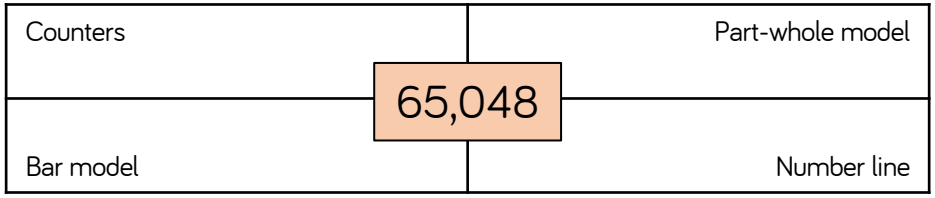


Write the number in figures and in words.

- Alex adds 10 to this number
- Tommy adds 100 to this number
- Eva adds 1,000 to this number

Write each of their new numbers in figures and in words.

Complete the grid to show the same number in different ways.



Complete the missing numbers.

59,000 = 50,000 + _____

_____ = 30,000 + 1,700 + 230

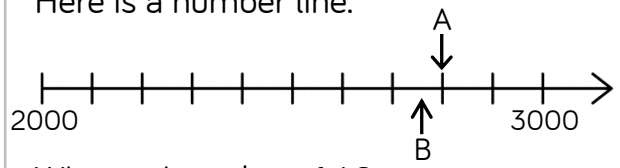
75,480 = _____ + 300 + _____

Numbers to 100,000

Reasoning and Problem Solving

R

Here is a number line.



What is the value of A?

B is 40 less than A.
What is the value of B?

C is 500 less than B.
Add C to the number line.

A = 2,800

B = 2,760

Here are three ways of partitioning 27,650

27 thousands and 650 ones
27 thousands, 5 hundreds and 150 ones
27 thousands and 65 tens

Write three more ways

Possible answers:

2 ten thousands, 6 hundreds and 5 tens

20 thousands, 7 thousands and 650 ones

Rosie counts forwards and backwards in 10s from 317

Circle the numbers Rosie will count.

427	997	−7
1,666	3,210	5,627
−23	7	−3

Explain why Rosie will not say the other numbers.

427
997
5,627
7
−3
−23

Any positive number will have to end in a 7

Any negative number will have to end in a 3

Numbers to One Million

Notes and Guidance

Children read, write and represent numbers to 1,000,000

They will recognise large numbers represented in a part-whole model, when they are partitioned in unfamiliar ways.

Children need to see numbers represented with counters on a place value grid, as well as drawing the counters.

Mathematical Talk

If one million is the whole, what could the parts be?

Show me 800,500 represented in three different ways.
Can 575,400 be partitioned into 4 parts in a different way?

Where do the commas go in the numbers?
How does the place value grid help you to represent large numbers?
Which columns will change in value when Eva adds 4 counters to the hundreds column?

Varied Fluency

R

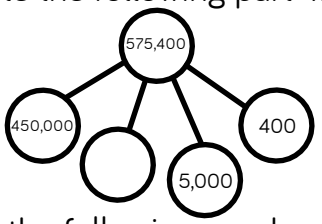
Thousands			Ones		
H	T	O	H	T	O

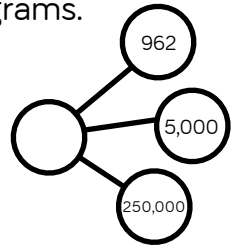
Use counters to make these numbers on the place value chart.

32,651 456,301 50,030

Can you say the numbers out loud?

Complete the following part-whole diagrams.





Eva has the following number.

Thousands			Ones		
H	T	O	H	T	O
	●●● ●●●	●●●● ●●●● ●	●●● ●●●	●● ●●	● ●

She adds 4 counters to the hundreds column.

What is her new number?

Numbers to One Million

Reasoning and Problem Solving

R

Describe the value of the digit 7 in each of the following numbers. How do you know?

407,338

700,491

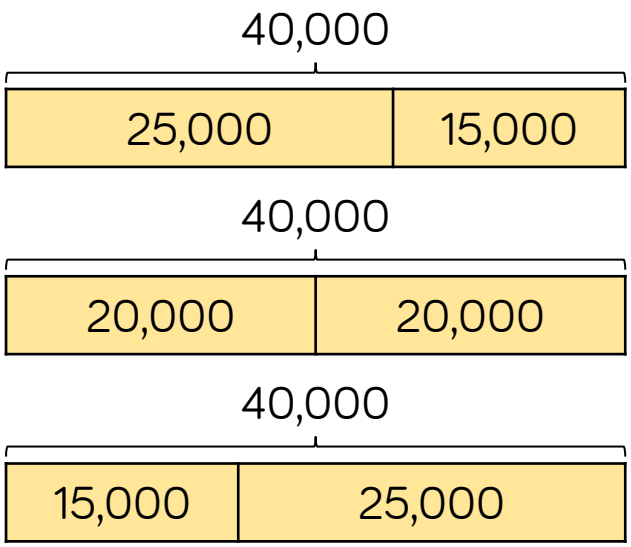
25,571

407,338: the value is 7 thousand. It is to the left of the hundreds column.

700,491: the value is 7 hundred thousand. It is a 6-digit number and there are 5 other numbers in place value columns to the right of this number.

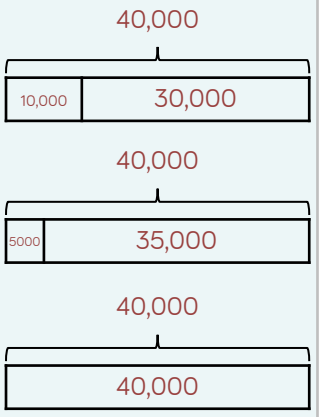
25,571: the value is 7 tens. It is one column to the left of the ones column.

The bar models are showing a pattern.



Draw the next three.

Create your own pattern of bar models for a partner to continue.



Numbers to Ten Million

Notes and Guidance

Children need to read, write and represent numbers to ten million in different ways.
Numbers do not always have to be in the millions – they should see a mixture of smaller and larger numbers, with up to seven digits. The repeating patterns of ones, tens, hundreds, ones of thousands, tens of thousands, hundreds of thousands could be discussed and linked to the placement of commas or other separators.

Mathematical Talk

Why is the zero in a number important when representing large numbers?

What strategies can you use to match the representation to the correct number?

How many ways can you complete the partitioned number?

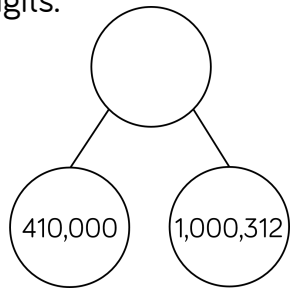
What strategy can you use to work out Teddy's new number?

Varied Fluency

Match the representations to the numbers in digits.

One million, four hundred and one thousand, three hundred and twelve.

M	HTh	TTh	Th	H	T	O
●		● ●	●	● ●	●	● ●



1,401,312 | 1,041,312 | 1,410,312

Complete the missing numbers.

6,305,400 = _____ + 300,000 + _____ + 400

7,001,001 = 7,000,000 + _____ + _____

42,550 = _____ + _____ + _____ + 50

Teddy's number is 306,042
He adds 5,000 to his number.
What is his new number?

Numbers to Ten Million

Reasoning and Problem Solving

Put a digit in the missing spaces to make the statement correct.

$4{,}62\_\,{,}645 < 4{,}623{,}64\_$

Is there more than one option? Can you find them all?

The first digit can be 0, 1, 2 or 3
When the first digit is 0, 1 or 2, the second digit can be any.
When the first digit is 3, the second digit can be 6 or above.

Dora has the number 824,650

She subtracts forty thousand from her number.

She thinks her new number is 820,650

Is she correct?

Explain how you know.

Dora is incorrect because she has subtracted 4,000 not 40,000
Her answer should be 784,650

Use the digit cards and statements to work out my number.

0	3	3	5	5	6	7

- The ten thousands and hundreds have the same digit.
- The hundred thousand digit is double the tens digit.
- It is a six-digit number.
- It is less than six hundred and fifty-five thousand.

Is this the only possible solution?

Possible solutions:

653,530
653,537
650,537
650,533

Compare and Order

Notes and Guidance

Children will compare and order whole numbers up to ten million using numbers presented in different ways.

They should use the correct mathematical vocabulary (greater than/less than) alongside inequality symbols.

Mathematical Talk

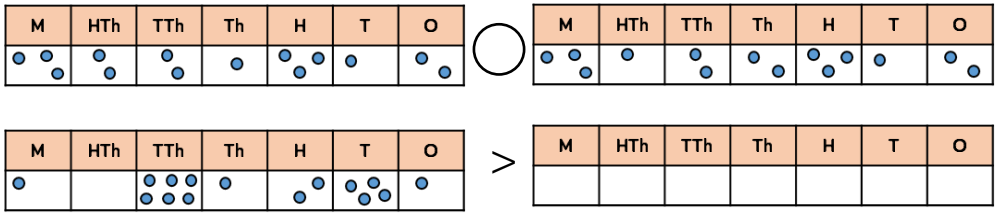
What is the value of each digit in the number?
What is the value of _____ in this number?

What is the value of the whole? Can you suggest other parts that make the whole?

What do you know about the covered number?
What could the number be? What must the number be? What can't the number be?

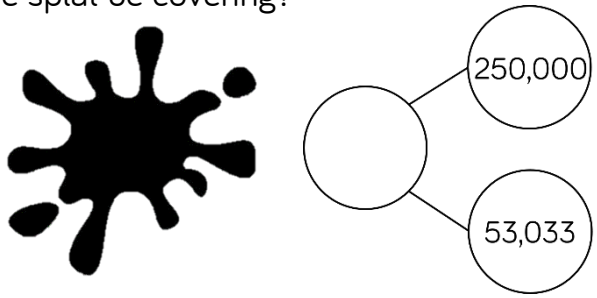
Varied Fluency

Complete the statements to make them true.



What number could the splat be covering?

Three hundred and thirteen thousand and thirty-three



Greatest → Smallest

A house costs £250,000
A motorised home costs £100,000
A bungalow is priced halfway between the two.
Work out the price of the bungalow.

Compare and Order

Reasoning and Problem Solving

Eva has ordered eight 6-digit numbers.

The smallest number is 345,900

The greatest number is 347,000

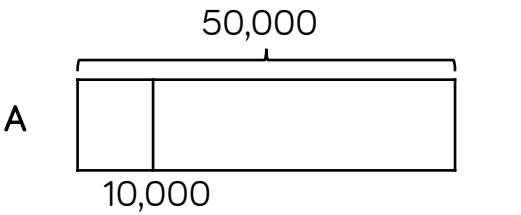
All the other numbers have a digit total of 20 and have no repeating digits.

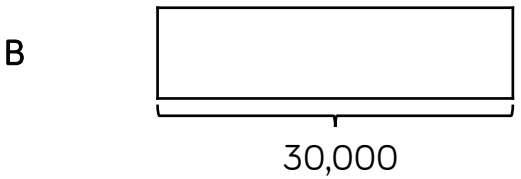
What are the other six numbers?

Can you place all eight numbers in ascending order?

The other six numbers have to have a digit total of 20 and so must start with 346, _ _ _ because anything between 345,900 and 346,000 has a larger digit total. The final three digits have to add up to 7 so the solution is:
345,900
346,025
346,052
346,205
346,250
346,502
346,520
347,000

Jack draws bar model A.
His teacher asks him to draw another where the total is 30,000





Explain how you know bar B is inaccurate.

Bar B is inaccurate because it starts at 10,000 and finishes after 50,000 therefore it is longer than 40,000

Round to 10, 100 and 1,000

Notes and Guidance

Children build on their knowledge of rounding to 10, 100 and 1,000 from Year 4. They need to experience rounding up to and within 10,000

Children must understand that the column from the question and the column to the right of it are used e.g. when rounding 1,450 to the nearest hundred – look at the hundreds and tens columns. Number lines are a useful support.

Mathematical Talk

Which place value column do we need to look at when we round to the nearest 1,000?

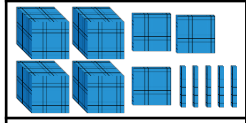
When is it best to round to the nearest 10? 100? 1,000?
Can you give an example of this?
Can you justify your reasoning?

Is there more than one solution?
Will the answers to the nearest 100 and 1,000 be the same or different for the different start numbers?

Varied Fluency

R

- Complete the table.

Start Number	Rounded to the nearest 10	Rounded to the nearest 100	Rounded to the nearest 1,000
			
			
DCCLXIX			

- For each number, find five numbers that round to it when rounding to the nearest 100

300 | 10,000 | 8,900

- Complete the table.

Start Number	Nearest 10	Nearest 100	Nearest 1,000
365			
1,242			
	4,770		

Rounding to 10, 100 and 1,000

Reasoning and Problem Solving

R

My number rounded to the nearest 10 is 1,150
Rounded to the nearest 100 it is 1,200
Rounded to the nearest 1,000 it is 1,000

Jack

What could Jack's number be?

Can you find all of the possibilities?

1,150
1,151
1,152
1,153
1,154

2,567 to the nearest 100 is 2,500

Whitney

Do you agree with Whitney?
Explain why.

I do not agree with Whitney because 2,567 rounded to the nearest 100 is 2,600. I know this because if the tens digit is 5, 6, 7, 8 or 9 we round up to the next hundred.

Teddy

4,725 to the nearest 1,000 is 5,025

Explain the mistake Teddy has made.

Teddy has correctly changed four thousand to five thousand but has added the tens and the ones back on. When rounding to the nearest thousand, the answer is always a multiple of 1,000

Round within Ten Million

Notes and Guidance

Children build on their prior knowledge of rounding.

They will learn to round any number within ten million.

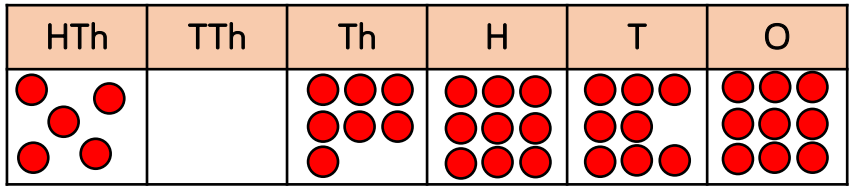
They use their knowledge of multiples and place value columns to work out which two numbers the number they are rounding sits between.

Mathematical Talk

Why do we round up when the following digit is 5 or above?
Which place value column do we need to look at when we round to the nearest 100,000?
What is the purpose of rounding?
When is it best to round to 1,000? 10,000?
Can you justify your reasoning?

What could/must/can't the missing digit be?
Explain how you know.

Varied Fluency



Round the number in the place value chart to:

- The nearest 10,000
- The nearest 100,000
- The nearest 1,000,000

Write five numbers that round to the following numbers when rounded to the nearest hundred thousand.

200,000 600,000 1,900,000

Complete the missing digits so that each number rounds to one hundred and thirty thousand when rounded to the nearest ten thousand.

12 __ ,657 1 __ 1,999 13 __ ,001

Round within Ten Million

Reasoning and Problem Solving

My number is 1,350 when rounded to the nearest 10

Mo

My number is 1,400 when rounded to the nearest 100

Rosie

Both numbers are whole numbers.

What is the greatest possible difference between the two numbers?

The greatest possible difference is 104 (1,345 and 1,449)

Whitney rounded 2,215,678 to the nearest million and wrote 2,215,000

Can you explain to Whitney what mistake she has made?

There should be no non-zero digits in the columns after the millions column.

Miss Grogan gives out four number cards.

15,987	15,813	15,101	16,101

Four children each have a card and give a clue to what their number is.

Tommy says, "My number rounds to 16,000 to the nearest 1,000"

Alex says, "My number has one hundred."

Jack says, " My number is 15,990 when rounded to the nearest 10"

Dora says, "My number is 15,000 when rounded to the nearest 1,000"

Can you work out which child has which card?

Tommy: 15,813

Alex: 16,101

Jack: 15,987

Dora: 15,101

Negative Numbers

Notes and Guidance

Children continue their work on negative numbers from year 5 by counting forwards and backwards through zero.

They extend their learning by finding intervals across zero.
Number lines, both vertical and horizontal are useful to support this, as these emphasise the position of zero.
Children need to see negative numbers in relevant contexts.

Mathematical Talk

Are all negative numbers whole numbers?
Why do the numbers on a number line mirror each other from 0?

Why does positive one add negative one equal zero?
Can you use a number line to show this?

Draw me a picture to show 5 subtract 8
Show 5 more than −2 on a number line.
Could Mo really afford the jumper? How do you know?

Varied Fluency

Use sandcastles (+1) and holes (−1) to calculate.
Here is an example.

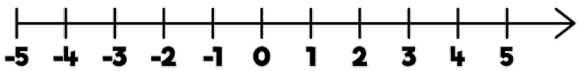
$-2 + 5 =$ 

Two sandcastles will fill two holes. There are three sandcastles left, therefore negative two add five is equal to three.

Use this method to solve:

$3 - 6$ $\quad -7 + 8$ $\quad 5 - 9$

Use the number line to answer the questions.



- What is 6 less than 4?
- What is 5 more than −2?
- What is the difference between 3 and −3?

Mo has £17.50 in his bank account. He pays for a jumper which costs £30
How much does he have in his bank account now?

Negative Numbers

Reasoning and Problem Solving

A company decided to build offices over ground and underground.

Do you agree? Explain why.

No, there would be 41 floors because you need to count floor 0

When counting forwards in tens from any positive one-digit number, the last digit never changes.

When counting backwards in tens from any positive one-digit number, the last digit does change.

Can you find examples to show this?

Explain why this happens.

Possible examples:

9, 19, 29, 39 etc.

9, −1, −11, −21

This happens because when you cross 0, the numbers mirror the positive side of the number line. Therefore, the final digit in the number changes and will make the number bond to 10

White Rose Maths

Autumn - Block 2

Four Operations

Overview

Small Steps

Add whole numbers with more than 4 digits	R
Subtract whole numbers with more than 4 digits	R
Inverse operations (addition and subtraction)	R
Multi-step addition and subtraction problems	R
Add and subtract integers	
Multiply 4-digits by 1-digit	R
Multiply 2-digits (area model)	R
Multiply 2-digits by 2-digits	R
Multiply 3-digits by 2-digits	R
Multiply up to a 4-digit number by 2-digit number	
Divide 4-digits by 1-digit	R
Divide with remainders	R
Short division	
Division using factors	

Notes for 2020/21

Year 6 assumes a lot of prior understanding of four operations. A deep understanding of these concepts are essential to help prepare children for secondary education and beyond.

Some children may not have had much practice in the last few months so we've included extended blocks and plenty of recap.

Overview

Small Steps

1. Long division (1)
2. Long division (2)
3. Long division (3)
4. Long division (4)
5. Factors R
6. Common factors
7. Common multiples
8. Primes to 100
9. Squares and cubes
10. Order of operations
11. Mental calculations and estimation
12. Reason from known facts

Notes for 2020/21

Year 6 assumes a lot of prior understanding of four operations. A deep understanding of these concepts are essential to help prepare children for secondary education and beyond.

Some children may not have had much practice in the last few months so we've included extended blocks and plenty of recap.

Add More than 4-digits

Notes and Guidance

Children will build upon previous learning of column addition. They will now look at numbers with more than four digits and use their place value knowledge to line the numbers up accurately.
Children use a range of manipulatives to demonstrate their understanding and use pictorial representations to support their problem solving.

Mathematical Talk

Will you have to exchange? How do you know which columns will be affected?

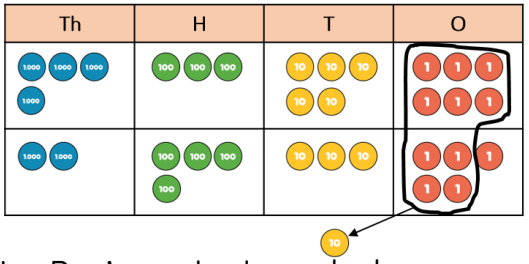
Does it matter that the two numbers don't have the same amount of digits?

Which number goes on top in the calculation? Does it affect the answer?

