WALT practice index laws

Success criteria I know how to apply the index laws

Example three is covering three laws

a) **Multiply**
b) **Divide**
c) **Powers outside the bracket**
d) **Any number raised to the power of zero is equal to 1**

EXAMPLE 3

Use the index laws to simplify the following.

a $y^7 \times y^3$ **b** $y^{18} \div y^{17}$

c $(b^5)^{32}$

Index comes from the Latin word 'indicare': to point, disclose, show; as in using your index finger.

	Solve	Think	Apply
a	$y^7 \times y^3 = y^{10}$	$y^7 \times y^3 = y^{7+3}$ $= y^{10}$	When multiplying powers with the same base, add the indices.
b	$y^{18} \div y^{17} = y^1 = y$	$y^{18} \div y^{17} = y^{18-17}$ $= y^1 = y$	When dividing powers with the same base, subtract the indices.
c	$(b^5)^3 = b^{15}$	$(b^5)^3 = b^{5 \times 3}$ $= b^{15}$	When raising a power of a number to a higher power, multiply the indices.

5 Use the index laws to simplify the following.

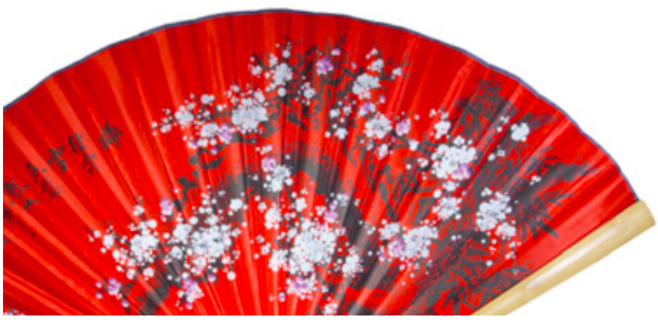
a $m^3 \times m^6$ **b** $q^8 \times q^7$ **c** $t^{10} \times t^9$ **d** $b^{15} \times b \times b^4$ **e** $v \times v^5 \times v^7$

6 Use the index laws to simplify the following.

a $a^{12} \div a^{10}$ **b** $x^{15} \div x^5$ **c** $w^8 \div w^2$ **d** $b^6 \div b^5$ **e** $z^{20} \div z^{19}$

7 Use the index laws to simplify the following.

a $(b^4)^2$ **b** $(h^5)^3$ **c** $(k^8)^2$ **d** $(z^{10})^6$ **e** $(n^2)^4$



8 Use the index laws to simplify the following.

a $m^4 \times m^2$ **b** $x^9 \div x^6$

c $(b^4)^6$ **d** $m^3 \times m^6 \times m^4$

e $(v^7)^{10}$ **f** $n^8 \div n^7$

g $b^8 \div b$ **h** $(y^5)^5$

i $t^{10} \times t^{20} \times t$ **j** $a^{12} \div a^6$

EXAMPLE 4

Explain why the index laws cannot be used to simplify the following.

a $p^3 \times q^4$ **b** $m^6 \div n^4$

	Solve/Think	Apply
a	$p^3 \times q^4 = p \times p \times p \times q \times q \times q \times q$ $= p^3q^4$ As the bases are not the same, we cannot simplify further.	The index laws can only be used if the bases are the same.
b	$m^6 \div n^4 = \dfrac{m \times m \times m \times m \times m \times m}{n \times n \times n \times n}$ $= \dfrac{m^6}{n^4}$ Again, as the bases are not the same, we cannot simplify further.	

9 Explain why the index laws cannot be used to simplify the following.

a $k^5 \times m^3$ **b** $x^9 \div y^6$

10 Determine whether these statements are true or false. If they are false, rewrite the answer to make them true.

a $b^4 \times b^3 = b^7$ **b** $m^5 \times m^2 = m^{10}$ **c** $p^4 \times p^5 = p^{20}$ **d** $e^6 \times e^{10} = e^{16}$

e $a^4 \times b^5 = ab^9$ **f** $z^{10} \div z^2 = z^8$ **g** $p^{12} \div p^3 = p^4$ **h** $t^8 \div t^7 = t$

i $w^{15} \div w^3 = w^5$ **j** $\dfrac{p^6}{q^2} = \dfrac{p^4}{q}$ **k** $(b^7)^2 = b^{14}$ **l** $(n^{10})^3 = n^{13}$

B Applying the index laws

EXAMPLE 1

Simplify the following.

