RICH MATHEMATICAL TASK BOOKLET

Conceptual Starters Phase THREE

How To Guide

These conceptual starters have been designed and planned to meet learning intentions of the New Zealand curriculum. Whilst it is a large collection of starters there are many more starters that can be used in your mathematics programs.

Each starter is:

- Designed to be used more than once.
- Written with a small number of other examples, however almost all starters could be adapted and used with a variety more different numbers, patterns and materials.
- Encouraging the use of mathematical practices.
- Supporting the use of dialogue and communication during these starters.
- Designed to be chosen intentionally and used to revisit or build upon concepts taught throughout the year.

Mathematical Practices are:

- Making an explanation
- Making a justification
- Arguing mathematically
- Making a generalisation
- Representing

Expect, scaffold, and support your students to use these mathematical practices when sharing their ideas during these starters.
Always, encourage and celebrate all contributions and ideas that are shared from all students.
Be ambitious, don't limit your students to small numbers. In Phase Two they need exposure and chances to reason with numbers to at least 1,000,000.

I**mportant Number Properties within this booklet:**

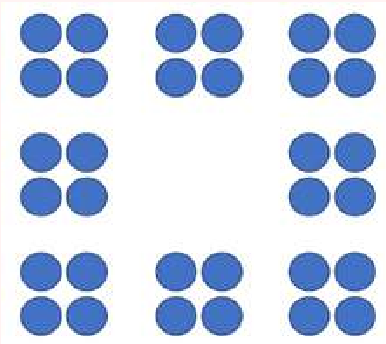
- Inverse: division is the inverse operation of multiplication (axb=c so c÷b=a). Multiplication facts give rise to families of facts that use division.
- Identity: when a number is added to 0 the result will be the same, when a number is multiplied or divided by 1 the result will be the same.
- Commutative: we can multiply or add two numbers in any order, and the sum will never change. This does not hold for division or subtraction. E.g., a x b = b x a, a + b = b + a.
- Associative: when adding or multiplying two or more numbers it does not matter what order they are added/multiplied in. E.g., (a x b) x c = a x (b x c)
- Distributive: each addend of a sum can be multiplied separately and the product will be the same (e.g., 3 x 17 =3 × (10 + 7) = (3 × 10) + (3 × 7)).

Most of these starters can be adapted and used as independent tasks as well.

All students can be successful mathematicians when given the opportunities to succeed.

NUMBER - MĀTAURANGA TAU

Quick Images – Groups Of



Teacher Notes

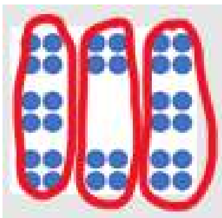
Instructions:
Explain to the students you are going to show them an image and they need to think about what they see, and how they see it.

Show the image to the students for 3 seconds. Allow students time to visualize what they saw.

Show the image again for another 3 seconds. Give more time for individual thinking.

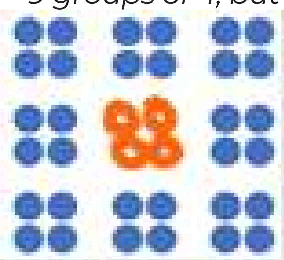
Ask students to turn and talk about how many dots they see and why.

Display image again, keeping it displayed this time.



Call on different students to share their thoughts. Record the different ways students saw the image. E.g.,
3 groups of 4, 2 groups of 4, 3 groups of 4

9 groups of 4, but the middle group is missing.



Celebrate the different ways students notice this image.

You may wish to explicitly highlight one of the number properties students used. E.g., distributive property (3 x 4) + (2 x 4) + (3 x 4) = 8 x 4. Or make links between repeated addition and multiplication (4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 8 x 4)

Curriculum Links

- *Recall multiplication facts to 10 × 10 and corresponding division facts*
- *Use the distributive, commutative, and associative properties*

Big Ideas

Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.

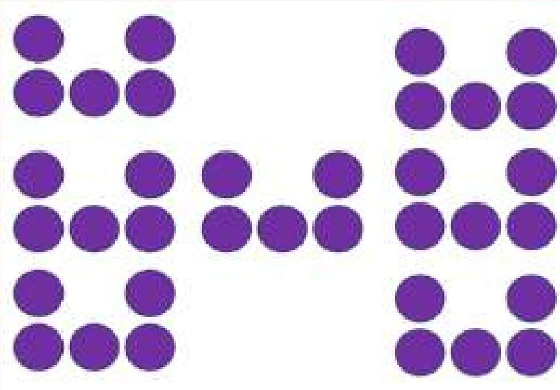
Suggested Learming Outcomes

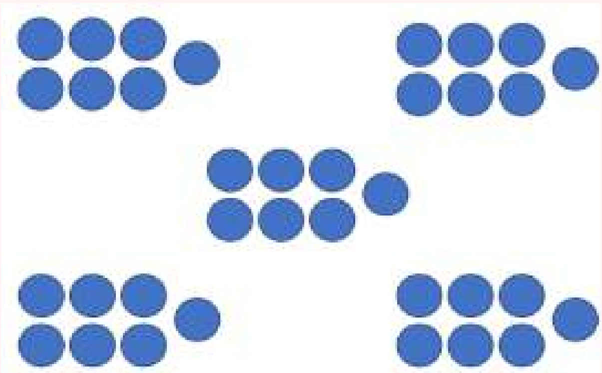
- *Notice and use groupings to find a total*
- *Recall and apply multiplication facts*
- *Explain how they see an image*

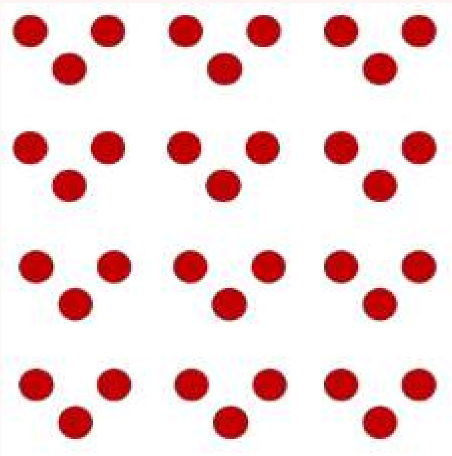
Mathematical Language

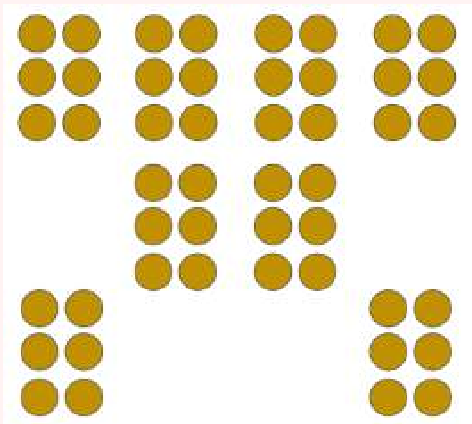
Multiplication, groups of, commutative property, associative property, distributive property, equal to.

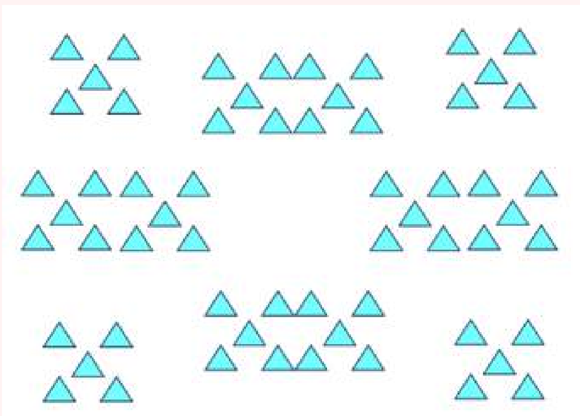
Other Examples











Place-Value to 100,000,000

876, 452, 019

What is this number? How do you know?

Teacher Notes

Instructions:

Display the image/ or write a number on a blank place-value house. Ask students to turn and tell a partner what the number is and why.

Read the number together. Ensure students are using the correct language "eight hundred & seventy six million, four hundred and fifty two thousand and nineteen.

Ask a series of questions that focus on the place-value of the numbers. E.g., "What does the 7 represent?", "What is the value of the tens place?", "How many ten-thousands are there?", "What digit is in the hundred-thousand place? What is that digit's place-value?"

Ask students to write the expanded form: 800,000,000 + 70,000,000 + 6,000,000 + 400,000 + 50,000 + 2,000 + 10 + 9.

Other Examples

Repeat with numbers that you notice students need support with.
Use numbers such as 804,400,072.

Repeat with students writing a number for their partner, asking them to read it, then ask questions about the value of different places.

Curriculum Links

Recognise, read, write, order, partition, recombine, and represent whole numbers up to 1,000,000

Big Ideas

The base ten numeration system is a scheme for recording numbers using digits 0-9, groups of ten, and place value.

Suggested Learning Outcomes

- *Read numbers up to 1,000,000*
- *Explain the place-value of each digit in numbers to 1,000,000*

Mathematical Language

Place-value, ones, tens, hundreds, thousands, ten-thousands, hundred-thousands, million, digit,

Reading and Explaining Numbers to 1,000,000,000

954,507,893

What is this number?
How can you write and explain this in different ways?

Teacher Notes

Instructions:

Ask students, what is this number? Support the students to read the number correctly.

Ask "how could you write or represent this number in different ways?"

Give time for students to work with a partner to record ideas.

Discuss and share the different ideas.

Support students to discuss thousands, hundreds, tens, ones and make links to place, face, and total value.

Link to the place value house as a representation and have this on the wall or whiteboard for students to refer to.

Notice use of place value and the ability to see hundreds as ten tens and tens as ten ones. Draw connections to represent these within place value houses.

To extend the task ask students questions like: "what would the number be if we changed the digit in the tens place to a 5?", "what would the number be if we add 1000?", "what would the number be if we moved each digit one place-value to the left/ or right?"

Other Examples

800,789,123
57,562
1,000,004
306,060

Curriculum Links

Recognise, read, write, order, partition, recombine, and represent whole numbers up to 1,000,000

Big Ideas

The base ten numeration system is a scheme for recording numbers using digits 0-9, groups of ten, and place value.

Suggested Learming Outcomes

- *Read numbers up to 1,000,000*
- *Explain the place-value of each digit in numbers to 1,000,000*

Mathematical Language

Place-value, ones, tens, hundreds, thousands, ten-thousands, hundred-thousands, million, digit,

Choral Counting

Count by 0.02 starting at 0.06.

0.06	0.08	0.1	0.12	0.14
0.16	0.18	0.2	0.22	0.24
0.26	0.28	0.3		
		?		

Teacher Notes

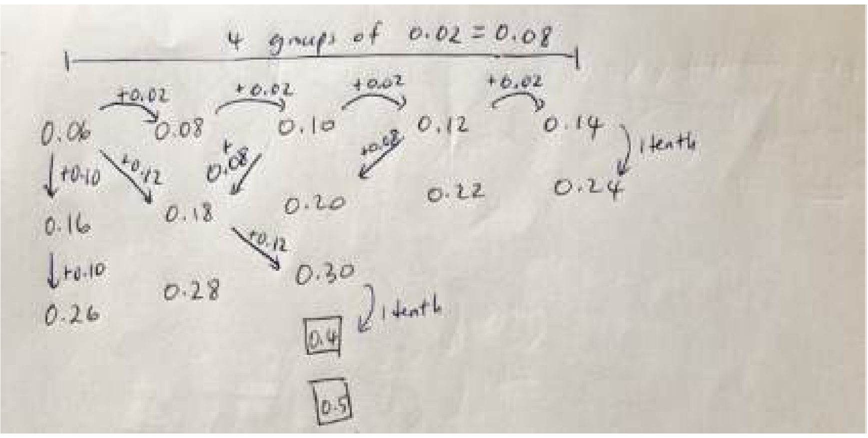
Instructions:

Choose a count that you know students will be successful in, perhaps beginning with a fraction number and then later use decimal number.

Think about how you will start the count.

Give students a moment to think about the sequence prior to counting out loud.

As the students count write down the count on the whiteboard. Pausing to support corrections when needed



After writing on the board, remember to start discussions with the open-ended question, "What do you notice?"

Give yourself space to listen to and can record students' noticing's.

Look for an opportunity to take up one student idea and ask the whole class, "Why does that work?" or "How do you know?"

- *Use talk moves (turn and talk, adding to someone's idea, etc) to engage students with one another's noticing's.*

Curriculum Links

- *Recognise, read, write, order, partition, recombine, and represent whole numbers up to 1,000,000*
- *Add and subtract whole numbers and decimals to two places*
- *Use a rule to make predictions*

Big Ideas

Skip counting on the number line generates number patterns. Known elements in a pattern can be used to predict other elements.

Suggested Learming Outcomes

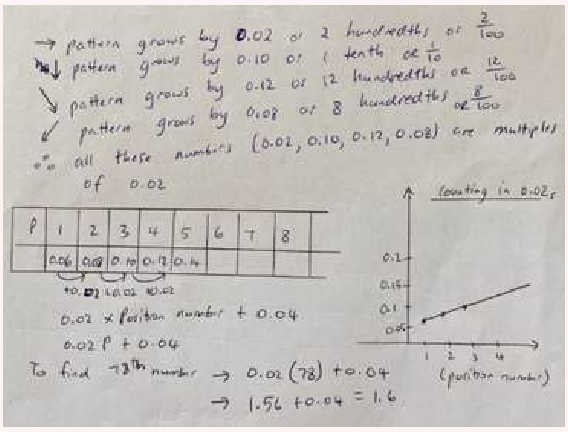
- *Recognise patterns*
- *Add fractions with the same denominators*
- *Group ideas in a multiplicative ways*
- *Identify equivalent fractions or mixed numbers*

Mathematical Language

Column, row, add, rule, position, pattern, more, less,

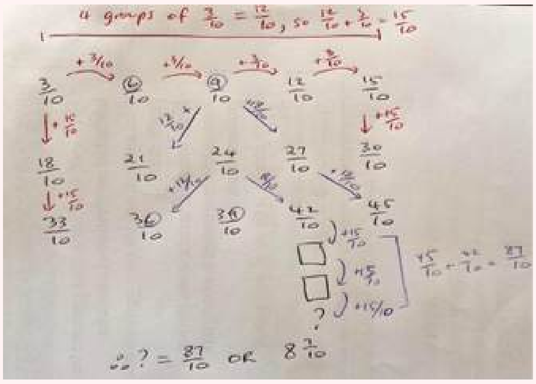
Other Examples

Ways to extend the 0.02 count over a series of days



Make predictions about further points in the count

Other counts:
Count in 3 tenths



Remember to plan your count before you begin and anticipate the patterns you think students will notice. Know what mathematical understandings could be reinforced in each count.

How many 1s,10s,100s,1000s

How many?

10s in 487,905?
1s in 487,905
1,000s in 487,905
100s in in 487,905
10,000 in 487,905
100,000 in 487,905

Teacher Notes

Instructions:

Present the first question "How many 10's in 28,107?"

Encourage students to turn and talk about what they think and why. Discuss students' ideas. Use materials such as a place-value house or place-value blocks to support student's explanations and understandings.