Varied Fluency

R

Ron uses place value counters to calculate 4,356 + 2,435



	Th	H	T	O
	4	3	5	6
+	2	4	3	5
	6	7	9	1
				1

Use Ron's method to calculate:

	3	2	4	6	1
+		4	3	5	2

	4	8	2	7	6
+		5	6	1	3

Jack, Rosie and Eva are playing a computer game. Jack has 3,452 points, Rosie has 4,039 points and Eva has 10,989 points.

How many points do Jack and Rosie have altogether?
How many points do Rosie and Eva have altogether?
How many points do Jack and Eva have altogether?
How many points do Jack, Rosie and Eva have altogether?

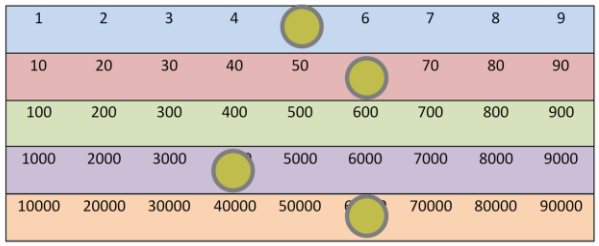
Add More than 4-digits

Reasoning and Problem Solving

R

Amir is discovering numbers on a Gattegno chart.

He makes this number.



Amir moves one counter three spaces on a horizontal line to create a new number.

When he adds this to his original number he gets 131,130

Which counter did he move?

He moved the counter on the thousands row, he moved it from 4,000 to 7,000

Work out the missing numbers.

	?	4	?	3	?
+	2	?	5	?	2
	7	8	5	2	9

54,937 + 23,592 = 78,529

Subtract More than 4-digits

Notes and Guidance

Building on Year 4 experience, children use their knowledge of subtracting using the formal column method to subtract numbers with more than four digits. Children will be focusing on exchange and will be concentrating on the correct place value.

It is important that children know when an exchange is and isn't needed. Children need to experience '0' as a place holder.

Mathematical Talk

Why is it important that we start subtracting the smallest place value first?

Does it matter which number goes on top? Why? Will you have to exchange? How do you know which columns will be affected?

Does it matter that the two numbers don't have the same amount of digits?

Varied Fluency

R

Calculate:

4,648 – 2,347

1,000s	100s	10s	1s
1000 1000 1000 1000	100 100 100 100 100 100	10 10 10 10	1 1 1 1 1 1 1 1

45,536 – 8,426

TTh	Th	H	T	O
10000 10000 10000 10000	1000 1000 1000 1000 1000	100 100 100 100 100	10 10 10	1 1 1 1 1 1

Represent each problem as a bar model, and solve them.

A plane is flying at 29,456 feet.
During the flight the plane descends 8,896 feet.
What height is the plane now flying at?

Tommy earns £37,506 pounds a year.
Dora earns £22,819 a year.
How much more money does Tommy earn than Dora?

There are 83,065 fans at a football match.
45,927 fans are male. How many fans are female?

Subtract More than 4-digits

Reasoning and Problem Solving

R

Eva makes a 5-digit number.

Mo makes a 4-digit number.

The difference between their numbers is 3,465

What could their numbers be?

Possible answers:

9,658 and 14,023
12,654 and 8,289
5,635 and 10,000

Etc.

Rosie completes this subtraction incorrectly.

$$\begin{array}{r} 28701 \\ -\ 7621 \\ \hline 21180 \\ \hline \end{array}$$

Explain the mistake to Rosie and correct it for her.

Rosie did not write down the exchange she made when she exchanged 1 hundred for 10 tens. This means she still had 7 hundreds subtract 6 hundreds when she should have 6 hundreds subtract 6 hundreds.
The correct answer is 21,080

Inverse Operations

Notes and Guidance

In this small step, children will use their knowledge of addition and subtraction to check their workings to ensure accuracy.

They use the commutative law to see that addition can be done in any order but subtraction cannot.

Mathematical Talk

How can you tell if your answer is sensible?

What is the inverse of addition?

What is the inverse of subtraction?

Varied Fluency

R

- When calculating 17,468 – 8,947, which answer gives the corresponding addition question?

  8,947 + 8,631 = 17,468

  8,947 + 8,521 = 17,468

  8,251 + 8,947 = 17,468

- I'm thinking of a number.
  After I add 5,241 and subtract 352, my number is 9,485
  What was my original number?

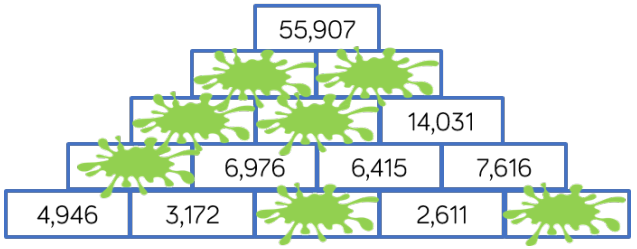
- Eva and Dexter are playing a computer game.
  Eva's high score is 8,524
  Dexter's high score is greater than Eva's.
  The total of both of their scores is 19,384
  What is Dexter's high score?

Inverse Operations

Reasoning and Problem Solving

R

Complete the pyramid using addition and subtraction.



From left to right:

Bottom row:
3,804, 5,005

Second row:
8,118

Third row:
15,094, 13,391

Fourth row:
28,485, 27,422

Mo, Whitney, Teddy and Eva collect marbles.

Mo: I have 1,648 marbles.

I have double the amount of marbles Mo has.

Whitney

Teddy: I have half the amount of marbles Mo has.

In total they have 8,524 marbles between them.
How many does Eva have?

Eva has 2,756 marbles.

Multi-step Problems

Notes and Guidance

In this small step children will be using their knowledge of addition and subtraction to solve multi-step problems.

The problems will appear in different contexts and in different forms i.e. bar models and word problems.

Mathematical Talk

What is the key vocabulary in the question?

What are the key bits of information?

Can we put this information into a model?

Which operations do we need to use?

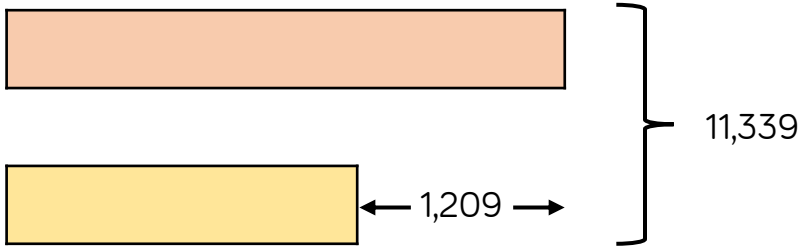
Varied Fluency

R

- When Annie opened her book, she saw two numbered pages.
  The sum of these two pages was 317
  What would the next page number be?

- Adam is twice as old as Barry.
  Charlie is 3 years younger than Barry.
  The sum of all their ages is 53.
  How old is Barry?

- The sum of two numbers is 11,339
  The difference between the same two numbers is 1,209
  Use the bar model to help you find the numbers.



Multi-step Problems

Reasoning and Problem Solving

R

A milkman has 250 bottles of milk.

He collects another 160 from the dairy, and delivers 375 during the day.

How many does he have left?

Tommy

My method:

$375 - 250 = 125$

$125 + 160 = 285$

Do you agree with Tommy?
Explain why.

Tommy is wrong. He should have added 250 and 160, then subtracted 375 from the answer.

There are 35 bottles of milk remaining.

On Monday, Whitney was paid £114

On Tuesday, she was paid £27 more than on Monday.

On Wednesday, she was paid £27 less than on Monday.

How much was Whitney paid in total?

How many calculations did you do?

Is there a more efficient method?

£342

Children might add 114 and 27, subtract 27 from 114 and then add their numbers.

A more efficient method is to recognise that the '£27 more' and '£27 less' cancel out so they can just multiply £114 by three.

Add & Subtract Integers

Notes and Guidance

Children consolidate their knowledge of column addition and subtraction, reinforcing the language of 'exchange' etc. After showing confidence with smaller numbers, children should progress to multi-digit calculations. Children will consider whether the column method is always appropriate e.g. when adding 999, it is easier to add 1,000 then subtract 1

They use these skills to solve multi-step problems in a range of contexts.

Mathematical Talk

What happens when there is more than 9 in a place value column?

Can you make an exchange between columns?

How can we find the missing digits? Can we use the inverse?

Is the column method always the best method?

When should we use mental methods?

Varied Fluency

Calculate.

	3	4	6	2	1
+	2	5	7	3	4

67,832 + 5,258

	4	7	6	1	3	2	5
–		9	3	8	0	5	2

834,501 – 299,999

A four bedroom house costs £450,000
A three bedroom house costs £201,000 less.
How much does the three bedroom house cost?
What method did you use to find the answer?

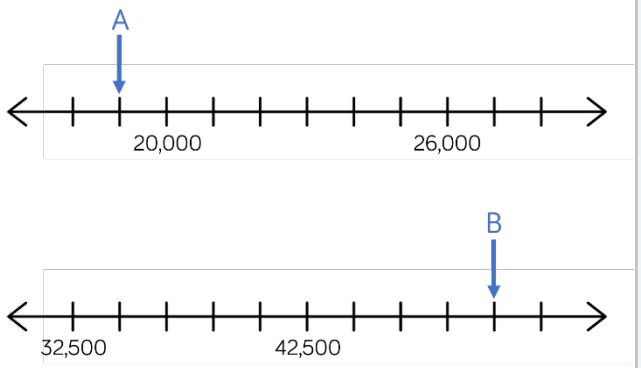
Find the missing digits. What do you notice?

	5	2	2	4	7	?
+	3	?	5	9	0	4
	9	0	?	3	?	2

Add & Subtract Integers

Reasoning and Problem Solving

Find the difference between A and B.

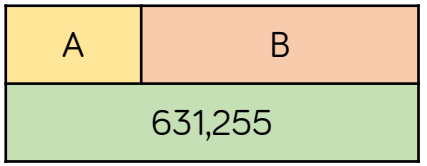


A = 19,000

B = 50,500

The difference is 31,500

Here is a bar model.



A is an odd number which rounds to 100,000 to the nearest ten thousand.
It has a digit total of 30

B is an even number which rounds to 500,000 to the nearest hundred thousand.
It has a digit total of 10

A and B are multiples of 5.

What are possible values of A and B?

Possible answer:

A = 99,255

B = 532,000

Multiply 4-digits by 1-digit

Notes and Guidance

Children build on previous steps to represent a 4-digit number multiplied by a 1-digit number using concrete manipulatives.
Teachers should be aware of misconceptions arising from using 0 as a place holder in the hundreds, tens or ones column.
Children then move on to explore multiplication with exchange in one, and then more than one column.

Mathematical Talk

Why is it important to set out multiplication using columns?

Explain the value of each digit in your calculation.

How do we show there is nothing in a place value column?

What do we do if there are ten or more counters in a place value column?

Which part of the multiplication is the product?

Varied Fluency

R

- Complete the calculation.

Thousands	Hundreds	Tens	Ones
1000		10 10	1 1 1
1000		10 10	1 1 1
1000		10 10	1 1 1

	Th	H	T	O
	1	0	2	3
×				3

- Write the multiplication calculation represented and find the answer.

Thousands	Hundreds	Tens	Ones
1000 1000	100		1 1 1 1 1 1
1000 1000	100		1 1 1 1 1 1

Remember if there are ten or more counters in a column, you need to make an exchange.

- Annie earns £1,325 per week.
How much would he earn in 4 weeks?

Thousands	Hundreds	Tens	Ones
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1

	Th	H	T	O
	1	3	2	5
×				4

Multiply 4-digits by 1-digit

Reasoning and Problem Solving

R

Alex calculated 1,432 × 4

Here is her answer.

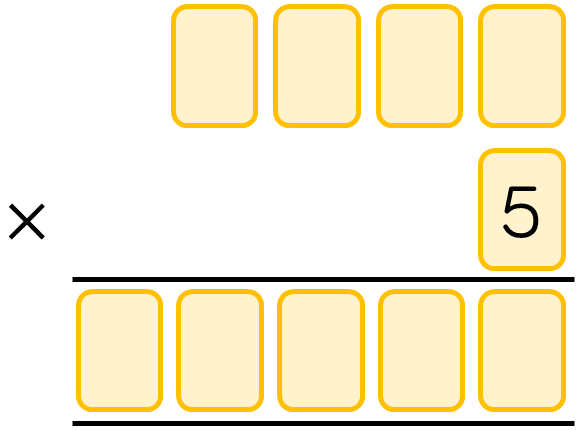
	Th	H	T	O
	1	4	3	2
×				4
	4	16	12	8

1,432 × 4 = 416,128

Can you explain what Alex has done wrong?

Alex has not exchanged when she has got 10 or more in the tens and hundreds columns.

Can you work out the missing numbers using the clues?



- The 4 digits being multiplied by 5 are consecutive numbers.
- The first 2 digits of the product are the same.
- The fourth and fifth digits of the answer add to make the third.

2,345 × 5 = 11,725

Multiply 2-digits (Area Model)

Notes and Guidance

Children use Base 10 to represent the area model of multiplication, which will enable them to see the size and scale linked to multiplying.

Children will then move on to representing multiplication more abstractly with place value counters and then numbers.

Mathematical Talk

What are we multiplying?
How can we partition these numbers?

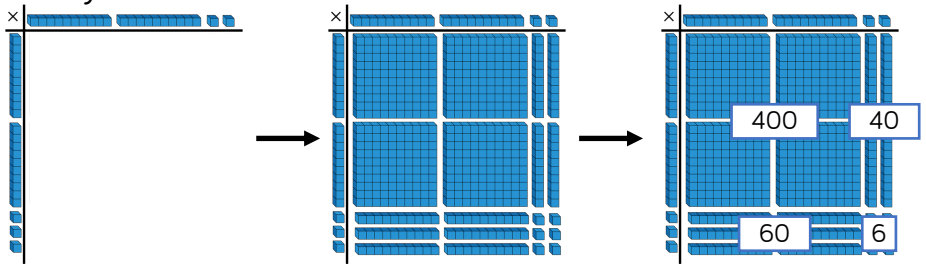
Where can we see 20 × 20?
What does the 40 represent?

What's the same and what's different between the three representations (Base 10, place value counters, grid)?

Varied Fluency

R

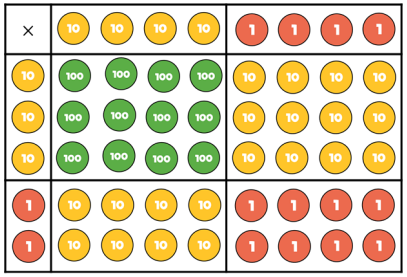
Whitney uses Base 10 to calculate 23 × 22



How could you adapt your Base 10 model to calculate these:

32 × 24 25 × 32 35 × 32

Rosie adapts the Base 10 method to calculate 44 × 32



×	40	4
30	1,200	120
2	80	8

Compare using place value counters and a grid to calculate:

45 × 42 52 × 24 34 × 43

Multiply 2-digits (Area Model)

Reasoning and Problem Solving

R

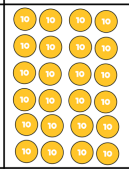
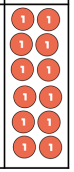
Eva says,

To multiply 23 by 57 I just need to calculate 20 × 50 and 3 × 7 and then add the totals.

What mistake has Eva made?
Explain your answer.

Eva's calculation does not include 20 × 7 and 50 × 3
Children can show this with concrete or pictorial representations.

Amir hasn't finished his calculation.
Complete the missing information and record the calculation with an answer.

×	40	2
40		
6		

Amir needs 8 more hundreds, 40 × 40 = 1,600 and he only has 800

His calculation is 42 × 46 = 1,932

Farmer Ron has a field that measures 53 m long and 25 m wide.

Farmer Annie has a field that measures 52 m long and 26 m wide.

Dora thinks that they will have the same area because the numbers have only changed by one digit each.

Do you agree? Prove it.

Dora is wrong. Children may prove this with concrete or pictorial representations.

Multiply 2-digits by 2-digits

Notes and Guidance

Children will move on from the area model and work towards more formal multiplication methods.

They will start by exploring the role of the zero in the column method and understand its importance.

Children should understand what is happening within each step of the calculation process.

Mathematical Talk

Why is the zero important?

What numbers are being multiplied in the first line and in the second line?

When do we need to make an exchange?

What can we exchange if the product is 42 ones?

If we know what 38 × 12 is equal to, how else could we work out 39 × 12?

Varied Fluency

R

Complete the calculation to work out 23 × 14

		2	3
×		1	4
		9 (1)	2
	2	3	0

(23 × 4)

(23 × 10)

Use this method to calculate:

34 × 26 58 × 15 72 × 35

Complete to solve the calculation.

		4	6
×		2	7
	3	2 (4)	2
	9 (1)	2	0

(___ × ___)

(___ × ___)

Use this method to calculate:

27 × 39 46 × 55 94 × 49

Calculate:

38 × 12 39 × 12 38 × 11

What's the same? What's different?

Multiply 2-digits by 2-digits

Reasoning and Problem Solving

R

Tommy says,

It is not possible to make 999 by multiplying two 2-digit numbers.

Do you agree?
Explain your answer.

Children may use a trial and error approach during which they'll further develop their multiplication skills.
They will find that Tommy is wrong because 27 × 37 is equal to 999

Amir has multiplied 47 by 36

		4	7
×		3	6
	2	8 (4)	2
	1	4 (2)	1
	3	2	3

Alex says,

Amir is wrong because the answer should be 1,692 not 323

Who is correct?
What mistake has been made?

Alex is correct. Amir has forgotten to use zero as a place holder when multiplying by 3 tens.

Multiply 3-digits by 2-digits

Notes and Guidance

Children will extend their multiplication skills to multiplying 3-digit numbers by 2-digit numbers. They will use multiplication to find area and solve multi-step problems.
Methods previously explored are still useful e.g. using an area model.

Mathematical Talk

Why is the zero important?

What numbers are being multiplied in the first line and the second line?

When do we need to make an exchange?

What happens if there is an exchange in the last step of the calculation?

Varied Fluency

R

- Complete:

		1	3	2
×			1	4
		5	2	8
	1	3	2	0

(132 × 4) (132 × 10)

Use this method to calculate:

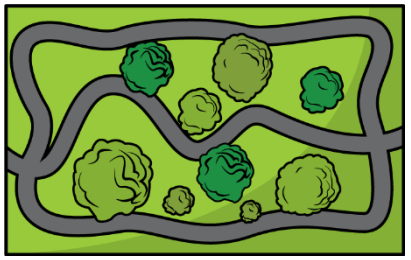
264 × 14 264 × 28

What do you notice about your answers?

- Calculate:

637 × 24 573 × 28 573 × 82

- A playground is 128 yards by 73 yards.



Calculate the area of the playground.

Multiply 3-digits by 2-digits

Reasoning and Problem Solving

R

$22 \times 111 = 2442$

$23 \times 111 = 2553$

$24 \times 111 = 2664$

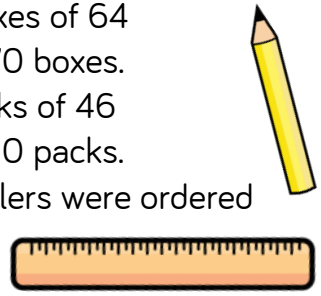
What do you think the answer to 25×111 will be?

What do you notice?

Does this always work?

The pattern stops at up to 28×111 because exchanges need to take place in the addition step.

Pencils come in boxes of 64
A school bought 270 boxes.
Rulers come in packs of 46
A school bought 720 packs.
How many more rulers were ordered than pencils?



15,840

Here are examples of Dexter's maths work.

			9	8	7
×				7	6
		5	5 9	4 2	2
		6	6 9	4 0	9
	1	1 2	8	1 3	1

			3	2	4
×				7	8
		2	1 5	3 9	2
	2	1 2	2 6	8	0
		3	2	7	2

He has made a mistake in each question.

Can you spot it and explain why it's wrong?

Correct each calculation.

In his first calculation, Dexter has forgotten to use a zero when multiplying by 7 tens.
It should have been
$987 \times 76 = 75{,}012$

In the second calculation, Dexter has not included his final exchanges.
$324 \times 8 = \underline{2},592$
$324 \times 70 = \underline{2}2{,}680$
The final answer should have been 25,272

Multiply 4-digits by 2-digits

Notes and Guidance

Children consolidate their knowledge of column multiplication, multiplying numbers with up to 4 digits by a 2-digit number. It may be useful to revise multiplication by a single digit first, and then 2- and 3- digit numbers before moving on when ready to the largest calculations.

