

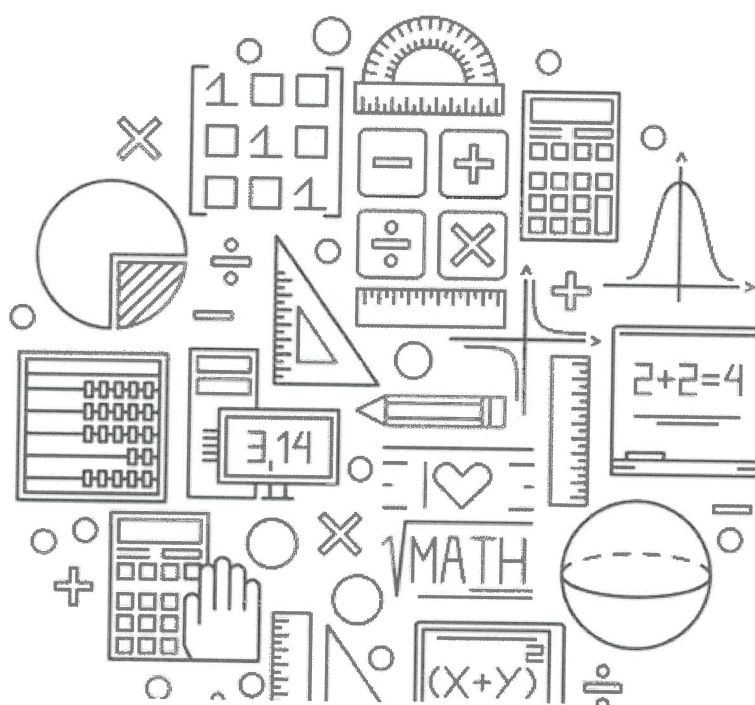
# Madani Boys School

## Mathematics

### YEAR 7

# KNOWLEDGE ORGANISER

YEAR 7	
WEEK	HALF TERM 1
3	Types of Number
4	Place Value
5	Whole Numbers (+/-/x/÷) including Negative Numbers
6	Decimal Calculations (+/-/x/÷)
7	Order of Operations
8	Rounding (10, 100, 1000, integer, dp)



# What do I need to be able to do?

You should be able to:

- Understand properties of addition and subtraction
- Understand properties of multiplication and division
- Use formal methods of addition and subtraction for integers
- Use formal methods of multiplication and division for integers
- Add and subtract directed numbers
- Multiply and divide directed numbers
- Understand and use order of operations with positive and negative integers

# NUMBER SKILLS

## Key Words

- **Commutative:** changing the order of operations does not change the result
- **Associative:** when you add or multiply you can do so regardless of how the numbers are grouped
- **Inverse:** the operation that undoes what was done by the previous operation
- **Subtract:** taking away one number from another
- **Negative:** a value less than zero
- **Debit:** money that leaves a bank account
- **Credit:** money that goes into a bank account
- **Integer:** a whole number
- **Product:** multiply terms
- **Operation:** a mathematical process

## Addition

Addition is commutative

$$2 + 4 = 4 + 2$$

The order of addition doesn't change the result

Addition is associative

$$6 + (3 + 4) = (6 + 3) + 4$$

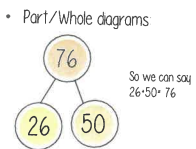
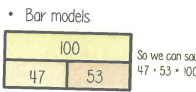
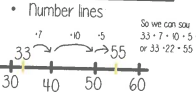
It doesn't matter how you group the numbers

Formal written method:

	H	T	U
	3	4	2
+	1	4	9
	4	9	1

Remember the place value for each column!

Models to help with addition



## Subtraction

Subtraction is NOT commutative or associative

$$12 - 8 \neq 8 - 12$$

When you subtract, the order must stay the same.

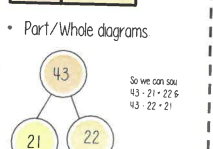
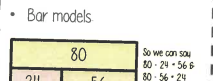
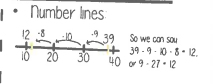
Formal written method:

	H	T	U
	5	3	2
-	2	1	6
	3	1	6

Remember 0 is a place holder!

