

### Ejercicio 1 Reduce paso a paso a una única potencia de exponente natural

a)  $(-5)^8 : [(-45)^2 : 9^2] \cdot (2^2)^3 = (-5)^8 : (-5)^2 \cdot 2^6 = (-5)^6 \cdot 2^6 = (-10)^6 = 1000000$

b)  $[3^4 \cdot (-2)^4]^{-1} : [(-12)^3 : 2^3]^2 \cdot (-6)^6 = [(-6)^4]^{-1} : [(-6)^3]^2 \cdot (-6)^7 = (-6)^{-4} : (-6)^6 \cdot (-6)^7 = (-6)^{-10} : (-6)^7 =$   
 $= (-6)^{-3} = \left(-\frac{1}{6}\right)^3 = -\frac{1}{216}$

c)  $[(-24)^4 : 3^4]^3 \cdot [(-2)^{14} \cdot (-4)^{14}]^{-1} = [(-8)^4]^3 \cdot (8^{14})^{-1} = \frac{(-8)^{12} \cdot 8^{-14}}{\text{exponente par}} = 8^{12} \cdot 8^{-14} = 8^{-2} = \left(\frac{1}{8}\right)^2 = \frac{1}{64}$

d)  $[(-4)^{11} : (-4)^{-3}] \cdot (6^2)^7 : (24^{-3})^{-5} = (-4)^{14} \cdot 6^{14} : 24^{15} = \frac{(-24)^{14} : 24^{15}}{\text{exponente par}} = 24^{14} : 24^{15} = 24^{-1} = \frac{1}{24}$

e)  $25^3 : \frac{(-5)^2}{\text{exponente par}} \cdot 125^{-2} = (5^2)^3 : 5^2 \cdot (5^3)^{-2} = 5^6 : 5^2 \cdot 5^{-6} = 5^4 \cdot 5^{-6} = 5^{-2} = \left(\frac{1}{5}\right)^2 = \frac{1}{25}$

f)  $\frac{(-2)^{21}}{\text{exponente impar}} \cdot 32^{-1} : 16^3 = -2^{21} \cdot (2^5)^{-1} : (2^4)^3 = -2^{21} \cdot 2^{-5} : 2^{12} = -2^{16} : 2^{12} = -2^4 = -16$

g)  $\left[7^3 \cdot \left(\frac{1}{2}\right)^3\right]^4 \cdot \left[\left(\frac{2}{7}\right)^5 : \left(\frac{2}{7}\right)^3\right]^7 : \left(-\frac{3}{7}\right)^2 = \left[\left(\frac{7}{2}\right)^3\right]^4 \cdot \left[\left(\frac{2}{7}\right)^2\right]^7 : \left(-\frac{3}{7}\right)^2 = \left(\frac{7}{2}\right)^{12} \cdot \left(\frac{2}{7}\right)^{14} : \left(-\frac{3}{7}\right)^2 =$   
 $= \left(\frac{2}{7}\right)^{-12} \cdot \left(\frac{2}{7}\right)^{14} : \left(-\frac{3}{7}\right)^2 = \left(\frac{2}{7}\right)^2 : \left(-\frac{3}{7}\right)^2 = \left(-\frac{2}{3}\right)^2 = \frac{4}{9}$

h)  $\frac{\left(-\frac{4}{3}\right)^2}{\text{exponente par}} : \left[\left(\frac{3}{4}\right)^4 \cdot \left(\frac{3}{4}\right)\right]^{-1} \cdot \left(-\frac{4}{5}\right)^3 = \left(\frac{4}{3}\right)^2 : \left[\left(\frac{3}{4}\right)^5\right]^{-1} \cdot \left(-\frac{4}{5}\right)^3 = \left(\frac{4}{3}\right)^2 : \left(\frac{3}{4}\right)^{-5} \cdot \left(-\frac{4}{5}\right)^3 =$   
 $= \left(\frac{3}{4}\right)^{-2} : \left(\frac{3}{4}\right)^{-5} \cdot \left(-\frac{4}{5}\right)^3 = \left(\frac{3}{4}\right)^3 \cdot \left(-\frac{4}{5}\right)^3 = \left(-\frac{3}{5}\right)^3 = -\frac{27}{125}$

