Indices

Definition

$2\times 2=2^2 \qquad 2\times 2\times 2=2^3 \qquad 2\times 2\times 2\times 2\times 2=2^5$

Multiplication

$2^2\times 2^3=2\times 2\times 2\times 2\times 2=2^5$ *and* $2^3\times 2^5=2\times 2\times 2\times 2\times 2\times 2\times 2\times 2=2^8$

So, the multiplication rule is adding indices

For example, $2^2\times 2^3=2^{2+3}=2^5$ *and* $2^3\times 2^5=2^{3+5}=2^8$

Division

$2^3\div 2^2=\dfrac{2\times 2\times 2}{2\times 2}=2,\ 2^5\div 2^3=\dfrac{2\times 2\times 2\times 2\times 2}{2\times 2\times 2}=2^2$ *and* $2^8\div 2^5=\dfrac{2\times 2\times 2\times 2\times 2\times 2\times 2\times 2}{2\times 2\times 2\times 2\times 2}=2^3$

So, the division rule is subtracting indices

For example, $2^3\div 2^2=2^{3-2}=2,\qquad 2^5\div 2^3=2^{5-3}=2^2 \qquad$ *and* $\qquad 2^8\div 2^5=2^{8-5}=2^3$

Work out the following:

(*a*) $2^7\times 2^3$ (*b*) $2^6\times 2^3$ (*c*) $2^9\times 2^4$ (*d*) $2^{15}\times 2^4$ (*e*) $2^{23}\times 2^{11}$

(*f*) $2^{10}\div 2^5$ (*g*) $2^{13}\div 2^7$ (*h*) $2^{29}\times 2^{15}$ (*i*) $2^{32}\div 2^{16}$ (*j*) $2^{64}\div 2^{48}$

(*k*) $\dfrac{2^3\times 2^8}{2^5}$ (*l*) $\dfrac{2^7\times 2^{10}}{2^8\times 2^3}$ (*m*) $\dfrac{2^{15}\times 2^3}{2^2\times 2^5\times 2^4}$ (*n*) $\dfrac{2^8}{2^{10}}$ (*o*) $\dfrac{2^7\times 2^3}{2^8\times 2^5}$

(*p*) $(3^2)^2$ (*q*) $(5^4)^3$ (*r*) $(7^2)^5$ (*s*) $(x^2)^3$ (*t*) $\left(x^{\frac{2}{1}}\right)^{\frac{1}{2}}\div\left(x^{\frac{1}{3}}\right)^3$ (*u*) $\left(2n^{\frac{2}{3}}\right)^4\div 8n^0$

(*v*) a^0 (*w*) 2^0 (*x*) *If* $2^x=16$ *find x.* (*y*) $4^{\frac{1}{2}}$ (*z*) $(27)^{\frac{2}{3}}$

Extension: (*i*) $\dfrac{1}{8}=2^a$ (*ii*) $2^{c-1}=16$ *Find a & c in the extension part*