Using the addition law for indices

1 **a)** Fill in the gaps in the calculation.

$2^4 \times 2^3 = 2 \times 2 \times 2 \times 2 \times \boxed{2} \times \boxed{2} \times \boxed{2} = 2^{\boxed{7}}$

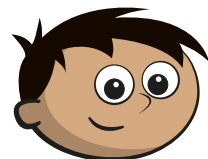**b)** What happens to the base value when 2^4 and 2^3 are multiplied?

It stays the same.

c) What happens to the indices when 2^4 and 2^3 are multiplied?
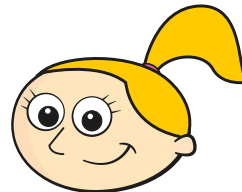
You add them together.

2 Amir and Eva are both trying a problem.

Simplify $3^{10} \times 3^{20}$

It is going to take a long time to answer this question because I have to write out the whole multiplication.

I can do it without writing out the multiplication.

What has Eva noticed?

3 Complete the statements.

a) $3^4 \times 3^5 = 3^{\boxed{9}}$

b) $4^2 \times 4^6 = \boxed{4^8}$

c) $7^8 \times 7^{10} = \boxed{7^{18}}$

d) $a^4 \times a^3 \equiv \underline{a^7}$

e) $y^{11} \times y^6 \equiv \underline{y^{17}}$

f) $p^4 \times p^7 \equiv \underline{p^{11}}$

4 The addition rule for indices can be described using algebra.

Complete the statement.

The addition rule for indices is $x^a \times x^b \equiv \underline{x^{a+b}}$

Describe the rule in your own words.

When multiplying, if the base is the same you can add the powers.

5 Simplify the expressions.

a) $x^3 \times x^4 \times x^5 \equiv \underline{x^{12}}$

b) $v^7 \times v^7 \times v^7 \equiv \underline{v^{21}}$

c) $h^3 \times h^8 \times h^{10} \equiv \underline{h^{21}}$

d) $w^{50} \times w^{100} \times w^{250} \equiv \underline{w^{400}}$

6 Identify and explain the mistake that has been made in each statement.

a) $3^2 \times 3^4 = 3^8$

Indices have been multiplied.
It should be $3^2 \times 3^4 = 3^6$

b) $5^2 \times 5^3 = 25^5$

Bases have been multiplied.
It should be $5^2 \times 5^3 = 5^5$

c) $10^4 + 10^5 = 10^9$

They are being added not multiplied.
$10^4 + 10^5$ can't be simplified.

d) $5^3 \times 2^6 = 7^9$

Bases have been added. The bases aren't the same so $5^3 \times 2^6$ can't be simplified.
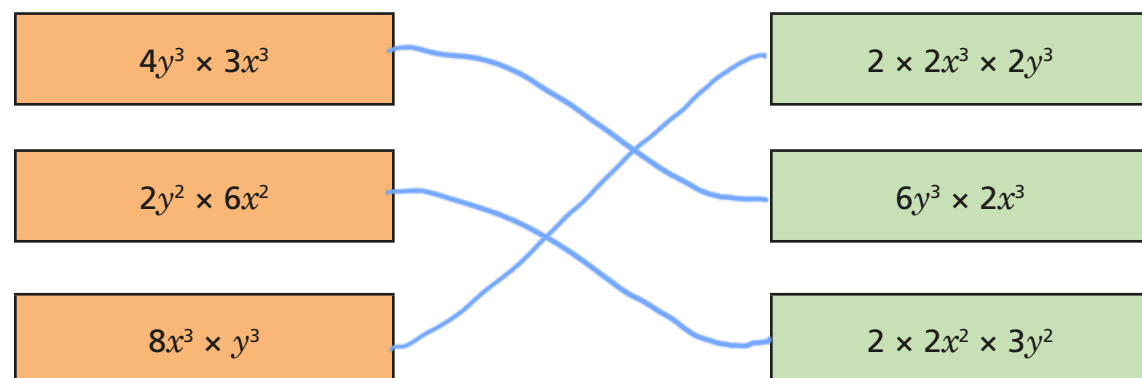
7 Simplify the expressions.

a) $a^3 \times b^2 \times a^4 \times b^5 \equiv a^{\boxed{7}} \times b^{\boxed{7}} \equiv \underline{a^7 b^7}$

b) $m^4 n^3 \times m^2 n^3 \equiv \underline{m^6 n^6}$

c) $p^2 q^2 \times p^3 r^3 \times q^4 r^4 \equiv \underline{p^5 q^6 r^7}$

8 Match the equivalent expressions.

$4y^3 \times 3x^3$	$2 \times 2x^3 \times 2y^3$
$2y^2 \times 6x^2$	$6y^3 \times 2x^3$
$8x^3 \times y^3$	$2 \times 2x^2 \times 3y^2$

9 Fill in the missing powers and coefficients.

a) $2k^3 \times 4k^{\boxed{3}} \equiv \boxed{8} k^6$

b) $2m^2 \times 3m^{\boxed{10}} \times \boxed{5} m^4 \equiv 30m^{16}$

c) $3d^{\boxed{3}} \times \boxed{2} D^2 \times 2d^4 \times 3D^{\boxed{3}} \equiv 36d^7 D^5$

10 Find the value of x.

a) $2^7 \times 2^x = 2^{12}$

$x = \boxed{5}$

c) $d^x \times d^{x+1} = d^{11}$

$x = \boxed{5}$
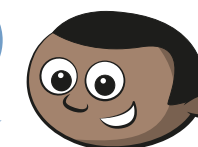
b) $3^x \times 3^x \times 3^4 = 3^{20}$

$x = \boxed{8}$

d) $5^{2x} \times 5^x \times 5^2 = 5^{23}$

$x = \boxed{7}$

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> $3^4 \times 3 \equiv 3^4$, because there is no power on the 3

a) Write out the full multiplication to show why Mo is incorrect.

$\underline{3 \times 3 \times 3 \times 3 \times 3 \equiv 3^5}$

b) Simplify the expressions.

$4^6 \times 4$	5×5^7	$a^3 \times a^2 \times a$	$3b^4 \times 4b$

$\boxed{4^7}$ $\quad$ $\boxed{5^8}$ $\quad$ $\underline{a^6}$ $\quad$ $\underline{12b^5}$