They use these skills to solve multi-step problems in a range of contexts.

Mathematical Talk

What is important to remember as we begin multiplying by the tens number?

How would you draw the calculation?

Can the inverse operation be used?

Is there a different strategy that you could use?

Varied Fluency

- Calculate.

	4	2	6	7
×			3	4

	3	0	4	6
×			7	3

5,734 × 26

- Jack made cookies for a bake sale.
He made 345 cookies.
The recipe says that he should have 17 raisins in each cookie.

How many raisins did he use altogether?

- Work out the missing number.

6 × 35 = ___ × 5

Multiply 4-digits by 2-digits

Reasoning and Problem Solving

True or False?

- 5,463 × 18 = 18 × 5,463
- I can find the answer to 1,100 × 28 by calculating 1,100 × 30 and subtracting 2 lots of 1,100
- 702 × 9 = 701 × 10

True

True

False

2	3	4	5	7	8

Place the digits in the boxes to make the largest product.

×				

8432
× 75
632000

Divide 4-digits by 1-digit

Notes and Guidance

Children use their knowledge from Year 4 of dividing 3-digits numbers by a 1-digit number to divide up to 4-digit numbers by a 1-digit number.

They use place value counters to partition their number and then group to develop their understanding of the short division method.

Mathematical Talk

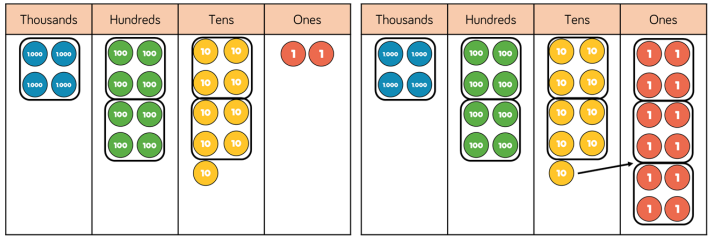
How many groups of 4 thousands are there in 4 thousands?
How many groups of 4 hundreds are there in 8 hundreds?
How many groups of 4 tens are there in 9 tens?
What can we do with the remaining ten?
How many groups of 4 ones are there in 12 ones?

Do I need to solve both calculations to compare the divisions?

Varied Fluency

R

- Here is a method to calculate 4,892 divided by 4 using place value counters and short division.



	1	2	2	3
4	4	8	9	$^{1}2$

Use this method to calculate:

6,610 ÷ 5 2,472 ÷ 3 9,360 ÷ 4

- Mr Porter has saved £8,934
He shares it equally between his three grandchildren.
How much do they each receive?

- Use <, > or = to make the statements correct.

3,495 ÷ 5 ◯ 3,495 ÷ 3

8,064 ÷ 7 ◯ 9,198 ÷ 7

7,428 ÷ 4 ◯ 5,685 ÷ 5

Divide 4-digits by 1-digit

Reasoning and Problem Solving

R

Jack is calculating 2,240 ÷ 7

He says you can't do it because 7 is larger than all of the digits in the number.

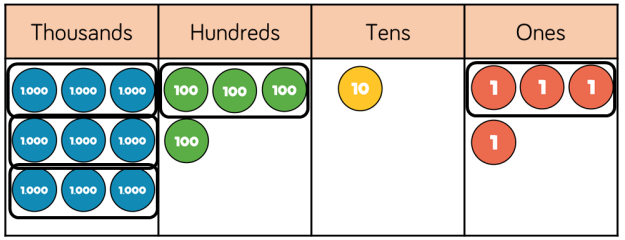
Do you agree with Jack?
Explain your answer.

Jack is incorrect.
You can exchange between columns.
You can't make a group of 7 thousands out of 2 thousand, but you can make groups of 7 hundreds out of 22 hundreds.

The answer is 320

Spot the Mistake

Explain and correct the working.



	3	1	0	1
3	9	4	1	4

There is no exchanging between columns within the calculation.
The final answer should have been 3,138

Divide with Remainders

Notes and Guidance

Children continue to use place value counters to partition and then group their number to further develop their understanding of the short division method.

They start to focus on remainders and build on their learning from Year 4 to understand remainders in context. They do not represent their remainder as a fraction at this point.

Mathematical Talk

If we can't make a group in this column, what do we do?

What happens if we can't group the ones equally?

In this number story, what does the remainder mean?

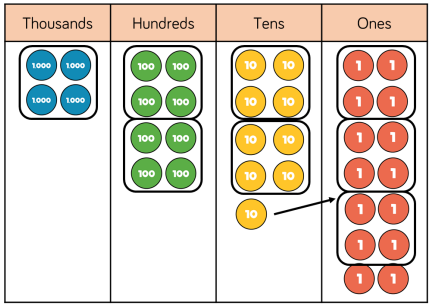
When would we round the remainder up or down?

In which context would we just focus on the remainder?

Varied Fluency

R

- Here is a method to solve 4,894 divided by 4 using place value counters and short division.



	1	2	2	3		
4	4	8	9	1 4		r2

Use this method to calculate:

6,613 ÷ 5 2,471 ÷ 3 9,363 ÷ 4

- Muffins are packed in trays of 6 in a factory.
In one day, the factory makes 5,623 muffins.
How many trays do they need?
How many trays will be full?
Why are your answers different?

- For the calculation 8,035 ÷ 4
  - Write a number story where you round the remainder up.
  - Write a number story where you round the remainder down.
  - Write a number story where you have to find the remainder.

Divide with Remainders

Reasoning and Problem Solving

R

I am thinking of a 3-digit number.

When it is divided by 9, the remainder is 3

When it is divided by 2, the remainder is 1

When it is divided by 5, the remainder is 4

What is my number?

Possible answers:

129	219
309	399
489	579
669	759
849	939

Encourage children to think about the properties of numbers that work for each individual statement.
This will help decide the best starting point.

Always, Sometimes, Never?

A three-digit number made of consecutive descending digits divided by the next descending digit always has a remainder of 1

$765 \div 4 = 191$ remainder 1

How many possible examples can you find?

Sometimes

Possible answers:

$432 \div 1 = 432$ r 0
$543 \div 2 = 271$ r 1
$654 \div 3 = 218$ r 0
$765 \div 4 = 191$ r 1
$876 \div 5 = 175$ r 1
$987 \div 6 = 164$ r 3

Short Division

Notes and Guidance

Children build on their understanding of dividing up to 4-digits by 1-digit by now dividing by up to 2-digits. They use the short division method and focus on the grouping structure of division. Teachers may encourage children to list multiples of the divisor (number that we are dividing by) to help them solve the division more easily. Children should experience contexts where the answer "4 r 1" means both 4 complete boxes or 5 boxes will be needed.

Mathematical Talk

In the hundreds column, how many groups of 5 are in 7? Are there are any hundreds remaining? What do we do next?

In the thousands column, there are no groups of three in 1 What do we do?

Why is the context of the question important when deciding how to round the remainders after a division?

Varied Fluency

Calculate using short division.

5	7	2	5

3	1	9	3	8

1	2	6	0	3	6

3,612 ÷ 14

List the multiples of the divisors to help you calculate.

A limousine company allows 14 people per limousine.

How many limousines are needed for 230 people?

Year 6 has 2,356 pencil crayons for the year.

They put them in bundles, with 12 in each bundle.

How many complete bundles can be made?

Short Division

Reasoning and Problem Solving

Find the missing digits.

$$\begin{array}{r} 041\square r3 \\ 4\overline{)1\square59} \end{array}$$

$$\begin{array}{r} 0414r3 \\ 4\overline{)16}59 \end{array}$$

Here are two calculations.

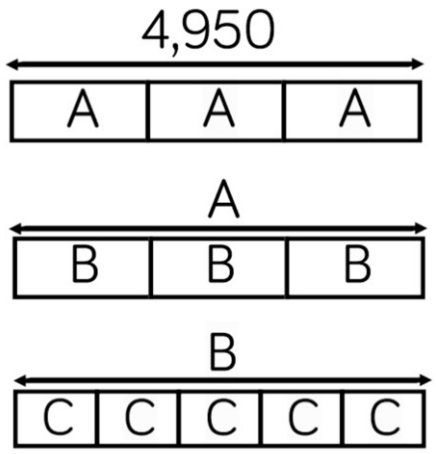
$$A = 396 \div 11$$

$$B = 832 \div 13$$

Find the difference between A and B.

$396 \div 11 = 36$
$832 \div 13 = 64$
$64 - 36 = 28$

Work out the value of C.
(The bar models are not drawn to scale)



$4{,}950 \div 3 = 1{,}650$

$1{,}650 \div 3 = 550$

$550 \div 5 = 110$

Division using Factors

Notes and Guidance

Children use their number sense, specifically their knowledge of factors, to be able to see relationships between the dividend (number being divided) and the divisor (number that the dividend is being divided by).

Beginning with multiples of 10 will allow children to see these relationships, before moving to other multiples.

Mathematical Talk

What is a factor?

How does using factor pairs help us to answer division questions?

Do you notice any patterns?

Does using factor pairs always work?

Is there more than one way to solve a calculation using factor pairs?

What methods can be used to check your working out?

Varied Fluency

- Calculate 780 ÷ 20

  Now calculate 780 ÷ 10 ÷ 2

  What do you notice? Why does this work?

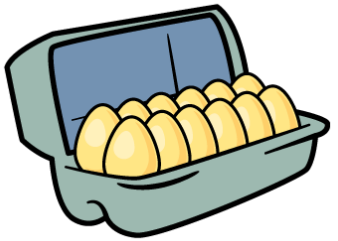
  Use the same method to calculate 480 ÷ 60

- Use factors to help you calculate.

  4,320 ÷ 15

- Eggs are put into boxes.
  Each box holds 12 eggs.
  A farmer has 648 eggs that need to go in the boxes.

  How many boxes will he fill?



Division using Factors

Reasoning and Problem Solving

Calculate:

- 1,248 ÷ 48
- 1,248 ÷ 24
- 1,248 ÷ 12

What did you do each time? What was your strategy?
What do you notice? Why?

26
52
104
Children should recognise that when the dividend is halved, the answer (quotient) is doubled.

Tommy says,

To calculate 4,320 ÷ 15 I will first divide 4,320 by 5 then divide the answer by 10

Do you agree?
Explain why.

Tommy is wrong: he has partitioned 15 when he should have used factor pairs. He could have used factor pairs 5 and 3 and divided by 5 then 3 (or 3 then 5).

Class 6 are calculating 7,848 ÷ 24

The children decide which factor pairs to use. Here are some of their suggestions:

- 2 and 12
- 1 and 24
- 4 and 6
- 10 and 14

Which will not give them the correct answer? Why?

Use the correct factor pairs to calculate the answer.
Is the answer the same each time?

Which factor pair would be the least efficient to use? Why?

10 and 14 is incorrect because they are not factors of 24 (to get 10 and 14, 24 has been partitioned).

The correct answer is 327

Children should get the same answer using all 3 factor pairs methods.

Using the factor pair of 1 and 24 is the least efficient.

Long Division (1)

Notes and Guidance

Children are introduced to long division as a different method of dividing by a 2-digit number.

They divide 3-digit numbers by a 2-digit number without remainders, starting with a more expanded method (with multiples shown), before progressing to the more formal long division method.

Mathematical Talk

How can we use multiples to help us divide by a 2-digit number?

Why are we subtracting the totals from the dividend (starting number)? This question supports children to see division as repeated subtraction.

In long division, what does the arrow represent? (The movement of the next digit coming down to be divided).

Varied Fluency

		0	3	6	
1	2	4	3	2	(×30)
	–	3	6	0	
			7	2	(×6)
	–		7	2	
				0	

Multiples of 12:

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

Use this method to calculate:

765 ÷ 17 450 ÷ 15 702 ÷ 18

		0	3	6	
1	2	4	3	2	
	–	3	6	↓	
			7	2	
	–		7	2	
				0	

Use the long division method to calculate:

836 ÷ 11
798 ÷ 14
608 ÷ 19

Long Division (1)

Reasoning and Problem Solving

Odd One Out

Which is the odd one out?
Explain your answer.

512 ÷ 16

672 ÷ 21

792 ÷ 24

792 ÷ 24 = 33 so this is the odd one out as the other two give an answer of 32

Spot the Mistake

855 ÷ 15 =

		0	5	1	0	
1	5	8	5	5		
	–	7	5		(×	4)
		1	0	5		
	–	1	0	5	(×	10)
				0		

The mistake is that 105 ÷ 15 is not equal to 10

105 ÷ 15 = 7 so the answer to the calculation is 57

Long Division (2)

Notes and Guidance

Building on using long division with 3-digit numbers, children divide 4-digit numbers by 2-digits using the long division method.

They use their knowledge of multiples and multiplying and dividing by 10 and 100 to calculate more efficiently.

Mathematical Talk

How can we use multiples to help us divide by a 2-digit number?

Why are we subtracting the totals from the dividend (starting number)? This question supports children to see division as repeated subtraction.

In long division, what does the arrow represent? (The movement of the next digit coming down to be divided).

Varied Fluency

Here is a division method.

	0	4	8	9	
15	7	3	3	5	
–	6	0	0	0	(×400)
	1	3	3	5	
–	1	2	0	0	(×80)
		1	3	5	
–		1	3	5	(×9)
				0	

Use this method to calculate:

2,208 ÷ 16 1,755 ÷ 45 1,536 ÷ 16

There are 1,989 footballers in a tournament.
Each team has 11 players and 2 substitutes.
How many teams are there in the tournament?

Long Division (2)

Reasoning and Problem Solving

Which calculation is harder?

$1{,}950 \div 13$

$1{,}950 \div 15$

Explain why.

Dividing by 13 is harder because 13 is prime so we cannot use factor knowledge to factorise it into smaller parts. The 13 times table is harder than the 15 times table because the 15 times table is related to the 5 times table whereas the 13 times table is not related to a more common times table (because 13 is prime).

$6{,}120 \div 17 = 360$

Explain how to use this fact to find

$6{,}480 \div$  $= 360$

6,480 is 360 more than 6,120, so there is 1 group of 360 more.

Therefore, there are 18 groups of 360, so the answer is 18

Long Division (3)

Notes and Guidance

Children now divide using long division where answers have remainders. After dividing, they check that the remainder is smaller than the divisor.

Children start to understand how to interpret the remainder e.g. **380 ÷ 12 = 31 r 8 could mean 31 full packs, or 32 packs needed depending on context.**

Mathematical Talk

How can we use multiples to help us divide?

What happens if we cannot divide the ones exactly by the divisor? How do we show what is left over?

Why are we subtracting the totals from the dividend (starting number)?

Why is the context of the question important when deciding how to round the remainders after a division?

Varied Fluency

Tommy uses this method to calculate 372 divided by 15
He has used his knowledge of multiples to help.

			2	4	r	1	2
1	5	3	7	2			
	–	3	0	0			
			7	2			
	–		6	0			
			1	2			

$1 \times 15 = 15$

$2 \times 15 = 30$

$3 \times 15 = 45$

$4 \times 15 = 60$

$5 \times 15 = 75$

$10 \times 15 = 150$

Use this method to calculate:

271 ÷ 17 623 ÷ 21 842 ÷ 32

A school needs to buy 380 biscuits for parents' evening.
Biscuits are sold in packs of 12

How many packets will the school need to buy?

Long Division (3)

Reasoning and Problem Solving

Here are two calculation cards.

A = 396 ÷ 11

B = 832 ÷ 11

Whitney thinks there won't be a remainder for either calculation because 396 and 832 are both multiples of 11

Rosie disagrees, she has done the written calculations and says **one** of them has a remainder.

Who is correct? Explain your answer.

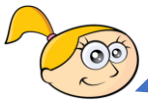
Rosie is correct because 832 is not a multiple of 11

396 ÷ 11 = 36

832 ÷ 11 = 75 r 7

576 children and 32 adults need transport for a school trip.
A coach holds 55 people.

Dora: We need 10 coaches.



Eva: We need 11 coaches.

Alex: We need 12 coaches.

Who is correct? Explain how you know.

How many spare seats will there be?

Alex is correct.

There are 608 people altogether, 608 ÷ 55 = 11 r 3, so 12 coaches are needed.

On 12 coaches there will be 660 seats, because 55 × 12 = 660
660 – 608 = 52 spare seats.

Long Division (4)

Notes and Guidance

Children now divide four-digit numbers using long division where their answers have remainders. After dividing, they check that their remainder is smaller than their divisor.

Children start to understand when rounding is appropriate to use for interpreting the remainder and when the context means that it is not applicable.

Mathematical Talk

How can we use multiples to help us divide?

What happens if we cannot divide the ones exactly by the divisor? How do we show what is left over?

Why are we subtracting the totals from the dividend (starting number)? This question supports children to see division as repeated subtraction.

Does the remainder need to be rounded up or down?

Varied Fluency

Amir used this method to calculate 1,426 divided by 13

			1	0	9	r	9	
1	3	1	4	2	6			
	–	1	3	0	0			(× 100)
			1	2	6			
	–		1	1	7			(×9)
					9			

Use this method to calculate:

2,637 ÷ 16 4,453 ÷ 22 4,203 ÷ 18

A large bakery produces 7,849 biscuits in a day which are packed in boxes.
Each box holds 64 biscuits.

How many boxes are needed so all the biscuits are in a box?

Long Division (4)

Reasoning and Problem Solving

Class 6 are calculating three thousand, six hundred and thirty-three divided by twelve.

Rosie says that she knows there will be a remainder without calculating.

Is she correct?
Explain your answer.

What is the remainder?

Rosie is correct because 3,633 is odd and 12 is even, and all multiples of 12 are even because 12 is even.

3,633 ÷ 12 = 302 r 9, so the remainder is 9

Which numbers up to 20 can 4,236 be divided by without having a remainder?

What do you notice about all the numbers?

1, 2, 3, 4, 6, 12

They are all factors of 12

Factors

Notes and Guidance

Children understand the relationship between multiplication and division and use arrays to show the relationship between them. Children learn that factors of a number multiply together to give that number, meaning that factors come in pairs. Factors are the whole numbers that you multiply together to get another whole number (factor × factor = product).

Mathematical Talk

How can you work in a systematic way to prove you have found all the factors?

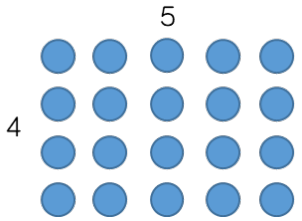
Do factors always come in pairs?

How can we use our multiplication and division facts to find factors?

Varied Fluency

R

If you have twenty counters, how many different ways of arranging them can you find?



How many factors of twenty have you found by arranging your counters in different arrays?

Circle the factors of 60

9, 6, 8, 4, 12, 5, 60, 15, 45

Which factors of 60 are not shown?

Fill in the missing factors of 24

1 × ___ ___ × 12

3 × ___ ___ × ___

What do you notice about the order of the factors?

Use this method to find the factors of 42

Factors

Reasoning and Problem Solving

R

Here is Annie's method for finding factor pairs of 36

1	36
2	18
3	12
4	9
5	X
6	6

When do you put a cross next to a number?

How many factors does 36 have?

Use Annie's method to find all the factors of 64

If it is not a factor, put a cross.

36 has 9 factors.

Factors of 64:

1	64
2	32
3	X
4	16
5	X
6	X
7	X
8	8

Always, Sometimes, Never

- An even number has an even amount of factors.
- An odd number has an odd amount of factors.

Sometimes, e.g. 6 has four factors but 36 has nine.

Sometimes, e.g. 21 has four factors but 25 has three.

True or False?

The bigger the number, the more factors it has.

False. For example, 12 has 6 factors but 13 only has 2

Common Factors

Notes and Guidance

Children find the common factors of two numbers.

Some children may still need to use arrays and other representations at this stage but mental methods and knowledge of multiples should be encouraged.

They can show their results using Venn diagrams and tables.

Mathematical Talk

How do you know you have found all the factors of a given number?

Have you used a systematic approach?

Can you explain your system to a partner?

How does a Venn diagram show common factors?

Where are the common factors?

Varied Fluency

Find the common factors of each pair of numbers.

