



Number (part 1)

Theory and examples

Learning Skills

Introduction:

An understanding of place value, addition, subtraction, multiplication and division is a foundation for work in primary mathematics. Explanations of some of the terms that have been used in this document can be found in the [glossary](#) on our website. [Part 2](#) of this document contains exercises to practise.

This sheet will teach you to:

- recognise place values of whole numbers 1
- rewrite numbers in expanded/compact form 2
- add and subtract numbers with two or more places 2
- multiply numbers ending in 0 2
- perform long multiplication 3
- divide whole numbers 4
- work out remainders 5
- recognise commutative properties 5
- determine an average 6
- operate with powers 6
- work through an equation using order of operations 6

1. Place value of whole numbers

Each digit in a number has a place value. The following table shows this order

HUNDRED THOUSANDS Or 100 000's	TEN THOUSANDS Or 10 000's	THOUSANDS Or 1000's	HUNDREDS Or 100's	TENS Or 10's	UNITS Or 1's
		4	3	1	9
	5	6	7	0	2

If we have the number 4319 and concentrate on the digit 4

- 4 is the **face** value of the first digit,
- **1000's** is the **place** value of the digit
- **4 000** is the **total** value of the digit

If we have the number 56702 and concentrate on the digit 7

- 7 is the **face** value of the third digit
- **100's** is the **place** value of the digit
- **700** is the **total** value of the digit

2. Expanded/compact form

Examples

4 319 can be written in expanded form as $4 \times 1000 + 3 \times 100 + 1 \times 10 + 9 \times 1$

56 709 can be written in expanded form as $5 \times 10000 + 6 \times 1000 + 7 \times 100 + 0 \times 10 + 9 \times 1$

$2 \times 1000 + 0 \times 100 + 6 \times 10 + 3 \times 1$ written in compact form is 2 063

3. Addition

Example

$$1025 + 798 + 52$$

$$\begin{array}{r} 1\ 0\ 2\ 5\ + \\ 7\ 9\ 8 \\ \hline 1\ 8\ 7\ 5 \end{array}$$

Notes

$5+8+2 = 15$, the 5 is entered and the 1 carries over to the next place,

$2+9+5+1 = 17$, the 7 is entered and the 1 carries over,

$0+7+1 = 8$,

1

4. Subtraction

Example 1

$$253 - 171$$

$$\begin{array}{r} 1 \\ 2\ 5\ 3\ - \\ 1\ 7\ 1 \\ \hline 8\ 2 \end{array}$$

Notes

$3-1 = 2$

$5 - 7$ cannot be done, trade 1 place from the next place along to make 5 into 15, now $15 - 7 = 8$

the 2 hundreds has been reduced to 1 hundred (it was traded to do the above subtraction), this leaves $1-1 = 0$

Example 2

$$632 - 89$$

$$\begin{array}{r} 5\ \ 12 \\ 6\ 3\ 2\ - \\ 8\ 9 \\ \hline 5\ 4\ 3 \end{array}$$

5. Multiplying numbers ending in 0

Examples

a) $6 \times 20 = 6 \times 2(0) = 120$

b) $800 \times 4 = 8 \times 4(00) = 3200 = 3\ 200$

c) $50 \times 100 = 5 \times 1(000) = 5000 = 5\ 000$

d) $600 \times 2000 = 6 \times 2(00000) = 1200000 = 1\ 200\ 000$

Notes

800×4 has two zero at the end, ignore those zeros

So $8 \times 4 = 32$

Then add two zero to the end of your answer

So $800 \times 4 = 3200$

6. Long multiplication

Examples

a) 23×46

(46 is $40 + 6$) so to multiply 23 by 46, 23 needs to be multiplied by 6, then by 40 then the two answers added together

$$\begin{array}{r}
 2^1_1 \ 3 \times \\
 4 \ 6 \\
 \hline
 1 \ 3 \ 8 \\
 9 \ 2 \ 0 \leftarrow \text{add a zero to keep the} \\
 \text{correct place value} \\
 \hline
 1 \ 0 \ 5 \ 8
 \end{array}$$