i)  $\frac{\left(-\frac{3}{5}\right)^9}{\text{exponente impar}} : \left[\left(\frac{5}{3}\right)^2 : \left(\frac{5}{3}\right)^{-4}\right]^{-2} : \left(\frac{9}{25}\right)^{10} = -\left(\frac{3}{5}\right)^9 : \left[\left(\frac{5}{3}\right)^6\right]^{-2} : \left(\frac{9}{25}\right)^{10} = -\left(\frac{3}{5}\right)^9 : \left(\frac{5}{3}\right)^{12} : \left(\frac{9}{25}\right)^{10} =$   
 $= -\left(\frac{3}{5}\right)^9 : \left(\frac{3}{5}\right)^{-12} : \left(\frac{9}{25}\right)^{10} = -\left(\frac{3}{5}\right)^{21} : \left(\frac{9}{25}\right)^{10} = -\left(\frac{3}{5}\right)^{21} : \left(\left(\frac{3}{5}\right)^2\right)^{10} = -\left(\frac{3}{5}\right)^{21} : \left(\frac{3}{5}\right)^{20} = -\left(\frac{3}{5}\right)^1 = -\frac{3}{5}$

$$\begin{aligned}
 \text{j)} \quad & \left[ \left( \frac{2}{3} \right)^2 \right]^3 : \left[ (-3)^3 \cdot \left( -\frac{1}{5} \right)^3 \right]^{-2} \cdot \left( \frac{25}{16} \right)^3 = \left( \frac{2}{3} \right)^6 : \left[ \left( \frac{3}{5} \right)^3 \right]^{-2} \cdot \left( \frac{25}{16} \right)^3 = \left( \frac{2}{3} \right)^6 : \left( \frac{3}{5} \right)^{-6} \cdot \left( \frac{25}{16} \right)^3 = \\
 & = \left( \frac{2}{3} \right)^6 \cdot \left( \frac{5}{3} \right)^6 \cdot \left( \frac{25}{16} \right)^3 = \left( \frac{2}{5} \right)^6 \cdot \left( \frac{25}{16} \right)^3 = \left( \frac{2}{5} \right)^6 \cdot \left( \frac{5}{4} \right)^3 = \left( \frac{2}{5} \right)^6 \cdot \left( \frac{5}{4} \right)^6 = \left( \frac{1}{2} \right)^6 = \frac{1}{64}
 \end{aligned}$$

$$\begin{aligned}
 \text{k)} \quad & \underbrace{\left( -\frac{1}{5} \right)^9}_{\substack{\text{exponente} \\ \text{impar}}} : \left[ \left( \frac{2}{3} \right)^2 : \left( \frac{3}{2} \right) \right]^3 \cdot \left( \frac{100}{9} \right)^6 = -\left( \frac{1}{5} \right)^9 : \left[ \left( \frac{2}{3} \right)^2 : \left( \frac{2}{3} \right)^{-1} \right]^3 \cdot \left( \frac{100}{9} \right)^6 = -\left( \frac{1}{5} \right)^9 : \left[ \left( \frac{2}{3} \right)^3 \right]^3 \cdot \left( \frac{100}{9} \right)^6 = \\
 & = -\left( \frac{1}{5} \right)^9 : \left( \frac{2}{3} \right)^9 \cdot \left( \frac{100}{9} \right)^6 = -\left( \frac{3}{10} \right)^9 \cdot \left( \frac{10}{3} \right)^6 = -\left( \frac{3}{10} \right)^9 \cdot \left( \frac{10}{3} \right)^{12} = -\left( \frac{10}{3} \right)^9 \cdot \left( \frac{10}{3} \right)^{12} = -\left( \frac{10}{3} \right)^3 = -\frac{1000}{27}
 \end{aligned}$$