	2	0	8
-	0	0	4

Models to help with addition



## Written Methods for Multiplication

LONG MULTIPLICATION:

	2	4	7
x		2	3
	7	4	1

GRID METHOD:

X	200	40	7
3	600	120	21
	600	120	21

$600 \cdot 120 + 21 = 741$

GELOSIA:

	2	4	7	X
0	6	1	2	3
7	4	1		

REPEATED ADDITION:

	H	T	U
	2	4	7
	2	4	7
+	2	4	7
	7	4	1
	1	2	

## Calculations with Directed Numbers

Addition

$$2 + -3$$

Remember: If I add a negative, I am adding something that will make it smaller, so it is the same as subtracting that number!

$$2 - 3 = -1$$

Subtraction

$$2 - -3$$

Remember: If I subtract a negative, I am taking away the amount that was making it smaller, so it is the same as adding that number!

$$2 + 3 = 5$$

## Written Methods for Division

SHORT DIVISION:

	0	4	2
6	2	5	2
	1	0	2
8	8	1	6

SHORT DIVISION with remainders

	1	2	5	5
2	2	5	1	0

Continue after the decimal point! If you start to get a repeating decimal, stop

LONG DIVISION:

	0	4	2
6	2	5	2
-	2	4	0
	0	1	2
-	0	1	2
			0

$6 \times 40$   
 $6 \times 2$

This method relies on you being comfortable with multiples of your divisor (in this case, 6!)

Generalisation:

$$+ - - - - = +$$

Multiplication

$$2 \times -3$$

'2 lots of -3'

$$= -6$$

$$-2 \times -3$$

Think of this as the negative of  $2 \times -3$

$$= 6$$

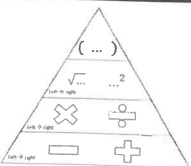
Division

Remember that multiplication and division are inverse operations

$$\text{Eg } 6 \div -3 = -2$$

$$-6 \div 2 = -3$$

## Order of Operations



Example 1

$$(4 \times 7) + 3$$

So we need to evaluate the brackets first,  $4 \times 7 = 28$

This is now  $28 + 3 = 31$

Example 2

$$(6 + 4 - 3)^2 \times 4$$

So we need to evaluate the brackets first and we work left to right;  $6 + 4 - 3 = 7$

This is now  $7^2 \times 4 = 49 \times 4 = 196$

Example 3

$$4 - 8 \times 2 + 12 \div 4$$

So first we do the multiplication/division left to right;  $4 - 16 + 3$

Now we do the addition/subtraction from left to right;  $-12 + 3 = -9$

Generalisation

X	+	-
+	+	-
-	-	+

Models to help

It can be helpful to put calculations involving directed numbers into real life contexts. Think about temperature or bank accounts when unsure.

# YEAR 7 — PLACE VALUE AND PROPORTION

## Ordering integers and decimals

@whisto\_maths

### What do I need to be able to do?

By the end of this unit you should be able to:

- Understand place value and the number system including decimals
- Understand and use place value for decimals, integers and measures of any size
- Order number and use a number line for positive and negative integers, fractions and decimals
- use the symbols  $=$ ,  $\neq$ ,  $\leq$ ,  $\geq$
- Work with terminating decimals and their corresponding fractions
- Round numbers to an appropriate accuracy
- Describe, interpret and compare data distributions using the median and range

### Keywords

- Approximate:** To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with
- Integer:** a whole number that is positive or negative
- Interval:** between two points or values
- Median:** A measure of central tendency (middle, average) found by putting all the data values in order and finding the middle value of the list
- Negative:** Any number less than zero, written with a minus sign
- Place holder:** We use 0 as a place holder to show that there are none of a particular place in a number
- Place value:** The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right
- Range:** The difference between the largest and smallest numbers in a set
- Significant figure:** A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal fraction is the first non-zero number after the decimal point