Reinforce the idea that understanding how many tens are in a number is different to reading the digit in the tens place (place naming). E.g., some students might say there are 0 tens in 28,107 because there is a 0 in the tens place. They may not realise there are 2,810 groups of ten in 28,107

Repeat for the other 4 questions. How many 1's etc.

Ensure students understand the place is 10 times bigger than the previous place when we move to the left. E.g. the hundreds place is ten times bigger than the tens place.

Other Examples

Complete this activity multiple times with a variety of different numbers.

98,763,201
3,481,190

Curriculum Links

- *The base ten numeration system is a scheme for recording numbers using digits 0-9, groups of ten, and place value.*

Big Ideas

Numbers, expressions, and measures can be compared by their relative values. Numerical and algebraic expressions can be compared using greater than, less than, or equal.

Suggested Learming Outcomes

Explain the number of 1's, 10's, 100's, 1000's, 10,000's, 100,000s in whole numbers.

Mathematical Language

Place value, base ten, ones, tens, hundreds, thousands, ten thousands, hundred thousands, millions, multiple, x10

Ordering numbers to 100,000,000

87,299,999	12,024,160	299,999.00	659,818	3,204,160

Order these numbers from biggest to smallest.

Teacher Notes

Students need multiple opportunities to notice and generalise patterns within the structure of our number system.

Instructions:

Ask the students; What are these numbers? Support the students to read the number correctly.

How can you order these numbers?

Give students an opportunity to work in pairs and record and represent their reasoning.

Allow students opportunities to discuss how the numbers are greater than or less than the others.

Explore concepts, of place, face, and total value. Reinforce that the digit 0 can be used as a place holder. E.g., some students may have the misconception that 299,999.0 is larger than 299,999 because it looks longer, not realising that .0 represents there are no tenths.

Other Examples

Use combinations of different numbers.

45,876	9,999	460,000
35,999	999	640,000
26,010	99,999	604,000
35,998	99,909	406,000

Curriculum Links

Recognise, read, write, order, partition, recombine, and represent whole numbers up to 1,000,000

Big Ideas

Numbers, expressions, and measures can be compared by their relative values. Numerical and algebraic expressions can be compared using greater than, less than, or equal.

Suggested Learning Outcomes

- *Order whole numbers up to 1,000,000*
- *Compare numbers using place-value*

Mathematical Language

Ones, tens, hundreds, thousands, tens of thousands, hundreds of thousands, add, subtract, place value, face value, total value, digit

Round to the nearest...

Round to the nearest...

	whole number	...tenth	...hundredth
76.9875			
126.897			
98,290.01			

How do you know?

Teacher Notes

Give an opportunity to discuss and justify with someone else before they share their ideas.

Have a place value house for whole and decimal numbers on the wall or give to students to use if needed.

Other Examples

Here are some other examples you can use on other days you can explore one of these numbers or get them to try one of the three to justify.

Day 2	3.231	93.149	33.645
Day 3	560.297	5610.999	301.732
Day 4	1299.777	2003.182	2110.618
Day 5	2999.847	7165.487	4999.956

Curriculum Links

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *recognise, read, write, represent, compare, and order fractions, decimals (to three places).*

Big Ideas

Decimals are a set of fractions that have powers of 10 as their denominators (e.g., 170 or 1070) and that can be written as numbers using a decimal point (e.g., 0.7 or 0.07).
A decimal is another name for a fraction and thus can be associated with the corresponding point on the number line

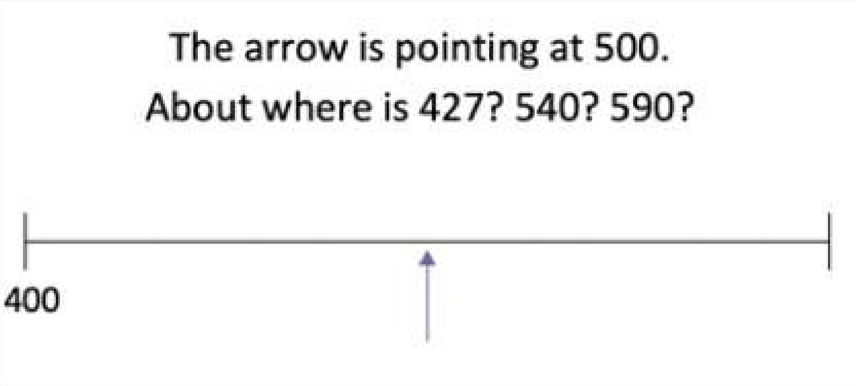
Suggested Learning Outcomes

- *Round decimals to the nearest whole number, tenth or hundredth.*
- *Justify their reasoning.*

Mathematical Language

Decimals, whole number, place value, tenths.

Numberline



Teacher Notes

Instructions:

Show the number line and explain that the arrow is pointing to 500.

Ask students to discuss where the numbers are one at a time.

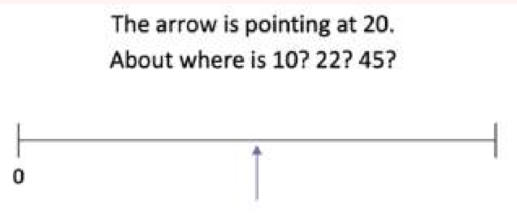
Facilitate a discussion that draws on students explaining and justifying their reasoning.

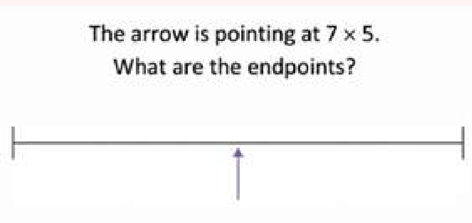
The teacher can annotate and record some benchmark numbers on the number line as the students explain their reasoning and refer to other positions on the number line.

Engage students to debate about whether they agree or disagree with shared reasoning

Other Examples

Repeat with a range of number lines, including fractions.





Curriculum Links

- *Recognise, read, write, order, partition, recombine, and represent whole numbers to 1,000,000.*
- *Use representations to find, compare, explore, simplify, illustrate, prove, and justify patterns and variations*

Big Ideas

The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.

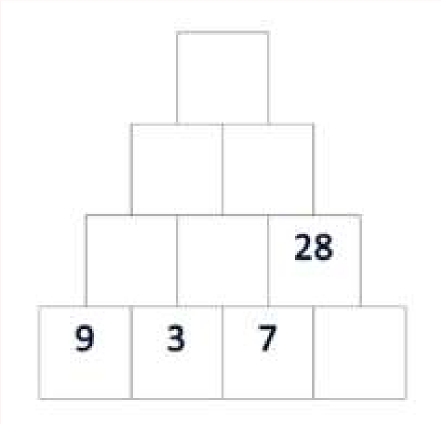
Suggested Learning Outcomes

- *Estimate the position of a number on a number line*
- *Use benchmarks to compare the size of a number*

Mathematical Language

More than, less than, between, approximate, ones, tens, hundred

Multiplication Pyramid

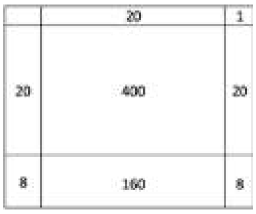


Teacher Notes

Instructions:

In pairs, give sufficient time for students to fill in the blank squares. Have access to paper/whiteboard/pen to record representations & times table charts.

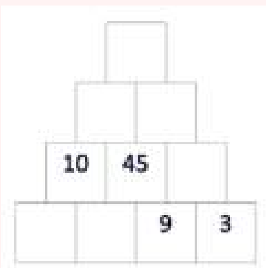
Expect students to explain and justify as the teacher facilitates discussion to complete the pyramid on the board. Record all student solutions as they are shared as a representation alongside the pyramid.

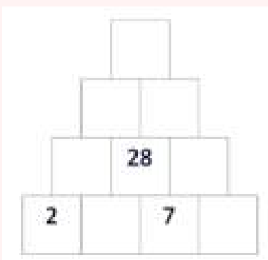


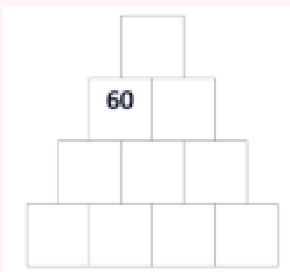
Make links between the inverse relationship between division and multiplication (7 x ? = 28, 28 ÷ 7 = ?).

Connect to number properties. E.g., distributive (20 x 20) + (8 x 20) + (1 x 20) + (1 x 8)

Other Examples







Curriculum Links

- *Recognise, read, write, order, partition, recombine, and represent whole numbers to 1,000,000.*
- *Use representations to find, compare, explore, simplify, illustrate, prove, and justify patterns and variations*

Big Ideas

The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.

Suggested Learming Outcomes

- *Estimate the position of a number on a number line*
- *Use benchmarks to compare the size of a number*

Mathematical Language

More than, less than, between, approximate, ones, tens, hundred

Square numbers

Think of a number.
Square it.
Subtract your starting number.
Is the number you are left with an even or odd number?
What do you notice and why?

Teacher Notes

Square numbers are integers that can be expressed as the product of a whole number multiplied by itself. In other words, they are the result of squaring a whole number.

For example, 4, 9, and 25 are square numbers because they can be written as 2×2, 3×3, and 5×5, respectively.

Square numbers are called square numbers (or squared numbers) because they form the area of a square. The sides are an equal number of units in length so they make a square.

Teaching for conceptual understanding requires children to understand how and why a concept works, rather than learning abstract rules.

Explaining to children that square numbers are numbers multiplied by themselves is the final generalisation

Mathematical Language

Number sentences, inverse property, division and multiplication. Commutative, associative, distributive, and identity properties work the same for all numbers.

Curriculum Links

- *Use a range of multiplicative and division strategies.*
- *Solve equivalence problems.*
- *Use inverse relationships and understanding of properties to solve problems.*
- *Represent a variety of ways to explain how to achieve an answer.*
- *Use prime numbers, common factors and multiples, and powers (including square roots)*

Big Ideas

Our number system is based on groupings of ten or base ten. Groupings of ones, tens, hundreds, and thousands can be taken apart in different ways. There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.

Suggested Learning Outcomes

- *Identify and describe the properties of prime, composite, square, and cube numbers and the divisibility rules for 2, 3, 5, 9, and 10.*
- *Use words and symbols to describe and represent the properties of operations (commutative, distributive, associative, inverse, and identity)*

Area Model

What equation is shown in this representation? Explain how you know.

	300	60	8
200	60,000	12,000	1,600
50	15,000	3,000	400
6	1,800	360	48

Can you show 337 x 568 or 142 x 13 using the area model.

Teacher Notes

Instructions

Display the image and give students time to turn and talk.

Share and discuss their ideas.

Reinforce that in this example students have used place-value partitioning to distribute the numbers into more manageable ones (e.g. 368 = 300 + 60 + 8).

You may also need to recap how we can use known basic facts such as 6 x 6 = 36 to solve 60 x 6 = 360

Record that this model represents application of the distributive property (300 x 200) + (300 x 50) + (300 x 6) + (Give students time to use the area model to represent other equations such as 33 x 56 or 142 x 13.

Other Examples

What equation does this represent?

	500	20	83
300			
90			
1			

Curriculum Links

- *Recall multiplication facts to 10 x 10*
- *Multiply two-and three-digit numbers*
- *Use the distributive, commutative, and associative properties*

Big Ideas

There are patterns in the products for multiplication facts

Suggested Learming Outcomes

- *Recall basic multiplication and division facts to 10*
- *Partition numbers into hundreds, tens and ones*
- *Use the distributive property to solve multiplication problems*

Mathematical Language

Area model, factors, multiplication, distributive property,

Divisibility

Using the Hundreds board / chart identifies the multiples of ...

What do you notice?
What patterns do you see?

Teacher Notes

Use a Hundred Board/Chart.
Ask the students in groups to find and circle the multiples of... Then discuss what they notice about those numbers.

Expect and encourage students to justify and explain their thinking to the group.

Highlight the importance of knowing these rules and patterns as they will support knowing basic facts and will allow students to estimate accurately when multiplying or dividing bigger numbers.

Encourage students to ***work out the divisibility rules for themselves.***

Divisibility rules.
All numbers are divisible by 1.
Divisible by 2, any arrangement of 4, 6, and 8 will be an even number.
Divisible by 3, the sum of the digits must be divisible by 3.
Divisible by 4, the number formed by the last two digits must be divisible by 4.
Divisible by 5, the number must end in 5 or 0.
Divisible by 6, the number must be even and divisible by 3.
Divisible by 7, division rules apply
Divisible by 8, last three digits in a number divisible by 8.
Divisible by 9, the sum of the digits must be divisible by 9.
Multiples of even numbers are always even.

Other Examples

Use across all of the basic facts numbers 1-12, then explore:

Divisibility / Multiples of 2 & 4 – Patterns and Generalisations

Divisibility / Multiples of 3,6, & 9 – Patterns and Generalisations.

Curriculum Links

Identify and describe the properties of prime, composite, and square numbers and the divisibility rules for 2, 3, 5, 9, and 10

Big Ideas

Our number system is based on groupings of ten or base ten. Groupings of ones, tens, hundreds, and thousands can be taken apart in different ways.

Suggested Learming Outcomes

- *Recall basic multiplication and division facts to 10*
- *Partition numbers into hundreds, tens and ones*
- *Use the distributive property to solve multiplication problems*

Mathematical Language

Divisible, digits, even, multiples

Division Strings – Partial Quotients

String 1	String 2	String 3
30 ÷ 3	200 ÷ 2	360 ÷ 4
24 ÷ 3	70 ÷ 2	24 ÷ 4
54 ÷ 3	270 ÷ 2	384 ÷ 4

Teacher Notes

These number strings support students to solve problems by breaking the dividend into smaller partial dividends (distributive property). These partial dividends must be divisible by the divisor.

Dividend: the number that will be divided
Divisor: the number the dividend is being divided by
Quotient: product/ answer

Instructions:
Display the first equation. E.g., 30 ÷ 3. Encourage students to turn and talk about the quotient and to justify their reasoning.

Students may draw on known multiplication/division facts or need access to a basic facts chart.

Display the second equation. E.g., 24 ÷ 3. Encourage students to turn and talk about the quotient and to justify their reasoning.

Display the final equation. E.g., 54 ÷ 3. Encourage students to look for relationships between the previous equations in the string and to use them to solve the next equation.

Record all student solutions as they are shared as a representation on the board alongside the number string.

Reinforce that (30 ÷ 3) + (24 ÷ 3) = 54 ÷ 3

Ask students "why might it be useful to break up a large division equation into smaller ones?" or "why are 30 and 24 useful numbers to choose?" (because they are both factors of the divisor).

