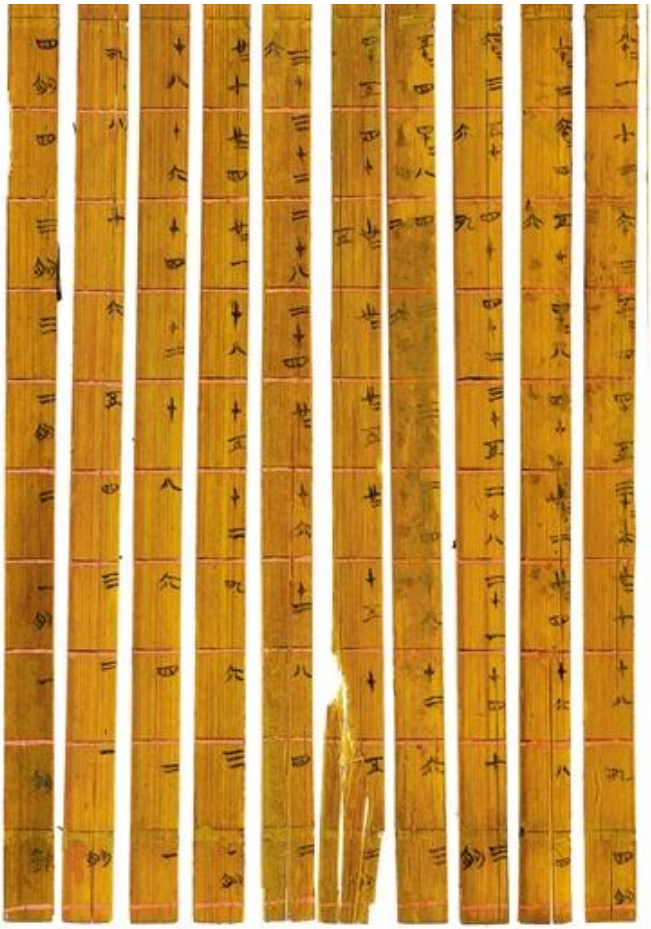
Hillhead High School

Department of Mathematics



Level 3 Phase 1

Whole Number

This textbook is designed to support you in preparing for the first topic of mathematics at Hillhead High School: Whole Numbers.

We invite you to work on these tasks to draw your attention to some new mathematical ideas.

These tasks are not always easy, please take your time with them and feel free to work with others by sharing your ideas.

Although these ideas may be new, they do not exist in isolation – other mathematical knowledge that you have gained over the years of primary school should be considered.

There is a self-evaluation exercise at the end of this book. It would be useful to bring this with you on your first day of Hillhead High School as well as any of the tasks that you have been working on.

Problem Book 0 and the Department Handbook should also help you prepare for life in our Mathematics Department. We really look forward to meeting you and working with you.

Usually, when you see the word **TUTORIAL**, this means that a meeting will be planned to discuss the previous task – this may take place on Teams or in class. Your teacher will let you know when this will be.

However, given the current circumstances, this is not possible. Please use your Glow email to message Mr Carson (Principal Teacher of Maths) if you need some help moving on.

EXERCISE will refer you to a worksheet. Click on the link and it will take you there. You can also find helpful videos and the answers on that site. This will give you the opportunity to get more practice of an action if you need it.

