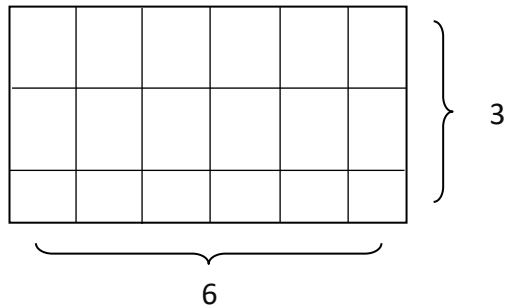


Algebra Basics

Algebra is generalized arithmetic.
Why?



Rectangle area – for one rectangle

$$A = 6 \times 3$$

Generalizes to



$$A = w \times h$$

for any rectangle

replace the numbers by letters and vice versa

Repeated Addition = Multiplication

Examples

$$1) \quad 6 + 6 + 6 + 6 + 6 = 5 \times 6 = 30 \quad (\text{or } 6 \times 5)$$

$$2) \quad a + a + a + a = 4 \times a = 4a \quad (\text{or } a \times 4)$$

we drop the \times sign

Here 4 is a counter for the number of a 's added together

$$3) \quad x + x = 2x$$

$$4) \quad t + t + t + 2 + 3 + t = 4t + 5 \quad \text{or} \quad 5 + 4t$$

$$5) \quad x + y + 2x - 3y = ?$$

This is the same as:

$$x + y + x + x - y - y - y = 3x - 2y$$

$$6) \quad a + a + a + x + a + x = 4a + 2x$$

NB $2 + 3 = 3 + 2$
 $2 \times 3 = 3 \times 2$

NB $xy \neq x + y$
 $2 \times 3 \neq 2 + 3$

NB The multiplication sign is dropped when algebraic (letter) terms are used



Repeated Multiplication = Power / Index / Exponent

Examples

1) $a \times a \times a = a^3$ Here 3 is a counter for the number of a 's multiplied together.

2) $y \times y \times y \times y = y^4$

3) $t \times t \times a \times t \times a \times t = a^2t^4$ (usually written in alphabetical order)

4) $y^2 \times y \times y^3 = y^6$ this is read as "y to the 6" or "y to the power of 6"

5) $2y \times 3y = 2 \times y \times 3 \times y = 6 \times y^2 = 6y^2$

The multiplication sign is dropped and the numbers are worked out separately to the letters.

6) $2y^4 \times y^3 \times y \times 3y^4 = 6y^{12}$

Order of Operations

First 	Brackets	$12 - (2 \times (1 + 1)) = 12 - (2 \times 2)$ $= 8$
	Operators – powers, roots, trig, functions	$3 \times 2^2 = 3 \times 4$ $= 12$
↓	\times and \div work left to right	$60 \div 2 \times 3 = 30 \times 3$ $= 90$
Last	$+$ and $-$ work left to right	$5 + 3 - 2 - 8 + 1 - 4 = -5$

Examples

1) $8 - 2 \times 3 + 2 \times 3^2 = 8 - 6 + 2 \times 9$
 $= 2 + 18$
 $= 20$

2) $4x^2y^6 \times (3x^2)^2 \div 6xy^2 = 4x^2y^6 \times 9x^4 \div 6xy^2$
 $= 36x^6y^6 \div 6xy^2$
 $= 6x^5y^4$



Exercises

1. $x + x + x + x + x + x + x =$

2. $a^6 \times a^3 \times a^4 \times a =$

3. $2a + 3a - a =$

4. $x \times x \times x^2$

5. $3x \times 4x =$

6. $x \times a \times y =$

7. $2ac \times 3c =$

8. $6a + 3 + 4a + 5 =$

9. $10a - 3a + y - 4y =$

10. $2 \times x \times 3 \times x \times 4 \times x =$

11. $14xy + 6a - 8xy + 5a =$

12. $2x \times 4y + 3x \times 4x^2 + 7x \times y =$

13. $24x^2y \div (10xy^3) =$

14. $9a - 16a \div a - a + 20 =$

Answers:

1. $7x$

2. a^{14}

3. $4a$

4. x^4

5. $12x$

6. axy

7. $6ac^2$

8. $10a + 8$

9. $7a - 3y$

10. $24x^2$

11. $6xy + 11a$

12. $15xy + 12x^3$

13. $12x/(5y^2)$

14. $8a + 4$