Repeat with other strings

Curriculum Links

- *Multiplication and division can involve equals groups, rates, comparisons, combinations, part-whole relationships, areas and volumes*
- *Recall multiplication facts to 10 x 10 and corresponding division facts*
- *Divide whole numbers by one- or two- digit divisors*
- *Find factors of numbers up to 100*

Big Ideas

For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra. Division algorithms use numerical estimation and the relationship between division and multiplication to find quotients

Suggested Learning Outcomes

- *Break numbers into partial dividends*
- *Find multiples and factors*
- *Apply multiplication facts to division problems*

Division Strings – Partial Quotients

Other Examples

$40 \div 4$
$24 \div 4$
$64 \div 4$

$30 \div 3$
$90 \div 3$
$93 \div 3$

$40 \div 4$
$16 \div 4$
$56 \div 4$

$5 \div 5$
$10 \div 5$
$25 \div 5$
$50 \div 5$
$75 \div 5$

$160 \div 8$
$16 \div 8$
$400 \div 8$
$80 \div 8$
$496 \div 8$

$100 \div 4$
$200 \div 4$
$40 \div 4$
$16 \div 4$
$256 \div 4$

$30 \div 15$
$90 \div 15$
$300 \div 15$
$150 \div 15$
$540 \div 15$

$400 \div 4$
$80 \div 4$
$16 \div 4$
$496 \div 4$

$130 \div 13$
$26 \div 13$
$52 \div 13$
$195 \div 13$

$100 \div 20$
$200 \div 20$
$400 \div 20$
$500 \div 20$

Mathematical Language

divide, division, divisor, dividend, quotient, inverse, multiplication, multiply, groups of, factor, product, equivalent, distributive property

Multiplication Strings

String 1	String 2
3 x 4	5 x 9
30 x 4	5 x 90
29 x 4	5 x 89
	6 x 89

Teacher Notes

These multiplications strings have been designed to encourage students to use known facts and place-value to make solving larger problems easier. Provide access to timetables card if students require them.

Instructions:
Display the first equation (3 x 4) and given students time to turn and talk about the product and to justify their reasoning.

Expect students to explain and justify as the teacher facilitates discussion about solution strategies.

Display the second equation (30 x 4). Encourage students to look for a relationship between the previous equation in the string and to use this to solve the next equation. E.g., 30 x 4 is ten times bigger than 3 x 4. Record all student solutions as they are shared as a representation on the board alongside the number string.

Display the final equation (29 x 4). Ask students "how could use 3 x 4 and 30 x 4 to solve 29 x 4?"

Name the numbers properties if they arise e.g. associative, commutative, distributive.

Curriculum Links

- *Recall multiplication facts to 10 x 10 and corresponding division facts*
- *Multiply two-and three-digit numbers*
- *Use the distributive, commutative and associative properties*

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties.
Equations show relationships of equality between parts on either side of the equal sign.

Suggested Learming Outcomes

- *Use known facts to solve multiplication problems*
- *Identify relationships between equations*

Multiplication Strings

Other Examples

2 x 9 = 20 x 9 = 19 x 9 =	6 x 8 = 6 x 80 = 6 x 79 =	3 x 11 = 30 x 11 = 27 x 11 =
3 x 50 = 50 x 50 = 53 x 50 = 53 x 49 =	2 x 25 = 4 x 25 = 8 x 25 = 10 x 25 = 16 x 25 =	2 x 7 = 4 x 7 = 40 x 7 = 38 x 7 =
3 x 10 = 3 x 50 = 3 x 100 = 3 x 149 =	5 x 200 = 20 x 200 = 25 x 200 = 25 x 199 =	6 x 20 = 6 x 100 = 6 x 120 = 6 x 119 =

Mathematical Language

Multiplication, groups of, factor, product, equals, equivalent, distributive property, commutative property, associative property,

Multiplication Strings - Place Value

4 x 6 =

40 x 6 =	4 x 60 =	40 x 60 =
400 x 6 =	4 x 600 =	400 x 600 =
4000 x 6 =	4 x 6000 =	4000 x 6000 =

Teacher Notes

These multiplications strings have been designed to encourage students to use known facts and place-value to make solving larger problems easier. Provide access to timetables card if students require them.

Instructions:
Display the first equation (4 x 6) and given students time to turn and talk about the product and to justify their reasoning.

Expect students to explain and justify as the teacher facilitates discussion about solution strategies.

Display the second equation (40 x 6). Encourage students to look for a relationship between the previous equation in the string and to use this to solve the next equation. E.g., 30 x 4 is ten times bigger than 40 x 6 is ten times bigger than 4 x 6.

Record all student solutions as they are shared as a representation on the board alongside the number string.

Ask the students what they notice with the answers as more of the string is complete.

Explicitly discuss that if students can access basic facts they can solve challenging multiplication tasks.

Other Examples

7 x 9 =

70 x 9 =	7 x 90 =	70 x 90 =
700 x 9 =	7 x 900 =	700 x 900 =
7000 x 9 =	7 x 9000 =	7000 x 9000 =

12 x 11 =

120 x 11 =	12 x 110 =	120 x 110 =
1200 x 11 =	12 x 1100 =	1200 x 1100 =
12000 x 11 =	12 x 11000 =	12000 x 11000 =

Curriculum Links

- *Recall multiplication facts to 10 x 10 and corresponding division facts*
- *Multiply two-and three-digit numbers*
- *Use the distributive, commutative and associative properties*

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties.
Equations show relationships of equality between parts on either side of the equal sign.

Suggested Learning Outcomes

- *Use known facts to solve multiplication problems*
- *Identify relationships between equations*

Mathematical Language

Multiplication, groups of, factor, product, equals, equivalent, distributive property, commutative property, associative property,

True or False (Powers)

$8 \times 8 \times 8 \times 8 = 8^4$

Explain and justify why.

Teacher Notes

Instructions:

Display the question for all students to see.

Allow students time to turn and talk and identify the patterns that they notice.

Discuss student's ideas and scribe their thinking on the board for them to see.

Encourage the students to solve the problem. What was this look like?

- *Ask the students – when would you use powers in real life?*

Other Examples

$(4 \times 4 \times 4 \times 4) + (4 \times 4 \times 4 \times 4 \times 4) = 4^3 + 4^5$

$(8 \times 8) + (9 \times 9 \times 9 \times 9) + (2 \times 2 \times 2) = 8^2 + 9^4 + 2^3$

$(5 \times 5 \times 5 \times 5) + (7 \times 7 \times 7 \times 7) = 12^8$

Curriculum Links

- *Use a range of multiplicative strategies when operating on*
- *whole numbers.*
- *Generalise properties of multiplication and division with*
- *whole numbers.*
- *Use prime numbers, common factors and multiples, and*
- *powers (including square roots).*

Big Ideas

Relationships can be described and generalisations made for mathematical situations that have numbers or objects that repeat in predictable ways.

Suggested Learning Outcomes

- *Identify that a power is represented by a base number and an*
- *exponent and that a power is the product of multiplying a number by itself.*
- *Calculate powers of numbers.*
- *Explain and justify patterns and relationships in powers of numbers.*

Mathematical Language

Power, base number, exponent, product, digit, conjecture, tens, hundreds, thousands.

True or False (adding Powers)

$(10 \times 10 \times 10) + (10 \times 10 \times 10 \times 10) = 10^3 + 10^4$

Explain and justify why.

Teacher Notes

Instructions:

Display the question for all students to see.

Allow students time to turn and talk and identify the patterns that they notice.

Discuss student's ideas and scribe their thinking on the board for them to see.

Encourage the students to solve the problem. What would this look like?

Other Examples

$(4 \times 4 \times 4 \times 4) + (4 \times 4 \times 4 \times 4 \times 4) = 4^3 + 4^5$

$(8 \times 8) + (9 \times 9 \times 9 \times 9) + (2 \times 2 \times 2) = 8^2 + 9^4 + 2^3$

$(5 \times 5 \times 5 \times 5) + (7 \times 7 \times 7 \times 7) = 12^8$

Curriculum Links

- *Use a range of multiplicative strategies when operating on*
- *whole numbers.*
- *Generalise properties of multiplication and division with*
- *whole numbers.*
- *Use prime numbers, common factors and multiples, and*
- *powers (including square roots).*

Big Ideas

Relationships can be described and generalisations made for mathematical situations that have numbers or objects that repeat in predictable ways.

Suggested Learming Outcomes

- *Identify that a power is represented by a base number and an*
- *exponent and that a power is the product of multiplying a number by itself.*
- *Calculate powers of numbers.*
- *Explain and justify patterns and relationships in powers of numbers.*

Mathematical Language

Power, base number, exponent, product, digit, conjecture, tens, hundreds, thousands.

If.... Then....

If... 60 x 30 = 180 and 30 x 60 = 180
Then...180 ÷ 60 = 30 and 180 ÷ 30 = 60
Could this pattern work for any multiplication sentence? Explore.

Teacher Notes

Every multiplication sentence has two related division sentences (a x b = c so c ÷ b = a and c ÷ a = b).

Instructions:

Ask students what they notice about the numbers in the equations. Expect students to justify and reason giving explanations. Highlight student thinking that draws on the inverse relationship.

Give students time to form the own set of related multiplication and division sentences. Share these with the class.

Encourage students to realise that if they know their multiplication facts they can easily solve division by using the inverse.

To extend the task discuss the generalization of a x b =c so c ÷ b = a.

Other Examples

If...4 x 9 = 36 and ___ x ___ = ___
Then...36 ÷ 4 = 9 and 36 ÷ 9 = 4

If...15 x 10 = 150 and 10 x 15 = 150
Then...150 ÷ 15 = 10 and ___ ÷ ___ = 15

If... 25 x ___ = 2500 and ___ x 25 = 2500
Then... 2500 ÷ 25 = 100 and ___ ÷ ___ = ___

Curriculum Links

- *Identify and describe the properties of prime, composite, square, and cube numbers and the divisibility rules for 2, 3, 5, 9, and 10.*
- *Use words and symbols to describe and represent the properties of operations (commutative, distributive, associative, inverse, and identity).*

Big Ideas

Division facts can be found by thinking about the related multiplication fact.

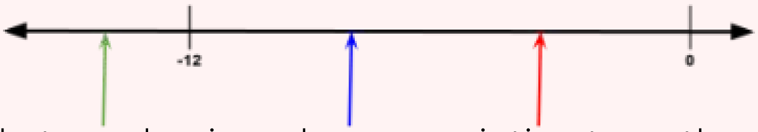
Suggested Learming Outcomes

- *Recognise and explore patterns, and make conjectures and draw conclusions about them.*
- *Identify relationships, including similarities, differences, and new connections.*
- *Look for patterns and regularities that can be applied in another situation or are always true.*
- *Make and test conjectures, using reasoning and counter examples to decide if they are true or not.*

Mathematical Language

Multiplication, division, inverse, related facts, commutative property

What's the Point? Positive and Negative Integers



What number is each arrow pointing to on the number line?
Justify your thinking

Teacher Notes

Purpose: to identify integers on a number line

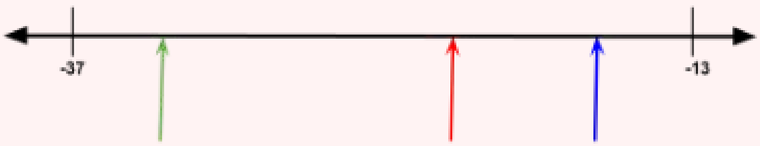
Instructions:

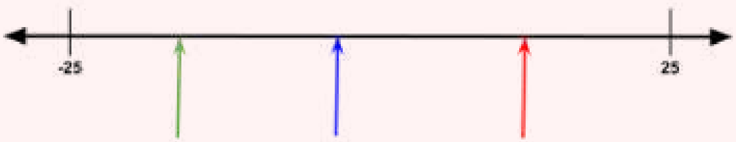
*Show students one number line at a time. Emphasise the need to justify their reasoning. The red arrow is …… **because**….*

Notice what benchmarks students are using. E.g. zero would be here, therefore I think the red arrow is pointing to….

Encourage students to talk with a buddy. Pay attention to any mathematical argumentation and highlight this with the larger group. Who thinks the same, who thinks differently and why? Who has changed their thinking and why? What convinced you?

Other Examples





This idea can be extended to include decimals. Challenge students to explore the idea of negative integers with decimals. Can you have -3.25? Why or why not?

What about fractions? Can we have half?

Where does this sit on the number line?

Curriculum Links

Order and compare integers on a number line

Big Ideas

Mathematical situations can be represented as equations which include both positive and negative integers.
A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

Suggested Learming Outcomes

- *Use a number line to represent the relationship between positive and negative integers in equations*
- *Explain and justify the role of zero as neither positive nor negative*
- *Explain and justify the use of – as an operation symbol (subtraction) and direction symbol (direction, size of movement) for negative numbers*

Mathematical Language

Integers, negative number, positive number

What is the story? Positive and Negative Integers

What could the story be?
-2 + 6 = 4
13 – 16 = -3

Teacher Notes

Instructions:

Start with one equation and students to share their ideas with their buddies.

Encourage students to then show this equation on an empty number line using arrows and notation to represent the equation, to then discuss what the real life context could be.

Notice the students that are using the correct language of negative numbers.

Represent student explanations on the board when facilitating whole class discussion.

If needed have a discussion of negative number brainstorm prior to starting: above and below sea level, weather reports, freezing details on food packages, money, going down a lift into a parking lot, golf scores etc.

Other Examples

Use a selection of both positive and negative integers in different combinations.
-5 + -5 = -10
-3 – 6 = -9
-4 - -7 = 3
4 - -4 = 8

Equations with missing variables e.g. -3 + _ = 4 or no solutions will increase the challenge to this task.

Curriculum Links

Add and subtract integers
Make statements and justify how to add and subtract integers

Big Ideas

Mathematical situations can be represented as equations which include both positive and negative integers.
A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

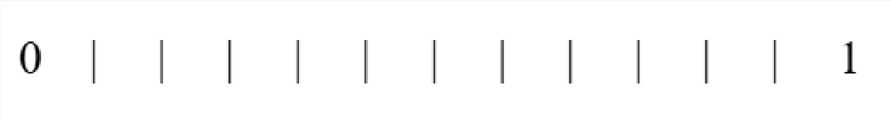
Suggested Learming Outcomes

- *Solve simple addition and subtraction equations*
- *Use a number line to represent the relationship between positive and negative integers in equations*
- *Explain and justify the role of zero as neither positive nor negative*
- *Explain and justify the use of – as an operation symbol (subtraction) and direction symbol (direction, size of movement) for negative numbers*

Mathematical Language

Integers, negative number, positive number, rise, fall, below

Fraction - Numberline



What fractions could go on this number line?

Teacher Notes

Key question to ask students "What do you notice?"

Instructions:
Place the number line up on the board.

Ask the students to turn and talk and discuss what numbers are between 0 and 1 on this number line.

The teacher draws attention to the fact that twelve spaces are between zero and one; through questioning, the class concludes that each space has a length of one-twelfth of the whole.

Through further questioning, the class determines that successive lines should be called one-twelfth, two-twelfths, three-twelfths and so on.

Use talk moves to facilitate participation and develop understanding.

Discuss what students notice when teacher asks students to crouch down and then calls out the fraction. What are the equivalent fractions? Which fraction is bigger and why?