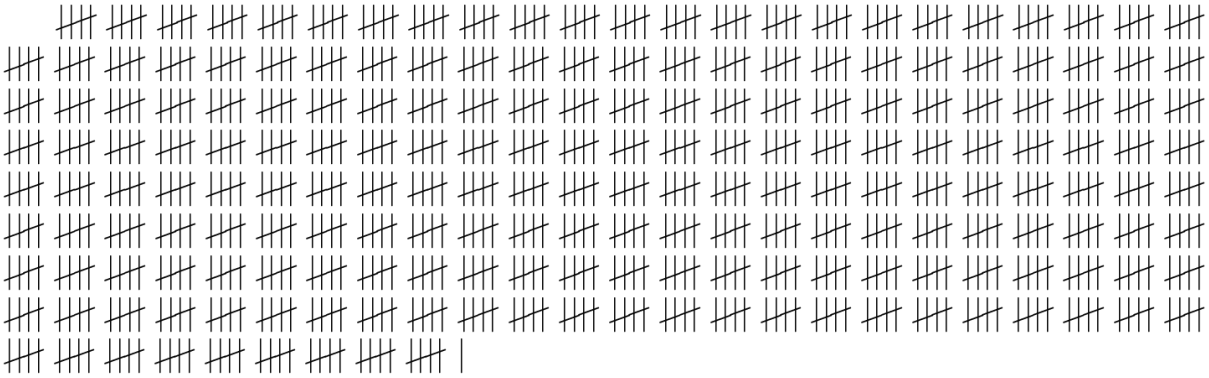
When you see the word **QUIZ**, usually you would complete a quiz before moving on. This would give you feedback on how you are doing with the topic to that point. Your teacher would see this, but it would be up to you take the initiative to find out what you did wrong before moving on to the next task.

Unfortunately this is not possible given the current situation but this feedback will be available to you when you join us.

EXTENSION tasks have also been designed to extend your thinking. These are useful to do but only after the other tasks have been worked on.

TASK 0 – Number Systems

One thousand two hundred and five



MMXX

1523

mille deux cent cinquante

Convert each of the five numerals into the decimal numeral system *i.e. like 1523 already is.*

Place these values in order in the following way:

A > B > C > D > E

[look up this symbol > if you are not sure what it means]

Place a value between each in the order so that you have something that looks like this:

A > F > B > G > C > H > D > I > E

EXERCISE 0 Numbers in words

TUTORIAL 0 Use your Glow account to email Mr Carson (gw11carsonthomas3@glow.sch.uk) if you need help moving forward at this point.

EXTENSION 0

Find out about another historical number system.

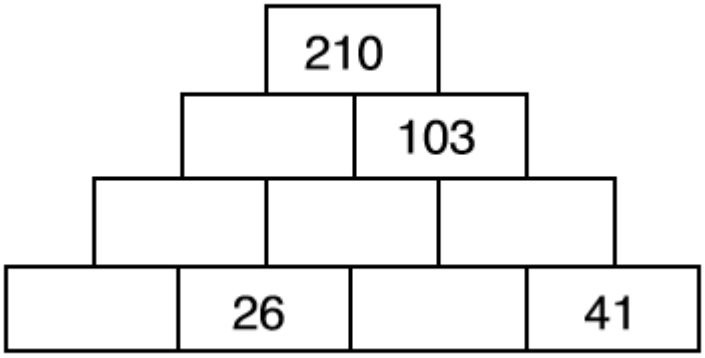
Write some numbers in this way.

What are the benefits and drawbacks of the system you have chosen?

Why do we use the decimal system and not this one?

TASK 1a – Number Pyramids

The value of a brick is the sum of the two bricks below it.



Show how you would find the missing value beside 103.

Find the remaining values that are missing.

Create some other number pyramids where the bottom right value is 41.

Create some other number pyramids where the top value is 210.

EXERCISE 1 Addition Subtraction

TUTORIAL 1 Use your Glow account to email Mr Carson (gw11carsonthomas3@glow.sch.uk) if you need help moving forward at this point.

EXTENSION 1

Create a number pyramid that contains a negative value.

