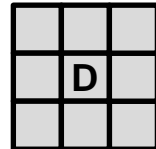
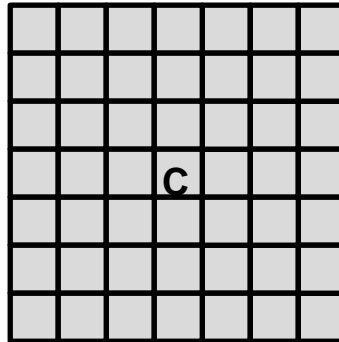
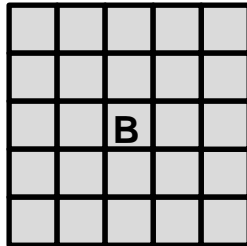
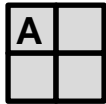
	NAME:				
	Gr 8		Date:		Time
CAPS Reference	1-2 Exponents (Term 1)				
Topic	1-2-1 Square numbers and their square roots				



## 1. Think First! [5 mins]

1.1 On squared paper draw the following diagrams (or use bottle tops to make an array).



1.2 Complete the following table with information from your diagrams or arrays.

	Kind of shape	Number of squares (objects)	Factors of this number
A			
B			
C			
D			



## 2. Got it? [5 mins]

Each of the above diagrams is a square.  
4, 25, 49 and 9 are square numbers because they each have two factors that are the same.

When we have a two (or more) factors that are the same, we write this in a shorter way using an exponent.

**Example:**  $4 = 2 \times 2 = 2^2$   
We say "2 to the power of 2"

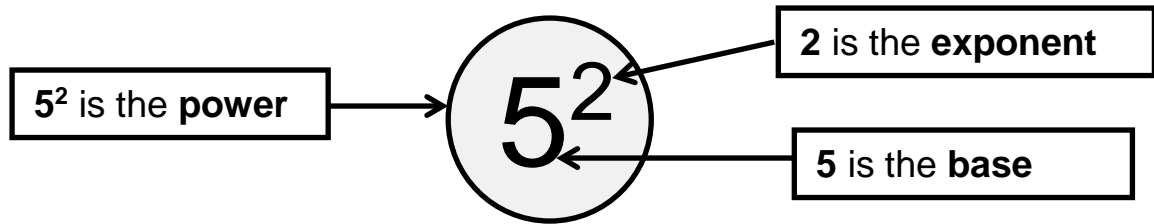
$25 = 5 \times 5 = 5^2$   
We say "5 to the power of 2".

$49 = 7^2$                        $9 = 3^2$

When the exponent is a 2 we usually say a number is "squared" e.g. "2 squared" or "7 squared".



### 3. Learn and remember! [own time]



### 3. Go ahead! [15 mins]

3.1 Draw a square diagram to represent the following numbers. Underneath the diagram write each of the numbers as a product of two factors.

3.1.1 16                      3.1.2 36                      3.1.3 81

3.2 Write these powers without exponents and then calculate the value.

3.2.1  $9^2$                       3.2.2  $50^2$                       3.2.3  $7^2$                       3.2.4  $12^2$

3.3 Write these numbers using a power. (Use a base and an exponent.)

3.3.1 64                      3.3.2 100                      3.3.3 144                      3.3.4 900

3.4 Make a multiplication tables grid like the one below. Fill in the missing numbers.

3.4.1 Colour in the answers given by 2 of the same factors, e.g. shade 9 as  $3 \times 3 = 9$ .

3.4.2 Where are the shaded numbers on the table?

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2							9			12
2	2		6	8	10	12	14	16			22	
3	3							24	27	30	33	
4	4										44	
5	5										55	
6	6	12			30	36	42			60	66	
7	7	14			35							
8	8	16	24	32	40	48	56	64	72	80	88	
9	9	18			45	54	63	72	81	90	99	
10	10										110	120
11	11											132
12	12	24										



### 4. Check your work! [10 mins]

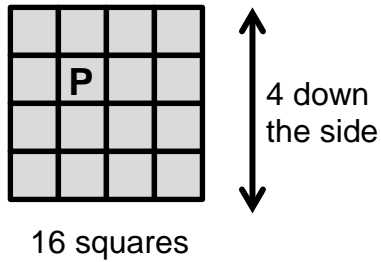


### 5. Learn and remember! [own time]

Learn all the square numbers.