Other Examples

Use a variety of different sized number lines and with different sized gaps between the numbers.
Repeat this warm up using whole numbers, for example a number line between numbers 20 and 21.

Curriculum Links

On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.

Big Ideas

A fraction describes the division of a whole into equal parts.
The bottom number in a fraction tells how many equal parts the hole our unit is divided into. The top number tells how many equal parts are indicated.
Each fraction can be associated with a unique point on the number line, but not all of the points between integers can be named by fractions.

Suggested Learning Outcomes

- *Notice fraction points on a number line*
- *Represent fractions in their simplest form*
- *Add and subtract fractions with related denominators*
- *Justify and explain their thinking*

Mathematical Language

Fraction numbers like one-twelfth, two-twelfths, six-twelfths and so on.
Equivalent fractions, denominators, numerators

True or False- Convert Improper Fractions

$$2\frac{1}{3} = \frac{7}{3}$$

Materials- Fraction tiles

Teacher Notes

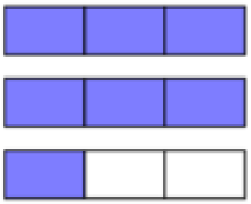
Ask students to name some proper and mixed fractions. Record it on the whiteboard.

Write the mixed fraction and improper fraction on the whiteboard and ask students to explain and justify if it's true or false.

When the students share back, record their justification including representation on the whiteboard.

Highlight to the students that an improper fraction has a numerator greater than the denominator.

Draw this representation on the whiteboard and count the thirds.



Write the fraction as a mixed fraction by counting how many wholes and parts

Other Examples

True or False

$$\frac{17}{5} = 2\frac{7}{5}$$

$$\frac{11}{4} = 3$$

Curriculum Links

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *Represent fractions in their simplest form.*

Big Ideas

A fraction describes the division of a whole (region, set, segment) into equal parts.
The bottom number in a fraction tells how many equal parts the whole or unit is divided into. The top number tells how many equal parts are indicated.
A fraction is relative to the size of the whole or unit.
A fraction describes division.(a/b = a ÷ b, a & b are integers & b ≠ 0), and it can be interpreted on the number line in two ways. For example, 2/3 = 2 ÷ 3. On the number line, 2 ÷ 3 can be interpreted as 2 segments where each is 1/3 of a unit (2 x 1/3) or 1/3 of 2 whole units (1/3 x 2); each is associated with the same point on the number line. (Rational number)

Suggested Learming Outcomes

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *Represent fractions in their simplest form.*

Mathematical Language

Whole, fraction, improper fraction, mixed fraction, denominator, numerator

True or False- Convert Improper Fractions

Where does it go? How do you know?
Convert the improper fraction into a mix number and place on the number

$$\frac{22}{4}$$

Teacher Notes

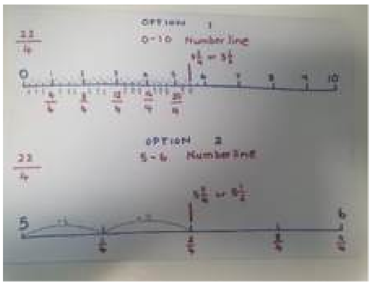
Fractions number line is for students to recognise that the whole is the distance between the students representing zero and one.

Key question to ask students "What do you notice?" and "How do you know?"

Instructions:
Notice the students that are using fractional language in their explanations to share their thinking with the class.

Attached are some examples below to solve the number line.

Note: students may use multiplication or division to solve as well.



Use talk moves to support participation and facilitate discussion.

Other Examples

Other improper fractions that will generate a discussion

$$\frac{67}{8} \text{ or } \frac{17}{6} \text{ or } \frac{39}{15} \text{ or } \frac{12}{9}$$

Have two fractions that they need to convert into mixed numbers and order them on the number line. Which is bigger and how do you know?

Curriculum Links

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *Represent fractions in their simplest form.*

Big Ideas

A fraction describes the division of a whole (region, set, segment) into equal parts.
The bottom number in a fraction tells how many equal parts the whole or unit is divided into. The top number tells how many equal parts are indicated.
A fraction is relative to the size of the whole or unit.
A fraction describes division.(a/b = a ÷ b, a & b are integers & b ≠ 0), and it can be interpreted on the number line in two ways. For example, 2/3 = 2 ÷ 3. On the number line, 2 ÷ 3 can be interpreted as 2 segments where each is 1/3 of a unit (2 x 1/3) or 1/3 of 2 whole units (1/3 x 2); each is associated with the same point on the number line. (Rational number)

Suggested Learning Outcomes

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *Represent fractions in their simplest form.*

Mathematical Language

Whole, fraction, improper fraction, mixed fraction, denominator, numerator

Find the whole amount when given a percentage or fraction amount.

70% of $___ = $175

$25	$25	$25	$25	$25	$25	$25	$25	$25	$25

Teacher Notes

Show the bar model to the students and ask them to turn and talk about what they notice about the model. Monitor the use of decimal and fractional language.

Ask students work with a buddy to find
70% of $___ = $175

Have materials available or mini whiteboards or paper if students want to draw their representations.

Ask the students to explain and justify that the total of the bar will be 100% and $250.

If students do not draw the bar model, colour 70% of the bar and add the $25 to prove that 70% of the bar = $175 and the value of the whole bar is $250= 100%

Facilitate the students to notice that the value of the 30% is $75. $175 and $75 = $250

Emphasise the idea that 70% + 30% = 100% so therefore

$$\frac{70}{100} + \frac{30}{100} = \frac{100}{100} \text{ or } \frac{7}{10} + \frac{3}{10} = \frac{10}{10}$$

Other Examples

Ask students to draw bar models or other representations to solve these equations:

1. 90% of ____ = $360
2. $\frac{6}{8}$ of ____ = $48
3. 45% of _____ = $1.90
4. $\frac{5}{7}$ of ____ = $22.50
5. 60% of _____ = $21

Curriculum Links

- *Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages.*
- *Represent fractions in their simplest form*

Big Ideas

Different real-world interpretations can be associated with the product of a whole number and fraction (decimal), a fraction (decimal) and whole number, and a fraction and fraction (decimal and decimal).

Different real-world interpretations can be associated with division calculations involving fractions (decimals).

Suggested Learming Outcomes

- *Explain and justify the comparison of a part to the whole.*
- *Use representations to find the whole when a percentage and fraction is given.*

Mathematical Language

Whole number, fraction, fractional number, decimal number, rational number, equal, equivalent, percentage,

Fractional part of a set

You have read 231 pages of your book. You celebrate reading one third of your book.

What fraction of your book do you have left to read?
How many pages is that?

How many pages in the whole book?

How many ways can you represent your thinking?

Teacher Notes

The purpose of this activity is for students to find the fraction of the whole set. Student's practice explaining and justifying.

Instructions:
Show the statement.

Give a short time for individual thinking, then ask students to explain their thinking to a buddy.

Encourage students to use a variety of representations eg. Materials, drawings, fraction tiles...

Encourage the students to recognise that

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

So $\frac{1}{3}$ is 231, $\frac{2}{3}$ = 462 and the whole book is 693.

Or 200 x 3 = 600 + 30 x 3 = 90 + 1 x 3 = 3

Other Examples

You have read 2102 pages of your book. You celebrate reading one quarter of your book.
How many pages in the whole book?

Curriculum Links

- *Fractions show parts of a whole in a region, a measurement, or a set of objects. The same amount (e.g., a half or a quarter) can be shown by equivalent fractions.*
- *Find a unit fraction of a whole (e.g., a region, measurement, or set of objects), and add unit fractions with the same*
- *denominator.*
- *recognise, read, write, represent, and order halves, thirds, quarters, fifths, sixths, sevenths and eighths*

Big Ideas

A fraction describes the division of a whole (region, set, segment) into equal parts.

Suggested Learning Outcomes

- *Put two, four and eight equal parts (units) together to make one whole.*
- *Count or add fractional parts to make one whole.*
- *Combine and recombine different units of fractions to*
- *make one whole.*

Mathematical Language

whole, quarters, fourths, thirds, sevenths, equal, equivalent, fair share, partitioning, numerator, denominator

Would you rather? (Fractions and percentages)

Would you rather have 24% of a pizza or 60% of half a pizza?

Discuss with your peers.

Teacher Notes

Instructions:

Display the statement where all students can see.

Encourage students to discuss their thinking with their group.

If students want to represent their thinking, provide mini whiteboards or paper to allow them the opportunity.

Notice students that are able to justify their thinking using fractional language.

Select students to share back to facilitate discussion amongst the whole class, asking the question "Do you agree or disagree with their reasoning?" "Why?".

To extend this warm up further into an independent task, ask the students to represent their thinking in multiple ways.

Other Examples

Would you rather the length of your overseas holiday be 2% of a year or $\frac{1}{3}$ of a month long?

Would you rather a third of a $\frac{1}{4}$ of a cake or 15% of the cake?

Curriculum Links

Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages

Big Ideas

Numbers can be described in many different ways including as fractions.
The whole is important in naming fractions. A fraction is relative to the size of the whole or unit.
A comparison of a part to the whole can be represented using a fraction.
A fraction describes the division of a whole (region, set, segment) into equal parts.
Each fraction can be associated with a unique point on a number line.
There is no least or greatest fraction on the number line.
There are an infinite number of fractions between any two fractions on the number line.

Suggested Learning Outcomes

Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages

Mathematical Language

whole, thirds, twelfths, eighths, fifteenths, twentieths, fraction, equal, equivalent, greater than, less than, numerator, denominator

Mix and Match : Fractions, Decimals and Percentages

Match the number in the first column with its equivalent value in the second column.

0.666666	$\frac{9}{20}$
$\frac{5}{10}$	one-quarter
45%	50%
60%	$\frac{16}{20}$
0.25	$\frac{2}{3}$
Eighty percent	0.6

Teacher Notes

Instructions:

Give the students the time to discuss with their peers.

Notice students who are able to explain their thinking using fractional language. Share their reasoning with the class.

Ask students if they agree or disagree and why?

If using as an independent activity expect the students to represent their thinking in multiple ways.

Other Examples

$\frac{7}{10}$	0.1
2.6	$\frac{6}{10}$
0.15	$2\frac{6}{10}$
10%	0.25
$\frac{11}{44}$	70%
60%	15%

Curriculum Links

Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages.

Big Ideas

A fraction describes the division of a whole (region, set, segment) into equal parts. The bottom number in a fraction tells how many equal parts the whole or unit is divided into. The top number tells how many equal parts are indicated. Each fraction can be associated with a unique point on a number line.

Suggested Learning Outcomes

- *Order and compare fractions.*
- *Find equivalent fractions.*

Mathematical Language

Whole, thirds, twelfths, eighths, fifteenths, twentieths, fraction, equal, equivalent, greater than, less than, numerator, denominator

Fractions, Decimals, Percentages

$$\frac{3}{5} = 60\% = 0.6$$

Is the number sentence true or false. Use representations to explain and justify.

(Materials: Empty number lines, fraction tiles)

Teacher Notes

This activity will support the students to convert between fractions, percentages and decimals.

Instructions:

Place the equation on the board or screen.

Give students the opportunity to discuss and represent their thinking with their peers.

When students share back, monitor for students using vocabulary within the language of rational number and that percent is out of one hundred.

Draw the different representations used by students on the whiteboard explaining why 60 percent is the same as three fifths and 0.6.

If students do not use a number line, show them the number line as another representation.

Other Examples

$$\frac{8}{12} = 67\% = 0.67$$

$$\frac{9}{20} = 45\% = 0.45$$

$$\frac{18}{20} = 90\% = 0.9$$

Curriculum Links

- *On a number line, fractions and decimals occur between integers, and negative numbers are to the left of 0.*
- *Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages.*

Big Ideas

- *Percent is relative to the size of the whole.*
- *A percent is a special type of ratio where a part is compared to a whole and the whole is 100.*
- *A decimal is another name for a fraction and thus can be associated with the corresponding point on the number line.*

Suggested Learming Outcomes

- *Explain and justify the comparison of a part to the whole*
- *Represent reasoning using different forms of notation, including words*
- *Use benchmark fractions to covert other fractions, percentages and decimals*

Mathematical Language

Percent, percentage, whole, fraction, fractional number, decimal number, rational number, equal, equivalent

Decimal Addition – Missing Addends

__ + __ = 9.12024

What could the missing addends be in this sum?

Teacher Notes

Instructions:

Recap that an addend is a number that is added to another one.

Give students sufficient time to record some possible solutions.

Call on students to explain possible solutions and ensure correct place-value language is used. E.g., 3 wholes & 2 hundredths + 1 whole and 4 thousandths.

Push for students to provide reasoning and justification about why their two missing addends are equal to 4.024 (they may need access to materials to prove this).

Facilitate discussion by asking students if they agree or disagree with the reasoning shared.

Refer to the place value house throughout the discussion to make connections to the value of the digits and to highlight the base ten number system.

Other Examples

__ + __ = 12.632 6.71 = __ + __ __ + __ = 7.985

10.10 = __ + __ __ + __ = 0.406 __ + __ = 0.030

Curriculum Links

- *Add and subtract decimal numbers to two places*
- *Solve open number sentences and true or false number sentences involving equality or inequality*

Big Ideas

- *Decimals are a set of fractions that have powers of 10 as their denominators and that can be written as numbers using a decimal point.*
- *Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.*

Suggested Learming Outcomes

- *Add tenths and hundredths*
- *Solve open-ended addition problems*
- *Justify and explain their thinking.*

Mathematical Language

Place value, base ten, tenths, hundredths, thousandths, decimal, equals, equivalent, addition, addend, sum

Multiply fractions and decimals by whole numbers

36 x 63 =
0.36 x 6.3 =
36 x 0.63 =
3.6 x 63 =
0.36 x 0.63 =

Teacher Notes

Instructions:

Have all equations visible for all pairs or small groups to access.

Have materials available or mini whiteboards or paper if students want to draw their representations.

Ask the students to explain and justify what is happening to the value of each equation when multiplied.

If students do not use a number line, show them the number line as another representation.

Facilitate the students to notice that when multiplying a rational number by a rational number that they need to convert the decimals to their fraction equivalents.

Support the students to notice the pattern of multiplying by ten.

Other Examples

You can provide the answer to the first question to allow students to use their decimal and place value knowledge to solve the remaining equations.

124 x 54 = 6696
12.4 x 54 =
1.24 x 54 =
124 x 0.54 =
0.124 x 0.54

Curriculum Links

- *Add and subtract decimal numbers to two places*
- *Solve open number sentences and true or false nUse multiplicative understanding of place value to solve*
- *multiplication and division problems with decimal*
- *numbers.*
- *umber sentences involving equality or inequality*

Big Ideas

- *The effects of operations for addition and subtraction with fractions and decimals are the same as those with whole numbers.*
- *Division with a decimal divisor is changed to an equivalent calculation with a whole number divisor by multiplying the divisor and dividend by an appropriate power of ten*

Suggested Learming Outcomes

- *Represent reasoning using different forms of notation,*
- *including symbols and words.*
- *Solve problems involving decimal numbers by multiplying*
- *and explain and justify the solution.*
- *Represent reasoning to explain and justify place value*
- *involving decimal numbers*

Mathematical Language

Whole number, fraction, fractional number, decimal number, rational number, equal, equivalent

Percentages: Number String

10% of 4.80 = 0.48

5% of 4.80 =
2.5% of 4.80 =
1.25% of $4.80 =

Teacher Notes

The aim of this string is to show students that they can use benchmark percentages and place value knowledge to solve for harder percentages.