$$\begin{aligned}
 \text{l)} \quad & \underbrace{\left( -\frac{5}{2} \right)^{15}}_{\substack{\text{exponente} \\ \text{impar}}} \cdot \left[ \left( \frac{1}{6} \right)^3 : \left( \frac{1}{3} \right)^3 \right]^5 \cdot \left( \frac{25}{16} \right)^{-8} = -\left( \frac{5}{2} \right)^{15} \cdot \left[ \left( \frac{1}{2} \right)^3 \right]^5 \cdot \left( \frac{25}{16} \right)^{-8} = -\left( \frac{5}{2} \right)^{15} \cdot \left( \frac{1}{2} \right)^{15} \cdot \left( \frac{25}{16} \right)^{-8} = -\left( \frac{5}{4} \right)^{15} \cdot \left( \frac{25}{16} \right)^{-8} = \\
 & = -\left( \frac{5}{4} \right)^{15} \cdot \left( \frac{5}{4} \right)^{-8} = -\left( \frac{5}{4} \right)^{15} \cdot \left( \frac{5}{4} \right)^{-16} = -\left( \frac{5}{4} \right)^{-1} = -\frac{4}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{m)} \quad & \underbrace{\left( -\frac{9}{25} \right)^{10}}_{\substack{\text{exponente} \\ \text{par}}} : \left( \frac{5}{3} \right)^{-16} \cdot \left[ \left( \frac{2}{3} \right)^7 \cdot \left( \frac{2}{3} \right)^{-5} \right]^2 \cdot \left( \frac{5}{2} \right)^3 = \\
 & = \left( \frac{9}{25} \right)^{10} : \left( \frac{3}{5} \right)^{16} \cdot \left[ \left( \frac{2}{3} \right)^2 \right]^2 \cdot \left( \frac{5}{2} \right)^3 = \\
 & = \left( \frac{3}{5} \right)^{20} : \left( \frac{3}{5} \right)^{16} \cdot \left( \frac{2}{3} \right)^4 \cdot \left( \frac{5}{2} \right)^3 = \left( \frac{3}{5} \right)^{20} : \left( \frac{3}{5} \right)^{16} \cdot \left( \frac{2}{3} \right)^4 \cdot \left( \frac{5}{2} \right)^3 = \\
 & = \left( \frac{3}{5} \right)^4 \cdot \left( \frac{2}{3} \right)^4 \cdot \left( \frac{5}{2} \right)^3 = \left( \frac{2}{5} \right)^4 \cdot \left( \frac{5}{2} \right)^3 = \left( \frac{2}{5} \right)^4 \cdot \left( \frac{2}{5} \right)^{-3} = \left( \frac{2}{5} \right)^1 = \frac{2}{5}
 \end{aligned}$$

**Ejercicio 2** Reduce paso a paso a una única potencia de exponente natural y después calcula

$$a) \frac{30^9 : (-3)^9 : (-10)^3}{(25^4 : 5^5)^5 \cdot 125^{-3}} = \frac{(-10)^9 : (-10)^3}{[(5^2)^4 : 5^5]^5 \cdot (5^3)^{-3}} = \frac{(-10)^6}{(5^8 : 5^5)^5 \cdot 5^{-9}} = \frac{(-10)^6}{(5^3)^5 \cdot 5^{-9}} = \frac{(-10)^6}{5^{15} \cdot 5^{-9}} = \frac{(-10)^6}{5^6} = (-2)^6 = 64$$

$$b) \frac{(8^3 \cdot 2^4)^2 : 16}{10^{15} : (-5)^{15} \cdot (2^3)^3} = \frac{[(2^3)^3 \cdot 2^4]^2 : 2^4}{\underbrace{(-2)^{15}}_{\text{exp. impar}} \cdot 2^9} = \frac{(2^9 \cdot 2^4)^2 : 2^4}{-2^{15} \cdot 2^9} = \frac{(2^{13})^2 : 2^4}{-2^{24}} = \frac{2^{26} : 2^4}{-2^{24}} = \frac{2^{22}}{-2^{24}} = -2^{-2} = -\left(\frac{1}{2}\right)^2 = -\frac{1}{4}$$