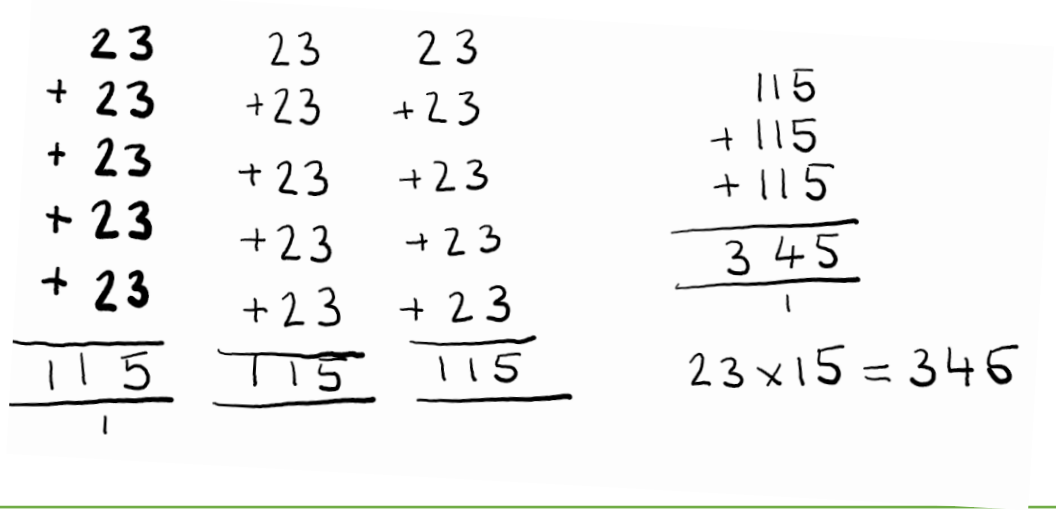
Create a number pyramid that contacts a decimal value.

Repeated addition of a number is known as multiplication.

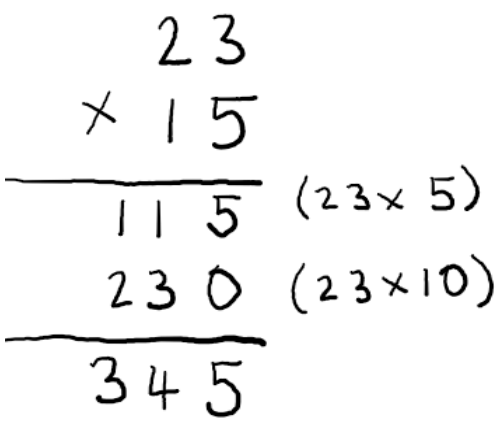
TASK 2a – Methods of Multiplication

Consider these ways of finding the product of 23 and 15.

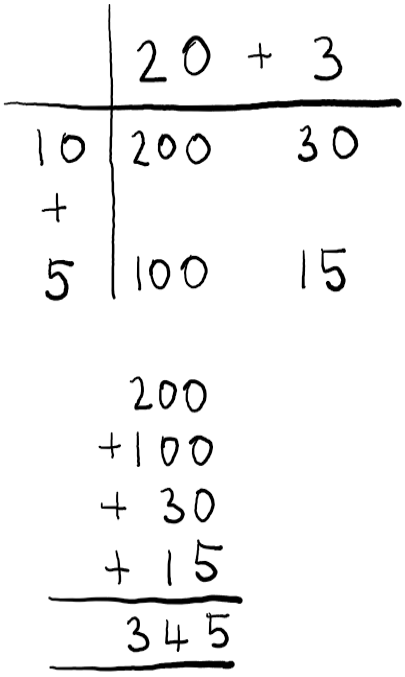
Method 1



Method 2



Method 3



Find the product of 42 and 16 in each way.

Find some other products in these ways.

What are the benefits and drawbacks of each approach?

EXERCISE 2a Multiplication 1 Multiplication 2

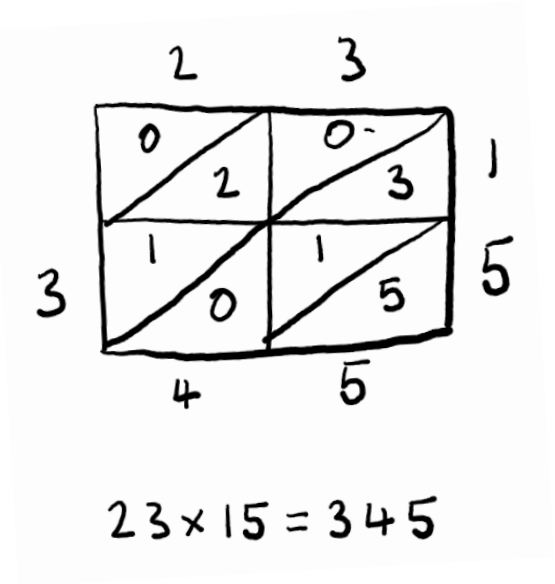
EXTENSION 2a

Consider these ways of finding the product of 23 and 15.