or the carrying over can be done in the answer line

$$\begin{array}{r}
 2 \ 3 \times \\
 4 \ 6 \\
 \hline
 1 \ 2 \ 8 \\
 8 \ 2 \ 0 \\
 \hline
 1 \ 0 \ 5 \ 8
 \end{array}$$

b) 169×56

$$\begin{array}{r}
 1^4_3 \ 6^5_4 \ 9 \times \\
 5 \ 6 \\
 \hline
 1 \ 0 \ 1 \ 4 \\
 8 \ 4 \ 5 \ 0 \leftarrow \text{add a 0} \\
 \hline
 9 \ 4 \ 6 \ 4
 \end{array}$$

Or

$$\begin{array}{r}
 1 \ 6 \ 9 \times \\
 5 \ 6 \\
 \hline
 3 \ 5 \\
 6 \ 6 \ 4 \\
 3 \ 4 \\
 5 \ 0 \ 5 \ 0 \\
 \hline
 9 \ 4 \ 6 \ 4
 \end{array}$$

Notes

6 times 3 = 18, the 8 is entered and the 1 is carried over

6 times 2 = 12, add on the 1 carried = 13

start a new line to multiply now by 40, do this by entering a 0 in the units column

4 times 3 = 12, enter the 2 in the tens column and carry the 1 over

4 times 2 = 8, add on the 1 carried = 9

now add our two products together: 138 and 920

Notes

6 times 9 = 54, the 4 is entered and the 5 is carried over

6 times 6 = 36, add on the 5 = 41, the 1 is entered and the 4 carried over

6 times 1 = 6, add on the 4 = 10

start a new line to multiply now by 50, do this by entering a 0 in the units column

5 times 9 = 45, enter the 5 in the tens column and carry the 4 over

5 times 6 = 30, add on the 4 = 34, enter the 4 and carry 3 over

5 times 1 = 5, add on the 3 = 8

now add our two products together: 1014 and 8450

7. Dividing whole numbers

Examples

a) $516 \div 4$ or $\frac{516}{4}$

long division method:

$$\begin{array}{r} 1 \\ 4 \overline{) 516} \\ \underline{4} \\ 1 \end{array}$$

$$\begin{array}{r} 12 \\ 4 \overline{) 516} \\ \underline{4} \downarrow \\ 11 \\ \underline{8} \\ 3 \end{array}$$

$$\begin{array}{r} 129 \\ 4 \overline{) 516} \\ \underline{4} \downarrow \\ 11 \\ \underline{8} \downarrow \\ 36 \\ \underline{36} \\ 0 \end{array}$$

Notes

divide 4 into 5 = 1

then multiply $4 \times 1 = 4$

then subtract $5 - 1 = 1$ to find left over

Notes

pick up the next digit: the number to be divided into becomes 11

4 into 11 = 2, multiply $4 \times 2 = 8$

then subtract $11 - 8 = 3$ to find left over

Notes

pick up the next digit: the number to be divided into becomes 36

4 into 36 = 9, multiply $4 \times 9 = 36$

then subtract $36 - 36 = 0$ to find left over or remainder

We have used up all the digits in the number being divided so the division is finished and there is none left after the final subtraction

So 4 divides into 516 exactly 129 times.

Or the shorter method $4 \overline{) 516} = 129$

the multiply and subtract is done mentally rather than writing it down

Notes

how many 4's in 5: 1 with 1 left over

the 1 joins with the 1 after the 5 to make the number to be divided into 11

how many 4's in 11: 2 with 3 left over

the 3 joins up with the 6 to make the number to be divided into 36

how many 4's in 36: 9 with none left over – that's the last digit so the division is finished.

b) $1256 \div 8$ or $\frac{1256}{8}$

long division method:

$$\begin{array}{r} 157 \\ 8 \overline{) 1256} \\ \underline{8} \downarrow \\ 45 \\ \underline{40} \downarrow \\ 56 \\ \underline{56} \\ 0 \end{array}$$

divide then multiply then subtract

Or $8 \overline{) 12^4 5^5 6} = 157$

8. Remainders

The remainder represents what is left over after the dividing a number.