$$c) \frac{(4^5 \cdot 2^{-7})^3 \cdot (3^3)^3}{[(-8)^{11} \cdot (-3)^{11}] : [(-4)^8 : (-4)^{-3}]} = \frac{[(2^2)^5 \cdot 2^{-7}]^3 \cdot 3^9}{24^{11} : (-4)^{11}} = \frac{(2^{10} \cdot 2^{-7})^3 \cdot 3^9}{(-6)^{11}} = \frac{(2^3)^3 \cdot 3^9}{(-6)^{11}} = \frac{2^9 \cdot 3^9}{(-6)^{11}} = \frac{6^9}{\underbrace{(-6)^{11}}_{\text{exp. impar}}} =$$

$$= \frac{6^9}{-6^{11}} = -6^{-2} = -\left(\frac{1}{6}\right)^2 = -\frac{1}{36}$$

$$d) \frac{(2^{-5} \cdot 16^2)^3 \cdot (-6)^9}{(-3)^{11} \cdot [(-4)^8 : (-4)^{-3}]} = \frac{[2^{-5} \cdot (2^4)^2]^3 \cdot (-6)^9}{(-3)^{11} \cdot (-4)^{11}} = \frac{(2^{-5} \cdot 2^8)^3 \cdot (-6)^9}{12^{11}} = \frac{(2^3)^3 \cdot (-6)^9}{12^{11}} = \frac{2^9 \cdot (-6)^9}{12^{11}} =$$

$$= \frac{\underbrace{(-12)^9}_{\text{exp. impar}}}{12^{11}} = \frac{-12^9}{12^{11}} = -12^{-2} = -\left(\frac{1}{12}\right)^2 = -\frac{1}{144}$$

$$e) \frac{\overbrace{(-20)^3}^{\text{exp. par}} \cdot 8^{-3}}{(-125)^5 \cdot 100^{-2} \cdot 64} = -\frac{20^4 \cdot \underbrace{8^{-3}}_{\text{exp. impar}}}{125^3 \cdot \underbrace{100^{-2}}_{\text{exp. impar}} \cdot 64} = -\frac{20^4 \cdot 100^2}{125^3 \cdot 64 \cdot 8^3} = -\frac{(2^2 \cdot 5)^4 \cdot (2^2 \cdot 5^2)^2}{(5^3)^3 \cdot 2^6 \cdot (2^3)^3} = -\frac{2^8 \cdot 5^4 \cdot 2^4 \cdot 5^4}{5^9 \cdot 2^6 \cdot 2^9} = -\frac{2^{12} \cdot 5^8}{2^{15} \cdot 5^9} =$$

$$= -\frac{1}{2^3 \cdot 5} = -\frac{1}{40}$$

$$f) \frac{18^{-7} \cdot 54^4 \cdot \overbrace{(-10)^3}^{\text{exp. impar}}}{27 \cdot \underbrace{(-25)^5}_{\text{exp. impar}} \cdot 15^{-6}} = (-) \cdot (-) \frac{\underbrace{18^{-7}}_{\text{exp. impar}} \cdot 54^4 \cdot 10^3}{27 \cdot 25^5 \cdot \underbrace{15^{-6}}_{\text{exp. impar}}} = \frac{54^4 \cdot 10^3 \cdot 15^6}{27 \cdot 25^5 \cdot 18^7} = \frac{(2 \cdot 3^3)^4 \cdot (2 \cdot 5)^3 \cdot (3 \cdot 5)^6}{3^3 \cdot (5^2)^5 \cdot (2 \cdot 3^2)^7} =$$