**6. Got it? [10 mins]**

Below are diagrams of two square numbers.  
Look at the total number of squares used for each.

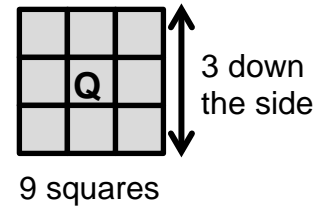


16 length of one side = 4

The opposite of this is that 4 is the square root of 16.

We write  $\sqrt{16} = 4$

We say "the square root of 16 is 4".



9 length of one side = 3

The opposite of this is that 3 is the square root of 9.

We write  $\sqrt{9} = 3$

We say "the square root of 9 is 3".

The "root" sign  $\sqrt{\quad}$  usually has a number written inside the "hook" part of the sign.

This tells us the number of the root we are finding.

(The square root is used so often that we usually leave out the 2 and just write  $\sqrt{\quad}$ .)

We say  $2 \times 2 = 4$  or  $2^2 = 4$

$$\sqrt{4} = \sqrt{2 \times 2} = 2$$

Here we have the square number 49.

We say  $7 \times 7 = 49$  or  $7^2 = 49$


$$\sqrt{49} = \sqrt{7 \times 7} = 7$$

**7. Go ahead! [10 mins]**

7.1 Copy this table and fill in the missing values. If necessary, use your calculator to help you with numbers 7.9 and 7.10.

	Number	Factors	Written with exponent	$\sqrt{\quad} =$
7.1	9	$3 \times 3$	$3^2$	3
7.2	25	$5 \times 5$		
7.3				8
7.4			$9^2$	
7.5	1			
7.6		$12 \times 12$		
7.7				11
7.8	100			
7.9			$25^2$	
7.10		$100 \times 100$		

**8. Check your work! [5 mins]**

	NAME:			
	Gr 8		Date:	Time 60 mins
CAPS Reference	1-2 Exponents (Term 1)			
Topic	1-2-2 Cubic numbers and their cube roots			



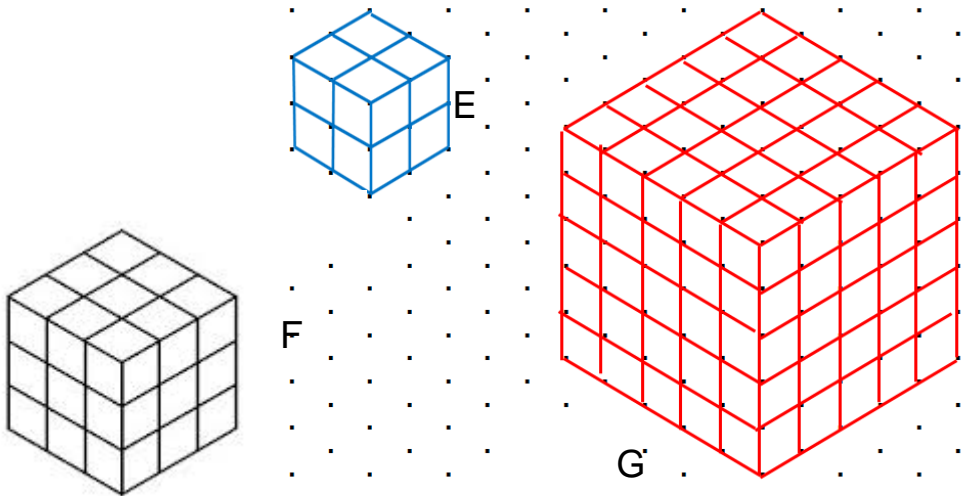
## 1. Think First! [10 mins]

1.1 On isometric dotted paper (page 4) draw a 3D array **OR** use little cubic blocks to make a model to represent the following numbers.