Instructions:

Show the students the first string asking; if we know ten percent, talk with your buddy how can we find 5%?

Notice students who are able to explain their thinking explaining using the language of place value

.
Solve each equation before moving onto the next.

Other Examples

10% of 156 = 15.6
5% of 156 =
2.5% of 156 =
27.5% of 156 =

10% of $18.99 =
90% of $18.99 =

Curriculum Links

Recognise, read, write, represent, compare, order, and convert between fractions, decimals, and percentages

Big Ideas

- *A percent is another way to write a decimal that compares part to a whole where the whole is 100 and thus can be associated with the corresponding point on the number line.*
- *Percent is relative to the size of the whole.*
- *A percent is a special type of ratio where a part is compared to a whole and the whole is 100.*
- *A decimal is another name for a fraction and thus can be associated with the corresponding point on the number line.*

Suggested Learming Outcomes

- *Calculate percentages of (dollar) amounts, including decimals.*
- *Describe the strategies used using mathematical language.*

Mathematical Language

Percentage, decimals, halving, division, multiplication.

Calculate costs and change for any amount of money.

$185.95

Current New Zealand Banknotes.

Photo credits: Nike, Investopedia websites

Which NZ bank notes could you use to buy this item?
Record different combinations and show how much change you would get?

Teacher Notes

The purpose of this activity is for students to Calculate costs and change using NZ bank notes.

Instructions:

Place students in groups and encourage them to share their ideas with their buddies.

Encourage students to use a variety of representations to explain and justify their thinking eg. Empty number lines or PV houses.

Notice students using the inverse relationship between add/sub. Notice use of place value and the ability to see hundreds as ten tens and tens as ten ones. Draw connections to represent these within the place value houses.

Continue this activity with the students choosing items to add together and finding change.

Curriculum Links

- *In our number system, each place value is a power of 10, and this continues infinitely.*
- *Represent whole numbers and decimals using powers of ten*

Big Ideas

- *Our number system is based on groupings of ten or base ten.*
- *Groupings of ones, tens, hundreds, and thousands can be taken apart in different ways.*
- *There are arithmetic properties that characterise addition and*
- *multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.*

Suggested Learning Outcomes

Explain and justify the use of place value to solve subtraction and problems.

Mathematical Language

Ones, tens, hundreds, thousands, add, subtract, difference, change
total value, digit, addition, subtraction, banknotes,

Where is the maths?

What maths can you see in this photo?
What maths question could we ask?

(Note: use photos that will be engaging for your local community)

Teacher Notes

This activity can cover all strands of the mathematics curriculum (number, measurement, algebra, space, statistics & probability).

Instructions:

Display the picture and ask students to discuss in pairs what mathematics they see in the picture.

Share and collate all the ideas. Notice what students identify and ask a question that will extend their thinking. E,g., "where might time/area/money be in this photo?"

Ask "what maths question could we ask about this picture?"

Give students time to work with a partner to record questions.

Collect and share ideas.

To extend the activity, ask students to estimate (with reasoning) the answer to one of their questions.

Other Examples

Use any photo, artwork or short video relatable to your students.

Curriculum Links

- *Pose a question for investigation*
- *Make connections with ideas in other learning areas and in familiar cultural, linguistic, and historical contexts.*

Big Ideas

- *The world is full of patterns and structures that we use mathematics and statistics to understand.*
- *Mathematical practices are central to learning and doing mathematics.*

Suggested Learming Outcomes

- *Pose a question for investigation*
- *Make connections with ideas in other learning areas and in familiar cultural, linguistic, and historical contexts.*

Mathematical Language

Question, length, time, angle, amount, money, height, area ...

ALEGEBRA - TAURANGI

True or False Statements with Symbols

6 + 8 > 15 - 12
(15 + 3) 2 < 1000 - 32

Are these equations true or false?
Justify your thinking.

Teacher Notes

Instructions:

Ask students in small groups to discuss what they notice.

Ask students to justify their thinking/explanations - Why is it true, false or equal?

Notice for students that are using arrows to justify their thinking across the equations

If needed remind students that = sign means the same on both sides/equal/balanced, > means greater than, < means less than.

Other Examples

$$7 \times 2 > 3 \times 4$$
$$3 + 2 = \frac{13}{3} + 2$$
$$20 - 12 < 3 \times 3$$
$$\frac{1}{8} + \frac{3}{8} \quad = \frac{1}{2}$$
$$15 - 12 < 19$$
$$14 < 14 - 1$$
$$15 > 15 - 13$$

Curriculum Links

- *Look for patterns and regularities that can be applied in another situation or are always true.*
- *Make and test conjectures, using reasoning and counterexamples to decide if they are true or not.*
- *Use appropriate symbols to express generalisations.*

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained;

Suggested Learning Outcomes

- *Use correct symbols in equality equations.*
- *Justify and explain their reasoning.*

Mathematical Language

Multiplication, division, A problems, patterns, factors, sum, common factors, equal, multiplicand, multiplier, greater than, less than, equal to.

True or False - integers

True or false?
Remember to justify your answers.

4 + 3 = - 4 – 3
7 + 5 = 7 + -5
-3 + 6 = 6 + -3

Teacher Notes

Select student solution strategies that use the properties of equality and understanding of negative numbers.

Highlight the difference between the use of - as an operation symbol (subtraction) and direction symbol (direction/size of movement) for negative numbers

Use equipment to show the idea of equality if needed

Instructions: Give students one of the equations to discuss with a partner before sharing back with the whole class.

Other Examples

4 + 3 = - 4 – 3
40 + 30 = - 40 – 30
400 + 30 = - 400 – 300

Curriculum Links

- *Solve simple addition and subtraction equations using integers.*
- *Use a number line to represent the relationship between positive and negative integers in equations.*
- *Explain, justify and represent reasoning related to maintaining equality between operations which involve integers.*

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign.
The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained.
Two quantities equal to the same third quantity are equal to each other.
Mathematical situations can be represented as equations which include both positive and negative integers.
A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

Suggested Learming Outcomes

- *Add or subtract using integers.*
- *Justify their thinking.*

Mathematical Language

Integers, negative number, positive number.

Balancing Equations

158 + 45 = 57 + __
47 + 46 + 45 = 37 + 36 + __

Teacher Notes

Instructions:

Reveal the equation (158 + 45 = 57 + __). Ask students "what numbers might we put in the space to balance this equation?"

Encourage students to turn and talk about the products and to justify their reasoning.

Record all student solutions as they are shared as equations on the whiteboard.

Highlight solutions that draw on noticing a relationship between the left and right side of the equation (as opposed to calculating answers through trial and error).

Encourage students to discuss the second equation. Again focusing on the relationship across the equals sign.

Other Examples

33 + 44 = 33 + 22 + __
456 + 789 = 466 + ___

98 – 78 = 88 - ___
35 – 12 = ___ - 22

Curriculum Links

- *Solve open number sentences and true or false number sentences involving equality or inequality*
- *Use the distributive, commutative and associative properties*

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations.
Equations show relationships of equality between parts on either side of the equal sign.

Suggested Learming Outcomes

- *Balance equations by finding relationships*
- *Explain the equals sign (=) represents balance*

Mathematical Language

Multiplication, multiply, groups of, factor, product, equals, commutative property, associative property, distributive property

Balancing Equations (multiplication and division)

20 x __ = 40 x 16

Teacher Notes

Instructions:

Reveal the first equation (2 x ? = 4 x ?). Ask students "what numbers might we put in the space to balance this equation?"

Encourage students to turn and talk about the products and to justify their reasoning.

Record all student solutions as they are shared as equations on the whiteboard. Discuss that there are multiple ways to balance this equation (e.g., 2 x 60 = 4 x 30, 2 x 5 = 4 x 2.5)

Highlight solutions that draw on noticing a relationship between the left and right side of the equation (as opposed to calculating answers through trial and error).

If students describe the equation 2 x 4 = 4 x 2 then discuss the commutative property of multiplication.

Reveal the second equation 2 x ? = 4 x 16. Give time for students to discuss what the missing factor is.

Use the questions as a discussion prompt to unpack the doubling and halving (proportional adjustment) relationship as the associative property of multiplication.

Other Examples

6 x ? = 3 x ?	5 x ? = 10 x ?	8 x ? = 4 x ?
6 x ? = 3 x 24	5 x 50 = 10 x ?	8 x ? = 4 x 19

Curriculum Links

- *Solve open number sentences and true or false number sentences involving equality or inequality*
- *Recall multiplication facts to 10 x 10 and corresponding division facts*
- *Use the distributive, commutative and associative properties*

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations.
Equations show relationships of equality between parts on either side of the equal sign.

Suggested Learning Outcomes

- *Recall and apply multiplication facts*
- *Balance equations by finding relationships*
- *Explain the equals sign (=) represents balance*

Mathematical Language

Multiplication, multiply, groups of, factor, product, equals, commutative property, associative property, distributive property

Solve simple equations with variables

$$a + 12 = 13 + 6$$

Teacher Notes

Instructions:

Remind students when looking at the equality in equations to look at the relationship across each side.

Place an equation on the board or screen.

Allow students time to think and then share their ideas with a buddy.

Notice students who are explaining their ideas to their buddies algebraically.

Use talk moves to facilitate participation and develop understanding when sharing back to the whole class.

Expect students to justify and explain their thinking when sharing back to their peers.

Other Examples

What's the value for each letter? Explain your thinking.

$51 - a = 26$

$15 \times a = 2 \times 1.5 \times 10$

$64 = 8 \times 2 \times a$

$125 = 5 \times 5 \times a$

Curriculum Links

- *The commutative, associative, distributive, and identity properties work the same for all numbers.*
- *A variable can be used to represent any number.*

Big Ideas

Three of more numbers can be grouped and added (or multiplied) in any order.
If the same number is added or subtracted to both sides of an equation, equality is maintained.

Suggested Learming Outcomes

- *Use words and symbols to describe and represent the properties of operations (commutative, distributive, associative, inverse and identity).*
- *Solve simple equations with variables*

Mathematical Language

commutative, distributive, associative, equality,

True or False – Expanding Brackets

Mele thinks that 12(2b-3) is equivalent to 24b – 3.
Do you agree with Mele? Why or why not?

Teacher Notes

Instructions:

Show the equation.

Give students the time to think. Allow students to talk to a buddy about their thinking and ideas.

Notice students who are able to reason algebraically discussing the equivalence on both sides.

Expect students to explain and justify their thinking when students are sharing back.

Use talk moves to facilitate participation and develop understanding.

Represent student ideas on the whiteboard.

Other Examples

True or False. Why?
4(2a + 3) = 8a + 3
6(2a – 6) = 12a – 36
4(8a – 4) = 2a – 1

1. Kiriwai thinks that 6(2b-3) is equivalent to 12b - 18. Do you agree with Kiriwai? Why or why not?

Curriculum Links

A variable can be used to represent any number.

Big Ideas

Algebraic expressions can be named in an infinite number of different but equivalent ways (e.g., 2(a – 12) = 2a – 24 = 2a – (28 – 4)).

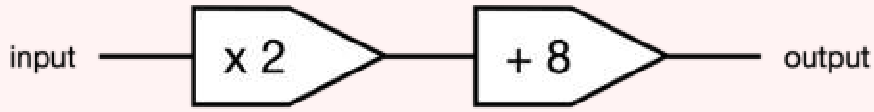
Suggested Learming Outcomes

- *Solve linear equations by trial and improvement and by applying inverse operations.*
- *Reason with algebraic thinking.*

Mathematical Language

Inverse operations, linear equations, variable

Function Machine



Run 3 consecutive numbers through the function machine.
What do you notice?
What would the algebraic rule be?

Teacher Notes

Ensure that prior to this warmup, your class has had exposure to patterns and algebraic rules.

Instructions:

Show students the function machine.

Ask the students to choose their own numbers within their peers to enter through the machine.

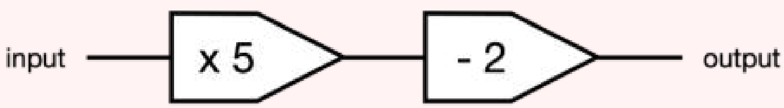
Encourage the students to explore the function machine before unpacking 'how to'.

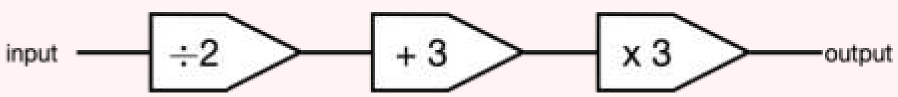
Notice students who are able to explain 'how to' using mathematical language.

When sharing back with the whole class use talk moves to highlight key mathematical ideas.

Prompt for the algebraic rule if necessary, representing on the board for all to see; outcome = number x 2 + 8, so y = 2x + 8.

Other Examples





Curriculum Links

- *Use tables, XY graphs, and diagrams to find relationships between elements of growing patterns.*
- *Develop a rule in words about a linear pattern.*

Big Ideas

Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.

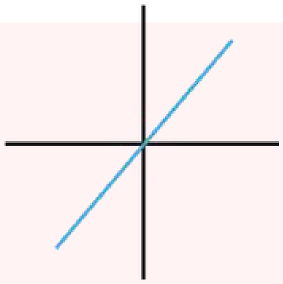
Suggested Learming Outcomes

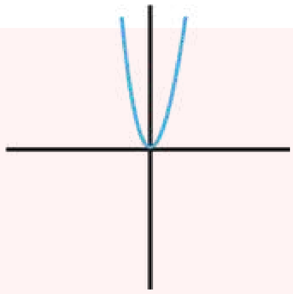
- *Identify the element for a repeating pattern for far terms.*
- *Explain that a pattern has consistency.*
- *Develop a rule for a function machine and express it in words.*

Mathematical Language

Constant, unit of repeat, rule, sequence, variable, function, machine, input, output, multiply, add.

Function Machine





What graph represents y = x ?
Explain and justify your thinking.

Teacher Notes

Ensure that prior to this warmup, your class has had exposure to patterns and algebraic rules.

This starter is designed for students to explore and have exposure to algebraic graphs.

Instructions:

Show students the graphs.

Encourage students to turn and talk with their peers. What do they notice? What could the variables be?

Notice students that are using algebraic language to explain their thinking.

If needed prompt students to give y a value.. If y = 1, then x = 1 etc... if these where graphed what would it look like?

Prompt students to think about the other graph what could the algebraic rule be.

Other Examples

Use www.desmos.com/calculator to create other graphs that can be discussed and compared.

Curriculum Links

- *Use tables, XY graphs, and diagrams to find relationships between elements of growing patterns.*
- *Develop a rule in words about a linear pattern.*

Big Ideas

They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula and then graphed.