Examples

What is the remainder when 212 is divided by 5?

$$\begin{array}{r} 42 \\ 5 \overline{) 212} \\ \underline{20} \downarrow \\ 12 \\ \underline{10} \\ 2 \end{array}$$

the remainder is 2

or $5 \overline{) 21^1 2} \text{ r}2$ the remainder is 2

Notes

5 divides into 212: 42 times and 2 left over

Notes

It can also be written in decimal or fraction term i.e $42\frac{2}{5}$ or 42.4

9. Commutative property

Examples

- $5 + 2 + 5 = 5 + 5 + 2 = 12$
- $4 \times 3 \times 25 = 4 \times 25 \times 3 = 100 \times 3 = 300$
- $8 - 4$ does not equal $4 - 8$
- $20 \div 5$ does not equal $5 \div 20$

Commutative definition

numbers may be added or multiplied together in any order

10. Average

Examples

- a) find the average of 2, 5 and 8

$$\text{average} = (2+5+8) \div 3 = 15 \div 3 = 5$$

- b) find the average of 8 and 13

$$\text{average} = 8+13=21 \div 2=10.5$$

As you can see the average need not be a whole number

11. Power

Examples

- a) 23×10^5 means

23 multiplied by $10 \times 10 \times 10 \times 10 \times 10 \Rightarrow 100000$

which equals 2 300 000

- b) 569×10^7 means

569×10000000

which equals 5 690 000 000

- c) 32 000 000 could be written as 32×10^6

Notes

the power matches the number of noughts

12. Order of operations

1. Work out inside grouping symbols first
2. Carry out multiplications and divisions from the left to the right
3. Carry out additions and subtractions from left to right.

Some people like to remember this as BODMAS

BODMAS

Brackets
Of
Division
Multiplication
Addition
Subtraction

Examples

- a) $20 - 4 + 8 - 2$

$$\begin{array}{r} 16 \quad 24 \quad 22 \\ 20 - 4 \uparrow + 8 \uparrow - 2 \uparrow = 22 \end{array}$$

- b) $40 \div 5 \times 3 \div 2$

$$\begin{array}{r} 8 \quad 24 \quad 12 \\ 40 \div 5 \uparrow \times 3 \uparrow \div 2 \uparrow = 12 \end{array}$$

Notes

work left to right: $20 - 4$ is 16
 $16 + 8$ is 24
 $24 - 2$ is 22

Notes

work left to right: 40 divided by 5 is 8
8 times 3 is 24
24 divided by 2 is 12

c) $20 - 6 \times 3 + 15$

$$\begin{array}{ccc} & 18 & 2 \\ & \uparrow & \uparrow \\ 20 - 6 \times 3 & + 15 & = 20 - 18 + 15 = 17 \end{array}$$

Notes

multiply before add or subtract:
6 times 3 is 18
then go back to the start:
20 - 18 is 2
2 + 15 is 17

d) $9 + 15 \div (3 + 2)$

$$\begin{array}{ccc} & 5 & 3 \\ & \uparrow & \uparrow \\ 9 + 15 \div (3 + 2) & = 9 + 15 \div 5 & = 9 + 3 = 12 \end{array}$$

Notes

work out the brackets first:
3 + 2 is 5
then work out the division:
15 divided by 5 is 3
then back to the start and finish off
the addition:
9 + 3 is 12

13. For more information

Visit our Learning Skills website at <http://www.csu.edu.au/division/studserv/maths/index.htm>

Part 2 of this document for exercises relating to this topic can be found at <http://www.csu.edu.au/division/studserv/maths/teachered.htm>

Other useful websites are available at:

<http://www.coolmath.com/>

There are many more of these types of sites available use your search engine to find them.

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