1.1 8

1.2 27

1.3 125



1.2 Complete the following table with information from your diagrams or arrays.

	Kind of shape	Number of cubes (objects)	Factors of this number
E			
F			
G			



## 2. Got it? [5 mins]

Each of the above models is a cube. 8, 27 and 125 are cubic numbers because they each have three factors that are the same.

In the same way as we did with square numbers, we write this in a shorter way using an exponent.

**Example:**  $8 = 2 \times 2 \times 2 = 2^3$  We say "2 to the power of 3"

$27 = 3 \times 3 \times 3 = 3^3$  We say "3 to the power of 3".

$125 = 5 \times 5 \times 5 = 5^3$  We say "5 to the power of 3".

When the exponent is a 3 we usually say a number is "cubed" e.g. "2 cubed" or "8 cubed".



### 3. Go ahead! [10 mins]

3.1 Write these powers without exponents and then calculate the value.  
(If necessary, use a calculator to help you.)

3.1.1  $7^3$     3.1.2  $6^3$     3.1.3  $4^3$     3.1.4  $10^3$     3.1.5  $1^3$

3.2 Write these numbers using a power (use a base and an exponent).

3.2.1 27    3.2.2 512    3.2.3 729    3.2.4 8 000    3.2.5 1331

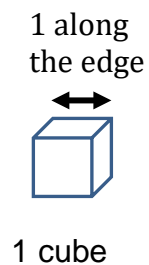
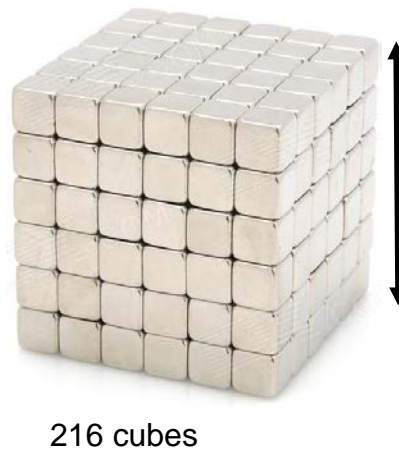
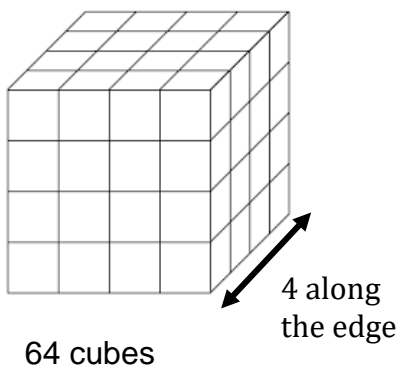
3.3 Write 64 in as many different ways as you can using powers.



### 4. Check your work! [5 mins]



### 5. Got it? [10 mins]



64: length of one edge = 4  
The opposite of this is that 4 is the cube root of 64.  
We write  $\sqrt[3]{64} = 4$   
We say "the cube root of 64 is 4".

216: length of one edge = 6  
The opposite of this is that 6 is the cube root of 216.  
We write  $\sqrt[3]{216} = 6$   
We say "the cube root of 216 is 6".

1: length of one edge = 1  
The opposite of this is that 1 is the cube root of 1.  
We write  $\sqrt[3]{1} = 1$   
We say "the cube root of 1 is 1".

The "root" sign  $\sqrt{\quad}$  has a number written inside the "hook" part of the sign.  
Here a 3 has been written because we are finding the cube root.

