Patterns, squares and roots

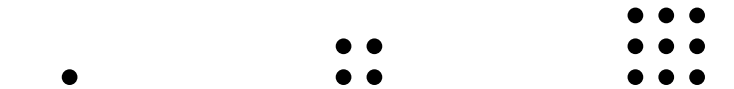
- Calculating square numbers and square roots
- Recognising the relationship between odd numbers and square numbers
- Identifying triangular numbers
- Recognising the relationship between triangular numbers and square numbers

Keywords

You should know

explanation 1

1 Here is a sequence of diagrams showing the square numbers 1, 4 and 9.



$1^2 = 1 \times 1 = 1$ $\quad 2^2 = 2 \times 2 = 4$ $\quad 3^2 = 3 \times 3 = 9$

a Copy and continue the pattern to show the next two square numbers.

b Copy and complete the table.

You should learn the square numbers.

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
n^2															

2 Find the square number between each pair of numbers.

a 11, 17 **b** 23, 31 **c** 57, 66 **d** 70, 82

e 101, 130 **f** 200, 250 **g** 180, 200 **h** 59.8, 72.6

3 Work out these calculations.

a $7^2 + 1^2$ **b** $3^2 + 4^2$ **c** $4^2 + 8^2$ **d** $10^2 - 7^2$

e $6^2 - 5^2$ **f** Twice 3^2 **g** Half of 8^2 **h** $6^2 \div 4$

4 Copy and complete the following calculations.

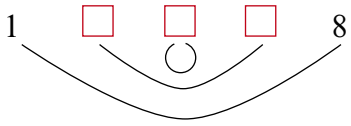
a $3^2 + 4^2 = \square^2$ **b** $13^2 - 12^2 = \square^2$ **c** $10^2 - \square^2 = 6^2$

5 **a** Write two consecutive odd numbers. Multiply them together, and then add 1. Repeat the process several times with different numbers.

b What do you notice about your final answers?

c What happens if you start with even numbers instead?

6 **a** Copy and complete the diagram to show the factor pairs of 16.



b Draw a diagram to show the factor pairs of 36.

c What can you say about the number of factors of a square number? Explain your answer.

explanation 2 — online

7 Write the value of each of these.

a $\sqrt{16}$	**b** $\sqrt{100}$	**c** $\sqrt{36}$	**d** $\sqrt{144}$
e $\sqrt{49}$	**f** $\sqrt{25}$	**g** $\sqrt{64}$	**h** $\sqrt{169}$
i $\sqrt{121}$	**j** $\sqrt{225}$	**k** $\sqrt{1}$	**l** $\sqrt{0}$
m $2 \times \sqrt{64}$	**n** $5 \times \sqrt{9}$	**o** $\sqrt{4} \times \sqrt{196}$	**p** $32 \div \sqrt{16}$

8 **a** Copy and complete: $\sqrt{900} = \sqrt{9} \times \sqrt{100} = \square \times \square = \square$

b Use the method of part **a** to work out these square roots:

i $\sqrt{400}$ **ii** $\sqrt{2500}$ **iii** $\sqrt{1600}$ **iv** $\sqrt{4900}$

9 $\sqrt{10}$ is not a whole number.

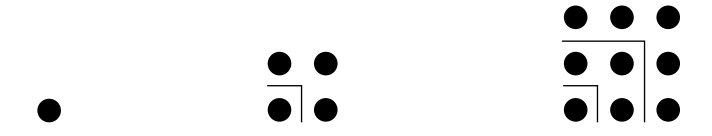
You can tell that $\sqrt{10}$ lies between 3 and 4 because $3 \times 3 = 9$ and $4 \times 4 = 16$.

Copy and complete the following statements by using two consecutive numbers.

a $\sqrt{3}$ lies between $\square$ and $\square$ because ...

b $\sqrt{20}$ lies between $\square$ and $\square$ because ...

10 These diagrams show square numbers. They show the relationship between square numbers and odd numbers.



$1^2 = 1$ $2^2 = 1 + 3$ $3^2 = 1 + 3 + 5$

a Copy and continue the pattern for the next three square numbers.

b Copy and complete.

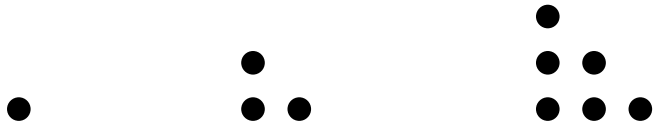
i The sum of the first 5 odd numbers is $\square^2$.

ii The sum of the first 10 odd numbers is $\square^2$.

c What is the sum of the first 100 odd numbers?

Use what you know about square numbers to help you.

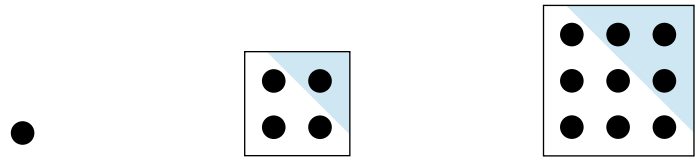
11 This diagram shows the first three triangular numbers.



1 3 6

a Copy and continue the pattern to show the first six triangular numbers.

b The first three square numbers are shown here. What connection do you think there is between triangular numbers and square numbers?



1 4 9

c Find these sums.

i The 9th and 10th triangular numbers

ii The 99th and 100th triangular numbers