Suggested Learming Outcomes

- *Identify the graph that matches the algebraic rule.*
- *Justify their algebraic reasoning.*

Mathematical Language

Constant, unit of repeat, rule, sequence, variable, function, machine, input, output, multiply, add,

MEASUREMENT - INE

Conversions of measurements

Which measurement is the greatest?

Distance to the River

THIS	THAT
34.7km	3470m
$3\frac{2}{5}$km	34000m
0. 37 km	34.7m

Explain and Justify your reasoning.

Teacher Notes

In this activity, students decide which option is the greater amount (this or that).

Instructions:

You can show one comparison at a time or all three at once.

Provide time for students to reason and compare the measurements, and to develop a justification for their answer.

Students can turn and talk and share their thinking with a partner. Encourage the use of agree or disagree and why with their partner.

Facilitate a large group discussion about different reasonings students had as they share their justifications.

Questions to support discussion:

- *How did you convert the units?*
- *How could we work out what the difference is between the two?*
- *What did you multiply/divide by to compare the measurements and why?*
- *Can you use decimals or fractions to give different representations of the same measurement?*

Curriculum Links

- *In the metric system, there are base measurements with prefixes added to show the size of units.*
- *Metric measurements can be converted from fractions to whole numbers, and vice versa, by changing units.*

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non standard units of measure and we use mathematical language to describe these.

Suggested Learming Outcomes

- *convert between units of measurement*
- *justify and explain their reasoning*

Mathematical Language

Unit of measure, measurement count, convert, millimetre, centimetre, metre, kilometre, millilitre, litre, milligram, gram, kilogram, gigabytes, megabytes, hours, minutes, seconds

Conversions of measurements

Other Examples

Amounts can be changed to decimal and fractional numbers to increase challenge.

Amount of milk left in the bottle

THIS	THAT
200.7ml	0.27l
$3\frac{2}{3}$l	3230ml
65.05ml	0.65l

Length of Lego bricks

THIS	THAT
555 mm	0.55m
$3\frac{1}{4}$ cm	35mm
75mm	0.07m

Length of Lego bricks

THIS	THAT
555 mm	0.55m
$3\frac{1}{4}$ cm	35mm
75mm	0.07m

Weight of apple bins

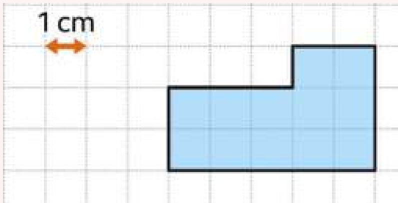
THIS	THAT
50.48kg	4800g
45005g	$45\frac{1}{5}$kg
380kg	308000g

Gigabytes of Data

THIS	THAT
550mb	0.5GB
$10\frac{1}{2}$GB	1500MB
28000MB	24.5GB

Estimating Area and Perimeter

Can you estimate the area and perimeter of this shape? Turn and talk to your buddy. Remember to explain and justify your thinking.



Can you convert your estimations to metres?

Teacher Notes

Please do not label the sides of the shape prior to students solving the starter. Direct student to noticing that each box is 1 cm.

Instructions:

Place the starter on the board and encourage students to share their thinking with a buddy.

Notice for students who break the shape into compound shapes and use the area formula.

Students may also count the number of squares in the shape to find area.

Select students to share back that have clear mathematical explanations.

Use talk moves to engage other students in the conversation and to support participation.

Curriculum Links

- *estimate and then measure length, area, volume, capacity, mass, temperature, data storage, time, and angle, using appropriate metric units.*
- *visualise, estimate, and find the perimeter and area of shapes composed of triangles and rectangles.*

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or nonstandard units of measure and we use mathematical language to describe these.

Suggested Learming Outcomes

- *Estimate and measure length in a range of measurement units (mm, cm, m).*
- *Identify the relationship between millimetres, centimetres and a metre.*

Mathematical Language

Metre, centimetre, millimetre, length, unit of measure, measurement count, ruler.

The perimeter is ....what is the Area?

The perimeter is 22cm. What is the area?

Teacher Notes

The objective is for students to explore the idea that objects can have the same perimeter however a different area.

Instructions:

Decide on the shape for the task (quadrilateral) or alternatively let students choose their own.

Pose the questions and then support students to discuss with their group.

Encourage the students to think of decimal options as well or notice for students that are using the language of measurement when sharing their ideas to their peers.

Use talk moves to facilitate the classroom discussion and support participation.

For example: 1cm x 10 cm = 10cm2 or .5cm x 10.5cm = 5.25cm2.

Encourage students to notice the pattern in the different options.

Other Examples

The perimeter is .75m what is the area?

The perimeter is 90cm what is the area?

Curriculum Links

- *Metric measurements can be converted from fractions to whole numbers, and vice versa, by changing units.*
- *Shapes can be decomposed or recomposed to help us find perimeters, areas, and volumes.*

Big Ideas

Relationships can be described and generalizations made for mathematical situations that have numbers or objects that repeat in predictable ways.
Some attributes of objects are measurable and can be quantified using unit amounts.

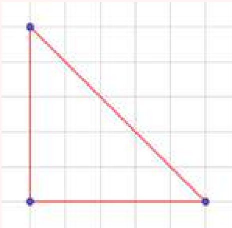
Suggested Learming Outcomes

- *Use non-standard units (squares) to measure area.*
- *Find the area of a surface by using multiplication.*
- *Develop a generalisation for finding the area of a rectangle.*
- *Use measurement language to describe how to measure area.*

Mathematical Language

Area, square, unit of measure, measurement count.

Exploring Area



Teacher Notes

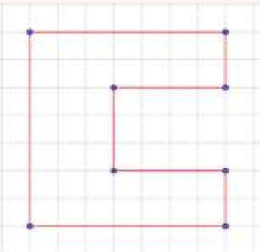
Provide access to grid paper.

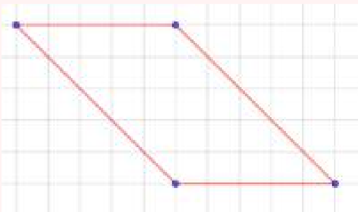
Instructions:

Notice students who are counting in unit squares or applying a rule to find the total area of this triangle (12.5cm2).

Explore different ways the total area can be partitioned into two parts, shapes that have an area of 6.25cm2

Other Examples





Repeat with a range of other regular and compound shapes. You can also change the number of parts. E.g., can you split this shape into three parts with the same area?

Curriculum Links

- *Estimate and then measure length, area, volume, capacity, mass, temperature, data storage, time, and angle, using appropriate metric units.*
- *Visualise, estimate, and find the perimeter and area of shapes composed of triangles and rectangles.*

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or nonstandard units of measure and we use mathematical language to describe these.

Suggested Learming Outcomes

- *Make two shapes with equal areas*
- *Recognise square units*

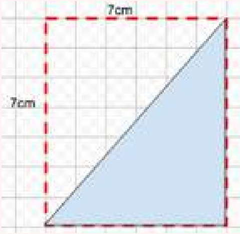
Mathematical Language

Area, length, height, cm2,, ½ cm2

Exploring Area of Right Angle Triangles

Lauren and Emily make the claim that they can find the area of this triangle by finding the area of the rectangle that this triangle fits inside, and then halving it.
Here are their workings:

Area of rectangle:
7x7 = 49cm^2
Area of triangle:
49 ÷ 2 = 24.5cm^2



Teacher Notes

Provide access to grid paper.

Instructions:

Notice students who are counting in unit squares or applying a rule to find the total area of this triangle
.
Students may fold and cut the paper to compare triangles to prove if this strategy works.

Listen for mathematical argumentation and justification and use talk moves to have students share their explanations.

Other Examples

Repeat with a range of other triangles. Start with right angle triangles and then progress to different types of triangles. How can they prove if this strategy still works on other triangles?

Curriculum Links

- *Estimate and then measure length, area, volume, capacity, mass, temperature, data storage, time, and angle, using appropriate metric units.*
- *Visualise, estimate, and find the perimeter and area of shapes composed of triangles and rectangles.*

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or nonstandard units of measure and we use mathematical language to describe these.

Suggested Learming Outcomes

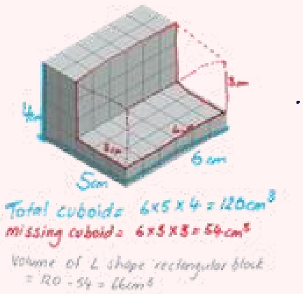
- *Find area of right angle triangles*
- *Recognise square units*

Mathematical Language

Area, length, height, cm2,, ½ cm2

Calculating Volume

Annah makes the claim that she can find the volume of an L shaped rectangular block by converting it into a cuboid and finding the total volume, and then subtracting the extra volume that was added to create the cuboid.
Here are her workings:



Can you explain what she has done in her own words? Do you agree that this works? Why or why not does this give an accurate measure of volume for an L shaped block? How could you test Annah's claim

Teacher Notes

Expect students to understand that volume is the measurement of space and therefore the volume of the "missing space" can also be calculated.

Instructions:

Show students Annah's workings and tell students to discuss the claim with a buddy.

Pay attention to any mathematical argumentation and highlight this with the larger group. Who thinks the same, who thinks differently and why? Who has changed their thinking and why? What convinced you?

Select several students to share how they could check if this claim is true.

Ask students if they think this strategy would work on other shapes? Why or why not?

Curriculum Links

- *Use appropriate scales, devices, and metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time.*
- *Use side or edge lengths to find the perimeters and areas of rectangles, parallelograms, and triangles and the volumes of cuboids.*
- *Use a range of multiplicative strategies when operating on whole numbers.*

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or nonstandard units of measure and we use mathematical language to describe these.

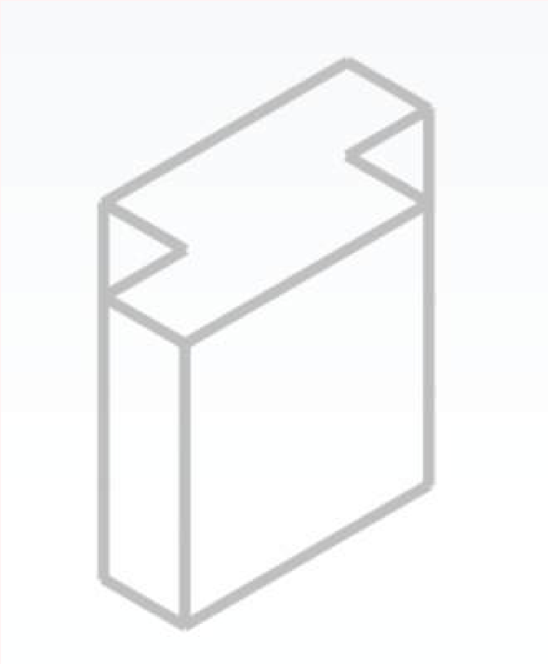
Suggested Learning Outcomes

- *Use multiplicative reasoning to find volume.*
- *Find the volume of a composite cuboid.*

Calculating Volume

Other Examples

You may choose to use this warm up over several days. Show students other examples and ask them how they could use this strategy to calculate the volume of these shapes.



Mathematical Language

Cuboid, length, breadth, height, surface, centimetre, 3-dimensional, 2-dimensional, volume, width, depth, rectangular prism, dimensions.

Scale factor – volume

Using a small unit cube. If the cube is enlarged by a factor (f) of 2. What scale factor is the volume enlarged?

Teacher Notes

Facilitate discussion using the small unit cubes.

Make available a pile of small cubes so that students can build up cubes that are twice and three times the size, and then count the new surface areas and volumes.

Expect students to justify their thinking when sharing statements to the classroom. Provide opportunities for students to reason with their peers thinking by asking if they agree or disagree.

Possible misconception is students calculate the volume by length x width x height and multiplying by 2.

Other Examples

Extend this task by asking the students to represent their enlargements.

Curriculum Links

Scale a shape by a factor and then derive the scale factor for the new shape's area or volume

Big Ideas

Relationships between scale factors for length, area, and volume is conceptually difficult to understand.
The notion of scale factors for lengths areas and volume.
The relationship between scale factors for length, area and volume.

Suggested Learming Outcomes

- *Use scale factors to investigate areas being enlarged.*
- *Use scale factors to investigate volumes being enlarged.*
- *Solve real life context problems involving scale factors.*

Mathematical Language

scale factors, surface area, volume, enlarged

Convert digital to analogue time

This is a time on a digital clock.
13:18
What analogue time is it? Prove your thinking.

Teacher Notes

Instructions:

Allow students to represent the time by drawing clocks if needed.

As students are discussing their ideas with a partner, notice for students that are using mathematical language to explain their thinking.

When sharing back ideas to the whole group, encourage students to justify their thinking i.e. explain why.

Other Examples

Use a variety of other times to consolidate this skill.

- 19:45
- 02:30
- 18:00
- 03:10
- 04:45

Curriculum Links

- *Convert between measurement units*
- *Read analogue and digital measurement tools, round appropriately, and interpret scales accurately*

Big Ideas

There are multiple ways to measure time and some units of time measurement are more appropriate than others within different contexts.
Time is displayed in different ways depending on the context.
Numbers that are used to measure time repeat themselves in a cycle.
Time measurements can be compared when they are converted into the same unit.

Suggested Learning Outcomes

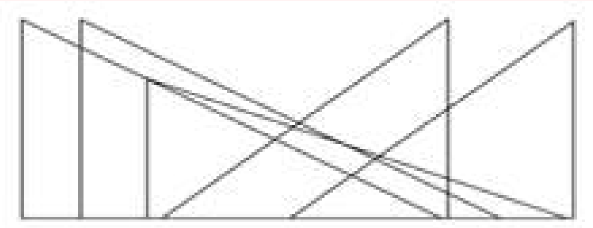
- *Convert between digital and analogue time*
- *Explain and justify my thinking*

Mathematical Language

Morning, afternoon, evening, night, day, tomorrow, yesterday, after, before, longer, shorter, equal, seconds, minutes, hours, week, month, year, decade, time, measurement, timeline, midday, midnight, noon, analogue clock, digital clock, clockwise, anticlockwise, circular numberline, circumference, intervals, quarter hour, half an hour, three quarters of an hour, duration

SPACE MOKOWĀ

Triangles



Can you name and explain the different triangles found in the shape above?

Teacher Notes

Note: This starter might be done over a few days, or as a starter and then finished as an independent activities (provide students with the opportunity to write clear definitions for each triangle).

Instructions:

Show the image and provide the students some time to discuss with a partner.

Notice for students who are using geometrical language to explain and justify their thinking.

Triangles can be classified by their sides or angle:
- *Equilateral Triangle: three equal sides*
- *Isosceles triangle: two equal sides*
- *Scalene triangle: no equal sides*
- *Acute Triangle: has three right angles*
- *Right Angle Triangle: Has one 90° angle*
- *Obtuse Triangle: has one angle > 90°*

When sharing back student ideas use talk moves to highlight key mathematical reasoning.

Further points of discussion?
- *Can triangles be classified by both angle and side, e.g. an Obtuse Isosceles Triangle?*
- *What irregular shapes can you find in this image?*

Other Examples

Explore and justify shapes in the environment around you.