$$4 \times 4 \times 4 = 4^3 = 64$$

$$\sqrt[3]{64}$$

$$= \sqrt[3]{4 \times 4 \times 4} = 4$$

$$6 \times 6 \times 6 = 6^3 = 216$$

$$\sqrt[3]{216}$$

$$= \sqrt[3]{6 \times 6 \times 6} = 6$$

$$1^1 = 1$$

$$\sqrt[3]{1}$$

$$\sqrt[3]{1 \times 1 \times 1} = 1$$



## 6. Go ahead! [15 mins]

6.1 Calculate the following:

6.1.1  $4^3$

6.1.2  $\sqrt[3]{64}$

6.1.3  $6 \times 6 \times 6$

6.1.4  $\sqrt[3]{216}$

6.1.5  $\sqrt[3]{1}$

6.2 Calculate these answers in your head. Write the answers in your exercise book.

6.2.1  $7^2$

6.2.2  $\sqrt[2]{49}$

6.2.3  $3^3$

6.2.4  $5^2$

6.2.5  $\sqrt{100}$

6.2.6  $6^2$

6.2.7  $\sqrt[2]{36}$

6.2.8  $\sqrt[2]{4}$

6.2.9  $10^2$

6.2.10  $\sqrt[2]{144}$

6.2.11  $1^3$

6.2.12  $\sqrt[2]{1}$

6.2.13  $3^2$

6.2.14  $\sqrt[3]{64}$

6.2.15  $4^2$

6.2.16  $\sqrt[2]{81}$

6.2.17  $\sqrt[2]{900}$

6.2.18  $12^2$

6.2.19  $\sqrt[2]{16}$

6.2.20  $4^3$

6.2.21  $1^2$

6.2.22  $\sqrt[3]{8}$

6.2.23  $\sqrt[2]{64}$

6.2.24  $2^2$

6.2.25  $\sqrt[3]{27}$

6.2.26  $\sqrt[2]{400}$

6.2.27  $11^2$

6.2.28  $\sqrt[2]{9}$

6.2.29  $2^3$

6.2.30  $8^2$

6.2.31  $\sqrt[3]{1}$

6.2.32  $\sqrt[2]{144}$

6.2.33  $5^3$

6.2.34  $9^2$

6.2.35  $\sqrt[3]{125}$

6.2.36  $\sqrt[2]{121}$

6.2.37  $6^3$

6.2.38  $11^2$

6.2.39  $\sqrt[3]{216}$

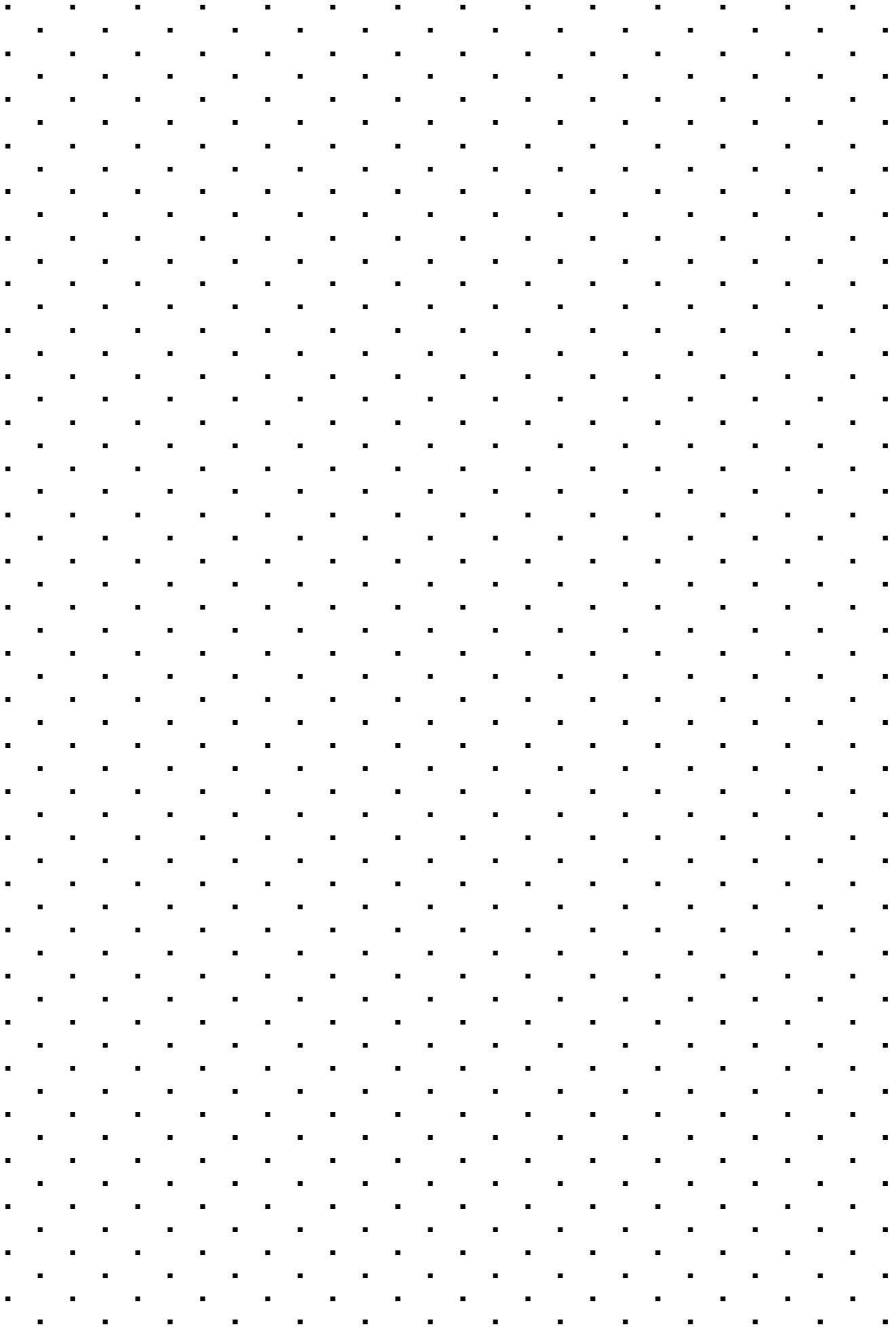
6.2.40  $\sqrt[2]{25}$


6.3 Copy this table and fill in the missing values. Use your calculator to help you with the bigger numbers

	Number	Factors	Written with exponent	$\sqrt[3]{\quad} =$
6.3.1	216	$6 \times 6 \times 6$	$6^3$	$\sqrt[3]{216} = 63$
6.3.2	125	$5 \times 5 \times 5$		
6.3.3			$9^3$	
6.3.4	1000			
6.3.5		$4 \times 4 \times 4$		
6.3.6	1			
6.3.7				3
6.3.8			$20^3$	
6.3.9				30
6.3.10	1 000 000			



## 7. Check your work! [5 mins]



		NAME:				
		Gr 8		Date:		Time
CAPS Reference	1-2 Exponents (Term 1)					