$$= \frac{2^4 \cdot 3^{12} \cdot 2^3 \cdot 5^3 \cdot 3^6 \cdot 5^6}{3^3 \cdot 5^{10} \cdot 2^7 \cdot 3^{14}} = \frac{2^7 \cdot 3^{18} \cdot 5^9}{2^7 \cdot 3^{17} \cdot 5^{10}} = \frac{3}{5}$$

$$g) \frac{12^4 \cdot 8^{-2} \cdot \overbrace{(-6)^3}^{\text{exp. impar}}}{(-27)^4 \cdot 36^{-1} \cdot 64} = -\frac{12^4 \cdot \underbrace{8^{-2}}_{\text{exp. impar}} \cdot 6^3}{27^4 \cdot \underbrace{36^{-1}}_{\text{exp. par}} \cdot 64} = -\frac{12^4 \cdot 6^3 \cdot 36}{27^4 \cdot 64 \cdot 8^2} = -\frac{(2^2 \cdot 3)^4 \cdot (2 \cdot 3)^3 \cdot 2^2 \cdot 3^2}{(3^3)^4 \cdot 2^6 \cdot (2^3)^2} =$$

$$= -\frac{2^8 \cdot 3^4 \cdot 2^3 \cdot 3^3 \cdot 2^2 \cdot 3^2}{3^{12} \cdot 2^6 \cdot 2^6} = -\frac{2^{13} \cdot 3^9}{2^{12} \cdot 3^{12}} = -\frac{2}{3^3} = -\frac{2}{27}$$

$$h) \frac{(x^4 \cdot y^{-5})^3 \cdot \left(\frac{x}{z}\right)^{-6}}{x^3 \cdot (x \cdot y^{-4})^3 \cdot (z^2)^3} = \frac{x^{12} \cdot y^{-15} \cdot (x \cdot z^{-1})^{-6}}{x^3 \cdot x^3 \cdot y^{-12} \cdot z^6} = \frac{x^{12} \cdot y^{-15} \cdot x^{-6} \cdot z^6}{x^3 \cdot x^3 \cdot y^{-12} \cdot z^6} = \frac{x^{12} \cdot z^6 \cdot y^{12}}{x^3 \cdot x^3 \cdot z^6 \cdot y^{15} \cdot x^6} = \frac{x^{12} \cdot z^6 \cdot y^{12}}{x^{12} \cdot y^{15} \cdot z^6} = \frac{1}{y^3}$$

Recuerda:  $\frac{A^n}{B^m} = A^n \cdot \frac{1}{B^m} = A^n \cdot B^{-m}$

$$i) \frac{36 \cdot \left(\frac{1}{3}\right)^{-2} \cdot \frac{27}{16} \cdot \overbrace{\left(\left(\frac{3}{2}\right)^{-2}\right)^0}^{(3/2)^0=1} \cdot \overbrace{\left(\frac{3}{4}\right)^{-1}}^{4/3}}{27^{-1} \cdot 81 \cdot \underbrace{\left(\frac{8}{9}\right)^{-1}}_{9/8} \cdot 72} = \frac{2^2 \cdot 3^2 \cdot 3^2 \cdot \frac{3^3}{2^4} \cdot 1 \cdot \frac{2^2}{3}}{(3^3)^{-1} \cdot 3^4 \cdot \frac{3^2}{2^3} \cdot 2^3 \cdot 3^2} = \frac{2^2 \cdot 3^2 \cdot 3^2 \cdot 3^3 \cdot 2^{-4} \cdot 2^2 \cdot 3^{-1}}{3^{-3} \cdot 3^4 \cdot 3^2 \cdot 2^{-3} \cdot 2^3 \cdot 3^2} =$$

$$= \frac{2^2 \cdot 3^2 \cdot 3^2 \cdot 3^3 \cdot 2^{-4} \cdot 2^2 \cdot 3^{-1}}{3^{-3} \cdot 3^4 \cdot 3^2 \cdot 2^{-3} \cdot 2^3 \cdot 3^2} = \frac{2^0 \cdot 3^6}{2^0 \cdot 3^5} = \frac{3}{1} = 3$$