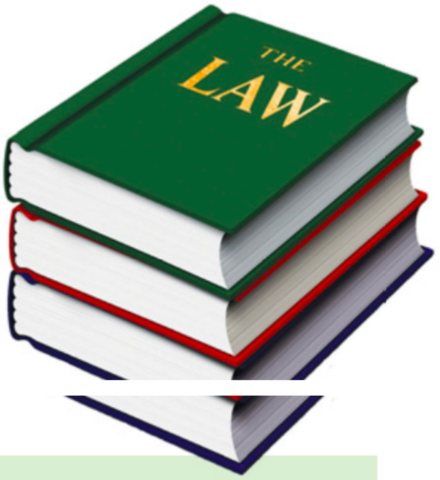
a $\dfrac{p^5 \times p^6}{p^8}$ **b** $\dfrac{(a^5)^4}{a^3 \times a^2}$

	Solve	Think	Apply
a	$\dfrac{p^5 \times p^6}{p^8} = p^3$	$\dfrac{p^5 \times p^6}{p^8} = \dfrac{p^{5+6}}{p^8}$ $= \dfrac{p^{11}}{p^8}$ $= p^{11-8}$ $= p^3$	When multiplying powers with the same base, add the indices. When dividing, subtract the indices.
b	$\dfrac{(a^5)^4}{a^3 \times a^2} = \dfrac{a^{20}}{a^5}$ $= a^{15}$	$\dfrac{(a^5)^4}{a^3 \times a^2} = \dfrac{a^{5\times 4}}{a^{3+2}}$ $= \dfrac{a^{20}}{a^5}$ $= a^{20-5}$ $= a^{15}$	When raising a power to a higher power, multiply the indices.

Exercise 2B

1 Simplify the following.

a $\dfrac{x^5 \times x^7}{x^6}$	**b** $\dfrac{w^3 \times w^{10}}{w^8}$	**c** $\dfrac{m^8 \times m^4}{m^{10}}$
d $\dfrac{k^{10} \times k^6}{k^8 \times k^5}$	**e** $\dfrac{a^7 \times a^6}{a^8 \times a^2}$	**f** $\dfrac{y^9 \times y^{11}}{y^{10} \times y^8}$
g $\dfrac{z^{16} \times z^2}{z^{10} \times z^7}$	**h** $\dfrac{x^{14}}{x^3 \times x^4}$	**i** $\dfrac{k^{30}}{k^{16} \times k^5}$
j $(m^2)^3 \times m^5$	**k** $(a^4)^5 \times (a^3)^4$	**l** $\dfrac{(t^5)^6}{t^{10}}$
m $\dfrac{(y^5)^5}{y^{20}}$	**n** $\dfrac{a^{16} \times a^6 \times a^4}{a^{12} \times a^8 \times a}$	**o** $\dfrac{b^{10} \times b^{20} \times b^{30}}{(b^4)^5}$



EXAMPLE 2

Simplify the following.

a $5m^4 \times 3m^6$ **b** $2k^7 \times 4k^3 \times 3k^5$

	Solve	Think	Apply
a	$5m^4 \times 3m^6 = 15m^{10}$	$5m^4 \times 3m^6 = 5 \times 3 \times m^4 \times m^6$ $= 15 \times m^{4+6}$ $= 15m^{10}$	Multiply the numerical coefficients and use the index laws to multiply the pronumerals.
b	$2k^7 \times 4k^3 \times 3k^5 = 24k^{15}$	$2k^7 \times 4k^3 \times 3k^5 = 2 \times 4 \times 3 \times k^7 \times k^3 \times k^5$ $= 24 \times k^{7+3+5}$ $= 24k^{15}$	

2 Simplify the following.

a $4m^5 \times 3m^7$	**b** $5p^4 \times 2p^6$	**c** $3t^8 \times 6t^4$
d $10a^{12} \times 7a^4$	**e** $4w^9 \times 6w^{10}$	**f** $5b^3 \times 6b^2 \times b^4$
g $3z^6 \times 4z^8 \times 2z^3$	**h** $2q^5 \times 5q^7 \times 8q^6$	**i** $d^4 \times 6d^6 \times 3d^8$

1 **a** Use the index laws to simplify $a^4 \div a^4$.
b Hence show that $a^0 = 1$.

EXAMPLE 2

Evaluate the following.

a x^0 **b** $(3x)^0$ **c** $3x^0$

	Solve	Think/Apply
a	$x^0 = 1$	Any number raised to the power zero is equal to 1.
b	$(3x)^0 = 1$	$3x = 3 \times x$ is a number. Any number raised to the power zero is equal to 1.
c	$3x^0 = 3$	$3x^0 = 3 \times x^0$ $= 3 \times 1$ $= 3$ The 3 is not to the power zero; only the x is to the zero power.

2 Evaluate the following.

a y^0	**b** $(3y)^0$	**c** $3y^0$	**d** $4k^0$
e $9t^0$	**f** $(6z)^0$	**g** $(10m)^0$	**h** $10m^0$
i $8b^0$	**j** $(7q)^0$	**k** $3m^0 + 1$	**l** $9e^0 - 3$
m $6p^0 + 7$	**n** $3a^0 + 2b^0$	**o** $6x^0 - 4y^0$	