



Powers

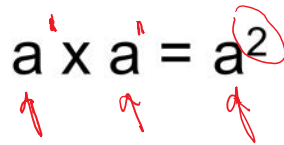
Aims:

To remember how to work out the HCF & LCM from any given pair of numbers

To be able to understand how indices (powers) work in algebra

To be able to manipulate the powers in an expression in order to simplify it

Powers Rules

$$a^1 \times a^1 = a^2$$


$$a \times a \times a \times a = a^4$$

Rule 1:

When you ***multiply*** powers of the same letter or number you ***add*** the indices...

But, what is $a^2 \times a^4$?

It's $(a \times a) \times (a \times a \times a \times a) = a^6$

What did you do with the powers?

You added them!

Indices Questions

If the bases are the same, you add the powers.

$$a^3 \times a^6 \times a^2 = a^{(3+6+2)} = a^{11}$$

$$c^3 \times c^5 \times c^1 = c^9$$

$$2y^2 \times 4y^5 = 8y^7$$

$$3m^3 \times 4m^5 = 12m^8$$

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①

$$3c^2 \times 3c^5 \times a^2 \times 2a^4$$

②

$$2a^4 \times 3a^6 + 2a^2 \times 2a^3$$

①

$$9c^7 \times 2a^6$$

$$18c^7a^6$$

②

$$6a^{10} + 4a^5$$

Harder Indices Questions

Q1. $2a^3b^6 \times a^6b^2 = 2a^9b^8$

Q2. $3c^5d^4 \times 5c^2d^4 = 15c^7d^8$

Q3. $2ab^4 \times 4a^2b^3 = 8a^3b^7$

Q4. $3mnp^3 \times 4mn^2p^5 = 12m^2n^3p^8$

$$a^3 \times a^6$$

$$a \times a \times a \times a \times a \times a \times a \times a \times a \times a$$

$$2^2 \times 2^3$$

$$= 2^5$$

Powers

$$a \times a \times a \times a \times a = a^5$$

$$a \times a \times a = a^3$$

Rule 2:

When you **divide** powers of the same letter or number you **subtract** the indices...

But, what is $a^5 \div a^3$?

It's $(a \times a \times a \times a \times a) \div (a \times a \times a) = a^2$

What did you do with the powers?

You subtracted them!

$$a^5 \div a^3$$

$$\frac{a^5}{a^3} = \frac{a \times a \times a \times a \times a}{a \times a \times a}$$

$$= a \times a = a^2$$

Indices Questions

$$a^6 \div a^2 = a^4$$

$$c^3 \div c^5 = \frac{\cancel{c} \times \cancel{c} \times \cancel{c}}{\cancel{c} \times \cancel{c} \times \cancel{c} \times c \times c}$$

$$\frac{3y^2 \times 4y^5}{2y^3} = \frac{12y^7}{2y^3}$$

$$6y^4$$

$$\frac{M}{S} \text{ or } m s^{-1}$$

$$\frac{1}{c^2} = c^{-2}$$

$$\text{or } c^3 \div c^5 = c^{(3-5)} = c^{-2}$$

Harder Indices Questions

Q1. $\frac{4a^6 \times 8a^2}{2a^9} =$

Q2. $\frac{30y^2 \times 4y^5}{6 \times y^4} =$

$$1/ \frac{32a^8}{2a^9}$$

$$16a^{(8-9)}$$

$$= 16a^{-1}$$

$$= \frac{16}{a}$$

$$2/ \frac{120y^7}{6y^4}$$

$$= 20y^3$$

Powers

$$a \times a \times a = a^3$$

What do you think is...

$$(a^3)^2 \\ = a^3 \times a^3 = \underline{a^6}$$

Rule 3:

When you **raise** a power by another power (separated by brackets) you **multiply** the indices...

what did you do with the powers here?

multiplied them!

$$(a^3)^2 = a^3 \times a^3 = a^6$$

Indices Questions

Q1. $(a^2)^4 \times (a^3)^2 = a^{14}$

Q2. $4(a^2)^3 = 4(a^2)(a^2)(a^2)$
 $= 4a^6$

Q3. $(4a^2)^3 = (4a^2)(4a^2)(4a^2)$

Q4. $(5ab^3)^2 = 25a^2b^6$

$(5ab^3)(5ab^3) = 25a^2b^6$

$$(a^2)(a^2)(a^2)(a^2)(a^3)(a^3)$$

$$2+2+2+2+3+3$$

$$= a^{14}$$

$$= a^{14}$$

or

$$a^8 \times a^6 = a^{14}$$

Have you really understood indices??

$$\frac{(2a^4)^5 \times 4(a^3)^6 \times ((a^5)^6)^2}{a^7 \times a^{19} \times (2a^9)^3}$$

$$\frac{(2^5)(a^4)^5(4)(a^3)^6 a^{60}}{(a^{26})(2)^3(a^9)^3}$$

$$\frac{(32)(a^{20})(4)(a^{18})(a^{60})}{8(a^{26})(a^{27})}$$

$$= \frac{128a^{98}}{8a^{53}}$$

$$= 16a^{45}$$

Simplify the following expressions:

1) $-4d + 6d$

2) $-5e - 4e$

3) $3f + 6g + 4f + 5g$

4) $5h + 8i - 3i - 2h$

5) $2p \times 5p$

6) $8q \times 7q^4$

7) $10rq \times 3r$

8) $9t^2u^3 \times 5t^3u^5$

9) $100w^4 \div 10w^2$

10) $63y^9 \div 9y^5$

11) $18a^3z^6 \div 6az^3$

12) $5(b - 8)$

13) $3c(4c + 8)$

14) $6d^2(3d - 8)$

15) $3ef(5ef + 2e)$

16) $3g^3h^2(2gh - 5g^2h^6)$

17) $5j^5k^4(3j^2k^3 + 8k^3m^2)$

18) $5(n + 6) + 4(n - 3)$

19) $2(3p - 7) - 3(2p + 1)$

20) $6q(5q^2 + 2q) + 3q(q - 1)$

Expanding the Brackets

Expand these expressions:

$$3(a + b) = 3 \times (a + b)$$

$$4(y + 6) = 4 \times (y + 6)$$

$$2(2a + 3b - 4c) = 2 \times (2a + 3b - 4c)$$

$$(3a) + (3b)$$

$$4y \times 24$$

$$4a + 6b - 8c$$

$$1/ \quad 3(2c + 4d - 5e) = (3)(2c) + (3)(4d) - (3)(5e) \\ 6c + 12d - 15e$$

$$2/ \quad c(8a + 4b - 2c) = 8ac + 4bc - 2c^2$$

$$3/ \quad -e(-2b - 2c + 3b) = 2be + 2ce - 3be \\ = 2ce - be$$

Expand the brackets...

$$1) 4(2p - 12) = 8p - 48$$

$$2) 5(2a + 4b) = 10a + 20b$$

$$3) 3(4c - 4b) = 12c - 12b$$

$$4) 7(3e + 2f - 4g) = 21e + 14f - 28g$$

$$5) 9(6w + 2y - 7z) = 54w + 18y - 63z$$

$$6) 10(3b - 9m) = 30b - 90m$$

$$7) 6(-6j - 7m) = -36j - 42m$$

$$8) 5(4a - 3b) = 20a - 15b$$

Factorising

Aims:

- To remember how to expand brackets, including expressions with indices
- To learn what the process factorising is and be able to apply it to any expression

Factorising

Reminder of how to expand brackets:

$$4(2m - 5) = \underline{8m - 20}$$

What is factorising then?

$$\text{Q1. } 8m - 20 = 4(2m - 5)$$

Factorising

Q2.

$$25a - 30b = 5(2m - 5)$$

Q3.

$$40a + 6a^2 = 2a(20 + 3a)$$

Adding Bracketed Expressions

Aims:

- ❖ To be able to multiply out the brackets from expressions...
- ❖ ... and then collect like-terms and simplify

Adding Bracketed Expressions

$$4(a + 5b) + 3(7a - b) =$$

$$4a + 20b + 21a - 3b =$$

Adding Bracketed Expressions

$$2(7a - 6b) + 6(3a + b) =$$

$$14a - 12b + 18a + 6b =$$

Questions

1) $7(2a - 4b) + 2(2a + b)$

2) $2(3y - w) + 3(2y + 5w)$

3) $4(p + q) + 5(2p - 3q)$

4) $6(2n + m) + 2(n - m)$

5) $2(4s + r) + 7(2s - 3r)$

Subtracting Bracketed Expressions

$$3(2a - 4b) - 2(a + 2b) =$$

Subtracting Bracketed Expressions

$$3(2a - 4b) - 2(a + 2b) =$$

$$6a - 12b - 2a - 4b =$$

Subtracting Bracketed Expressions

$$3(2a - 4b) - 2(a + 2b) =$$

$$6a - 12b - 2a - 4b =$$

$$4a - 16b$$

Subtracting Bracketed Expressions

$$3(2p + 3q) - 4(p - 2q) =$$

Subtracting Bracketed Expressions

$$3(2p + 3q) - 4(p - 2q) =$$

$$6p + 9q - 4p + 8q =$$

Subtracting Bracketed Expressions

$$3(2p + 3q) - 4(p - 2q) =$$

$$6p + 9q - 4p + 8q =$$

$$\underline{2p + 17q}$$

Invisible 1

$$7(m - 2n) - (m - 3n) =$$

Invisible 1

$$7(m - 2n) - (m - 3n) =$$

$$7m - 14n - m + 3n =$$

Invisible 1

$$7(m - 2n) - (m - 3n) =$$

$$7m - 14n - m + 3n =$$

$$6m - 11n$$

Questions

1) $3(4n + 5m) - 5(2n - 4m)$

2) $5(n - 2m) - (m + 2n)$

3) $3(2n + 6m) - 6(n - 2m)$

4) $2(3n - m) - 7(n - 5m)$

5) $8(5n - m) - 2(2n + m)$

Questions

1) $3(4n + 5m) - 5(2n - 4m)$

2) $5(n - 2m) - (m + 2n)$

3) $3(2n + 6m) - 6(n - 2m)$

4) $2(3n - m) - 7(n - 5m)$

5) $8(5n - m) - 2(2n + m)$

Multiplying two brackets

$$(a + b)(c + d)$$

$$ac + bc + ad + bd$$

F	I	O	S
1	n	u	e
r	s	t	c
s	i	s	o
t	d	i	n
s	e	d	d
	s	e	s

eg F I O S

$$(2a + 3b)(4a + 2c)$$

$$(2a)(4a) + (3b)(4a) + (2a)(2c) + (3b)(2c)$$

$$8a^2 + 12ab + 4ac + 6bc$$

$$1/ (x + 2y)(2x - 3y)$$

$$(x)(2x) + (2x)(2y) + (x)(-3y) + (2y)(-3y)$$

$$2x^2 + 4xy - 3xy - 6y^2$$

$$2x^2 + xy - 6y^2$$