Curriculum Links

Classify shapes based on their geometric properties.

Big Ideas

Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes.
Shapes have sides that are parallel, perpendicular, or neither.
Shapes have line symmetry, rotational symmetry, or neither.
Shapes are similar, congruent, or neither.

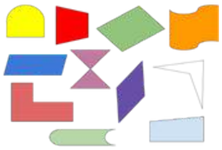
Suggested Learming Outcomes

Identify classes of shapes in a range of different ways using geometrical language to explain and justify.

Mathematical Language

2-dimensional, straight, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, triangle, quadrilateral, diamond, kite, trapezoid, rhombus, rectangle, square, parallelogram, square corner, right angle, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle.

Is it a Quadrilateral?



Are these shapes quadrilaterals? Justify your thinking.

Teacher Notes

A quadrilateral is a 2D shape that has four straight sides and four corners. Quadrilaterals can be grouped based on their properties.

Instructions:
Show students the 2D shapes. Emphasise the need to justify their reasoning. This shape is not a quadrilateral because….

Pay attention to any mathematical argumentation and highlight this with the larger group. Who thinks the same, who thinks differently and why? Who has changed their thinking and why? What convinced you?

Questions to further support discussion:

- *What do you notice about number of sides, length of sides, number of parallel lines, size of angles?*

Other Examples

You may choose to use one shape per day and use this warm up over a series of days or independent tasks. Use materials within your environment when available.

Curriculum Links

Sort and classify plane shapes into classes and sub classes according to defined geometrical properties

Big Ideas

Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes.

Suggested Learming Outcomes

- *Identify classes of shapes in a range of different ways using geometrical language to explain and justify.*
- *Use commonly shared rules to communicate ideas about defining shapes.*

Mathematical Language

2-dimensional, straight, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, triangle, quadrilateral, diamond, kite, trapezoid, rhombus, rectangle, square, parallelogram, square corner, right angle, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle.

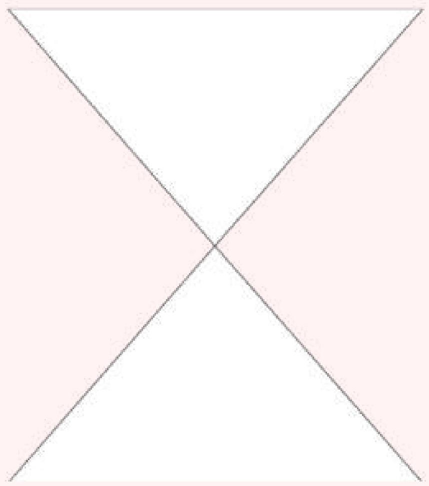
Other Examples

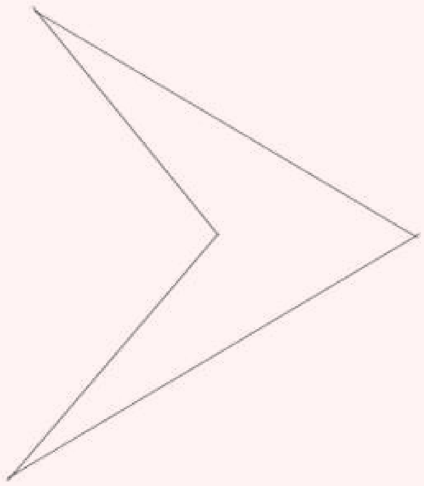
This activity can be further extended by looking at different quadrilaterals and seeing if they can be classed as more than one type of quadrilateral. For example, a square is a rectangle, is a rectangle also a square? Can a rhombus also be a parallelogram? Why or why not?

Show students a hierarchy of quadrilaterals and get them to come up with their own descriptions of each type of quadrilateral based on length of sides, number of parallel lines, size of angles.

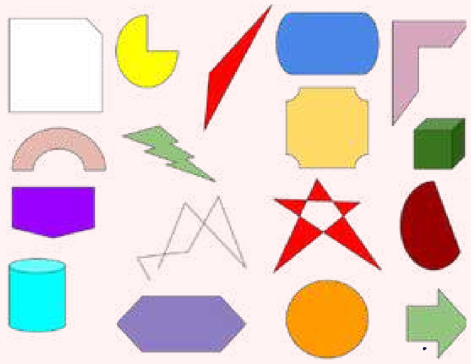
Note: The following shapes are quadrilaterals:

Intersecting quadrilateral and concave quadrilateral. Why are these shapes classified as quadrilaterals?





Is it a polygon?



Are these shapes quadrilaterals? Justify your thinking.

Teacher Notes

A polygon is a 2D closed shape with three or more straight sides.

Instructions:
Show students the 2D shapes. Emphasise the need to justify their reasoning. This shape is not a polygon because....

Pay attention to any mathematical argumentation and highlight this with the larger group. Who thinks the same, who thinks differently and why? Who has changed their thinking and why? What convinced you?

- *Questions to further support discussion:*
- *What do you notice about number of sides, length of sides, number of parallel lines, size of angles?*
- *Introduce regular and irregular polygon terminology. Ask students what they think this means and which shapes do they think belong in each category.*

Other Examples

You may choose to use one shape per day and use this warm up over a series of days or independent tasks. Use materials within your environment when available.

Curriculum Links

Sort and classify plane shapes into classes and sub classes according to defined geometrical properties

Big Ideas

Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes.

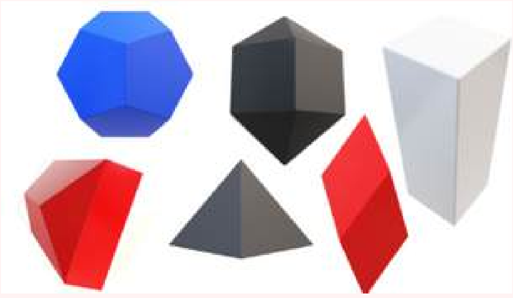
Suggested Learming Outcomes

- *Identify classes of shapes in a range of different ways using geometrical language to explain and justify.*
- *Use commonly shared rules to communicate ideas about defining shapes.*

Mathematical Language

2-dimensional, straight, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, triangle, quadrilateral, diamond, kite, trapezoid, rhombus, rectangle, square, parallelogram, square corner, right angle, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle.

Is it a Prism?



Are these shapes quadrilaterals? Justify your thinking.

Teacher Notes

A prism has two congruent, parallel polygon shaped bases facing each other. The bases are connected by rectangular or parallelogram-shaped sides. The number of sides on each base defines the type of prism.

Instructions:

Show students the 3d shapes. Emphasise the need to justify their reasoning. This shape is not a prism because....

Pay attention to any mathematical argumentation and highlight this with the larger group. Who thinks the same, who thinks differently and why? Who has changed their thinking and why? What convinced you?

Questions to further support discussion:
-What would a cross section of a prism look like in different places?
-How is this different to a 3d shape that is not a prism?

Other Examples

You may choose to use one shape per day and use this warm up over a series of days or independent tasks. Use materials within your environment when available.

Curriculum Links

Sort and classify plane shapes into classes and sub classes according to defined geometrical properties

Big Ideas

Two-and-three dimensional objects with or without curved surfaces can be described, classified, and analysed by their attributes.

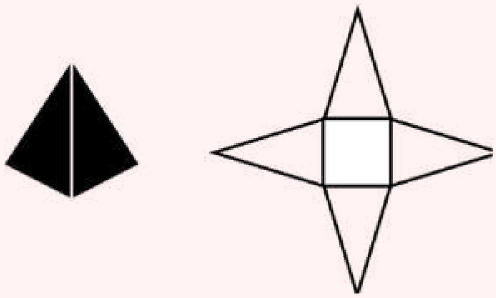
Suggested Learming Outcomes

- *Identify classes of shapes in a range of different ways using geometrical language to explain and justify.*
- *Use commonly shared rules to communicate ideas about defining shapes.*

Mathematical Language

2-dimensional, straight, collinear, angles, vertices, vertex, sides, vertical, horizontal, diagonal, symmetrical, face, curved, edge, corner, triangle, quadrilateral, diamond, kite, trapezoid, rhombus, rectangle, square, parallelogram, square corner, right angle, regular, irregular, pentagon, hexagon, heptagon, octagon, equilateral, scalene, acute angle, obtuse angle.

Is this the correct net for this 3D shape?



Is this the correct net for this 3d shape?

Explain and justify how you know.

Teacher Notes

This task is designed to explore geometrical properties when justifying if a net is accurate for the 3d shape being displayed.

Instructions:

Display the shape and ask students to turn and talk to their partner/group. Do they think this net is correct?

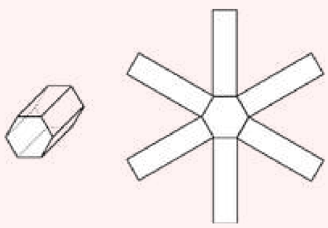
Notice for students that are using geometrical language when justifying their answers.

Encourage students to reason with their peers answers, e.g. do you agree or disagree with their idea?

Further questions for discussion:
- *Could a net for this shape look different? If so, what could it look like?*

Other Examples

Use a series of correct or incorrect nets for a variety of 3d shapes.
e.g.



Curriculum Links

visualise and draw nets for prisms that have a fixed cross section

Big Ideas

Two- and three-dimensional shapes have consistent properties that can be used to define, compare, classify, predict, and identify relationships between them.

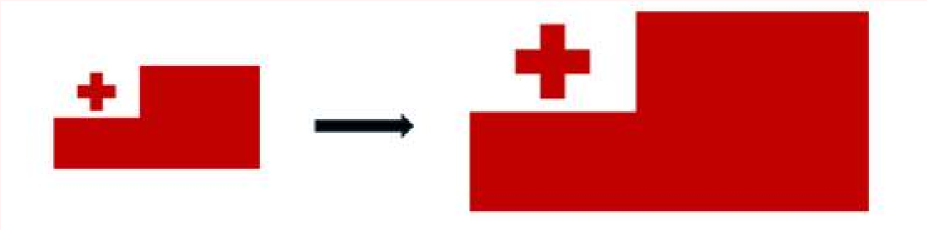
Suggested Learming Outcomes

visualise and draw nets for a variety of 3d shapes.

Mathematical Language

cube, cuboid, net, Properties, square, attribute, 3-dimensional, shape, equal, straight, pyramid, prism, parallel, congruent, quadrilateral, faces, edges, vertices,

Invariant properties



Look at this transformation.
What properties have stayed the same? What properties have changed?

Teacher Notes

Invariant properties do not change (e.g., the angle of each corner remains 90°, orientation remains the same). Variant properties do change (e.g., area increases, length increases)

Instructions:
Show students the image and allow sufficient time for students to discuss what properties are changing and staying the same.

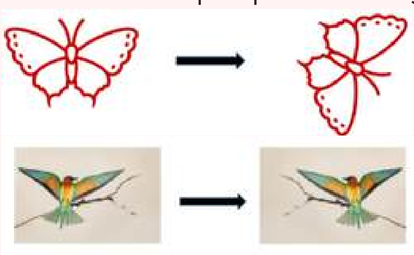
Listen for students who are analysing the shape mathematically (e.g., discussing angles, area, orientation, length, width...).

Encourage students to share their ideas. Press towards developing a claim about which properties will be invariant when a shape undergoes enlargement.

Reinforce the concept that invariant properties are those that do not change under transformation.

Other Examples

Repeat this task for translations, rotations & reflections. Keep the focus on analysing the invariant and variant properties. E.g.,



Curriculum Links

The invariant properties of two- and three-dimensional shapes do not change under different transformations.

Big Ideas

Objects in space can be transformed in an infinite number of ways, and those transformations can be described and analysed mathematically.

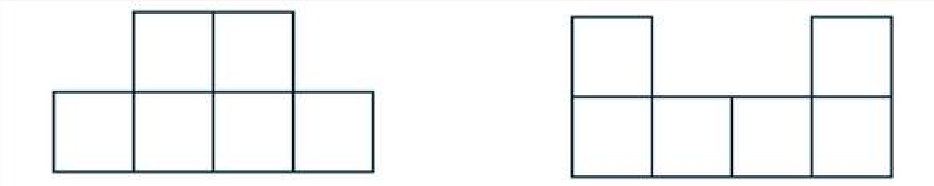
Suggested Learming Outcomes

- *Identify variant and invariant properties of a shape under transformation*
- *Analyse a transformation mathematically*

Mathematical Language

Angle, area, length, width, shape, position, orientation, enlargement, transformation, translation, reflection, rotation, invariant, variant

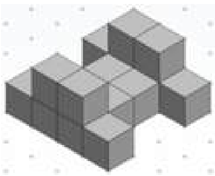
Using Plan Views



Here are the plan views. What might the 3-dimensional building look like?

Teacher Notes

These plan views were drawn from this 3D shape.



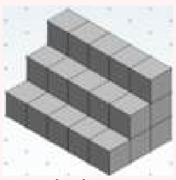
Instructions:

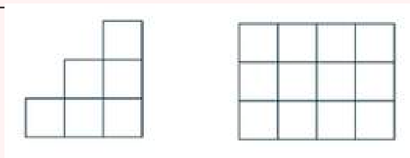
Students will need access to isometric grid paper/ multilink cubes/ or an online tool.

Present the image and give sufficient time for students to explore creating a building that will align with the dimensions of the given plans.

Expect students to justify their 3D building using mathematical language (height, length, units)

Other Examples





Explore giving students the 3D model and asking them to draw it from a particular viewpoint (e.g., top-down, right-side). Or continue with providing more complex view plans, with students constructing the 3D model.
https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Isometric-Drawing-Tool/

Curriculum Links

- *Use plan-view drawings to visualise and construct three-dimensional shapes*
- *Three-dimensional shapes can be represented by two-dimensional images.*

Big Ideas

Objects in space can be oriented in an infinite number of ways,
and an object's location in space can be described quantitatively.

Suggested Learming Outcomes

- *Use 2D plans to create a 3D shape.*
- *Represent a 3D from various viewpoints.*
- *Explain an image using mathematical language.*

Mathematical Language

3D shape, plan-view, top-down, left-side, front-side, right-side, length, height, elevation, depth, width, square, cube

Geometry: What angles do you notice?

(Artist: Tui Emma Gillies, 2023)
What angles do you notice?

Teacher Notes

Key question to ask students "What do you notice?" "What angles do you notice on the picture?"

Use talk moves to facilitate participation and develop understanding.

Discuss what students notice. Teacher to facilitate and emphasise the angles that students notice and discuss their properties.

Other Examples

(Artist: Tui Emma Gillies, 2017)
Or use images from around the community.

Curriculum Links

Position , direction, and pathways can be described using te ao tūroa, as in Māori and Pacific systems of knowledge, or using scale, compass points, and environmental features.

Big Ideas

Objects in space can be oriented in an infinite number of ways, and an object's location in space can be described quantitatively.