Topic	1-2-3 Representing and comparing numbers in exponential form					



### 1. Got it? [5 mins]

Reminder:

An exponent represents the number of factors we have of a certain number or symbol.

Example 1:  $3^5 = 3 \times 3 \times 3 \times 3 \times 3$  (5 factors)

Example 2:  $5^6 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$

Important Note:

$3^5 \neq 3 \times 5$      $3 \times 5 = 5 + 5 + 5 + 5 + 5$      $5^6 \neq 6 \times 5$      $6 \times 5 = 5 + 5 + 5 + 5 + 5 + 5$



### 2. Go ahead! [20 mins]

2.1 Write each of the following without using exponents. Do not calculate the answer.

2.1.1  $7^5$                       2.1.2  $10^3$                       2.1.3  $5^{10}$                       2.1.4  $8^2$   
 2.1.5  $21^5$                       2.1.6  $9^7$                       2.1.7  $2^4$                       2.1.8  $10^6$

2.2 Write each of the following using exponents:

2.2.1  $6 \times 6 \times 6$                       2.2.2  $20 \times 20 \times 20 \times 20 \times 20$   
 2.2.3  $1 \times 1 \times 1 \times 1 \times 1 \times 1$                       2.2.4  $3 \times 3 \times 3 \times 3 \times 3$   
 2.2.5  $100 \times 100 \times 100 \times 100$                       2.2.6  $4 \times 4 \times 4$   
 2.2.7  $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$                       2.2.8  $8 \times 8 \times 8 \times 8 \times 8$

2.3 Say whether the following statements are True or False. If False, write a true statement starting with the left side of the = sign.

2.3.1  $4^3 = 12$                       2.3.2  $5 \times 5 \times 5 \times 5 = 5^4$   
 2.3.3  $7^4 = 7 \times 4$                       2.3.4  $3 \times 3 = 3^3$   
 2.3.5  $6 \times 6 \times 6 \times 6 \times 6 \times 6 = 6^6$                       2.3.6  $5 \times 4 = 4 + 4 + 4 + 4 + 4$



### 3. Check your work! [10 mins]



### 4. Got it? [5 mins]

What about 1?