### Ejercicio 3 Expresa en notación científica

a)  $8.000.000 = 8 \cdot 10^6$

b)  $1.240.000.000.000 = 1,24 \cdot 10^{12}$

c)  $156.000.000.000.000 = 1,56 \cdot 10^{14}$

d)  $7.000.000.000 = 7 \cdot 10^9$

e)  $0,000004 = 4 \cdot 10^{-6}$

f)  $0,00000000012 = 1,2 \cdot 10^{-10}$

g)  $0,0032 = 3,2 \cdot 10^{-3}$

h)  $0,00000003 = 3 \cdot 10^{-8}$

i)  $0,0000000009 = 9 \cdot 10^{-10}$

j)  $12.500.000.000 = 1,25 \cdot 10^{10}$

k)  $0,000000000000002 = 2 \cdot 10^{-15}$

l)  $34.500.000.000 = 3,45 \cdot 10^{10}$

### Ejercicio 4 Expresa en notación científica

a)  $753 \cdot 10^6 = 7,53 \cdot 10^2 \cdot 10^6 = 7,53 \cdot 10^8$

b)  $212,5 \cdot 10^4 = 2,125 \cdot 10^2 \cdot 10^4 = 2,125 \cdot 10^6$

c)  $0,07 \cdot 10^5 = 7 \cdot 10^{-2} \cdot 10^5 = 7 \cdot 10^3$

d)  $0,0043 \cdot 10^8 = 4,3 \cdot 10^{-3} \cdot 10^8 = 4,3 \cdot 10^5$

e)  $1204 \cdot 10^{-6} = 1,204 \cdot 10^3 \cdot 10^{-6} = 1,204 \cdot 10^{-3}$

f)  $432 \cdot 10^{-12} = 4,32 \cdot 10^2 \cdot 10^{-12} = 4,32 \cdot 10^{-10}$

g)  $0,05 \cdot 10^{-16} = 5 \cdot 10^{-2} \cdot 10^{-16} = 5 \cdot 10^{-18}$

h)  $0,027 \cdot 10^{-10} = 2,7 \cdot 10^{-2} \cdot 10^{-10} = 2,7 \cdot 10^{-12}$

i)  $231 \cdot 10^{-9} = 2,31 \cdot 10^2 \cdot 10^{-9} = 2,31 \cdot 10^{-7}$

j)  $0,006 \cdot 10^{13} = 6 \cdot 10^{-3} \cdot 10^{13} = 6 \cdot 10^{10}$

k)  $0,045 \cdot 10^{-14} = 4,5 \cdot 10^{-2} \cdot 10^{-14} = 4,5 \cdot 10^{-16}$

