Chapter 1

Number properties

A WORDS USED IN MATHEMATICS

four basic **operations**

Addition	$+$	to find the **sum**
Subtraction	$-$	to find the **difference**
Multiplication	$\times$	to find the **product**
Division	$\div$	to find the **quotient**

B EXPONENT NOTATION

exponential or **index notation**

7^4 ← exponent or index

← base number

there are 4 factors of 7 multiplied together, or $7 \times 7 \times 7 \times 7$

Any non-zero number raised to the power zero is equal to 1.

$$a^0 = 1, \quad a \neq 0$$

0^0 is undefined.

Write in exponent form: $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$2^4 \times 3^3$

Write as a natural number: $2^3 \times 3^2 \times 5$

$8 \times 9 \times 5$

$72 \times 5 = 360$

360

Copy and complete:

$2^1 = \ldots.$ 2

$2^1 + 2^2 = \ldots.$ 2+4=6

$2^1 + 2^2 + 2^3 = \ldots.$ 14

$2^1 + 2^2 + 2^3 + 2^4 = \ldots.$ 30

4 8 16

$2^2 - 2 = \ldots.$ 2

$2^3 - 2 = \ldots.$ 6

$2^4 - 2 = \ldots.$ 14

$2^5 - 2 = \ldots.$ 30

2+4+8+16+32+64 +12

Hence predict an expression for $2^1 + 2^2 + 2^3 + ... + 2^7$.
Check your prediction using your calculator.

$2^8 - 2$

$256 - 2 = 254$

Teng is designing a house. In each room he can choose between tiles, floorboards, or carpet for the floor.

a How many combinations of flooring materials are possible in the design of a 2-room "studio"?

L	B
T	F
T	C
F	C
F	T
C	T
C	F

L	B
T	T
F	F
C	C

3^2

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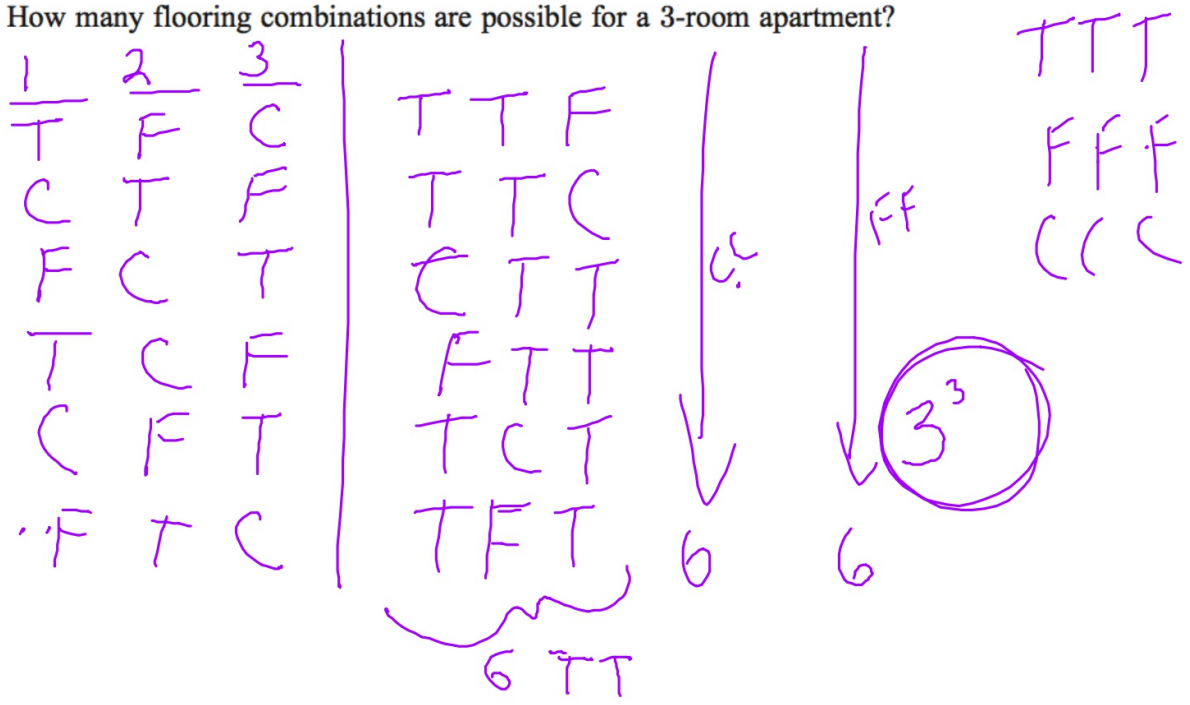
a How many combinations of flooring materials are possible in the design of a 2-room "studio"?

b How many flooring combinations are possible for a 3-room apartment?



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a How many combinations of flooring materials are possible in the design of a 2-room "studio"?

b How many flooring combinations are possible for a 3-room apartment?

c How many flooring combinations are possible for a 4-room flat?

$3^4 = 81$ options

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a How many combinations of flooring materials are possible in the design of a 2-room "studio"?

b How many flooring combinations are possible for a 3-room apartment?

c How many flooring combinations are possible for a 4-room flat?

d Find a pattern and write down a formula for the number of combinations of flooring materials for an n-room house.

3^n

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e Eventually Teng designs an 8-room house. How many flooring combinations does he have to choose from?

$3^8 = 6561$

NEGATIVE BASES

Consider the statements below:

$(-1)^1 = -1$
$(-1)^2 = -1 \times -1 = 1$
$(-1)^3 = -1 \times -1 \times -1 = -1$
$(-1)^4 = -1 \times -1 \times -1 \times -1 = 1$

$(-2)^1 = -2$
$(-2)^2 = -2 \times -2 = 4$
$(-2)^3 = -2 \times -2 \times -2 = -8$
$(-2)^4 = -2 \times -2 \times -2 \times -2 = 16$

Evaluate:

a $(-5)^2$ **b** -5^2 **c** $(-5)^3$ **d** $-(-5)^3$

$(-5) \cdot (-5)$
25

$-1(5)^2$
-25

$(-5)(-5)(-5)$
-125

$-1(-5)^3$
$-1(-5)(-5)(-$
125

A **negative** base raised to an **odd** power is negative
A **negative** base raised to an **even** power is positive

C FACTORS OF POSITIVE INTEGERS

The **factors** of a positive integer are the positive integers which divide exactly into it.

When we write a number as a product of factors, we say it is **factorised**.

EVEN AND ODD NUMBERS

A whole number is **even** if it has 2 as a factor and thus is divisible by 2.
A whole number is **odd** if it is not divisible by 2.

List all the factors of 15.

1, 3, 5, 15

List all the factors of 16.

1, 2, 4, 8, 16

PRIMES AND COMPOSITES

Prime numbers can be written as the product of only one pair of factors, one and the number itself.

A **prime** number is a natural number which has exactly two different factors.

A **composite** number is a natural number which has more than two factors.

From the definition of prime and composite numbers we can see that:

The number 1 is neither prime nor composite.

HIGHEST COMMON FACTOR

A number which is a factor of two or more other numbers is called a **common factor** of those numbers.

We can find the **highest common factor (HCF)** of two or more natural numbers by first expressing them as the product of prime factors.

Assignment:

Exercises

1 C.1 # 5, 6, 7

1 C.3 # 2