Reminder:  $1 \times 1 = 1$                        $1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$   
 $1^5 = 1$                        $1^8 = 1$                        $1^{99} = 1$                        $1^{\text{any number}} = 1$   
 $6^1$     How many factors of 6 are there?    1 factor.  $6^1 = 6$ .

Normally we don't write the exponent 1, we just write the number without an exponent.

Be careful:  $6^1$  is not the same as  $1^6$ .  
 $6^1 = 6$ ;                       $1^6 = 1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$

Be careful:  $6^0 \neq 6$                       More about this later.





## 5. Go ahead! [15 mins]

5.1 Write these powers out in full without using exponents, and then give the value.

5.1.1  $1^4$                       5.1.2  $8^1$                       5.1.3  $27^1$                       5.1.4  $1^9$   
 5.1.5  $4^1$                       5.1.6  $\sqrt{1}$                       5.1.7  $557^1$                       5.1.8  $90^1$

5.2 Write the following products using exponents, and then give the value.

5.2.1  $1 \times 1 \times 1 \times 1 \times 1$                       5.2.2  $5$                       5.2.3  $1 \times 1 \times 1 \times 1$                       5.2.4  $90$

5.3 Write the value of each of the following

5.3.1  $1^9$                       5.3.2  $9 \times 1$                       5.3.3  $9^1$                       5.3.4  $1 \times 9$



## 6. Check your work! [5 mins]

### 7. Think Again! [10 mins]

7.1 Write down whether the following number statements are true or False.

7.1  $2^4 = 8$                       7.2  $3^2 = 9$                       7.3  $2^6 = 6^2$                       7.4  $1^7 = 1^{11}$   
 7.5  $8^3 = 8 \times 8 \times 8$                       7.6  $8^8 = 64$                       7.7  $11 \times 2 = 11^2$                       7.8  $8 \times 8 = 4^3$   
 7.1 F                      7.2 T                      7.3 F                      7.4 T  
 7.5 T                      7.6 F                      7.7 F                      7.8 T



## 8. Got it? [10 mins]

Common errors:

7.1	$2^4 = 2 \times 2 \times 2 \times 2 = 16$	$2 \times 4 = 8$
7.3	$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$	$6^2 = 6 \times 6 = 36$
7.6	$8^8 = 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$ $= 16\ 777\ 216$	$8 \times 8$ or $8^2 = 64$
7.7	$11 \times 2 = 22$	$11^2 = 11 \times 11 = 121$



## 9. Go ahead! [15mins]

9.1 Say whether the following statements are True or False. If False, write **two** correct statements showing why the statement is False.


9.1.1  $3^4 = 12$                       9.1.2  $4^2 = 16$                       9.1.3  $2^4 = 4^2$                       9.1.4  $1^{15} = 1^{23}$   
 9.1.5  $6^3 = 6 \times 6 \times 6$                       9.1.6  $9^2 = 81$                       9.1.7  $4^4 = 16$                       9.1.8  $3^2 = 9$   
 9.1.9  $6 \times 3 = 6^3$                       9.1.10  $6^3 = (2 \times 3)^3$

9.2 Fill in the correct sign from  $>$ ,  $<$  or  $=$  to make each number sentence True.

9.2.1  $4^3$  \_\_\_  $4 \times 3$                       9.2.2  $\sqrt{99^2}$  \_\_\_  $10^2 - 1$                       9.2.3  $2^6$  \_\_\_  $6^2$   
 9.2.4  $\sqrt{64}$  \_\_\_  $2^3$                       9.2.5  $5^2$  \_\_\_  $2^5$                       9.2.6  $7 \times 2$  \_\_\_  $7^2$   
 9.2.7  $4 \times 9$  \_\_\_  $9 \times 4$                       9.2.8  $(5 + 6)^2$  \_\_\_  $(5 \times 6)^2$