### Integer Place Value

Billions			Millions			Thousands			Ones			
H	T	O	H	T	O	H	T	O	H	T	O	
			3	1	4	8	0	3	3	0	2	9

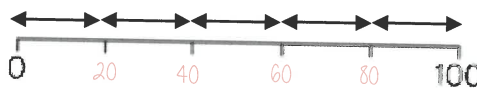
Placeholder

Three billion, one hundred and forty eight million, thirty three thousand and twenty nine

1 billion 1,000,000,000

1 million 1,000,000

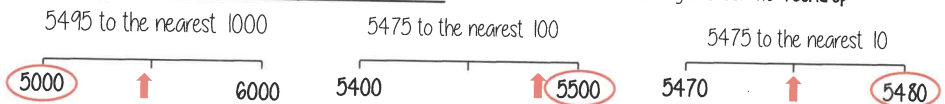
### Intervals on a number line



Divide the difference by the number of intervals (gaps).  
E.g.  $100 \div 5 = 20$

### Rounding to the nearest power of ten

If the number is halfway between we "round up"



### Compare integers using $<$ , $>$ , $=$ , $\neq$

- $<$  less than  
 $>$  greater than  
 $=$  equal to  
 $\neq$  not equal to
- Two and a half million  $\text{⊖}$  2 500 000  
300 000 000  $\text{⊖}$  Three billion  
Six thousand and eighty  $\text{⊖}$  68 000

### Range

Spread of the values

Difference between the biggest and smallest

3 9 8 12

Range: Biggest value - Smallest value

$$12 - 3 = 9$$

Range = 9

### Median

The middle value

Example 1

4 3 9 8 12

Median: put the in order 3 4 8 9 12

find the middle number 3 4 **8** 9 12

Example 2

150 154 148

137 160 158

Median: put the in order

There are 2 middle numbers

Find the midpoint

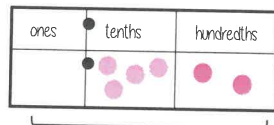
137 148 **150 154** 158 160

152

### Decimals

We say "nought point five two"

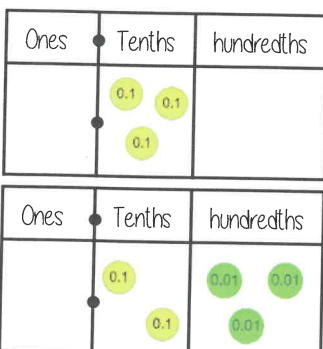
Five tenths and two hundredths



$$\begin{aligned} &0 \text{ ones, } 5 \text{ tenths and } 2 \text{ hundredths} \\ &0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01 \\ &= 0 + 0.5 + 0.02 \\ &= 0.52 \end{aligned}$$

### Comparing decimals

Which the largest of 0.3 and 0.23?



$0.3 > 0.23$

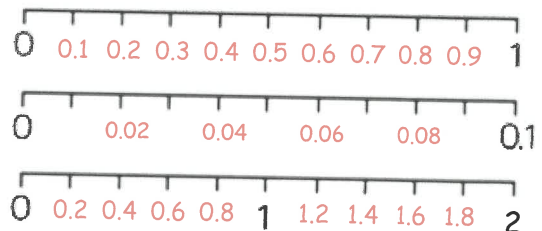
"There are more counters in the furthest column to the left"

0.30  
0.23

Comparing the values both with the same number of decimal places is another way to compare the number of tenths and hundredths

### Decimal intervals on a number line

One whole split into 10 parts makes tenths = 0.1  
One tenth split into 10 parts makes hundredths = 0.01



### Round to 1 significant figure

370 to 1 significant figure is 400

37 to 1 significant figure is 40

3.7 to 1 significant figure is 4

0.37 to 1 significant figure is 0.4

0.00000037 to 1 significant figure is 0.0000004

Round to the first non zero number



## What do I need to be able to do?

You should be able to:

- Understand place value and the number system
- Read and write decimal numbers
- Order decimals of any size
- Use inequality symbols
- Add and subtract decimals
- Multiply and divide decimals
- Use related calculations to find the answers to questions