24 and 36

20 and 30

28 and 45

Which number's factors make it the odd one out?

12, 30, 54, 42, 32, 48

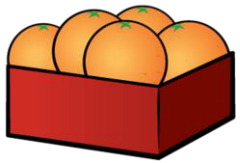
Can you explain why?

Two numbers have common factors of 4 and 9
What could the numbers be?

Common Factors

Reasoning and Problem Solving

There are 49 pears and 56 oranges.



They need to be put into baskets of pears and baskets of oranges with an equal number of fruit in each basket.

Amir says,

There will be 8 pieces of fruit in each basket.

Jack says,

There will be 7 pieces of fruit in each basket.

Who is correct? Explain how you know.

Jack is correct. There will be seven pieces of fruit in each basket because 7 is a common factor of 49 and 56

Tommy has two pieces of string.

One is 160 cm long and the other is 200 cm long.

He cuts them into pieces of equal length.

What are the possible lengths the pieces of string could be?

The possible lengths are: 2, 4, 5, 8, 10, 20 and 40 cm.

Dora has 32 football cards that she is giving away to his friends.

She shares them equally between her friends.

How many friends could Dora have?

Dora could have 1, 2, 4, 8, 16 or 32 friends.

Common Multiples

Notes and Guidance

Building on knowledge of multiples, children find common multiples of numbers. They should continue to use visual representations to support their thinking.

They also use abstract methods to calculate multiples, including using numbers outside of those known in times table facts.

Mathematical Talk

Is the lowest common multiple of a pair of numbers always the product of them?

Can you think of any strategies to work out the lowest common multiples of different numbers?

When do numbers have common multiples that are lower than their product?

Varied Fluency

- On a 100 square, shade the first 5 multiples of 7 and then the first 8 multiples of 5

  What common multiple of 7 and 5 do you find?

  Use this number to find other common multiples of 7 and 5

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	42	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

- List 5 common multiples of 4 and 3

- Alex and Eva play football at the same local football pitches. Alex plays every 4 days and Eva plays every 6 days.

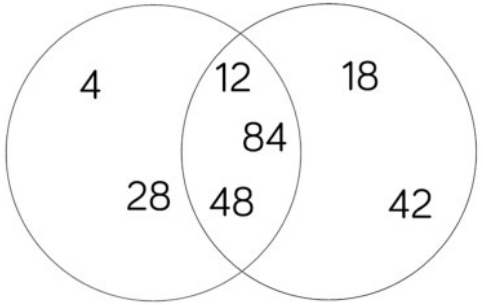
  They both played football today.

  After a fortnight, how many times will they have played football on the same day?

Common Multiples

Reasoning and Problem Solving

Work out the headings for the Venn diagram.



Add in one more number to each section.

Can you find a square number that will go in the middle section of the Venn diagram?

Multiples of 4
Multiples of 6

144 is a square number that can go in the middle.

Annie is double her sister's age.

They are both older than 20 but younger than 50

Their ages are both multiples of 7

What are their ages?

Annie is 42 and her sister is 21

A train starts running from Leeds to York at 7am.
The last train leaves at midnight.

Platform 1 has a train leaving from it every 12 minutes.
Platform 2 has one leaving from it every 5 minutes.

How many times in the day would there be a train leaving from both platforms at the same time?

18 times

Primes to 100

Notes and Guidance

Building on their learning in year 5, children should know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.

They should be able to use their understanding of prime numbers to work out whether or not numbers up to 100 are prime. Using primes, they break a number down into its prime factors.

Mathematical Talk

What is a prime number?

What is a composite number?

How many factors does a prime number have?

Are all prime numbers odd?

Why is 1 not a prime number?

Why is 2 a prime number?

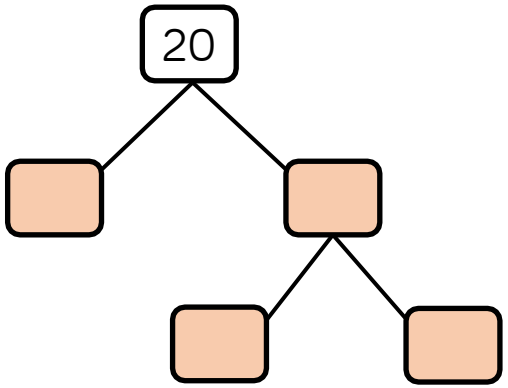
Varied Fluency

- List all of the prime numbers between 10 and 30

- The sum of two prime numbers is 36

  What are the numbers?

- All numbers can be broken down into prime factors.
  A prime factor tree can help us find them.
  Complete the prime factor tree for 20



Primes to 100

Reasoning and Problem Solving

Use the clues to work out the number.

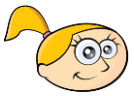
- It is greater than 10
- It is an odd number
- It is not a prime number
- It is less than 25
- It is a factor of 60

15

Shade in the multiples of 6 on a 100 square.

What do you notice about the numbers either side of every multiple of 6?

Eva says,



I noticed there is always a prime number next to a multiple of 6

Is she correct?

Both numbers are always odd.

Yes, Eva is correct because at least one of the numbers either side of a multiple of 6 is always prime for numbers up to 100

Square & Cube Numbers

Notes and Guidance

Children have identified square and cube numbers previously and now explore the relationship between them, and solve problems involving them.
They need to experience sorting the numbers into different diagrams and look for patterns and relationships. They explore general statements regarding square and cube numbers. This step is a good opportunity to practise efficient mental methods of calculation.

Mathematical Talk

What do you notice about the sequence of square numbers?

What do you notice about the sequence of cube numbers?

Explore the pattern of the difference between the numbers.

Varied Fluency

Use <, > or = to make the statements correct.

3 cubed ◯ 4 squared

8 squared ◯ 4 cubed

11 squared ◯ 5 cubed

This table shows square and cube numbers. Complete the table.
Explain the relationships you can see between the numbers.

		1			1
					8
	3×3		3^3		27
	4×4			$4 \times 4 \times 4$	
		25	5^3		
				$6 \times 6 \times 6$	
8^2					

___ + 35 = 99

210 − ___ = 41

Which square numbers are missing from the calculations?

Square & Cube Numbers

Reasoning and Problem Solving

Place 5 odd and 5 even numbers in the table.

	Not Cubed	Cubed
Over 100		
100 or less		

Possible cube numbers to use:

1, 8, 27, 64, 125, 216, 343, 512, 729, 1,000

Jack says,

The smallest number that is both a square number and a cube number is 64

Do you agree with Jack? Explain why you agree or disagree.

Jack is incorrect. 1 is the smallest number that is both a square number ($1^2 = 1$) and cube number ($1^3 = 1$).

Shade in all the square numbers on a 100 square.

Now shade in multiples of 4

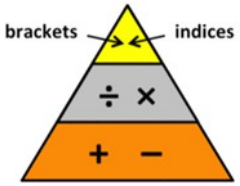
What do you notice?

Square numbers are always either a multiple of 4 or 1 more than a multiple of 4

Order of Operations

Notes and Guidance

Children will look at different operations within a calculation and consider how the order of operations affects the answer.
Children will learn that, in mixed operation calculations, calculations are not carried out from left to right.
Children learn the convention that when there is no operation sign written this means multiply e.g. $4(2 + 1)$ means $4 \times (2 + 1)$. This image is useful when teaching the order of operations.



Mathematical Talk

Does it make a difference if you change the order in a mixed operation calculation?

What would happen if we did not use the brackets?

Would the answer be correct?

Why?

Varied Fluency

- Alex has 7 bags with 5 sweets in each bag.
She adds one more sweet to each bag.
Which calculation will work out how many sweets she now has in total? Explain your answer.

$$7 \times (5 + 1)$$

$$7 \times 5 + 1$$

- Teddy has completed this calculation and got an answer of 5

$$14 - 4 \times 2 \div 4 = 5$$

Explain and correct his error.

- Add brackets and missing numbers to make the calculations correct.

$$6 + \_\_\_ \times 5 = 30$$

$$25 - 6 \times \_\_\_ = 38$$

Order of Operations

Reasoning and Problem Solving

Countdown

Big numbers: 25, 50, 75, 100

Small numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Children randomly select 6 numbers.

Reveal a target number.

Children aim to make the target number ensuring they can write it as a single calculation using order of operations.

Write different number sentences using the digits 3, 4, 5 and 8 before the equals sign that use:

- One operation
- Two operations with no brackets
- Two operations with brackets

Possible solutions:

$58 - 34 = 24$

$58 + 3 \times 4 = 60$

$5(8 - 3) + 4 = 29$

Mental Calculations

Notes and Guidance

We have included this small step separately to ensure that teachers emphasise this important skill. Discussions with children around efficient mental calculations and sensible estimations need to run through all steps.

Sometimes children are too quick to move to computational methods, when more efficient mental strategies should be used.

Mathematical Talk

Is there an easy and quick way to do this?

Can you use known facts to answer the problem?

Can you use rounding?

Does the solution need an exact answer?

How does knowing the approximate answer help with the calculation?

Varied Fluency

How could you change the order of these calculations to be able to perform them mentally?

$50 \times 16 \times 2$

$30 \times 12 \times 2$

$4 \times 17 \times 25$

Mo wants to buy a t-shirt for £9.99, socks for £1.49 and a belt for £8.99
He has £22 in his wallet.
How could he quickly check if he has enough money?

What number do you estimate is shown by arrow B when:

- A = 0 and C = 1,000
- A = 30 and C = 150
- A = −7 and C = 17
- A = 1 and C = 2
- A = 1,000 and C = 100,000

Mental Calculations

Reasoning and Problem Solving

Class 6 are calculating the total of 3,912 and 3,888

Alex says,

We can just double 3,900

Is Alex correct? Explain.

Alex is correct because 3,912 is 12 more than 3,900 and 3,888 is 12 less than 3,900

3,900 × 2 = 7,800

2,000 – 1,287

Here are three different strategies for this subtraction calculation:

I used the column method.

Dora

I used my number bonds from 87 to 100 then from 1,300 to 2,000

Tommy

I subtracted one from each number and then used the column method.

Jack

Whose method is most efficient?

Children share their ideas. Discuss how Dora's method is inefficient for this calculation because of the need to make multiple exchanges.

Jack's method is known as the 'constant difference' method and avoids exchanging.

Reason from Known Facts

Notes and Guidance

Children should use known facts from one calculation to determine the answer of another similar calculation without starting afresh.

They should use reasoning and apply their understanding of commutativity and inverse operations.

Mathematical Talk

What is the inverse?

When do you use the inverse?

How can we use multiplication/division facts to help us answer similar questions?

Varied Fluency

Complete.

$70 \div \_\_\_ = 7$ $3.5 \times 10 = \_\_\_$

$70 \div \_\_\_ = 3.5$ $\_\_\_ = 3.5 \times 20$

$70 \div \_\_\_ = 14$ $\_\_\_ = 3.5 \times 2$

Make a similar set of calculations using $90 \div 2 = 45$

$5{,}138 \div 14 = 367$

Use this to calculate 15×367

$14 \times 8 = 112$

Use this to calculate:

- 1.4×8
- 9×14

Reason from Known Facts

Reasoning and Problem Solving

$$3{,}565 + 2{,}250 = 5{,}815$$

Use this calculation to decide if the following calculations are true or false.

True or False?

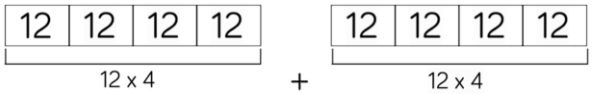
4,565 + 1,250 = 5,815	True
5,815 – 2,250 = 3,565	True
4,815 – 2,565 = 2,250	True
3,595 + 2,220 = 5,845	False

Which calculations will give an answer that is the same as the product of 12 and 8?

$$3 \times 4 \times 8$$

$$12 \times 4 \times 2$$

$$2 \times 10 \times 8$$



The product of 12 and 8 is 96

The 1st and 2nd calculations give an answer of 96
In the 1st calculation 12 has been factorised into 3 and 4, and in the 2nd calculation 8 has been factorised into 4 and 2

The third calculation gives an answer of 160

White Rose Maths

Autumn - Block 3

Fractions

Overview

Small Steps

Equivalent fractions	R
Simplify fractions	
Improper fractions to mixed numbers	R
Mixed numbers to improper fractions	R
Fractions on a number line	
Compare and order (denominator)	
Compare and order (numerator)	
Add and subtract fractions (1)	
Add and subtract fractions (2)	
Add mixed numbers	R
Add fractions	
Subtract mixed numbers	R
Subtract fractions	

Notes for 2020/21

Many children may have missed the block of learning from Y5 on fractions therefore we are suggesting recapping this.

Spend time ensuring children can add and subtract proper fractions, before moving onto mixed numbers.

These skills require understanding of equivalent fractions.

Overview

Small Steps

- Mixed addition and subtraction
- Multiply fractions by integers
- Multiply fractions by fractions
- Divide fractions by integers (1)
- Divide fractions by integers (2)
- Four rules with fractions
- Fraction of an amount
- Fraction of an amount – find the whole

Notes for 2020/21

Many children may have missed the block of learning from Y5 on fractions therefore we are suggesting recapping this.

Spend time ensuring children can add and subtract proper fractions, before moving onto mixed numbers.

These skills require understanding of equivalent fractions.

Equivalent Fractions

Notes and Guidance

Children explore equivalent fractions using models and concrete representations.

They use models to make the link to multiplication and division. Children then apply the abstract method to find equivalent fractions.

It is important children have the conceptual understanding before moving on to just using an abstract method.

Mathematical Talk

What equivalent fractions can we find by folding the paper? How can we record these?

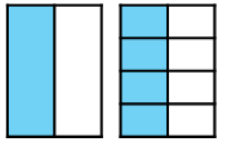
What is the same and what is different about the numerators and denominators in the equivalent fractions?

How does multiplication and division help us find equivalent fractions? Where can we see this in our model?

Varied Fluency

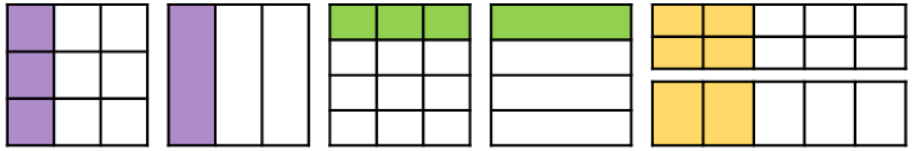
R

Take two pieces of paper the same size.
Fold one piece into two equal pieces.
Fold the other into eight equal pieces.
What equivalent fractions can you find?

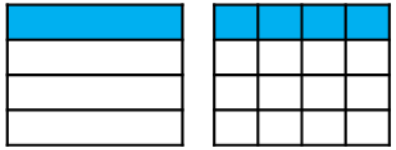


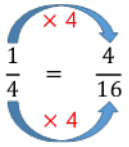
$\frac{1}{2} = \frac{4}{8}$

Use the models to write equivalent fractions.



Eva uses the models and her multiplication and division skills to find equivalent fractions.





Use this method to find equivalent fractions to $\frac{2}{4}$, $\frac{3}{4}$ and $\frac{4}{4}$ where the denominator is 16

Eva uses the same approach to find equivalent fractions for these fractions. How will her method change?

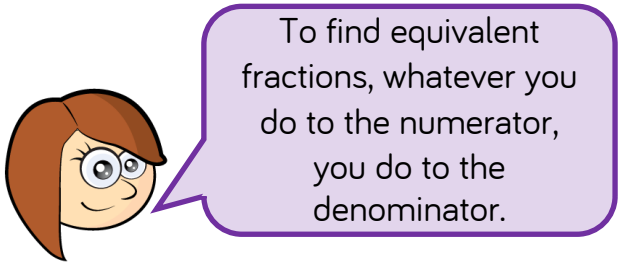
$\frac{4}{12} = \frac{\square}{3}$ $\quad \frac{6}{12} = \frac{\square}{4}$ $\quad \frac{6}{12} = \frac{\square}{2}$

Equivalent Fractions

Reasoning and Problem Solving

R

Rosie says,



Using her method, here are the equivalent fractions Rosie has found for $\frac{4}{8}$

$\frac{4}{8} = \frac{8}{16}$ $\quad$ $\frac{4}{8} = \frac{6}{10}$

$\frac{4}{8} = \frac{2}{4}$ $\quad$ $\frac{4}{8} = \frac{1}{5}$

Are all Rosie's fractions equivalent?
Does Rosie's method work?
Explain your reasons.

$\frac{4}{8} = \frac{1}{5}$ and $\frac{4}{8} = \frac{6}{10}$ are incorrect.

Rosie's method doesn't always work. It works when multiplying or dividing both the numerator or denominator but not when adding or subtracting the same thing to both.

Ron thinks you can only simplify even numbered fractions because you keep on halving the numerator and denominator until you get an odd number.

Do you agree?
Explain your answer.

Ron is wrong. For example $\frac{3}{9}$ can be simplified to $\frac{1}{3}$ and these are all odd numbers.

Here are some fraction cards.
All of the fractions are equivalent.

$\frac{4}{A}$ $\quad$ $\frac{B}{C}$ $\quad$ $\frac{20}{50}$

A + B = 16
Calculate the value of C.

A = 10
B = 6
C = 15

Simplify Fractions

Notes and Guidance

Children use their understanding of the highest common factor to simplify fractions, building on their knowledge of equivalent fractions in earlier years.

Children apply their understanding when calculating with fractions and simplifying their answers. Encourage children to use pictorial representations to support simplifying e.g. a fraction wall.

Mathematical Talk

Can you make a list of the factors for each number?

Which numbers appear in both lists? What do we call these (common factors)?

What is the highest common factor of the numerator and denominator?

Is a simplified fraction always equivalent to the original fraction? Why?

If the HCF of the numerator and denominator is 1, can it be simplified?

Varied Fluency

Alex is simplifying $\frac{8}{12}$ by dividing the numerator and denominator by their highest common factor.

Factors of 8: 1 , 2 , 4 , 8
Factors of 12: 1 , 2 , 3 , 4 , 6 , 12
4 is the highest common factor.

$$\frac{8}{12} \overset{\div 4}{=} \frac{2}{3}$$

Use Alex's method to simplify these fractions:

$$\frac{6}{9} \quad \frac{6}{18} \quad \frac{10}{18} \quad \frac{10}{15} \quad \frac{15}{50}$$

Mo has 3 boxes of chocolates. 2 boxes are full and one box is $\frac{4}{10}$ full.

To simplify $2\frac{4}{10}$, keep the whole number the same and simplify the fraction. $\frac{4}{10}$ simplifies to $\frac{2}{5}$

$$2\frac{4}{10} = 2\frac{2}{5}$$

Use Mo's method to simplify:

$$3\frac{4}{8}, \quad 5\frac{9}{21}, \quad 2\frac{7}{21}, \frac{32}{10}, \frac{32}{6}$$

Simplify Fractions

Reasoning and Problem Solving

Find the total of the fractions.
Give your answer in its simplest form.

$\frac{5}{9}+\frac{1}{9}=$ $\frac{5}{9}+\frac{3}{9}=$ $\frac{5}{9}+\frac{7}{9}=$

Do all the answers need simplifying?
Explain why.

$\frac{5}{9}+\frac{1}{9}=\frac{6}{9}=\frac{2}{3}$

$\frac{5}{9}+\frac{3}{9}=\frac{8}{9}$

$\frac{5}{9}+\frac{7}{9}=1\frac{3}{9}=1\frac{1}{3}$

$\frac{8}{9}$ does not need simplifying because the HCF of 8 and 9 is 1

Tommy is simplifying $4\frac{12}{16}$

$$4\frac{12}{16}=1\frac{3}{4}$$

Explain Tommy's mistake.

Tommy has divided the whole number by 4 instead of just simplifying $\frac{12}{16}$ by dividing the numerator and denominator by 4

Sort the fractions into the table.

Simplifies to $\frac{1}{2}$	Simplifies to $\frac{1}{3}$	Simplifies to $\frac{1}{4}$

$\frac{5}{15}$ $\frac{2}{4}$ $\frac{4}{16}$ $\frac{8}{16}$ $\frac{5}{10}$ $\frac{3}{9}$ $\frac{6}{12}$ $\frac{2}{8}$

Can you see any patterns between the numbers in each column?
What is the relationship between the numerators and denominators?
Can you add three more fractions to each column?