Russian Multiplication

small	big
15	23
7	46
3	92
1	184
	345

Chinese Multiplication



Find the product of 42 and 16 in each way.

Find some other products in these ways.

What are the benefits and drawbacks of each approach?

On the front cover of this book you can see the Tsinghua Bamboo Slips. This is the world's earliest multiplication table (305BC). Look this up to find out more about it.

Repeated multiplication of a number by itself is known as powering.

TASK 2b – Multiplying (and Dividing) by Multiples and Powers of 10

Below you can see Gattegno's Tens Chart with a multiplication journey shown in green:

0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900
1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	20000	30000	40000	50000	60000	70000	80000	90000

The journey shows $0.03 \times 2 \times 10 \times 10 \times 10 = 600$

It also shows $0.03 \times 2 \times 1000 = 600$

It also shows $0.03 \times 2000 = 600$

It also shows $0.03 \times 2 \times 10^3 = 600$ $[10 \times 10 \times 10 = 10^3]$

It also shows $600 \div 10 \div 10 \div 10 \div 2 = 0.3$

Use the Gattegno Chart to show someone these journeys.

How many different journeys like these can you make from 0.2 to 8000? Write them down in the same way as above.

How many different journeys like these can you make from 90000 to 0.001? Write them down in the same way as above.

EXERCISE 2b 10,100, 1000 Powers of 10

TUTORIAL 2 Use your Glow account to email Mr Carson (gw11carsonthomas3@glow.sch.uk) if you need help moving forward at this point.

EXTENSION 2

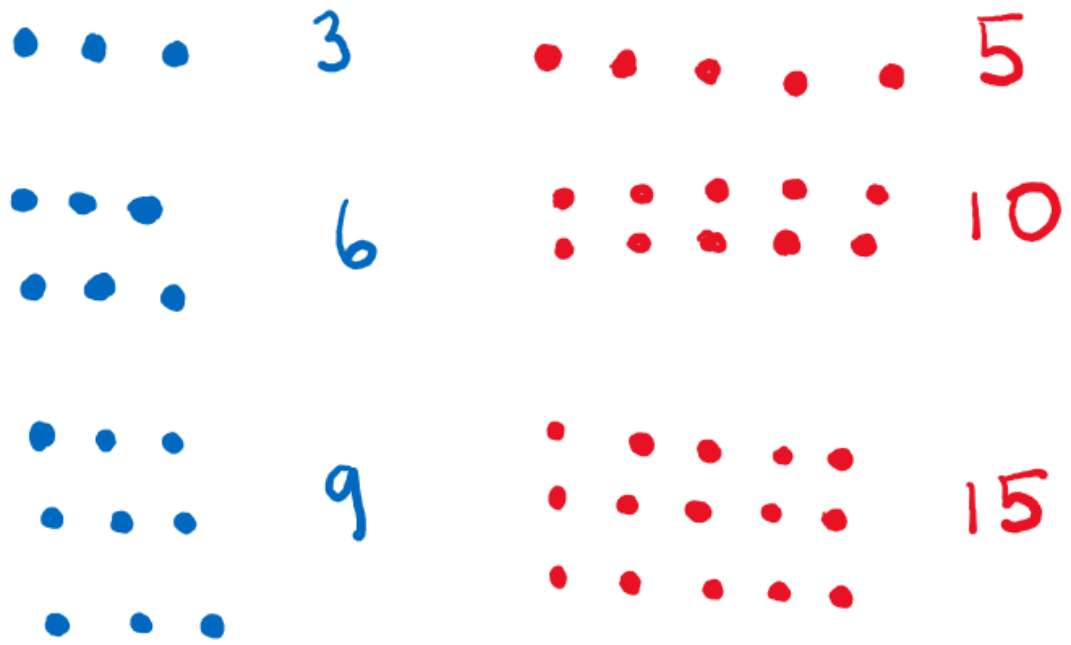
You can find an interactive Gattegno Chart at https://mathsbot.com/tools/gattegnoChart

Toggle the options at the top. What is the longest possible journey that you can show using the Chart on the website?