# DECIMALS

## Key Words

- **Place Value:** the value of a digit depending on its place in a number
- **Place Holder:** we use 0 as a place holder to show there are none of a particular place in a number
- **Integer:** a whole number that is positive or negative
- **Decimal:** a number with a decimal point used to separate ones, tenths, hundredths etc...
- **Inequality:** compares two values and indicates which is larger

## Place Value

Decimal Place Value Chart										
Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	Decimal point	Tenths	Hundredths	
Whole part								Decimal part		

3 2 4 7 3 5 | . 1 4 5

"Three million, two hundred and forty seven thousand, three hundred and fifty one point four five"

## Decimal Place Value

ones	tenths	hundredths
1	3	4

1 one, 3 tenths and 4 hundredths

$$1 \cdot 01 + 01 \cdot 01 + 001 \cdot 001 + 001 \cdot 001$$

$$= 1 + 0.3 + 0.04$$

$$= 1.34$$

We say "one point three four"

## Inequalities

> greater than

< less than

≥ greater than or equal to

≤ less than or equal to

= equal to

≠ not equal to

### Examples

$$5 > 3 \quad 5 \text{ is greater than } 3$$

$$2 + 2 = 4 \quad 2+2 \text{ is equal to } 4$$

$$5 - 3 \times 2 \neq 4 \quad 5-3 \times 2 \text{ is not equal to } 4$$

$$x \leq 3 \quad x \text{ is less than or equal to } 3$$

## Ordering Decimals

Example

WHICH IS BIGGER, 16 OR 166?

Method 1:

Compare both numbers with the same number of decimal places

160 } We can clearly see that 166 > 16

Method 2:

ones	tenths	hundredths
1	6	
1	6	6

Some amount of units      Some amount of tenths      166 has 6 more hundredths than 16

Therefore 166 > 16

Example WHICH IS BIGGER, 0.304 or 0.034?

By looking, we can see that 0.304 > 0.034 as it has 3 tenths compared to 0

We call this 0 a place holder

## Decimal intervals on a number line



## Adding Decimals

Formal written method:

			.		
	1	2	.	5	8
+	9	.	6	3	
<hr/>					
	2	2	.	2	1

Tths = tenths  
Hths = hundredths

## Visual Prompt

$$12.58 + 9.63$$

T	U	Tths	Hths
1	2	5	8
9	6	3	

We can only fit 10 in each box and then we carry the rest

T	U	Tths	Hths
2	2	2	1

$$22.21$$

## Multiplying Decimals

$$12.5 \times 3.42$$

You can use any method to multiply but this way is very clear and fun!

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

$$= 42.75$$

## Related Calculations

Example 1

If I know that  $5 \times 2 = 10$ , what is  $0.5 \times 2$ ?

$$\begin{aligned} \div 10 \quad 5 \times 2 &= 10 \\ 0.5 \times 2 &= 1 \end{aligned}$$

Example 2

$$19 \times 900 = 17100$$

$$19 \times 90 = 1710$$

$$19 \times 9 = 171$$

$$19 \times 0.09 = 1.71$$

$$19 \times 0.0009 = 0.171$$

90 - 10 = 90 therefore we need to divide 1710 by 10!

100

## Subtracting Decimals

Formal Written Method

Worded Problem

I have a £10 note and spent £4.27 on sweets. How much do I have left?

10	.	0	0
-	4	.	2
<hr/>			
5	.	7	3

£5.73 left

10	.	0	0
-	4	.	2
<hr/>			
9	.	2	6

## Dividing Decimals

The place holder is very important in division.

