



Deriving expressions and formulae

- Finding expressions and formulae in a variety of situations

Keywords

You should know

explanation 1

1 Write an expression for the number that is

- | | | |
|-----------------------------|--------------------------|------------------------------|
| a 3 more than m | b 5 less than m | c twice as big as m |
| d half as big as m | e m more than 7 | f m less than 11 |

2 Write an expression for the number that is

- | | | |
|-------------------------------------|---------------------------------|----------------------------------|
| a the product of m and n | b the sum of m and n | c m more than n |
| d n less than m | e m less than n | f m times as big as n |

3 n is an odd number. Write an expression for

- | | |
|-----------------------------------|----------------------------------|
| a the next odd number | b the next even number |
| c the previous even number | d the previous odd number |

4 p is a prime number greater than 2. Write an expression for

- | | |
|------------------------------|-----------------------------------|
| a the next odd number | b the previous even number |
|------------------------------|-----------------------------------|

5 Each card below shows an expression that represents a number.

$$n + 2$$

$$n - 1$$

$$n + 5$$

- Write the numbers shown on the cards in order, smallest first.
- What is the median of the numbers?
- Find and simplify an expression for the sum of the numbers.
- Factorise your answer to part **c**.
- Write an expression for the mean of the numbers.
- What is the range of the numbers?

explanation 2

6 Write an expression for the number midway between each pair of values.

a $n, n + 2$

b $n - 1, n + 1$

c $3n, 3n + 4$

7 The numbers represented by the expressions on these cards are in order, smallest first.

$t + 2$

$2t$

$2t + 6$

$3t + 4$

a Write an expression for

i the median of the numbers

ii the range of the numbers

iii the sum of the numbers

iv the mean of the numbers

b What do you notice about the median and the mean?

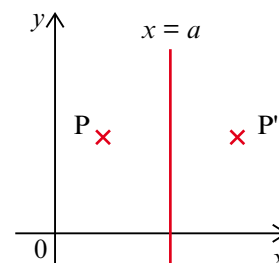
8 In this diagram, P has coordinates $(a - 2, 3)$.

a How far is P from the line $x = a$?

b P' is the image of P after reflection in the line $x = a$.

What are the coordinates of P'?

c What is the distance PP'?



9 Repeat question 8 but take the coordinates of P to be $(1, 5)$.

10 The point Q is mapped to Q' by the translation 3 right and 5 down.

Find the coordinates of Q' when Q is

a $(1, 7)$

b $(x, 3)$

c (x, y)

11 Describe the translation that will map $P(a - 1, b + 2)$ to $P'(a + 3, 2)$.

explanation 3

12 Write a formula for y in terms of x for each of these function machines.

a $x \rightarrow \boxed{\times 6} \rightarrow \boxed{- 5} \rightarrow y$

b $x \rightarrow \boxed{\div 3} \rightarrow \boxed{+ 1} \rightarrow y$

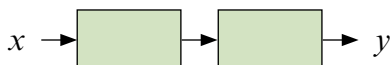
c $x \rightarrow \boxed{- 4} \rightarrow \boxed{\times 7} \rightarrow y$

d $x \rightarrow \boxed{+ 9} \rightarrow \boxed{\div 8} \rightarrow y$

13 To find T , start with n , double it, add 5 and divide the answer by 3.
Write a formula for T in terms of n .

14 To find y , start with x , divide it by 4 and add on 7.
Write a formula for y in terms of x .

15 a Copy and complete this function machine for the formula $y = 3(x + 5)$.



b Draw a function machine for the formula $P = 2n - 7$.

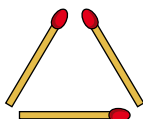
c Draw a function machine for the formula $R = \frac{d - 6}{10}$.

explanation 4

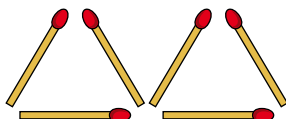
16 Here are some matchstick patterns.

a How many matchsticks will there be in Pattern 10?

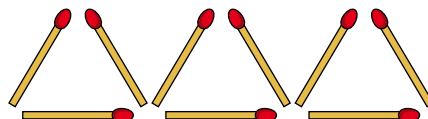
b Write a formula for the number of matchsticks, m , in Pattern n .



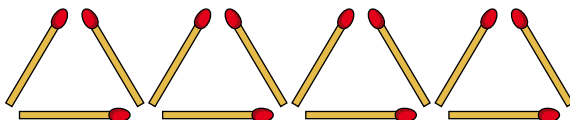
Pattern 1



Pattern 2

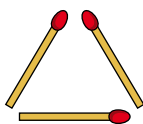


Pattern 3

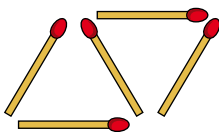


Pattern 4

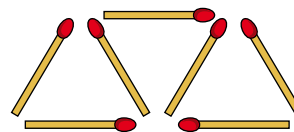
17 Here are some more matchstick patterns.



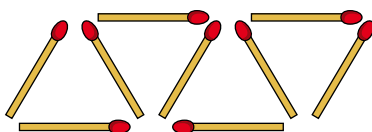
Pattern 1



Pattern 2



Pattern 3



Pattern 4

a Copy and complete the table below.

Pattern number (n)	Number of matchsticks (m)
1	
2	
3	
4	
5	
6	

b How many matchsticks will there be in Pattern 10?

c Find a formula for m in terms of n .

d Which pattern contains 301 matches?

18 a Write down the next two terms of the following sequence.

4, 7, 10, 13, ...

b What is the tenth term of the sequence?

c Find a formula for the n th term of the sequence.

19 a Write down the next two terms of the following sequence.

95, 90, 85, 80, ...

b What is the tenth term of the sequence?

c Find a formula for the n th term of the sequence.