Complete the sentence to describe the patterns:
When a fraction is equivalent to ____, the numerator is _____ the denominator.

Simplifies to $\frac{1}{2}$ - $\frac{2}{4}$, $\frac{8}{16}$, $\frac{5}{10}$, $\frac{6}{12}$
Simplifies to $\frac{1}{3}$ - $\frac{5}{15}$, $\frac{3}{9}$
Simplifies to $\frac{1}{4}$ - $\frac{4}{16}$, $\frac{2}{8}$

When a fraction is equivalent to a half, the numerator is half the denominator.
Children could also discuss the denominator being double the numerator.
Repeat for $\frac{1}{3}$ and $\frac{1}{4}$

Improper to Mixed Numbers

Notes and Guidance

Children convert improper fractions to mixed numbers for the first time. An improper fraction is a fraction where the numerator is greater than the denominator. A mixed number is a number consisting of an integer and a proper fraction.

It is important for children to see this process represented visually to allow them to make the connections between the concept and what happens in the abstract.

Mathematical Talk

How many parts are there in a whole?

What do you notice happens to the mixed number when the denominator increases and the numerator remains the same?

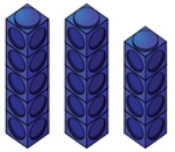
What happens when the numerator is a multiple of the denominator?

Varied Fluency

R

- Whitney converts the improper fraction $\frac{14}{5}$ into a mixed number using cubes.

She groups the cubes into 5s, then has 4 left over.

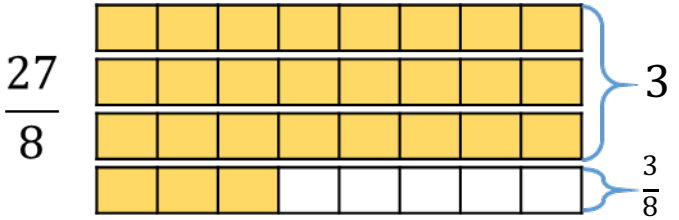


$\frac{5}{5}$ is the same as ☐ $\frac{10}{5}$ is the same as ☐

$\frac{14}{5}$ as a mixed number is ☐ $\frac{☐}{☐}$

Use Whitney's method to convert $\frac{11}{3}$, $\frac{11}{4}$, $\frac{11}{5}$ and $\frac{11}{6}$

- Tommy converts the improper fraction $\frac{27}{8}$ into a mixed number using bar models.



Use Tommy's method to convert $\frac{25}{8}$, $\frac{27}{6}$, $\frac{18}{7}$ and $\frac{32}{4}$

Improper to Mixed Numbers

Reasoning and Problem Solving

R

Amir says,

$\frac{28}{3}$ is less than $\frac{37}{5}$ because 28 is less than 37

Do you agree?
Explain why.

Possible answer

I disagree because $\frac{28}{3}$ is equal to $9\frac{1}{3}$ and $\frac{37}{5}$ is equal to $7\frac{2}{5}$

$\frac{37}{5} < \frac{28}{3}$

Spot the mistake

- $\frac{27}{5} = 5\frac{1}{5}$
- $\frac{27}{3} = 8$
- $\frac{27}{4} = 5\frac{7}{4}$
- $\frac{27}{10} = 20\frac{7}{10}$

What mistakes have been made?

Can you find the correct answers?

Correct answers

- $5\frac{2}{5}$ (incorrect number of fifths)
- 9 (incorrect whole)
- $6\frac{3}{4}$ (still have an improper fraction)
- $2\frac{7}{10}$ (incorrect number of wholes)

Mixed Numbers to Improper

Notes and Guidance

Children now convert from mixed numbers to improper fractions using concrete and pictorial methods to understand the abstract method.

Ensure children always write their working alongside the concrete and pictorial representations so they can see the clear links to the abstract.

Mathematical Talk

How many quarters/halves/eighths/fifths are there in a whole?

How does multiplication support us in converting from mixed numbers to improper fractions?

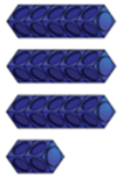
Can you explain the steps in converting an improper fraction to a mixed number? Use the vocabulary: numerator, denominator, multiply, add

How could we use the previous bar model to help?

Varied Fluency

R

Whitney converts $3\frac{2}{5}$ into an improper fraction using cubes.



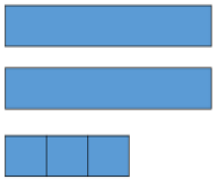
1 whole is equal to ☐ fifths.

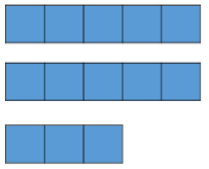
3 wholes are equal to ☐ fifths.

☐ fifths + two fifths = ☐ fifths

Use Whitney's method to convert $2\frac{2}{3}$, $2\frac{2}{4}$, $2\frac{2}{5}$ and $2\frac{2}{6}$

Jack uses bar models to convert a mixed number into an improper fraction.





$2\frac{3}{5}$ = ☐ wholes + ☐ fifths

2 wholes = ☐ fifths

☐ fifths + ☐ fifths = ☐ fifths

Use Jack's method to convert $2\frac{1}{6}$, $4\frac{1}{6}$, $4\frac{1}{3}$ and $8\frac{2}{3}$

Mixed Numbers to Improper

Reasoning and Problem Solving

R

Three children have incorrectly converted $3\frac{2}{5}$ into an improper fraction.

Annie

$3\frac{2}{5} = \frac{6}{15}$

Mo

$3\frac{2}{5} = \frac{15}{5}$

Dexter

$3\frac{2}{5} = \frac{32}{5}$

What mistake has each child made?

Annie has multiplied the numerator and denominator by 3

Mo has multiplied the correctly but then forgotten to add on the extra 2 parts.

Dexter has just placed 3 in front of the numerator.

Fill in the missing numbers.

How many different possibilities can you find for each equation?

$$2\frac{\square}{8} = \frac{\square}{8}$$

$$2\frac{\square}{5} = \frac{\square}{5}$$

Compare the number of possibilities you found.

$2\frac{1}{8} = \frac{17}{8}$ $2\frac{2}{8} = \frac{18}{8}$

$2\frac{3}{8} = \frac{19}{8}$ $2\frac{4}{8} = \frac{20}{8}$

$2\frac{5}{8} = \frac{21}{8}$ $2\frac{6}{8} = \frac{22}{8}$

$2\frac{7}{8} = \frac{23}{8}$

There will be 4 solutions for fifths.

Teacher notes: Encourage children to make generalisations that the number of solutions is one less than the denominator.

Fractions on a Number Line

Notes and Guidance

Children count forwards and backwards in fractions. They compare and order fractions with the same denominator or denominators that are multiples of the same number.
Encourage children to draw extra intervals on the number lines to support them to place the fractions more accurately.
Children use the divisions on the number line to support them in finding the difference between fractions.

Mathematical Talk

Which numbers do I say when I count in eighths and when I count in quarters?

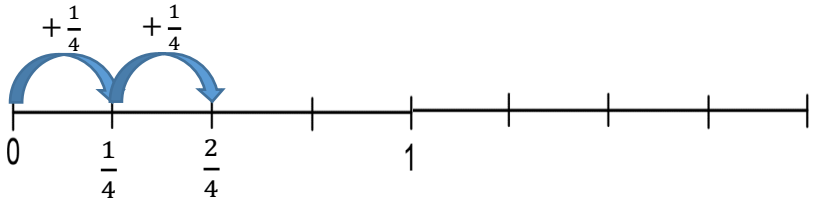
Can you estimate where the fractions will be on the number line?

Can you divide the number line into more intervals to place the fractions more accurately?

How can you find the difference between the fractions?

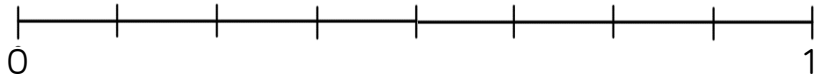
Varied Fluency

Jack is counting in quarters. He writes each number he says on a number line.
Complete Jack's number line.



Can you simplify any of the fractions on the number line?
Can you count forward in eighths? How would the number line change?

Place $\frac{1}{4}, \frac{1}{2}, \frac{1}{8}, \frac{5}{8}, \frac{7}{8}$ and $\frac{3}{16}$ on the number line.



Which fractions were the easiest to place?
Which fractions were the hardest to place?
Which fraction is the largest? Which fraction is the smallest?
What is the difference between the largest and smallest fraction?

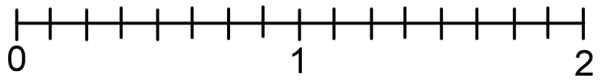
Fractions on a Number Line

Reasoning and Problem Solving

Rosie is counting backwards in fifths.
She starts at $3\frac{2}{5}$ and counts back nine fifths.
What number does Rosie end on?
Show this on a number line.

Rosie ends on $1\frac{3}{5}$

How many ways can you show a difference of one quarter on the number line?



Various answers available.

Plot the sequences on a number line.

$3\frac{1}{2}, 4, 4\frac{1}{2}, 5, 5\frac{1}{2}, 6$

$\frac{13}{4}, \frac{15}{4}, \frac{17}{4}, \frac{19}{4}, \frac{21}{4}, \frac{23}{4}$

$5\frac{5}{8}, 5\frac{1}{8}, 4\frac{5}{8}, 4\frac{1}{8}, 3\frac{5}{8}, 3\frac{1}{8}$

$3\frac{1}{8}, 3\frac{3}{8}, 3\frac{5}{8}, 3\frac{7}{8}, 4\frac{1}{8}, 4\frac{3}{8}$

Which sequence is the odd one out?
Explain why.

Can you think of a reason why each of the sequences could be the odd one out?

Children may choose different sequences for different reasons.
First sequence: the only one containing 6 or it is the only one containing whole numbers.
Second sequence: only one using improper fractions
Third sequence: the only one going backwards.
Fourth sequence: only one not counting in halves.

Compare & Order (Denominator)

Notes and Guidance

Children use their knowledge of equivalent fractions to compare fractions where the denominators are not multiples of the same number.

They find the lowest common multiple of the denominators in order to find equivalent fractions with the same denominators. Children then compare the numerators to find the larger or smaller fraction. Encourage children to also use their number sense to visualise the size of the fractions before converting.

Mathematical Talk

When I know the lowest common multiple, how do I know what to multiply the numerator and denominator by to find the correct equivalent fraction?

How is comparing mixed numbers different to comparing proper fractions? Do I need to compare the whole numbers? Why? If the whole numbers are the same, what do I do?

Can you plot the fractions on a number line to estimate which is the smallest? Which fractions are larger/smaller than a half? How does this help me order the fractions?

Varied Fluency

Use the bar models to compare $\frac{3}{4}$ and $\frac{2}{3}$

____ is greater than ____

____ is less than ____

Dora is comparing $\frac{5}{6}$ and $\frac{3}{4}$ by finding the lowest common multiple of the denominators.

Multiples of 6: 6, 12, 18, 24

Multiples of 4: 4, 8, 12, 16,

12 is the LCM of 4 and 6

$\frac{5}{6} = \frac{10}{12}$ $\frac{3}{4} = \frac{9}{12}$

$\frac{10}{12} > \frac{9}{12}$

Use Dora's method to compare the fractions.

$\frac{4}{5} \bigcirc \frac{3}{4}$ $\frac{3}{5} \bigcirc \frac{4}{7}$ $\frac{3}{4} \bigcirc \frac{7}{10}$ $2\frac{2}{5} \bigcirc 2\frac{3}{8}$

Order the fractions in descending order.

$\frac{3}{8}, \frac{11}{20}, \frac{1}{2}, \frac{2}{5}, \frac{3}{4}, \frac{7}{10}$

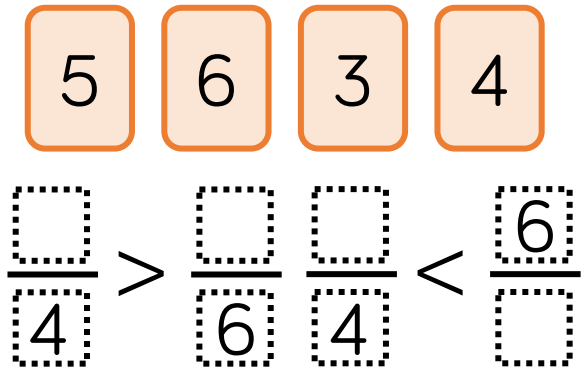
Which fraction is the greatest?

Which fraction is the smallest?

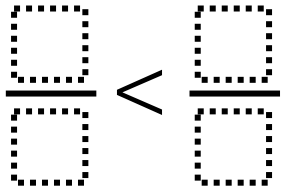
Compare & Order (Denominator)

Reasoning and Problem Solving

Use the digit cards to complete the statements.



Find three examples of ways you could complete the statement.



Can one of your ways include an improper fraction?

$\frac{5}{4} > \frac{3}{6}$

$\frac{3}{4} < \frac{6}{5}$ or $\frac{5}{4} < \frac{6}{3}$

$\frac{3}{5} < \frac{6}{4}$

$\frac{3}{4} < \frac{6}{5}$

$\frac{4}{5} < \frac{6}{3}$

More answers available.

Teddy is comparing $\frac{3}{8}$ and $\frac{5}{12}$

To find the lowest common multiple, I will multiply 8 and 12 together.
$8 \times 12 = 96$
I will use a common denominator of 96

Is Teddy correct?
Explain why.

Teddy is incorrect because the LCM of 8 and 12 is 24
96 is a common multiple so he would still compare the fractions correctly but it is not the most efficient method.

Compare & Order (Numerator)

Notes and Guidance

Building on their prior knowledge of comparing unit fractions, children look at comparing fractions by finding a common numerator. They focus on the idea that when the numerators are the same, the larger the denominator, the smaller the fraction.
Children consider the most efficient method when comparing fractions and decide whether to find common numerators or common denominators.

Mathematical Talk

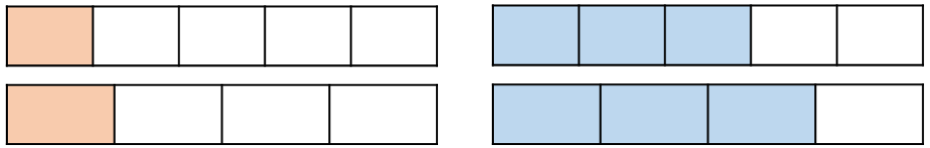
What's the same and what's different about the fractions on the bar models? How can we compare them? Can you use the words greatest and smallest to complete the sentences?

Do you need to change one or both numerators? Why?

How can you decide whether to find a common numerator or denominator?

Varied Fluency

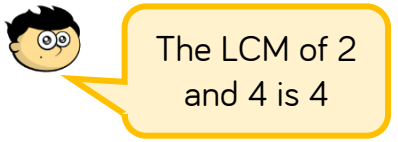
Compare the fractions.



$\frac{1}{5} \bigcirc \frac{1}{4}$ $\frac{1}{5} \bigcirc \frac{3}{5}$ $\frac{1}{4} \bigcirc \frac{3}{4}$ $\frac{3}{5} \bigcirc \frac{3}{4}$

When the denominators are the same, the _____ the numerator, the _____ the fraction.
When the numerators are the same, the _____ the denominator, the _____ the fraction.

Jack is comparing $\frac{2}{5}$ and $\frac{4}{7}$ by finding the LCM of the numerators.



$\frac{2}{5} = \frac{4}{10}$ $\frac{4}{10} < \frac{4}{7}$

Use Jack's method to compare the fractions.

$\frac{3}{5} \bigcirc \frac{12}{17}$ $\frac{6}{11} \bigcirc \frac{3}{5}$ $\frac{5}{9} \bigcirc \frac{4}{7}$ $\frac{8}{5} \bigcirc \frac{12}{7}$

Compare & Order (Numerator)

Reasoning and Problem Solving

Mo is comparing the fractions $\frac{3}{7}$ and $\frac{6}{11}$

He wants to find a common denominator.

Explain whether you think this is the most effective strategy.

This is not the most effective strategy because both denominators are prime. He could find a common numerator by changing $\frac{3}{7}$ into $\frac{6}{14}$ and comparing them by using the rule 'when the numerator is the same, the smaller the denominator, the bigger the fraction' $\frac{6}{11}$ is bigger.

Two different pieces of wood have had a fraction chopped off.

Here are the pieces now, with the fraction that is left.

$\frac{5}{6}$

$\frac{3}{4}$

Which piece of wood was the longest to begin with?

Explain your answer.

Can you explain your method?

The second piece was longer because $\frac{1}{4}$ is greater than $\frac{1}{6}$. Children can explain their methods and how they compared one quarter and one sixth.

Add & Subtract Fractions (1)

Notes and Guidance

Children add and subtract fractions within 1 where the denominators are multiples of the same number. Encourage children to find the lowest common multiple in order to find a common denominator. Ensure children are confident with the understanding of adding and subtracting fractions with the same denominator. Bar models can support this, showing children that the denominators stay the same whilst the numerators are added or subtracted.

Mathematical Talk

If the denominators are different, when we are adding or subtracting fractions, what do we need to do? Why?

How does finding the lowest common multiple help to find a common denominator?

Can you use a bar model to represent Eva's tin of paint? On which day did Eva use the most paint? On which day did Eva use the least paint? How much more paint did Eva use on Friday than Saturday?

Varied Fluency

- Whitney is calculating $\frac{5}{8} + \frac{3}{16}$
  She finds the lowest common multiple of 8 and 16 to find a common denominator.
  LCM of 8 and 16 is 16 $\quad \frac{5}{8} = \frac{10}{16} \quad \frac{10}{16} + \frac{3}{16} = \frac{13}{16}$
  Use this method to calculate:
  $\frac{1}{3} + \frac{2}{9} =$ $\quad \frac{3}{7} + \frac{7}{21} =$ $\quad \frac{8}{15} + \frac{1}{5} =$ $\quad \frac{3}{16} + \frac{3}{8} + \frac{1}{4} =$

- Find a common denominator for each pair of fractions by using the lowest common multiple. Subtract the smaller fraction from the larger fraction in each pair.
  $\frac{3}{4}, \frac{5}{8}$ $\quad \frac{7}{12}, \frac{1}{3}$ $\quad \frac{11}{16}, \frac{3}{4}$ $\quad \frac{14}{15}, \frac{2}{5}$ $\quad \frac{8}{9}, \frac{1}{3}$

- Eva has a full tin of paint. She uses $\frac{1}{3}$ of the tin on Friday, $\frac{1}{21}$ on Saturday and $\frac{2}{7}$ on Sunday. How much paint does she have left?

Add & Subtract Fractions (1)

Reasoning and Problem Solving

Use the same digit in both boxes to complete the calculation.
Is there more than one way to do it?

$$\frac{\square}{20} + \frac{1}{\square} = \frac{9}{20}$$

$\frac{4}{20} + \frac{1}{4} = \frac{9}{20}$

$\frac{5}{20} + \frac{1}{5} = \frac{9}{20}$

Dexter subtracted $\frac{3}{5}$ from a fraction and his answer was $\frac{8}{45}$

What fraction did he subtract $\frac{3}{5}$ from?
Give your answer in its simplest form.

$\frac{8}{45} + \frac{3}{5} = \frac{8}{45} + \frac{27}{45}$

$\frac{8}{45} + \frac{27}{45} = \frac{35}{45} = \frac{7}{9}$

Dexter subtracted $\frac{3}{5}$ from $\frac{7}{9}$

Alex is adding fractions.

$$\frac{3}{5} + \frac{1}{15} = \frac{4}{20} = \frac{1}{5}$$

Do you agree with her?
Explain your answer.

Alex is wrong because she has added the numerators and the denominators rather than finding a common denominator.
It should be

$\frac{9}{15} + \frac{1}{15} = \frac{10}{15} = \frac{2}{3}$

Add & Subtract Fractions (2)

Notes and Guidance

Children add and subtract fractions where the denominators are not multiples of the same number. They continue to find the lowest common multiple, but now need to find equivalent fractions for both fractions in the calculation to find a common denominator.
When the denominators are not multiples of the same number, support children to notice that we need to multiply the denominators together in order to find the LCM.

