

Squares and Square roots

Sunday, 25 March 2018 9:54 pm



★ By the end of teaching all students will be asked to complete the following work:

Year 7 Textbook

Chapter 3

Exercise 3G

Questions: 6-9(s), 11, 12, 13, 15

Extension: 16

RECAP:

We have come across lots of power numbers in the previous lesson.

We used them to help us write prime decomposition in a simpler form (index form).

Expanded Notation

There is one power number which is really important in Mathematics and is used a lot in later chapters.

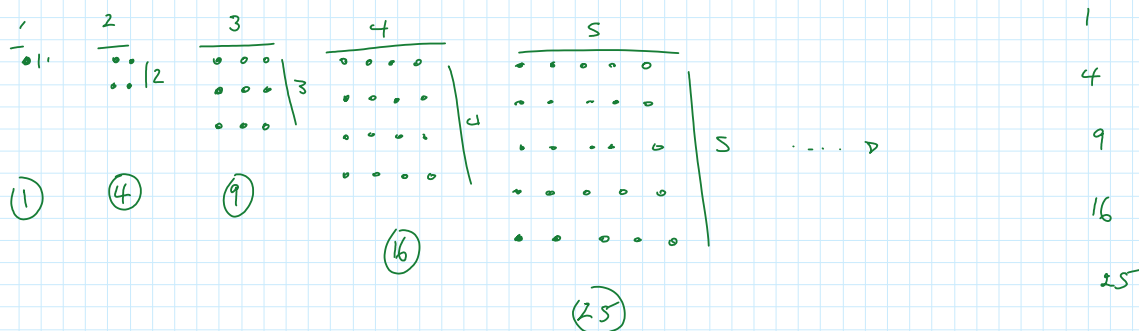
This is a "floaty 2".

You have already met the idea of square numbers at Year 6 (and the start of this module).

$$2^2 \quad 3^2 \quad 4^2 \quad x^2$$

Square Numbers

If you remember, we can express certain numbers by drawing squares, made up of dots.

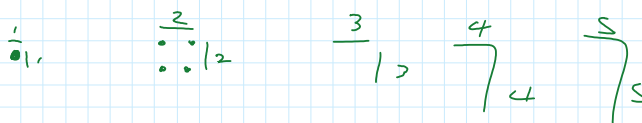


Drawing lots of these gets really time consuming! So ... there has to be another way to finding the square numbers!

Squares have side lengths which are the same!

We know that the side lengths of each square are:

- 1 by 1
- 2 by 2
- 3 by 3
- 4 by 4
- 5 by 5
- and so on ...



If we now replace the word "by" with a times sign we get:

- 1×1
- 2×2
- 3×3
- 4×4
- 5×5

$$6 \times 6 = 36$$

$$7 \times 7 = 49$$

$$8 \times 8 = 64$$

Which ... when we do the actual calculation ... we get the square numbers:

- 1
- 4
- 9
- 16
- 25
- 36
- 49
- 64
- 81
- 100
- 121
- 144

$$12 \times 12$$

$$13 \times 13 = 169$$

$$14 \times 14 = 196$$

$$15 \times 15 = 225$$

$$20 \times 20 = 400$$

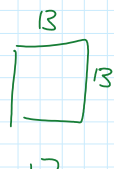
This means we can now find the any square number so long as we know the side length:

Examples:

What is the square of 13?

What is the square of 17?

What is the square of 20?



$$\begin{array}{r} 13 \\ \times 13 \\ \hline 169 \end{array}$$

$$\begin{array}{r} 17 \\ \times 17 \\ \hline 289 \end{array}$$

$$400$$

What is the square of 17?
What is the square of 20?

$$17^2$$

$$17^2$$

$$13^2 = 169$$

$$11^2 = 121$$

$$1^2 = 1$$

Making things easier

Writing "What is the square of..." is pretty time consuming.
Remember, Mathematicians are lazy ... we don't want to write too much stuff!

We can use floaty numbers to help me write "What is the square of ..."

What is the square of 13 is the same as 13^2

What is the square of 17 can now be expressed as 17^2

What is the square of 20 can now be expressed as 20^2

Examples:

What is 7^2 ?

What is 12^2 ?

$$7 \times 7 = 49$$

$$12 \times 12 = 144$$

$$13^2$$

$$17^2$$

$$20^2$$

$$12^2$$



Doing things backwards

In Mathematics, what we do forwards, we can also do backwards.
This is really important to remember.
We spend a LOT of time as teachers showing you how to do things forwards, but not as much time showing you how to do things backwards. We sort of hope you'll be able to work it out!

Question:

If the square of a number is 196, what is the number?

Here we are giving you the answer!!!!
We have to work out the question.

So ... **WHAT NUMBERS, WHEN MULTIPLIED BY ITSELF, GIVES YOU 196???**

We have to use some trial and error!

$$?^2 = 196$$

$$? = 14$$

$$14^2 = 196$$

$$13 \times 13 = 169$$

$$14 \times 14 = 196$$



A quicker way to write "What numbers, when multiplied by itself give you ..."

Again, the above sentence is a LOT of writing!!!
We need a quicker way.

Let's say hello to the "Square ROOT".

It even has the word SQUARE in its title!!!!





Let's say hello to the "Square ROOT".

It even has the word SQUARE in its title!!!!

Sadly, there is no quick way to remember it ... so you just have to learn it.



Square root

Examples:

$\sqrt{64}$	$\rightarrow$	$\sqrt{64}$	$\Rightarrow$	$?^2 = 64$	$\boxed{8} \times 8 = 64$
$\sqrt{81}$	$\rightarrow$	$\sqrt{81}$		$?^2 = 81$	$\boxed{9}$
$\sqrt{144}$	$\rightarrow$	$\sqrt{144}$		$?^2 = 144$	$\boxed{12}$

Square Roots are like Brackets

When we did BIDMAS we knew that we have to do all the things in any brackets first. We couldn't touch anything outside the brackets until we had simplified what was in the brackets.

The same is true to Square Root signs.

Examples:

Evaluate: $\sqrt{3^2 + 4^2}$

$= 5$

$\sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$

$?^2 = 25$

$3 \times 3 \quad 4 \times 4$

Evaluate: $\sqrt{5^2 + 12^2}$

$\sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169} = 13$

$?^2 = 169$

$5 \times 5 \quad 12 \times 12$

And finally ...