TASK 3a - Arrays

In blue, you can see the first three multiples of 3.

In red, you can see the first three multiples of 5.



If these patterns were continued, what would the first number be that appears in both? *This is called the* ***Lowest Common Multiple*** *of 3 and 5.*

What would the lowest common multiple of 3 and 7 be?

What would the lowest common multiple of 6 and 15 be?

9 is a square number.

Looking at the array for 9, explain why this is.

Find some other numbers like this.

TASK 3b – Cubes

1, 8, and 27 are the first three cube numbers.

Why do you think they are known as cube numbers?

Find the next three cube numbers.

EXERCISE 3 Multiples Square Numbers Cube Numbers

TUTORIAL 3 Use your Glow account to email Mr Carson (gw11carsonthomas3@glow.sch.uk) if you need help moving forward at this point.

EXTENSION 3

Compute by mental arithmetic (using pencil only to record results), then learn by heart:

(i) the squares of positive integers: first up to 122; then to 312
(ii) the cubes of positive integers up to 113
(iii) the powers of 2 up to 210.

If you do this, please see Mr Carson as soon as you come to Hillhead High School in August.

TASK 4 – Word Problems

Each of these problems can be represented by the very simple mathematical structure "3 - 1 = 2":

(a) I was given three apples, and then ate two of them. How many were left?

(b) A barge-pole three metres long stands upright on the bottom of the canal, with one metre protruding above the surface. How deep is the water in the canal?

(c) Tanya said: "I have three more brothers than sisters". How many more boys are there in Tanya's family than girls?

(d) How many cuts do you have to make to saw a log into three pieces?

(e) A train was due to arrive one hour ago. We are told that it is three hours late. When can we expect it to arrive?

Reflect upon each problem. Can you see 3 – 1 = 2?

Draw a diagram that represents each problem.

Change each problem in as small a way as possible so that it could be represented by 4 – 1 = 3.

Change each problem in as small a way as possible so that it could be represented by 6 – 4 = 2.

EXERCISE 4 There are many word problems towards the end of the addition, subtraction and multiplication exercises linked earlier in this book.

TUTORIAL 4 Use your Glow account to email Mr Carson (gw11carsonthomas3@glow.sch.uk) if you need help moving forward at this point.

EXTENSION 4

Create three different word problems that can be represented by the following structures:

(a) $3 \times 4 = 12$
(b) $15 \times 20 = 300$
(c) $210 \div 3 = 70$
(d) $5 \times 6 + 8 = 38$
(e) $5 \times (6 + 8) = 70$

LEARNING INTENTIONS – Self Evaluation

At the end of this topic, consider how confident you feel.

Use your experiences of quizzes, tasks, tutorials and exercises to determine with you would consider yourself **GREEN** (confident and ready to move on), **AMBER** (still need more practice), or **RED** (do not understand at all).

TASK 1

I can add and subtract single digit numbers.

I can add and subtract two-digit numbers.

I can add and subtract n-digits numbers.

TASK 2

I understand what multiplication is.

I can use different methods of long multiplication.

I can multiply by multiples of 10, 100 and 1000.

I understand what a power represents.

I can multiply by powers of 10.

TASK 3

I can find multiples of a numbers.

I can find the lowest common multiple of two numbers.

I can identify square numbers.

I can identify cube numbers.

TASK 4

I can use mathematical structures to represent word problems.

If you are **GREEN**, then do as you feel – move on.

If you are **AMBER**, then it may be worth working on the exercises a bit more, checking your work as you go.

If you are **RED**, then seek help immediately – contact a classmate or your teacher.