Mathematical Talk

What is the same about all the subtractions? ($\frac{3}{4}$)

What do you notice about the LCM of all the denominators?

Which of the subtractions has the biggest difference? Explain how you know. Can you order the differences in ascending order?

How can we find the LCM of three numbers? Do we multiply them together? Is 120 the LCM of 4, 5 and 6?

Varied Fluency

Amir is calculating $\frac{7}{9} - \frac{1}{2}$
He finds the lowest common multiple of 9 and 2
LCM of 9 and 2 is 18

$$\frac{7}{9} - \frac{1}{2} = \frac{14}{18} - \frac{9}{18} = \frac{5}{18}$$

Use this method to calculate:

$\frac{3}{4} - \frac{1}{3} =$ $\frac{3}{4} - \frac{3}{5} =$ $\frac{3}{4} - \frac{2}{7} =$ $\frac{3}{4} - \frac{7}{11} =$

Eva has a bag of carrots weighing $\frac{3}{4}$ kg and a bag of potatoes weighing $\frac{2}{5}$ kg. She is calculating how much they weigh altogether.

The LCM of 4 and 5 is 20. I will convert the fractions to twentieths.

$\frac{3}{4} + \frac{2}{5} = \frac{15}{20} + \frac{8}{20} = \frac{23}{20} = 1\frac{3}{20}$ kg

Use this method to calculate:

$\frac{1}{4} + \frac{2}{5} =$ $\frac{7}{8} + \frac{1}{3} =$ $\frac{5}{6} + \frac{5}{7} =$ $\frac{13}{20} + \frac{2}{3} =$

On Friday, Ron walks $\frac{5}{6}$ km to school, $\frac{3}{4}$ km to the shops and $\frac{4}{5}$ km home. How far does he walk altogether?

Add & Subtract Fractions (2)

Reasoning and Problem Solving

A car is travelling from Halifax to Brighton.
In the morning, it completes $\frac{2}{3}$ of the journey.
In the afternoon, it completes $\frac{1}{5}$ of the journey.
What fraction of the journey has been travelled altogether?
What fraction of the journey is left to travel?

The car has travelled $\frac{13}{15}$ of the journey altogether.

There is $\frac{2}{15}$ of the journey left to travel.

If the journey is 270 miles, how far did the car travel in the morning?
How far did the car travel in the afternoon?
How far does the car have left to travel?

The car travelled 180 miles in the morning.
The car travelled 54 miles in the afternoon.
The car has 36 miles left to travel.

Mr and Mrs Rose and knitting scarves.
Mr Rose's scarf is $\frac{5}{9}$ m long.
Mrs Rose's scarf is $\frac{1}{5}$ m longer than Mr Rose's scarf.
How long is Mrs Rose's scarf?
How long are both the scarves altogether?

Mrs Rose's scarf is $\frac{34}{45}$ m long.

Both scarves together are $1\frac{14}{45}$ m long.

Fill in the boxes to make the calculation correct.

$$\square\frac{\square}{10} = \frac{3}{\square} + \frac{\square}{10}$$

Various answers available. E.g.

$$1\frac{1}{10} = \frac{3}{5} + \frac{5}{10}$$

Add Mixed Numbers

Notes and Guidance

Children move on to adding two fractions where one or both are mixed numbers or improper fractions.

They will use a method of adding the wholes and then adding the parts. Children will record their answer in its simplest form.

Children can still draw models to represent adding fractions.

Mathematical Talk

How can we partition these mixed numbers into whole numbers and fractions?

What will the wholes total? Can I add the fractions straight away?

What will these mixed numbers be as improper fractions?

If I have an improper fraction in the question, should I change it to a mixed number first? Why?

Varied Fluency

R

$1\frac{1}{3} + 2\frac{1}{6} = 3 + \frac{3}{6} = 3\frac{3}{6}$ or $3\frac{1}{2}$

$1 + 2 = 3$

$\frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{1}{6} = \frac{3}{6}$

Add the fractions by adding the whole first and then the fractions. Give your answer in its simplest form.

$3\frac{1}{4} + 2\frac{3}{8}$ $\quad$ $4\frac{1}{9} + 3\frac{2}{3}$ $\quad$ $2\frac{5}{12} + 2\frac{1}{3}$

$1\frac{3}{4} + 2\frac{1}{8} = \frac{7}{4} + \frac{17}{8} = \frac{14}{8} + \frac{17}{8} = \frac{31}{8} = 3\frac{7}{8}$

Add the fractions by converting them to improper fractions.

$1\frac{1}{4} + 2\frac{5}{12}$ $\quad$ $2\frac{1}{9} + 1\frac{1}{3}$ $\quad$ $2\frac{1}{6} + 2\frac{2}{3}$

Add these fractions.

$4\frac{7}{9} + 2\frac{1}{3}$ $\quad$ $\frac{17}{6} + 1\frac{1}{3}$ $\quad$ $\frac{15}{8} + 2\frac{1}{4}$

How do they differ from previous examples?

Add Mixed Numbers

Reasoning and Problem Solving

R

Jack and Whitney have some juice.

Jack drinks $2\frac{1}{4}$ litres and Whitney drinks $2\frac{5}{12}$ litres.

How much do they drink altogether?

Complete this using two different methods.

Which method do you think is more efficient? Why?

They drink $4\frac{2}{3}$ litres altogether.

Encourage children to justify which method they prefer and why. Ensure children discuss which method is more or less efficient.

Fill in the missing numbers.

$$4\ \frac{5}{6} + \square\frac{\square}{\square} = 10\ \frac{1}{3}$$

$5\frac{3}{6}$ or $5\frac{1}{2}$

Add Fractions

Notes and Guidance

Children explore adding mixed numbers. They look at different methods depending on whether the fractions total more than one. They add fractions with any denominators, building on their understanding from the previous steps.
Encourage children to draw bar models to support them in considering whether the fractions will cross the whole. They continue to simplify answers and convert between improper fractions and whole numbers when calculating.

Mathematical Talk

How many wholes are there altogether?

Can you find the LCM of the denominators to find a common denominator?

Do you prefer Tommy or Whitney's method? Why?

Does Tommy's method work when the fractions add to more than one? How could we adapt his method?

Does Whitney's method work effectively when there are large whole numbers?

Varied Fluency

Tommy is adding mixed numbers. He adds the wholes and then adds the fractions. Then, Tommy simplifies his answer.

$$1\frac{1}{2} + 2\frac{1}{6} = 1\frac{3}{6} + 2\frac{1}{6} = 3\frac{4}{6} = 3\frac{2}{3}$$

Use Tommy's method to add the fractions.

$3\frac{1}{2} + 2\frac{3}{8} =$ $34\frac{1}{9} + 5\frac{2}{5} =$ $12\frac{5}{12} + 2\frac{1}{7} =$

Whitney is also adding mixed numbers. She converts them to improper fractions, adds them, and then converts them back to a mixed number.

$$1\frac{1}{2} + 2\frac{1}{6} = \frac{3}{2} + \frac{13}{6} = \frac{9}{6} + \frac{13}{6} = \frac{22}{6} = 3\frac{4}{6} = 3\frac{2}{3}$$

Use Whitney's method to add the fractions.

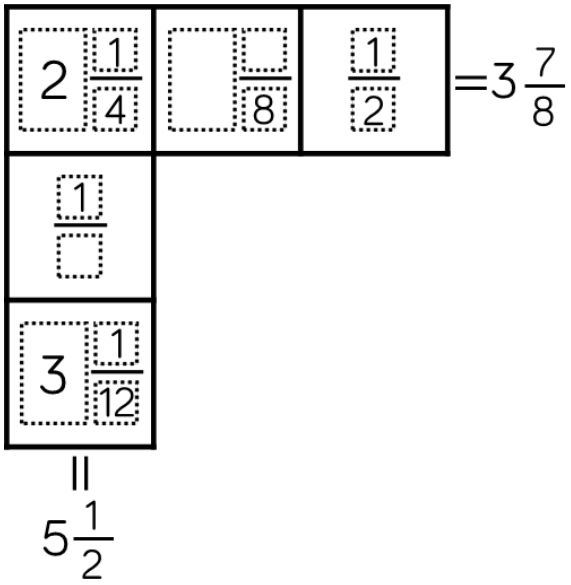
$3\frac{1}{2} + 2\frac{3}{8}$ $2\frac{1}{9} + 2\frac{2}{5}$ $2\frac{7}{9} + 2\frac{2}{5}$ $4\frac{3}{4} + 3\frac{11}{15}$

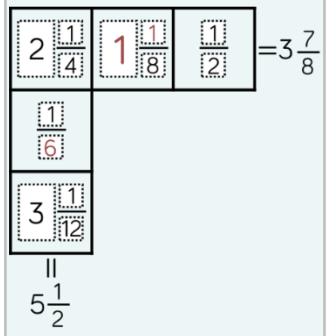
Jug A has $2\frac{3}{4}$ litres of juice in it. Jug B has $3\frac{4}{5}$ litres of juice in it. How much juice is there in Jug A and Jug B altogether?

Add Fractions

Reasoning and Problem Solving

Each row and column adds up to make the total at the end.
Use this information to complete the diagram.





Dora is baking muffins.
She uses $2\frac{1}{2}$ kg of flour, $1\frac{3}{5}$ kg of sugar and $1\frac{1}{4}$ kg of butter.

How much flour, sugar and butter does she use altogether?

How much more flour does she use than butter?

How much less butter does she use than sugar?

Dora uses $5\frac{7}{20}$ kg of flour, sugar and butter altogether.

Dora uses $1\frac{1}{4}$ kg more flour than butter.

Dora uses $\frac{7}{20}$ kg less butter than sugar.

Subtract Mixed Numbers (1)

Notes and Guidance

Children apply their understanding of subtracting fractions where one denominator is a multiple of the other to subtract proper fractions from mixed numbers.

They continue to use models and number lines to support their understanding.

Mathematical Talk

Which fraction is the greatest? How do you know?

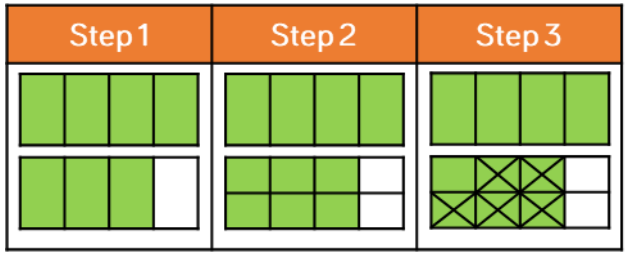
If the denominators are different, what can we do?

Can you simplify your answer?

Which method do you prefer when subtracting fractions: taking away or finding the difference?

Varied Fluency

R



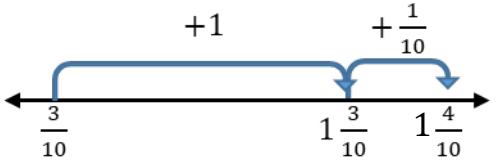
$1\frac{3}{4} - \frac{5}{8} = 1\frac{1}{8}$

Use this method to help you solve:

$2\frac{3}{5} - \frac{3}{10}$ $1\frac{2}{3} - \frac{1}{6}$ $1\frac{5}{6} - \frac{7}{12}$

Use a number line to find the difference between $1\frac{2}{5}$ and $\frac{3}{10}$

$1\frac{2}{5} = 1\frac{4}{10}$



Use a number line to find the difference between:

$3\frac{5}{6}$ and $\frac{1}{12}$ $5\frac{5}{7}$ and $\frac{3}{14}$ $2\frac{7}{9}$ and $\frac{11}{18}$

Solve:

$1\frac{2}{3} - \frac{5}{6}$ $1\frac{3}{4} - \frac{7}{8}$ $2\frac{3}{8} - \frac{11}{16}$

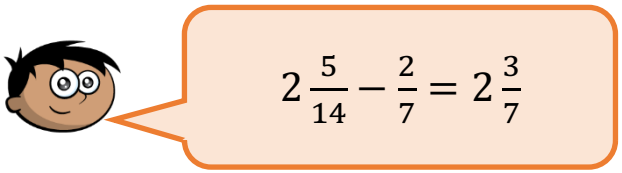
Subtract Mixed Numbers (1)

Reasoning and Problem Solving

R

Amir is attempting to solve $2\frac{5}{14} - \frac{2}{7}$

Here is his working out:

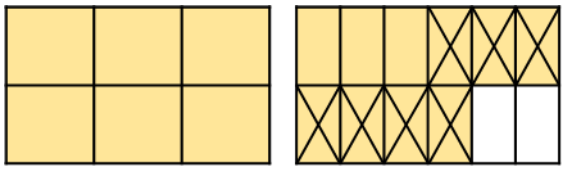


Do you agree with Amir?
Explain your answer.

Possible answer:

Amir is wrong because he hasn't found a common denominator when subtracting the fractions he has just subtracted the numerators and the denominators. The correct answer is $2\frac{1}{14}$

Here is Rosie's method.
What is the calculation?



Can you find more than one answer?
Why is there more than one answer?

The calculation could be $1\frac{5}{6} - \frac{7}{12}$ or $1\frac{10}{12} - \frac{7}{12}$

There is more than one answer because five sixths and ten twelfths are equivalent. Children should be encouraged to write the question as $1\frac{5}{6} - \frac{7}{12}$ so that all fractions are in their simplest form.

Subtract Fractions

Notes and Guidance

Children subtract mixed numbers. They explore different methods including exchanging wholes for fractions and subtracting the wholes and fractions separately and converting the mixed number to an improper fraction.
Encourage children to consider which method is the most efficient depending on the fractions they are subtracting. Bar models can support to help children to visualise the subtraction and understand the procedure.

Mathematical Talk

How many eighths can we exchange for one whole?

What is the same about the first set of subtractions?

What is different about the subtractions? (How does this affect the subtraction?

Do you prefer Annie's or Amir's method? Why?

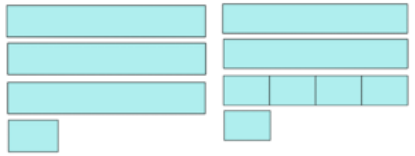
Look at Amir's calculation, what do you notice about the relationship between $3\frac{2}{5}$ and $1\frac{7}{10}$? ($3\frac{2}{5}$ is double $1\frac{7}{10}$)

Varied Fluency

Annie is calculating $3\frac{1}{4} - 1\frac{3}{4}$

I can't subtract the wholes and fractions separately because $\frac{1}{4}$ is less than $\frac{3}{4}$. I will exchange 1 whole for 4 quarters. $3\frac{1}{4} = 2\frac{5}{4}$

$$3\frac{1}{4} - 1\frac{3}{4} = 2\frac{5}{4} - 1\frac{3}{4} = 1\frac{2}{4} = 1\frac{1}{2}$$



Use Annie's method to calculate:

$3\frac{1}{8} - 1\frac{3}{8} =$ $3\frac{1}{8} - 1\frac{1}{2} =$ $3\frac{1}{8} - 1\frac{1}{5} =$ $3\frac{1}{8} - 1\frac{3}{5} =$

Amir is calculating $3\frac{2}{5} - 1\frac{7}{10}$

He converts the mixed numbers to improper fractions to subtract them.

$$3\frac{2}{5} - 1\frac{7}{10} = \frac{17}{5} - \frac{17}{10} = \frac{34}{10} - \frac{17}{10} = \frac{17}{10} = 1\frac{7}{10}$$

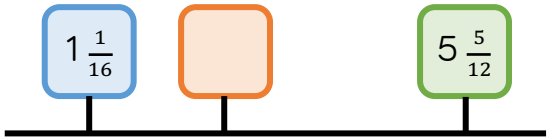
Convert the mixed numbers to improper fractions to calculate:

$4\frac{4}{5} - 1\frac{9}{10} =$ $2\frac{1}{7} - 1\frac{1}{3} =$ $3\frac{5}{12} - 1\frac{7}{9} =$ $3\frac{5}{11} - 1\frac{4}{5} =$

Subtract Fractions

Reasoning and Problem Solving

A blue, orange and green box are on a number line.



The number in the green box is $3\frac{2}{3}$ more than the orange box.

The number in the orange box is:

The number in the orange box is  greater than the number in the blue box.

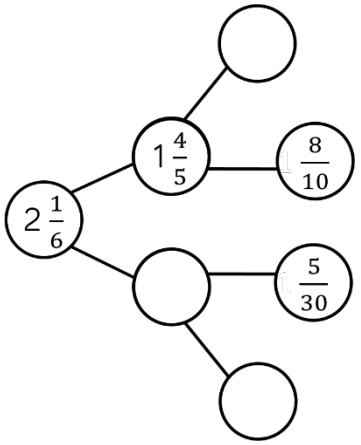
$5\frac{5}{12} - 3\frac{2}{3} = 1\frac{9}{12}$

The orange box is $1\frac{3}{4}$

$1\frac{3}{4} - 1\frac{1}{16} = \frac{11}{16}$

The orange box is $\frac{11}{16}$ greater than the blue box.

Complete the part-whole model.



$2\frac{1}{6} - 1\frac{4}{5} = 1\frac{11}{30}$

$1\frac{4}{5} - \frac{8}{10} = 1$

$1\frac{11}{30} - \frac{5}{30} = 1\frac{6}{30} = 1\frac{1}{5}$

Jack is calculating $4\frac{2}{7} - 2\frac{6}{7}$

He adds $\frac{1}{7}$ to both numbers.

$4\frac{2}{7} - 2\frac{6}{7} = 4\frac{3}{7} - 3$
so the answer is $1\frac{3}{7}$

Explain why Jack is correct.

Jack has increased both mixed numbers by $\frac{1}{7}$ so the difference has remained constant.

Mixed Addition & Subtraction

Notes and Guidance

Children solve problems that involve adding and subtracting fractions and mixed numbers. Encourage children to consider the most efficient method of adding and subtracting fractions and to simplify their answers when possible.
Children can use bar models to represent the problems and support them in deciding whether they need to add or subtract. They can share their different methods to gain a flexible approach to calculating with fractions.

Mathematical Talk

Can you draw a bar model to represent the problem? Do we need to add or subtract the fractions?

How do I know if my answer is simplified fully?

What is the lowest common multiple of the denominators?

How can I calculate the area covered by each vegetable? If you know the area for carrots and cabbages, how can you work out the area for potatoes? Can you think of 2 different ways?

Varied Fluency

- Alex has 5 bags of sweets.

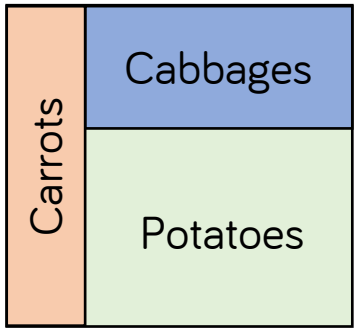
  On Monday she eats $\frac{2}{3}$ of a bag and gives $\frac{4}{5}$ of a bag to her friend.

  On Tuesday she eats $1\frac{1}{3}$ bags and gives $\frac{2}{5}$ of a bag to her friend.

  What fraction of her sweets does Alex have left?

  Give your answer in its simplest form.

- Here is a vegetable patch. $\frac{1}{5}$ of the patch is for carrots. $\frac{3}{8}$ of the patch is for cabbages.



  What fraction of the patch is for carrots and cabbages altogether?
  What fraction of the patch is for potatoes?
  What fraction more of the patch is for potatoes than cabbages?
  Give your answers in their simplest form.

  The vegetable patch has an area of 80 m^2
  What is the area covered by each vegetable?

Mixed Addition & Subtraction

Reasoning and Problem Solving

The mass of Annie's suitcase is $29\frac{1}{2}$ kg.

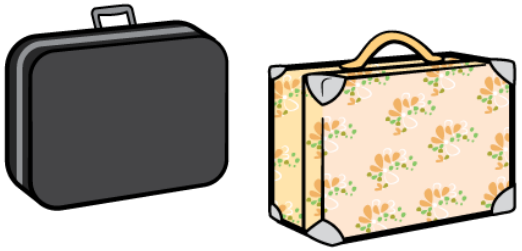
Teddy's suitcase is $2\frac{1}{5}$ kg lighter than Annie's.

How much does Teddy's suitcase weigh?

How much do the suitcases weigh altogether?

There is a weight allowance of 32 kg per suitcase.

How much below the weight allowance are Annie and Teddy?



