

# Completing the Square



## Did you know?

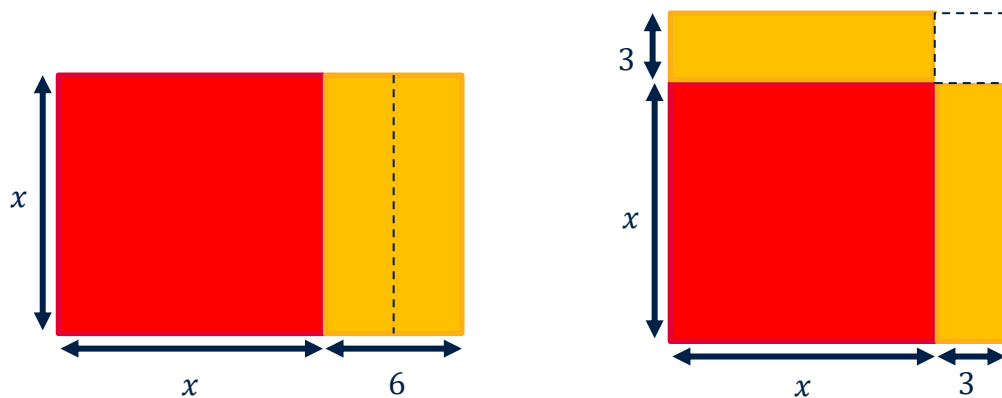
These are different forms of the same algebraic expression

$$x^2 + 6x = x(x + 6) = (x + 3)^2 - 9$$

expanded  
form

factorised  
form

completed  
square form



Do the diagrams help you see why this is called **Completing the square**?



## Completing the square 1



Write these expressions in the form  $(x + a)^2 + b$

1.  $x^2 + 4x$

5.  $x^2 - 12x + 41$

2.  $x^2 + 4x + 5$

6.  $k^2 + 10k - 2$

3.  $y^2 - 8y$

7.  $y^2 + 3y + 1$

4.  $y^2 - 8y + 7$

8.  $p^2 - 2p + 1$



## Completing the square 2



Write these expressions in the form  $(x + a)^2 + b$

1.  $x^2 + 10x$

5.  $x^2 - 8x + 25$

2.  $x^2 + 10x + 30$

6.  $k^2 + 14k - 1$

3.  $y^2 - 2y$

7.  $y^2 + 5y + 6$

4.  $y^2 - 2y + 3$

8.  $t^2 + 6t + 9$



## Different Forms




It is important to be able to convert expressions between the different forms:

expanded form

factorised form

completed square form

In this problem there are 4 sets of three equivalent expressions, however, some expressions are missing. Match the sets and find the 3 missing expressions.

$a^2 - 2a - 8$		$a^2 - 8a + 15$
	$a^2 + 2a - 15$	$(a + 2)(a + 4)$
$(a + 1)^2 - 16$	$(a - 3)(a - 5)$	
$(a + 5)(a - 3)$	$(a - 1)^2 - 9$	$(a + 3)^2 - 1$



## Extra Puzzle 1

What is the value of

$$\frac{\frac{(5^2 - 3^2)}{5 + 3} + \frac{(4^2 - 2^2)}{4 + 2} + \frac{(3^2 - 1^2)}{3 + 1}}{2} ?$$



## Extra Puzzle 2

Given that

$$55^2 - 45^2 = (55 + 45)(55 - 45) = 1000$$

and

$$60^2 - 40^2 = (60 + 40)(60 - 40) = 2000$$

- Find numbers  $a$  and  $b$  such that  $a^2 - b^2 = 3000$
- Find numbers  $c$  and  $d$  such that  $c^2 - d^2 = 4000$
- Find numbers  $e$  and  $f$  such that  $e^2 - f^2 = 100\,000$