All of these give the same solution:

$$15 \div 0.05 \rightarrow 15 \div 0.5 \rightarrow 150 \div 5$$

Multiply both values until the divisor becomes an integer

Method 1

$$\begin{aligned} \times 10 \quad 0.12 \div 0.003 \\ \times 10 \quad 12 \div 0.03 \\ \times 10 \quad 12 \div 0.3 \\ \times 10 \quad 120 \div 3 \\ = 40 \end{aligned}$$

Method 2

Remember that a divide sign is just an empty fraction!

$$0.12 \div 0.003 \text{ becomes } \frac{0.12}{0.003}$$

Which we can rewrite as

$$\frac{120}{3} = 40$$

## EXAMPLES

Related calculations to  $6 \times 8 = 48$

$$0.6 \times 8 = 4.8$$

$$0.6 \times 0.8 = 0.48$$

$$48 \div 8 = 6$$

$$4.8 \div 0.6 = 8$$

## Key Points

- Keep the values in proportion
- If you are stuck with a division, write it as a fraction and simplify that

# YEAR 7 — DIRECTED NUMBER

## Operations with equations and directed numbers

@whisto\_maths

### What do I need to be able to do?

By the end of this unit you should be able to:

- Perform calculations that cross zero
- Add/ Subtract directed numbers
- Multiply/ Divide directed numbers
- Evaluate algebraic expressions
- Solve two-step equations
- Use order of operations with directed number

### Keywords

**Subtract:** taking away one number from another.

**Negative:** a value less than zero

**Commutative:** changing the order of the operations does not change the result

**Product:** multiply terms

**Inverse:** the opposite function

**Square root:** a square root of a number is a number when multiplied by itself gives the value (symbol  $\sqrt{\quad}$ )

**Square:** a term multiplied by itself

**Expression:** a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

### Perform calculations that cross zero

Number lines are useful to help you visualise the calculation crossing 0

$4 - 6 = -2$

Use the number line to guide subtraction of 6

Start at 4

Find the difference between 6 and -4

From 6 to 0  
6  
From 0 to -4  
4  
10 beads between them

$-5 + 5 = 0$  Rearrangements of the same equation

$5 - 5 = 0$

### Add directed numbers

$2 + -4 = -2$

Red = -1  
Yellow = 1

Representations

Zero pair (-1 + 1 = 0)

Two '1' left = 2

$8 + -3 = 5$

Partitioning

$8 + -3 = 5$       $5 + 3 + -3 = 5$

Partition the value to create a zero pair calculation

Generalisation  
+ - = -

### Subtract directed numbers

Red = -1  
Yellow = 1

Representations

Representation for calculation

2 "Subtract" — means take away or remove

$2 - -1 = 3$

Take away one

Start with the representation of 2

$2 - -3 = 5$

Generalisation  
- - = +

### Multiply/ Divide directed numbers

Two representations of the same calculation

$2 \times -3 = -6$

Negative, Negative calculation

$-2 \times -3$

This is the negative of  $2 \times -3$

$-2 \times -3 = 6$

The act of making counters into their negative is turning them over

Divisions are the inverse operations

### Evaluate algebraic expressions

$a = 5$       $b = -4$

$a^2 = 5^2$       $b^2 = (-4)^2$

$a^2 = 25$       $b^2 = 16$

With negative numbers the brackets are important so that it performs  $-4 \times -4$ .

Brackets around negative substitutions helps remove calculation errors

$2a - b = 2 \times 5 - (-4) = 10 + 4 = 14$

$3b - 2a = 3(-4) - 2(5) = -12 - 10 = -22$

### Two-step equations

Bar Model

$4x + 2 = 10$

Representing the same question (use fact families)

$10 - 4x = 2$

Function machine

$x \rightarrow \boxed{\times 4} \rightarrow \boxed{+2} \rightarrow 10$

Inverse operations to find x

### Use order of operations

Brackets

Indices or roots

Multiplication or division

Addition or subtraction

Remember square roots have a positive and negative value

Brackets around negative substitutions helps remove calculation errors

x	-3	-2	-1	0	1	2	3
-3	9	6	3	0	-3	-6	-9
-2	4	2	0	-2	-4	-6	-8
-1	1	1	0	-1	-2	-3	-4
0	0	0	0	0	0	0	0
1	-1	-2	-1	0	1	2	3
2	-4	-4	-2	0	2	4	6
3	-9	-6	-3	0	3	6	9