Teddy's suitcase weighs $27\frac{3}{10}$ kg

The suitcases weigh $56\frac{4}{5}$ kg altogether.

Annie is $2\frac{1}{2}$ kg under the weight allowance.

Teddy is $4\frac{7}{10}$ kg under the weight allowance.

Find the value of the ☀

♥ $+ 3\frac{4}{9} = 6\frac{1}{3}$

$8\frac{1}{10} -$ ♥ $=$ ☀

The value of the ♥ is $2\frac{8}{9}$

The value of the ☀ is $5\frac{19}{90}$

Multiply Fractions by Integers

Notes and Guidance

Children multiply fractions and mixed numbers by integers. They use diagrams to highlight the link between multiplication and repeated addition. This supports the children in understanding why the denominator stays the same and we multiply the numerator.

When multiplying mixed numbers, children partition into wholes and parts to multiply more efficiently. They compare this method with multiplying improper fractions.

Mathematical Talk

How is multiplying fractions similar to adding fractions?

How does partitioning the mixed number into wholes and fractions support us to multiply?

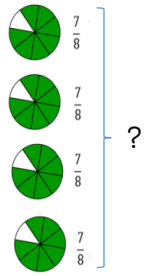
Do you prefer partitioning the mixed number or converting it to an improper fraction to multiply? Why?

Does it matter if the integer is first or second in the multiplication sentence? Why?

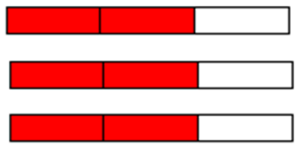
Varied Fluency

Complete:

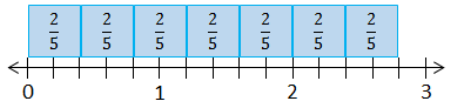
$4 \times \frac{7}{8}$ = ?



$3 \times \frac{2}{3}$ = ?



$\frac{2}{5} \times 7$

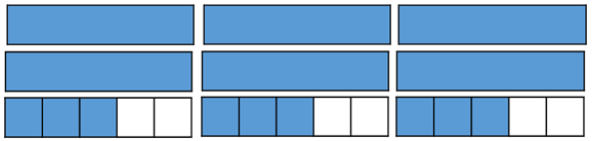


Eva partitions $2\frac{3}{5}$ to help her to calculate $2\frac{3}{5} \times 3$

$2 \times 3 = 6$

$\frac{3}{5} \times 3 = \frac{9}{5} = 1\frac{4}{5}$

$6 + 1\frac{4}{5} = 7\frac{4}{5}$



Use Eva's method to calculate:

$2\frac{5}{6} \times 3$ $\quad 1\frac{3}{7} \times 5$ $\quad 2\frac{2}{3} \times 3$ $\quad 4 \times 1\frac{1}{6}$

Convert the mixed number to an improper fraction to multiply.

$$2\frac{3}{5} \times 3 = \frac{13}{5} \times 3 = \frac{39}{5} = 7\frac{4}{5}$$

Use this method to calculate:

$3 \times 2\frac{2}{5}$ $\quad 1\frac{5}{7} \times 3$ $\quad 2 \times 1\frac{3}{4}$ $\quad 2 \times 1\frac{1}{6}$

Multiply Fractions by Integers

Reasoning and Problem Solving

There are 9 lamp posts on a road. There is $4\frac{3}{8}$ of a metre between each lamp post.

What is the distance between the first and last lamp post?

$8 \times 4\frac{3}{8} = 8 \times \frac{35}{8}$

$= \frac{280}{8} = 35$

The distance between the first and last lamp post is 35 metres.

Use pattern blocks, if  is equal to 1 whole, work out what fraction the other shapes represent.
Use this to calculate the multiplications.
Give your answers in their simplest form.

 $\times 5 =$

 $\times 5 =$

 $\times 5 =$

 $\times 5 = \frac{5}{6}$

 $\times 5 = \frac{5}{3} = 1\frac{2}{3}$

 $\times 5 = \frac{5}{2} = 2\frac{1}{2}$

Eva and Amir both work on a homework project.


Eva

I spent $4\frac{1}{4}$ hours a week for 4 weeks doing my project.

I spent $2\frac{3}{4}$ hours a week for 5 weeks doing my project.


Amir

Who spent the most time on their project?

Explain your reasoning.

$4 \times 4\frac{1}{4} = \frac{68}{4}$

$= 17$ hours

$5 \times 2\frac{3}{4} = \frac{55}{4}$

$= 13\frac{3}{4}$ hours

Eva spent $3\frac{1}{4}$ hours longer on her project than Amir did.

Multiply Fractions by Fractions

Notes and Guidance

Children use concrete and pictorial representations to support them to multiply fractions. Support children in understanding the link between multiplying fractions and finding fractions of an amount: $\frac{1}{3} \times \frac{1}{2}$ is the same as $\frac{1}{3}$ of $\frac{1}{2}$

Encourage children to spot the patterns of what is happening in the multiplication, to support them in unpicking the procedure of multiplying fractions by multiplying the numerators and multiplying the denominators.

Mathematical Talk

Could you use folding paper to calculate $\frac{2}{3} \times \frac{1}{2}$? How? Use a piece of paper to model this to a friend.

How are the diagrams similar to folding paper? Which do you find more efficient?

What do you notice about the product of the fractions you have multiplied? What is the procedure to multiply fractions?

Does multiplying two numbers always give you a larger product? Explain why.

Varied Fluency

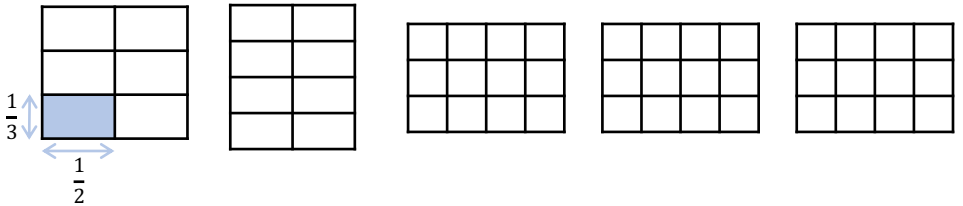
Dexter is calculating $\frac{1}{3} \times \frac{1}{2}$ by folding paper. He folds a piece of paper in half. He then folds the half into thirds.He shades the fraction of paper he has created. When he opens it up he finds he has shaded $\frac{1}{6}$ of the whole piece of paper.

$\frac{1}{3} \times \frac{1}{2}$ means $\frac{1}{3}$ of a half. Folding half the paper into three equal parts showed me that $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$

Represent and calculate the multiplications by folding paper.

$\frac{1}{4} \times \frac{1}{2} =$ $\frac{1}{4} \times \frac{1}{3} =$ $\frac{1}{4} \times \frac{1}{4} =$

Alex is drawing diagrams to represent multiplying fractions.



Shade the diagrams to calculate:

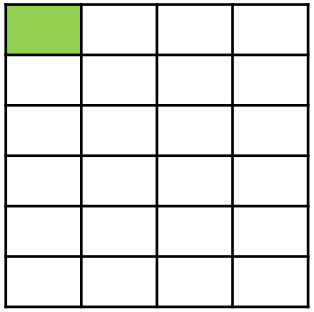
$\frac{1}{3} \times \frac{1}{2} =$ $\frac{1}{4} \times \frac{1}{2} =$ $\frac{1}{3} \times \frac{1}{4} =$ $\frac{2}{3} \times \frac{1}{4} =$ $\frac{2}{3} \times \frac{3}{4} =$

Write your answers in their simplest form.

Multiply Fractions by Fractions

Reasoning and Problem Solving

The shaded square in the grid below is the answer to a multiplying fractions question.
What was the question?



$\frac{1}{6} \times \frac{1}{4}$

How many ways can you complete the missing digits?

$\frac{\square}{\square} \times \frac{3}{\square} = \frac{6}{12}$

$= \frac{\square}{2}$

Possible answers:

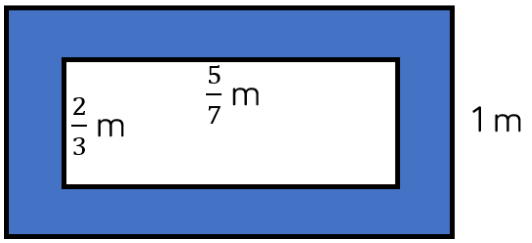
$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$

$\frac{2}{2} \times \frac{3}{6} = \frac{6}{12} = \frac{1}{2}$

Children could also use improper fractions.

Find the area of the shaded part of the shape.

Not drawn accurately



$1 \times 1 = 1$

$\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$

$1 - \frac{10}{21} = \frac{11}{21}$

The shaded area is $\frac{11}{21}$ m^2.

Alex says,

$\frac{1}{4} \times \frac{1}{2}$ is the same as $\frac{1}{2}$ of a quarter.

Do you agree?
Explain why.

Alex is correct. Multiplication is commutative so $\frac{1}{4} \times \frac{1}{2}$ is the same as $\frac{1}{2}$ of a quarter or $\frac{1}{4}$ of a half.

Divide Fractions by Integers (1)

Notes and Guidance

Children are introduced to dividing fractions by integers for the first time. They focus on dividing fractions where the numerator is a multiple of the integer they are dividing by. Encourage children to spot the pattern that the denominator stays the same and the numerator is divided by the integer
Children link dividing fractions to multiplying by unit fractions. Use the diagrams children drew for multiplying fractions to discuss how and why the calculations are similar.

Mathematical Talk

How could you represent this fraction?
Is the numerator divisible by the integer?

Why doesn't the denominator change?

What pattern can you see when dividing elevenths?

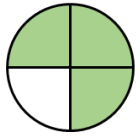
How can we use the pattern to help us to calculate a mixed number by an integer? Can you convert it to an improper fraction?

Varied Fluency

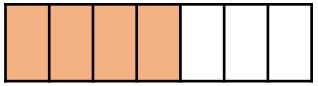
Dexter has $\frac{2}{5}$ of a chocolate bar. He shares it with his friend. What fraction of the chocolate bar do they each get?

Use the diagrams to help you calculate.

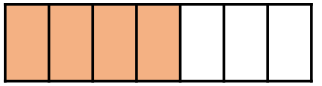
$\frac{3}{4} \div 3 =$



$\frac{4}{7} \div 4 =$



$\frac{4}{7} \div 2 =$



Calculate.

$\frac{1}{11} \div 1 =$ $\frac{2}{11} \div 2 =$ $\frac{3}{11} \div 3 =$ $\frac{4}{11} \div 4 =$

$\frac{2}{11} \div 2 =$ $\frac{4}{11} \div 2 =$ $\frac{6}{11} \div 2 =$ $\frac{8}{11} \div 2 =$

$\frac{3}{11} \div 3 =$ $\frac{6}{11} \div 3 =$ $\frac{9}{11} \div 3 =$ $1\frac{1}{11} \div 3 =$

Divide Fractions by Integers (1)

Reasoning and Problem Solving

Tommy says,

> Dividing by 2 is the same as finding half of a number so $\frac{4}{11} \div 2$ is the same as $\frac{1}{2} \times \frac{4}{11}$

Do you agree?
Explain why.

Tommy is correct. It may help children to understand this by reinforcing that $\frac{1}{2} \times \frac{4}{11}$ is the same as $\frac{1}{2}$ of $\frac{4}{11}$

Match the equivalent calculations.

$\frac{1}{4} \times \frac{12}{13}$	$\frac{12}{13} \div 2$
$\frac{1}{6} \times \frac{12}{13}$	$\frac{12}{13} \div 6$
$\frac{1}{2} \times \frac{12}{13}$	$\frac{12}{13} \div 4$
$\frac{1}{3} \times \frac{12}{13}$	$\frac{12}{13} \div 3$

$\frac{1}{4} \times \frac{12}{13} = \frac{12}{13} \div 4$

$\frac{1}{6} \times \frac{12}{13} = \frac{12}{13} \div 6$

$\frac{1}{2} \times \frac{12}{13} = \frac{12}{13} \div 2$

$\frac{1}{3} \times \frac{12}{13} = \frac{12}{13} \div 3$

Complete the missing integers.

$\frac{15}{16} \div \square = \frac{5}{16}$

$\frac{15}{16} \div \square = \frac{3}{16}$

$\frac{20}{23} \div \square = \frac{4}{23}$

$\frac{20}{23} \div \square = \frac{5}{23}$

3
5
5
4

Rosie walks for $\frac{3}{4}$ of an hour over 3 days.
She walks for the same amount of time each day.
How many minutes does Rosie walk each day?

Rosie walks for $\frac{1}{4}$ of an hour each day.
She walks for 15 minutes each day.

Divide Fractions by Integers (2)

Notes and Guidance

Children divide fractions where the numerator is not a multiple of the integer they are dividing by.
They draw diagrams to divide fractions into equal parts and explore the link between multiplying by a unit fraction and dividing by an integer.
Children find equivalent fractions to support the divisions and draw diagrams to model how this works.

Mathematical Talk

How is Mo's method of dividing fractions similar to multiplying $\frac{1}{3}$ by $\frac{1}{2}$?

Do you prefer Mo's or Annie's method? Explain why.

Why does finding an equivalent fraction help us to divide fractions by integers?

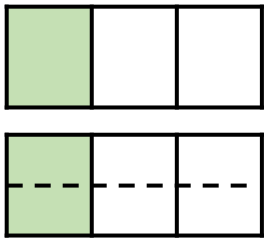
What multiplication can I use to calculate $\frac{3}{5} \div 2$? Explain how you know.

Varied Fluency

Mo is dividing $\frac{1}{3}$ by 2

I have divided one third into 2 equal parts. Each part is worth $\frac{1}{6}$

$\frac{1}{3} \div 2 = \frac{1}{6}$

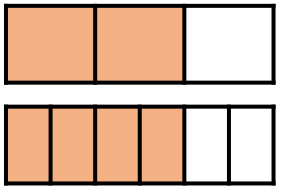


Draw diagrams to calculate:

$\frac{1}{3} \div 3 =$ $\frac{2}{3} \div 3 =$ $\frac{1}{5} \div 3 =$ $\frac{2}{5} \div 3 =$

Annie is dividing $\frac{2}{3}$ by 4

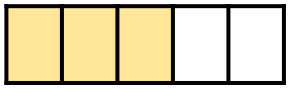
The numerator isn't a multiple of the integer I am dividing by so I will find an equivalent fraction to help me divide the numerator equally.



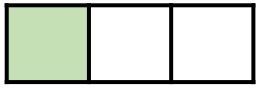
$\frac{2}{3} = \frac{4}{6}$ $\frac{4}{6} \div 4 = \frac{1}{6}$

Find equivalent fractions to calculate:

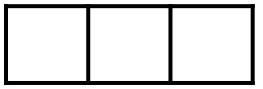
$\frac{3}{5} \div 2$



$\frac{1}{3} \div 3$



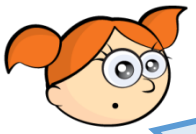
$\frac{2}{3} \div 3$



Divide Fractions by Integers (2)

Reasoning and Problem Solving

Alex says,



I can only divide a fraction by an integer if the numerator is a multiple of the divisor.

Do you agree?
Explain why.

Alex is wrong, we can divide any fraction by an integer.

Calculate the missing fractions and integers.

$$\square \div 4 = \frac{7}{36}$$

$$\frac{3}{20} \div \square = \frac{3}{80}$$

$$\square \div \square = \frac{2}{5}$$

Is there more than one possibility?

$\frac{7}{9}$

4

There are many possibilities in this last question. Children could look for patterns between the fractions and integers.

Four Rules with Fractions

Notes and Guidance

Children combine the four operations when calculating with fractions.
This is a good opportunity to recap the order of operations as children calculate equations with and without brackets.
Encourage children to draw bar models to represent worded problems in order to understand which operation they need to use?

Mathematical Talk

Which part of the equation do we calculate first when we have more than one operation?

What do you notice about the six questions that begin with $3\frac{1}{3}$?

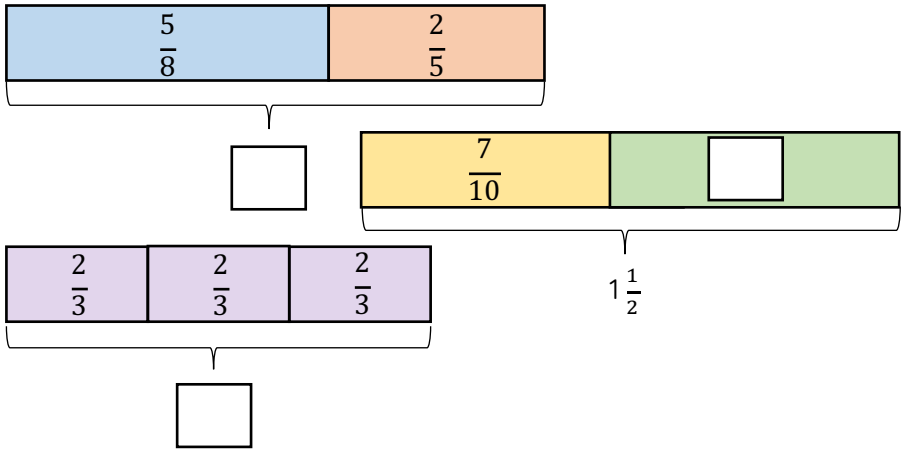
What's the same about the equations? What's different?

Which equation has the largest answer? Can you order the answers to the equations in descending order?

Can you write the worded problem as a number sentence?

Varied Fluency

- Complete the missing boxes.



- Calculate:

$3\frac{1}{3}+\frac{1}{3}-2=$ $3\frac{1}{3}+\frac{1}{3}+2=$ $3\frac{1}{3}+\frac{1}{3}\times 2=$

$3\frac{1}{3}+\frac{1}{3}\div 2=$ $(3\frac{1}{3}+\frac{1}{3})\times 2=$ $(3\frac{1}{3}+\frac{1}{3})\div 2=$

- Jack has one quarter of a bag of sweets and Whitney has two thirds of a bag of sweets. They combined their sweets and shared them equally between themselves and Rosie.
What fraction of the sweets does each child receive?

Four Rules with Fractions

Reasoning and Problem Solving

Add two sets of brackets to make the following calculation correct:

$$\frac{1}{2} + \frac{1}{4} \times 8 + \frac{1}{6} \div 3 = 6\frac{1}{18}$$

Explain where the brackets go and why.
Did you find any difficulties?

$(\frac{1}{2} + \frac{1}{4}) \times 8 + (\frac{1}{6} \div 3)$

Match each calculation to the correct answer.

$(\frac{2}{3} + \frac{2}{9}) \div 4$	$\frac{5}{9}$
$\frac{2}{3} - \frac{1}{3} \div 3$	$\frac{2}{9}$
$\frac{1}{3} \times 2 - (1\frac{1}{9} \div 2)$	$\frac{1}{9}$

$(\frac{2}{3} + \frac{2}{9}) \div 4 = \frac{2}{9}$

$\frac{2}{3} - \frac{1}{3} \div 3 = \frac{5}{9}$

$\frac{1}{3} \times 2 - (1\frac{1}{9} \div 2) = \frac{1}{9}$

Fraction of an Amount

Notes and Guidance

Children calculate fractions of an amount. They recognise that the denominator is the number of parts the amount is being divided into, and the numerator is the amount of those parts we need to know about.
Encourage children to draw bar models to support the procedure of dividing by the denominator and multiplying by the numerator to find fractions of amounts.

Mathematical Talk

What is the value of the whole?

How many equal parts are there altogether?

How many equal parts do we need?

What is the value of each equal part?

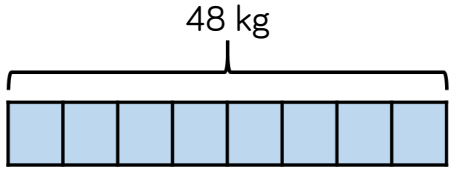
Can you see a pattern in the questions starting with $\frac{1}{5}$ of 30?

What would the next column to the right of the questions be?

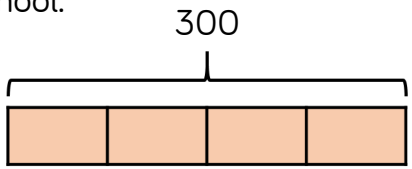
What would the next row of questions underneath be? How do you know? How can you predict the answers?