## 10. Check your work! [10 mins]

	NAME:			
	Gr 8		Date:	Time 40 mins
CAPS Reference	1-2 Exponents (Term 1)			
Topic	1-2-6 Calculating using exponents: Raising to a power			

**1. Think First! [5 mins]**

Write each of the following out in full. Re-write without using brackets,

1.1  $(4^3)^2$       1.2  $(6^2)^4$       1.3  $(10^5)^2$

**2. Got it? [5 mins]**

1.1	$(4^3)^2$	$= 4^3 \times 4^3$	$= 4^6$
1.2	$(6^2)^4$	$= 6^2 \times 6^2 \times 6^2 \times 6^2$	$= 6^8$
1.3	$(10^5)^2$	$= 10^5 \times 10^5$	$= 10^{10}$

← Compare these columns →

A shorter way to “raise a power to another power”, is to **multiply the exponents**.

**3. Go ahead! [5 mins]**

Write each of the following using one exponent only:

3.1  $(7^2)^4$       3.2  $(5^3)^5$       3.3  $(2^6)^3$       3.4  $(10^3)^3$

**4. Check your work! [5 mins]****5. Think Again! [5 mins]**

Write each of the following out in full:

5.1  $(4 \times 5)^2$       5.2  $(3 \times 6)^4$       5.3  $(10 \times 2)^3$

**6. Got it? [5 mins]**

5.1	$(4 \times 5)^2$	$= (4 \times 5) \times (4 \times 5)$	$= 4^2 \times 5^2$
5.2	$(3 \times 6)^4$	$= (3 \times 6) \times (3 \times 6) \times (3 \times 6) \times (3 \times 6)$	$= 3^4 \times 6^4$
5.3	$(10 \times 2)^3$	$= (10 \times 2) \times (10 \times 2) \times (10 \times 2)$	$= 10^3 \times 2^3$

← Compare these columns →


When raising factors to a power, **each factor in the bracket is to that power**.

**6. Go ahead! [5 mins]**

Write each of the following without brackets

6.1  $(3 \times 5)^4$       6.2  $(2 \times 8)^5$       6.3  $(7 \times 3 \times 2)^3$       6.4  $(10 \times 3)^3$

**7. Check your work! [5 mins]**

	NAME:				
	Gr 8		Date:		Time 30 mins
CAPS Reference	1-2 Exponents (Term 1)				
Topic	1-2-7 Solving problems using exponents				



### Go ahead! [25 mins]

1.1 Calculate each of the following. Use your calculator if necessary.

1.1.1  $5^2$

1.1.2  $8^3$

1.1.3  $(0,6)^2$

1.1.4  $(0,25)^3$

1.1.5  $\sqrt{0,04}$

1.1.6  $6^3 \times 5^2 \times 16^0$

1.1.7  $(16 - 6)^4$

1.1.8  $\sqrt{27 + 22}$

1.1.9  $\frac{3^8}{3^2}$

1.1.10  $\left(\frac{5}{6}\right)^2$

1.1.11  $\sqrt{\frac{36}{25}}$

1.1.2  $\sqrt{99 - 18}$

1.2 Say whether the following are True or False. If false, write a correct statement.

1.2.1  $(-2)^2 + 4^2 + 8^1 = 28$

1.2.2  $-4^3 - 3^2 + 12 = -61$

1.2.3  $[(-2)(-3)]^2 + \sqrt{49} = 43$

1.2.4  $(9^2 + 10^2)^0 = 181$

1.3 Give the value of each of the following if  $k = 2$

1.3.1  $\left(\frac{k^3}{k^2}\right)^2$

1.3.2  $\sqrt{\left(\frac{k^5}{k^3}\right)^2}$

1.3.3  $k^6 - k^5 + k^4 - k^3 + k^2 - k + k^0$

2. Write these numbers in standard form:

2.1  $9,842 \times 10^4$

2.2  $8,3582 \times 10^{10}$

2.3  $0,004912 \times 10^8$

3 Write the large numbers in each of the following using Scientific notation:

3.1 Light travels 1 800 000km in six seconds.

3.2 A spacecraft weighed about 700 000 000kg at take-off.

3.3 The sun is 1 000 000 bigger than the earth.

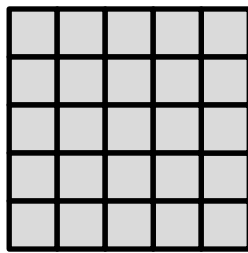
3.4 The temperature of the sun is 5 727degrees Celsius.