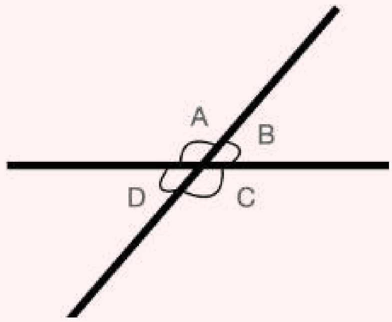
Suggested Learming Outcomes

- *Find unknown angles and identify angle properties of intersecting lines*
- *Talk about angles formed by two intersecting lines in the plane are related in special ways (e.g., vertical angles)*
- *Notice when a line intersects two parallel lines the angles formed are related in special ways.*

Mathematical Language

Acute, Obtuse, Reflex, Right Angle, Straight Line Angle, Complete Angle

Intersecting Angles



Hamish believes we only need to know the measure of one of these angles to calculate the rest.
Do you agree or disagree with this mathematical claim?

Teacher Notes

This starter is designed to encourage students to reason and state clear mathematical justifications and explanations about angles.

The angle properties of lines are:
Vertically opposite angles are equal (a and c or b and d)
Adjacent angles add to 180° (a and b)

Instructions:

Pose the mathematical claim to the students and ask them to turn and talk with a partner to share their ideas.

Notice for students who are able to use correct terminology when justifying their thinking.

When sharing back ideas to the class, use talk moves to highlight key mathematical ideas demonstrated.

Expect students to give the angles values when justifying their thinking.

Other Examples

Explore this idea using shapes. Does this claim work on all intersecting lines?

Curriculum Links

- *describe an angle using the benchmarks 90 degrees, 180 degrees, and 360 degrees.*
- *find unknown angles and identify angle properties of intersecting lines*

Big Ideas

Relationship between the connecting rays that constitutes the angle. That relationship is the turning of one ray onto the other, at about the point where they meet.

Suggested Learming Outcomes

- *Identify angles.*
- *Explain angles using mathematical language*
- *Justify their mathematical reasoning*

Mathematical Language

Turn, angle, degrees, rotation, right, acute, obtuse, parallel, properties of lines, adjacent angle, intersecting, corresponding angles

Latitude and longitude

How could you describe the location of Wellington using this map?

Teacher Notes

Instructions:

Have available a globe or large world map.

Students to discuss how they would describe the location of Wellington.

Listen for students who are using compass directions/ latitude/longitude in their explanations. E.g., "Wellington is almost sitting on the 175°E latitude line."

Share explanations and annotate evidence on the map. Press students to compare the location of Wellington to the latitude and longitude lines.

Ask students "why might it be important to have an accurate way to give locations of places in the world?"

Other Examples

Describe the location of any country/city/landmark of interest to students using a variety of world maps or globes.

Curriculum Links

Use scale, compass points, and coordinate systems to interpret and describe positions and pathways.

Big Ideas

A geographic coordinate system is a spherical or geodetic coordinate system for measuring and communicating positions directly on the Earth as latitude and longitude.

Suggested Learming Outcomes

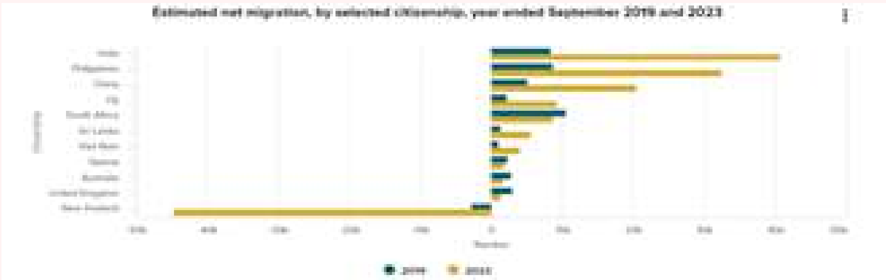
Describe the location of a landmark using latitude and longitude.

Mathematical Language

Latitude, longitude, compass directions (N,S,E,W), degrees

STATISTICS - TAUANGA

Bar Graph Starter



Ref: https://www.stats.govt.nz/information-releases/international-migration-september-2023/

What do you notice?

Teacher Notes

Instructions

Show the bar graph on the board.

Give students time to reflect on the data and then ask them what they notice about the data.

Building on their observations ask them:
What is the data telling us?
From which country did the largest group of immigrants come from?
Which country saw a drop in migration to NZ?
Why might this data have been collected?

Other Examples

A further question might be:
What reasons can you think of for the changes in migration between 2019 and 2023?

Curriculum Links

- *analyse data and communicate findings in context*
- *examine the data-collection methods, data visualisations, and findings of others' statistical investigations to see if their claims are believable and reasonable.*

Big Ideas

Ideas and questions about a specific topic can be investigated through collecting data and using it to answer the questions.
Data can vary in different ways (e.g., an object can be different sizes and colours) and it can be organised in different ways and by different characteristics (categorical, numerical).
Data can be represented and communicated in multiple ways including data visualisations.

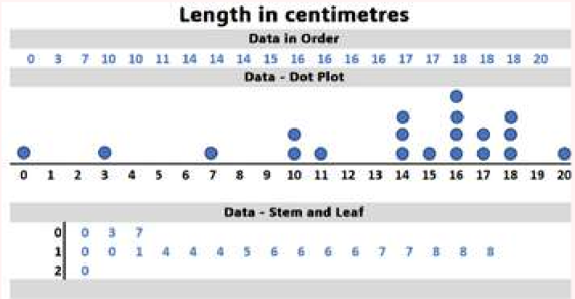
Suggested Learming Outcomes

- *make statements and give explanations inductively based on observations or data*
- *recognise and explore patterns, and make conjectures and draw conclusions about them*

Mathematical Language

Statistics, data, sample, investigate, organise, display, sort, classify, represent, communicate, predict, outcomes, stem-and-leaf graph, mode, median, range, cluster, outlier.

Graphs - What do you notice?



What do you notice about the graphs?
Do both graphs represent and show the same and different information.
Explain and justify why?

Teacher Notes

Encourage students to make statements about the graphs and how could the graphs be the same and different.

What is the same and difference between a dot plot and stem and leaf.

The graph(s) show the variable of distance in cm's. Distance is a discrete variable.

Students are to understand both graphs could be used to highlight and describe the idea of clustering. A "cluster" is a group of data found together in a clump.

Support students to identify outliers, decide if values in the data and graph are at the extremes.

Other Examples

Use statistics NZ to source graphs to discuss.

Curriculum Links

Data visualisations show patterns, trends, and variations. Alternative visualisations of the same data can lead to different insights and communicate different information

Suggested Learning Outcomes

Describe the location of a landmark using latitude and longitude.

Big Ideas

A graph for displaying the distribution of a numerical variable in which each dot represents each value of the variable.
Dot plots are particularly useful for comparing the distribution of a numerical variable for two or more categories of a category variable by displaying side-by-side dot plots on the same scale.
Ideally the numbers in the 'stem' represent the highest place-value digit in the values and the 'leaves' display the second highest place-value digits in each individual value.

Mathematical Language

Graphs, dot plot, stem and leaf, distribution, cluster, outliers

Stem and Leaf starter

Time spent per month

On Screens (e.g. Computer or TV) Leaf	Stem	Playing Outside Leaf
	0	2 3 5 6 6 8 9
6 5 4 3 1 0	1	0 2 5 5 7 7 8 9
9 8 7 5 4 3 2 0 0	2	1 2 6 8 9
6 5 4 4 2	3	0
6 5 5 5	4	2 3
	5	
	6	6
	7	
	8	

What does this graph tell us?

Teacher Notes

Instructions

Show the stem and leaf graph on the board.

Give students time to reflect on the data and then ask them what they notice about the data, what is the graph telling us?

Notice students using statistical language in their conversations.

Building on their observations ask them:
What is the data telling us?
What activity is shown in the graph as being more popular?
Where might this data have been collected?

Other Examples

Use other varieties of Stem and Leaf Graph to discuss the data.

Curriculum Links

- *analyse data and communicate findings in context*
- *examine the data-collection methods, data visualisations, and findings of others' statistical investigations to see if their claims are believable and reasonable.*

Suggested Learming Outcomes

- *make statements and give explanations inductively based on observations or data*
- *recognise and explore patterns, and make conjectures and draw conclusions about them*

Big Ideas

Data can vary in different ways (e.g., an object can be different sizes and colours) and it can be organised in different ways and by different characteristics (categorical, numerical). Predictions can be made through using sets of data.

Mathematical Language

Statistics, data, sample, investigate, organise, display, sort, classify, represent, communicate, predict, outcomes, stem-and-leaf graph, mode, median, range, cluster, outlier.

Statistics Claim

Tip Top want to know what ice cream is the most favourite in Aotearoa. They interviewed 146 people in Auckland to find out the favourite ice cream flavour of all New Zealanders.
Is that a clear representation of Aotearoa's favourite ice cream?

Teacher Notes

The aim of this starter it to encourage students to think critically about statistical claims that are made.

Instructions

Present the question to the students.
Give students time to reflect on the claim and then ask them to share their ideas with their partner.
Notice students using statistical language in their conversations.
When sharing back students ideas, encourage their peers to reason with their statements by asking do you agree or disagree with ____ idea?

Other questions to pose:

- *Why is it important to know the sample size?*
- *How could we make this claim more valid?*
- *What would be a good sample size to represent New Zealand?*
- *Should we believe all statistics when they are shared in the media?*

Other Examples

Use other statements made in the media to encourage students to think critically about the maths around them.

For example: Flu strain hits New Zealand. There has been a 30% increase in the flu virus throughout New Zealand. Questions to prompt would be: What months are they comparing the flu (summer verses winter?). Where was the sample size taken? Is it the same sample of people compared to notice the increase?

Curriculum Links

examine the data-collection methods, data visualisations, and findings of others' statistical investigations to see if their claims are believable and reasonable.

Big Ideas

Data can vary in different ways (e.g., an object can be different
sizes and colours) and it can be organised in different ways and by different characteristics (categorical, numerical).
Predictions can be made through using sets of data.

Suggested Learming Outcomes

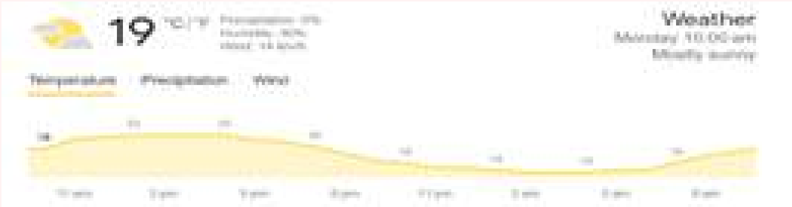
- *Data can vary in different ways (e.g., an object can be different*
- *sizes and colours) and it can be organised in different ways and by*
- *different characteristics (categorical, numerical).*
- *Predictions can be made through using sets of data.*

Mathematical Language

Statistics, data, sample, investigate, organise, sort,
classify, represent, communicate, predict, outcomes.

PROBABILITY : TŪPONOTANGA

Probability – continuum



The figure above shows the predicted temperature for our local area on Monday.
What is the probability it will be 23° at 4pm?
What is the probability it will be warmer at 5pm than 11am?

Teacher Notes

This is designed to encourage students to make predictions using mathematical language.

Instructions:
Show the local weather and ask each question individually.

Encourage students to use the language of probability when explaining their reasoning.

Support the students to think big picture, if we know this information and can make predictions how does this help us plan... when to go swimming? When to play sport?

Other Examples

Use Google Weather to explore other regions around NZ and make probability statements.

Curriculum Links

Use data visualisations to describe the distribution of observed outcomes from probability experiments and possible outcomes for theoretical probability models

Big Ideas

If all possible outcomes in a chance situation are equally likely, the probability of an event happening is a fraction where the numerator is the number of ways the event can happen, the denominator is the total number of possible outcomes.
Data visualisations can be used to show what outcomes are possible and more likely. They can also be used to represent the results of a probability investigation.

Suggested Learning Outcomes

- *Compare the likelihood of events and represent these as a fraction.*
- *Make a prediction about a chance situation.*

Mathematical Language

Probability, chance, unlikely, possible, likely, certain, equal chance.

Theoretical probabiility verses experimental probability

The theoretical probability is 6 is rolled on a dice is $\frac{1}{6}$

.

If you roll a dice 100 times and 42 of those times it lands on a six, the experimental probability is $\frac{42}{100}$

What are the chances you would roll a six on the 101 dice roll?

Teacher Notes

The focus of this activity is for students to understand that the results of trials will differ each time, and these results may/or may not reflect the theoretical probability.

Instructions:

Display the question and give students time to turn and talk about what they notice and what they wonder.

Notice students that are able to discuss the difference in theoretical probability and experimental probability.

Facilitate a group discussion around the idea that each dice roll is not impacted on the roll before. It is chance.

Other Examples

Flip a coin 10 or 20 times and record the results and then discuss theoretical or experimental probability.

Curriculum Links

examine the data-collection methods, data visualisations, and findings of others' statistical investigations to see if their claims are believable and reasonable.

Big Ideas

- *Probabilities and the language of probability are associated with values between 0 or 0% (impossible) and 1 or 100% (certain).*
- *A probability experiment involves repeated trials. Results may vary in trials.*

Suggested Learning Outcomes

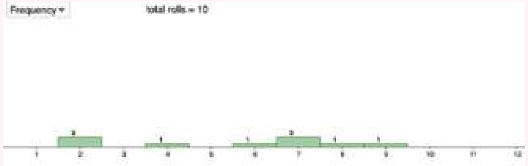
- *Identify similarities and differences in results of trials*
- *Compare theoretical and experimental probabilities*
- *Make statements and form questions about trial results*

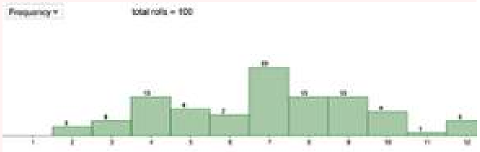
Mathematical Language

Trial, outcomes, sample size, theoretical probability, experimental probability, similar, different, percentage

Comparing Results

These graphs show the sum of two dice after 10, 100 and 1000 trials. What do you notice? What do you wonder?





Teacher Notes

The focus of this activity is for students to understand that the results of trials will differ each time, and these results may/or may not reflect the theoretical probability. The larger number of trials conducted, the more likely the results should reflect the theoretical probability.

Instructions:

Display the graphs and give students time to turn and talk about what they notice and what they wonder.

Facilitate a group discussion on what students notice and wonder. Record/annotate these ideas and ask questions that will deepen student thinking.

Prompt the students to think about if there was another 1000 trials done, what could they anticipate the graph to look like?

Curriculum Links

- *Probabilities and the language of probability are associated with values between 0 or 0% (impossible) and 1 or 100% (certain).*
- *A probability experiment involves repeated trials. Results may vary in trials.*

Big Ideas

The chance of an event occurring can be described numerically by a number between 0 and 1 inclusive and used to make predictions about other events.

Suggested Learning Outcomes

- *Identify similarities and differences in results of trials*
- *Compare theoretical and experimental probabilities*
- *Make statements and form questions about trial results*

Mathematical Language

Trial, outcomes, sample size, theoretical probability, experimental probability, similar, different, percentage