Varied Fluency

- A cook has 48 kg of potatoes. He uses $\frac{5}{8}$ of the potatoes. How many kilograms of the potatoes does he have left?
Use the bar model to find the answer to this question.



- A football team has 300 tickets to give away.
They give $\frac{3}{4}$ of them to a local school.
How many tickets are left?



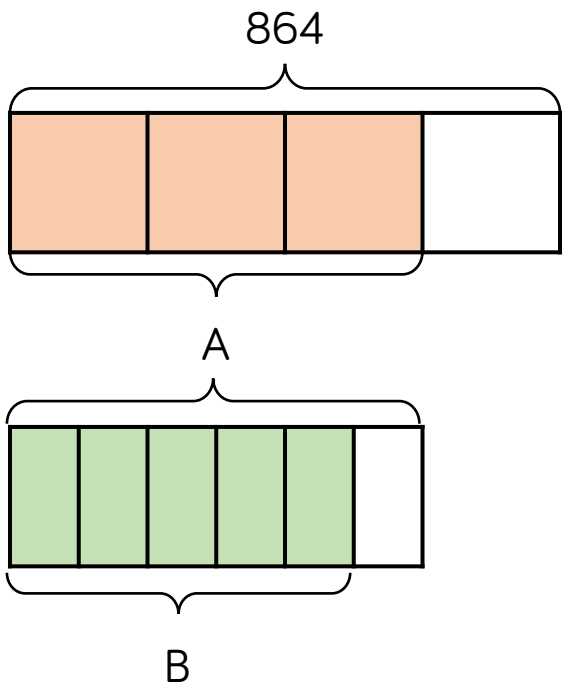
- Calculate:

$\frac{1}{5}$ of 30 =	$\frac{1}{5}$ of 60 =	$\frac{1}{5}$ of 120 =	$\frac{1}{5}$ of 240 =
$\frac{2}{5}$ of 30 =	$\frac{1}{5}$ of 600 =	$\frac{1}{10}$ of 120 =	$\frac{6}{5}$ of 240 =
$\frac{4}{5}$ of 30 =	$\frac{1}{5}$ of 6,000 =	$\frac{1}{20}$ of 120 =	$\frac{11}{5}$ of 240 =

Fraction of an Amount

Reasoning and Problem Solving

What is the value of A?
What is the value of B?



A = 648
B = 540

Two fashion designers receive $\frac{3}{8}$ of 208 metres of material.

One of them says:

We each receive 26 m

Is she correct?
Explain your reasoning.

She is incorrect because 26 is only one eighth of 208 She needs to multiply her answer by 3 so that they each get 78 m each.

Calculate the missing digits.

$\frac{3}{8}$ of 40 = $\frac{?}{10}$ of 150

1

$\frac{1}{5}$ of 315 = $\frac{?}{8}$ of 72

7

Find the Whole

Notes and Guidance

Children find the whole amount from the known value of a fraction. Encourage children to continue to use bar models to support them in representing the parts and the whole.
Children will consider looking for patterns when calculating the whole. Highlight the importance of multiplication and division when calculating fractions of amounts and how knowing our times-tables can support us to calculate the whole more efficiently.

Mathematical Talk

How many equal parts are there altogether?

How many equal parts do we know?

What is the value of each equal part?

What is the value of the whole?

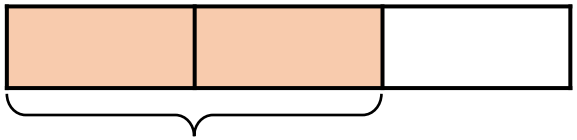
Can you see a pattern in the questions ?

How can we find the whole?

Can you estimate what the answer is? Can you check the answer using a bar model?

Varied Fluency

Jack has spent $\frac{2}{3}$ of his money.
He spent £60, how much did he have to start with?



Use a bar model to represent and solve the problems.

- Rosie eats $\frac{2}{5}$ of a packet of biscuits. She eats 10 biscuits.
  How many biscuits were in the original packet?
- In an election, $\frac{3}{8}$ of a town voted. If 120 people voted, how many people lived in the town?

Calculate:

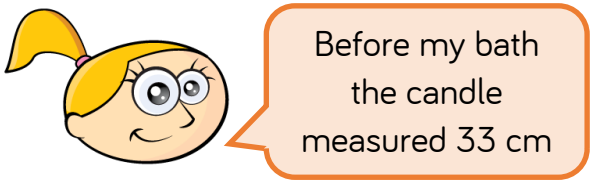
$\frac{1}{4}$ of ___ = 12 $\frac{1}{4}$ of ___ = 36 $\frac{1}{4}$ of ___ = 108

$\frac{1}{12}$ of ___ = 12 $\frac{3}{4}$ of ___ = 36 $\frac{4}{4}$ of ___ = 108

Find the Whole

Reasoning and Problem Solving

Eva lit a candle while she had a bath.
After her bath, $\frac{2}{5}$ of the candle was left.
It measured 13 cm.
Eva says:



Is she correct?
Explain your reasoning.

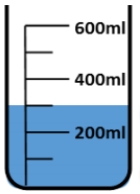
She is incorrect.
$13 \div 2 = 6.5$
$6.5 \times 5 = 32.5$cm

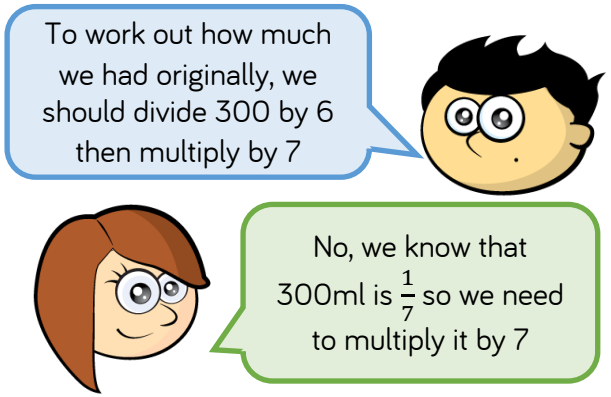
She either didn't halve correctly or didn't multiply correctly

Write a problem which this bar model could represent.

Many possibilities.
$\frac{5}{8}$ of children have blue eyes. 15 children do not have blue eyes.
How many children are there altogether?

Rosie and Jack are making juice.
They use $\frac{6}{7}$ of the water in a jug and are left with this amount of water:





Who is correct?
Explain your reasoning.

Rosie is correct.
Jack would only be correct if $\frac{6}{7}$ was **remaining** but $\frac{6}{7}$ is what was used.
Rosie recognised that $\frac{1}{7}$ is left in the jug therefore multiplied it by 7 to correctly find the whole.

White Rose Maths

Autumn - Block 4

Position and Direction

Overview

Small Steps

- The first quadrant
- Four quadrants
- Translations
- Reflections

Notes for 2020/21

Position and direction was probably missed in the summer of Y5 so treat this topic as brand new learning.

The First Quadrant

Notes and Guidance

Children recap work from Year 4 and Year 5 by reading and plotting coordinates in the first quadrant (the quadrant where both x and y coordinates are positive.).

Children draw shapes on a 2-D grid from given coordinates and may use their increasing understanding to write coordinates for shapes without plotting the points.

Mathematical Talk

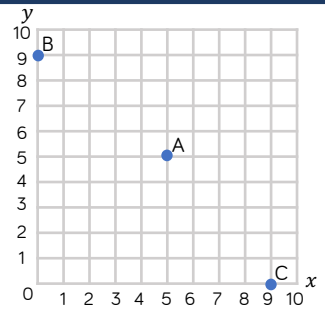
Which axis do we look at first?

Does joining up the vertices already given help you to draw the shape?

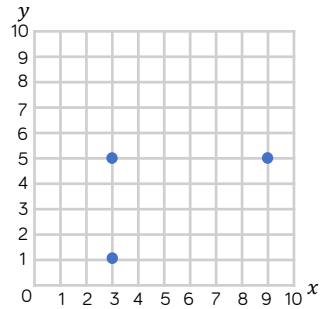
Can you draw a shape in the first quadrant and describe the coordinates of the vertices to a friend?

Varied Fluency

- Whitney plots three coordinates.
  Write down the coordinates of points A, B and C.



- Tommy is drawing a rectangle on a grid.
  Plot the final vertex of the rectangle.
  Write the coordinate of the final vertex.

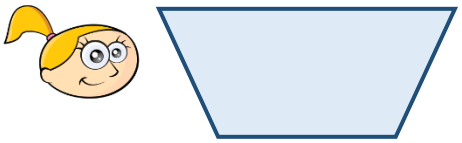


- Draw the vertices of the polygon with the coordinates (7, 1), (7, 4) and (10, 1)
  What type of polygon is the shape?

The First Quadrant

Reasoning and Problem Solving

Eva is drawing a trapezium.
She wants her final shape to look like this:



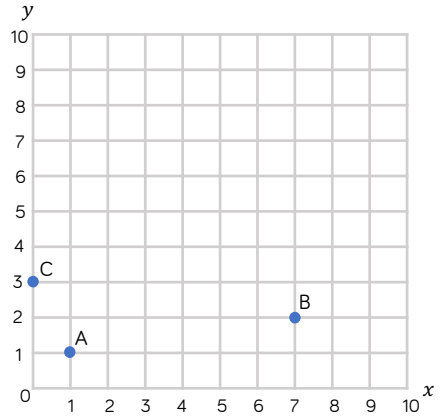
Eva uses the coordinates (2, 4), (4, 5), (1, 6) and (5, 6).
Will she draw the shape that she wants to?
If not, can you correct her coordinates?

Eva has plotted the coordinate (4, 5) incorrectly. This should be plotted at (4, 4) to make the trapezium that she wanted to draw (an isosceles trapezium).

Mo has written the coordinates of points A, B and C.

A (1, 1) **B** (2, 7) **C** (3, 0)

Mark Mo's work and correct his mistakes.



Explain why Mo could not make the same mistake for point A as he made for points B and C.

A is correct.

B and C have been plotted incorrectly because Mo has plotted the x and y coordinates the wrong way round.

Because the coordinates for point A are both the same number it does not matter if Mo incorrectly reads the y coordinate as the first and the x coordinate as the second.

Four Quadrants

Notes and Guidance

Children extend their knowledge of the first quadrant to read and plot coordinates in all four quadrants.

They draw shapes from coordinates given.

Children need to become fluent in deciding which part of the axis is positive or negative.

Children need to develop understanding of how to find the length of a line by using the coordinates of its two endpoints.

Mathematical Talk

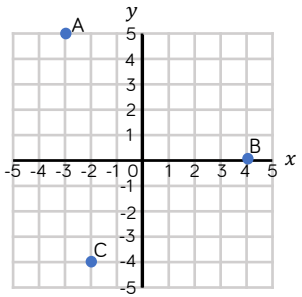
Which axis do we look at first?

If (0, 0) is the centre of the axis (the origin), which way do you move along the x-axis to find negative coordinates?

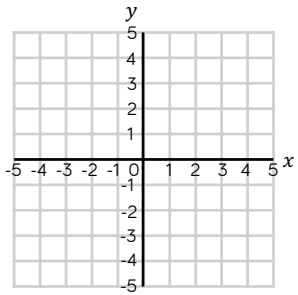
Which way do you move along the y-axis to find negative coordinates?

Varied Fluency

- Dora plotted three coordinates.
  Write down the coordinates of points A, B and C.

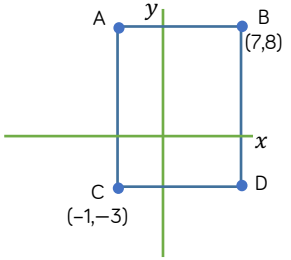


- Draw a shape using the coordinates (-2, 2), (-4, 2), (-2, -3) and (-4, -2).
  What is the name of shape?



- Work out the missing coordinates of the rectangle.

  What is the length of side AB?



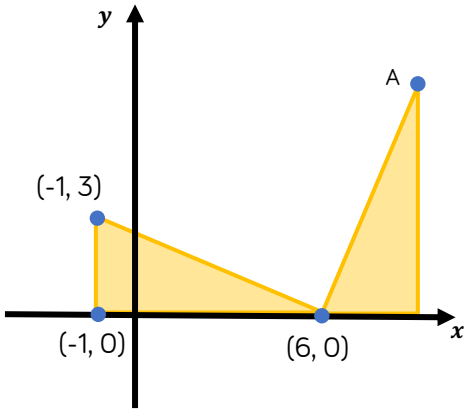
Four Quadrants

Reasoning and Problem Solving

The diagram shows two identical triangles.

The coordinates of three points are shown.

Find the coordinates of point A.



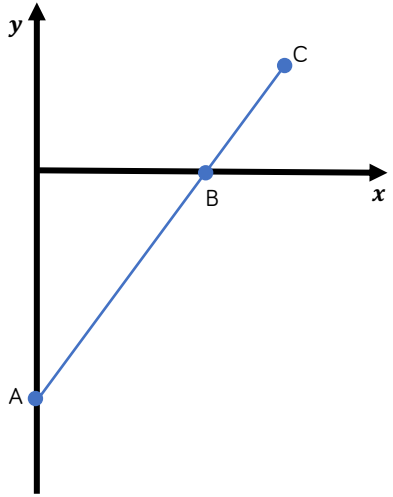
(9, 7)

A is the point (0, – 10)

B is the point (8, 0)

The distance from A to B is two thirds of the distance from A to C.

Find the coordinates of C.



(12, 5)

Translations

Notes and Guidance

Children use knowledge of coordinates and positional language to translate shapes in all four quadrants.

They describe translations using directional language, and use instructions to draw translated shapes.

Mathematical Talk

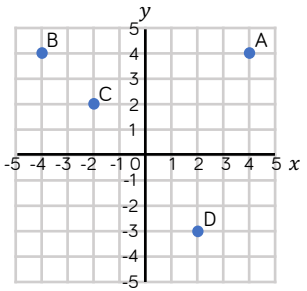
What does translation mean?

Which point are you going to look at when describing the translation?

Does each vertex translate in the same way?

Varied Fluency

Use the graph to describe the translations.
One has been done for you.



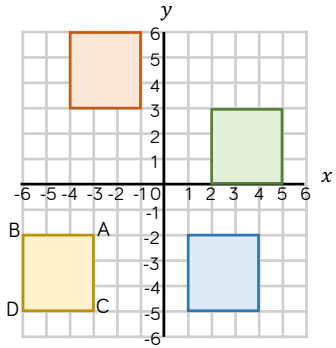
From **A** to **B** translate **8** units to the **left**.

From **C** to **D** translate __ units to the **right** and __ units **down**.

From **D** to **B** translate **6** units to the _____ and **7** units _____.

From **A** to **C** translate __ units to the ____ and __ units ____.

Write the coordinates for vertices A, B, C and D.
Describe the translation of ABCD to the blue square.



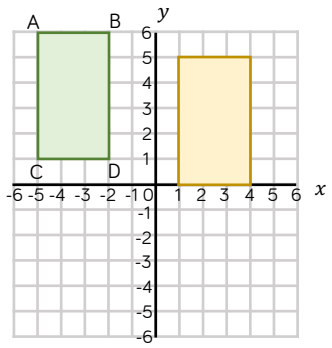
ABCD is moved 2 units to the right and 8 units up. Which colour square is it translated to?
Write the coordinates of the vertices of the translated shape.

Translations

Reasoning and Problem Solving

True or False?

Dexter has translated the rectangle ABCD 6 units down and 1 unit to the right to get to the yellow rectangle.

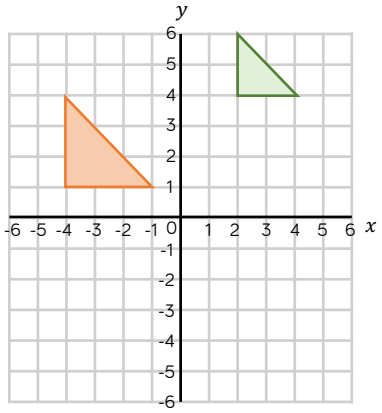


Explain your reasoning.

False.
The translation is 6 units to the right and 1 unit down.

Spot the Mistake.

The green triangle has been translated 6 units to the left and 3 units down.



The triangle has changed size.
When a shape is translated its size does not change.

-6

Reflections

Notes and Guidance

Children extend their knowledge of reflection by reflecting shapes in four quadrants. They will reflect in both the x-axis and the y-axis.

Children should use their knowledge of coordinates to ensure that shapes are correctly reflected.

Mathematical Talk

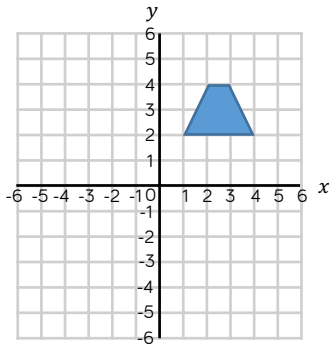
How is reflecting different to translating?

Can you reflect one vertex at a time? Does this make it easier to reflect the shape?

Which axis are you going to use as the mirror line?

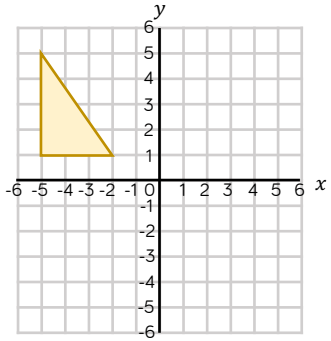
Varied Fluency

Reflect the trapezium in the x-axis and then the y –axis.
Complete the table with the new coordinates of the shape.



	Reflected in the x-axis	Reflected in the y-axis
(1, 2)		
(4, 2)		
(2, 4)		
(3, 4)		

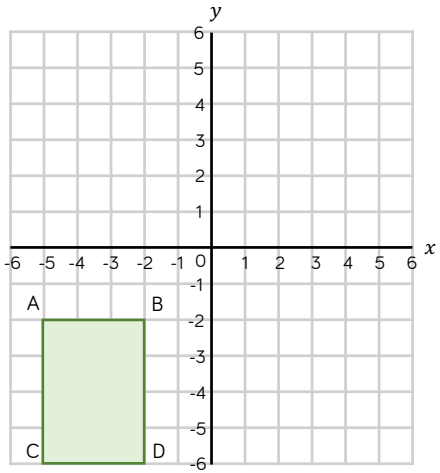
Translate the shape 4 units to the right.
Then reflect the translated shape in the y-axis.



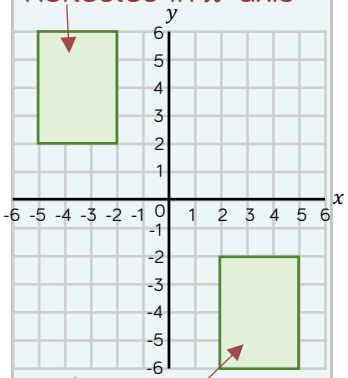
Reflections

Reasoning and Problem Solving

Rectangle ABCD is the result of a rectangle being reflected in either the x- or the y-axis.
Where could the original rectangle have been? Draw the possible original rectangles on the coordinate grid, and label the coordinates of each vertex.



The two original rectangles are:
Reflected in x-axis

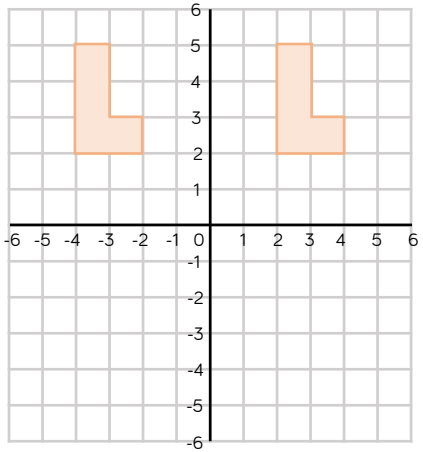


Reflected in y-axis

x-axis reflection original coordinates:
(-5, 6), (-2, 6), (-5, 2), (-2, 2)

y-axis reflection original coordinates:
(2, -2), (5, -2), (2, -6), (5, -6)

Annie has reflected the shape in the y-axis.
Is her drawing correct?
If not explain why.



Annie has used the correct axis, but her shape has not been reflected. She has just drawn the shape again on the other side of the axis.