4 A man released 10 rabbits into a nature reserve in the Karoo. The number of rabbits trebled every month. Use exponents to answer the following:

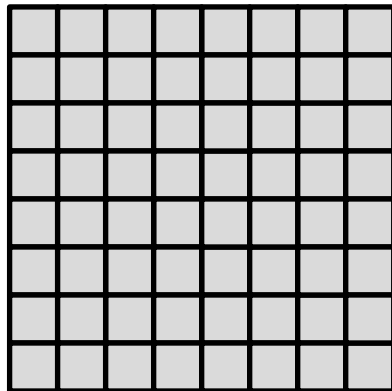
4.1 How many rabbits are there after one month, two months and three months respectively?

4.2 How long will it take before there are more than 2400 rabbits?

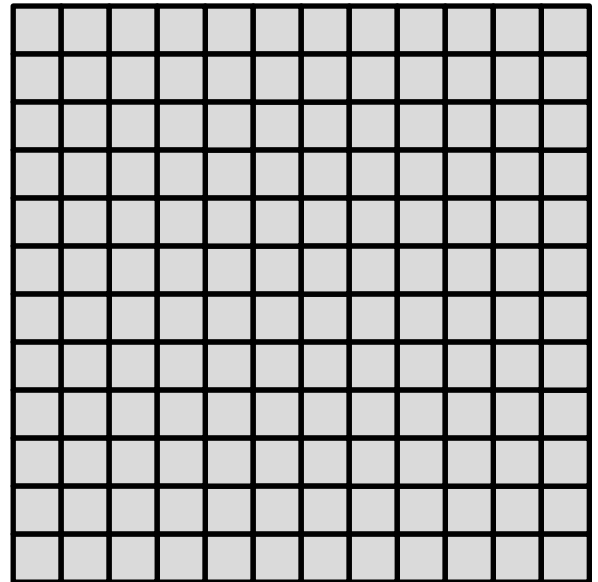
5 A builder paves square patios using square tiles. Here is what the patios look like, and the number of tiles used.



← Small 5  
tiles across →



Medium 64 tiles



Large 144 tiles

- 5.1 The small patio measures 5 tiles across. How many tiles are used for this patio?
- 5.2 If 64 tiles are used for a medium patio, how many tiles are used down one side? Write your answer using a  $\sqrt{\quad}$  sign.
- 5.3 Use the same method to calculate how many tiles are down one side of the large patio.
- 5.4 Each tile costs the builder R45,00 and he allows for a 20% mark-up per tile. He charges R25,00 per tile to lay them.
- 5.4.1 How much do the tiles cost the builder for each sized patio?
- 5.4.2 How much profit does he make on the tiles for each of the three patios?
- 5.4.3 How much do home owners pay to have each patio built?
- 5.5 Some people want patios of other sizes.  
How many tiles are needed for a square with a side measure of:
- 5.5.1 10 tiles?    5.5.2 15 tiles?
- 5.6 How many tiles are there down the side of a patio using:
- 5.6.1 121 tiles?    5.6.2 400 tiles?
- 5.7 The builder has an odd lot of 72 tiles. Can he use all the tiles to make a square patio? What could he do?

## 6. A challenge

### The story of the two neighbours.

A multi billionaire offered to give his neighbor R1 000 000,00 for a Christmas present. The clever neighbor said that he would prefer to be given the money over December as follows: R1,00 on Dec 1, R2,00 on Dec 2, R4,00 on Dec 3 and so on, doubling the amount he gave each day in December until Christmas Day, 25 December. The multi billionaire agreed immediately thinking the neighbor was crazy to ask for so little.

Who “laughed all the way to the bank”?

Give a reason for your answer, showing all necessary working.



## 7. Check your work! [5 mins]