l)  $23,1 \cdot 10^{14} = 2,31 \cdot 10^1 \cdot 10^{14} = 2,31 \cdot 10^{15}$

m)  $0,003 \cdot 10^{-10} = 3 \cdot 10^{-3} \cdot 10^{-10} = 3 \cdot 10^{-13}$

n)  $0,42 \cdot 10^{-6} = 4 \cdot 10^{-1} \cdot 10^{-6} = 4 \cdot 10^{-7}$

**Ejercicio 5** Calcula dando el resultado en notación científica

a) $(3 \cdot 10^6) + (7,2 \cdot 10^8) - (1,4 \cdot 10^7) =$ $= (0,03 \cdot 10^8) + (7,2 \cdot 10^8) - (0,14 \cdot 10^8) =$ $= 7,09 \cdot 10^8$	b) $(3,2 \cdot 10^{-4}) - (6 \cdot 10^{-5}) + (1,5 \cdot 10^{-3}) =$ $= (0,32 \cdot 10^{-3}) - (0,06 \cdot 10^{-3}) + (1,5 \cdot 10^{-3}) =$ $= 1,76 \cdot 10^{-3}$
c) $(0,012 \cdot 10^{12}) \cdot (0,02 \cdot 10^{-19})^2 : (64000 \cdot 10^{-15}) =$ $= (1,2 \cdot 10^{10}) \cdot (2 \cdot 10^{-21})^2 : (6,4 \cdot 10^{-11}) =$ $= (1,2 \cdot 10^{10}) \cdot (4 \cdot 10^{-42}) : (6,4 \cdot 10^{-11}) =$ $= (4,8 \cdot 10^{-32}) : (6,4 \cdot 10^{-11}) =$ $= 0,75 \cdot 10^{-21} =$ $= 7,5 \cdot 10^{-22}$	d) $(0,002 \cdot 10^{-5})^3 \cdot 1800000000 : (0,03 \cdot 10^{15})^2 =$ $= (2 \cdot 10^{-8})^3 \cdot (1,8 \cdot 10^9) : (3 \cdot 10^{13})^2 =$ $= (8 \cdot 10^{-24}) \cdot (1,8 \cdot 10^9) : (9 \cdot 10^{26}) =$ $= (1,44 \cdot 10^{-14}) : (9 \cdot 10^{26}) =$ $= 0,16 \cdot 10^{-40} =$ $= 1,6 \cdot 10^{-41}$
e) $(1,4 \cdot 10^{-10}) - \frac{(0,0003)^2}{50000000 \cdot 0,00036} =$ $= (1,4 \cdot 10^{-10}) - \frac{(3 \cdot 10^{-4})^2}{(5 \cdot 10^7) \cdot (3,6 \cdot 10^{-4})} =$ $= (1,4 \cdot 10^{-10}) - \frac{9 \cdot 10^{-8}}{1,8 \cdot 10^4} =$ $= (1,4 \cdot 10^{-10}) - (5 \cdot 10^{-12}) =$ $= (1,4 \cdot 10^{-10}) - (0,05 \cdot 10^{-10}) =$ $= 1,35 \cdot 10^{-10}$	f) $(3,18 \cdot 10^3 + 5 \cdot 10^2) : (0,000000002)^{-2} =$ $= (3,18 \cdot 10^3 + 0,5 \cdot 10^3) : (2 \cdot 10^{-9})^{-2} =$ $= (3,68 \cdot 10^3) : (2,5 \cdot 10^{17}) =$ $= 1,472 \cdot 10^{-14}$  $2^{-2} = \frac{1}{2^2} = \frac{1}{4} = 0,25$

**Ejercicio 6 Reduce a una única potencia de exponente natural:**

$$\text{a) } \underbrace{\left(-\frac{3}{2}\right)^8}_{\substack{\text{exponente} \\ \text{par}}} : \left[\left(\frac{1}{6}\right)^5 : \left(\frac{1}{4}\right)^5\right]^{-1} = \left(\frac{3}{2}\right)^8 : \left[\left(\frac{2}{3}\right)^5\right]^{-1} = \left(\frac{3}{2}\right)^8 : \left(\frac{2}{3}\right)^{-5} = \left(\frac{3}{2}\right)^8 : \left(\frac{3}{2}\right)^5 = \left(\frac{3}{2}\right)^3$$

$$\text{b) } \left[7^3 \cdot \left(\frac{1}{2}\right)^3\right]^4 \cdot \left[\left(\frac{2}{7}\right)^5 : \left(\frac{2}{7}\right)^3\right]^7 = \left[\left(\frac{7}{2}\right)^3\right]^4 \cdot \left[\left(\frac{2}{7}\right)^2\right]^7 = \left(\frac{7}{2}\right)^{12} \cdot \left(\frac{2}{7}\right)^{14} = \left(\frac{2}{7}\right)^{-12} \cdot \left(\frac{2}{7}\right)^{14} = \left(\frac{2}{7}\right)^2$$

$$\text{c) } \left[\left(\frac{2}{3}\right)^4\right]^3 : \left[3^6 \cdot \left(-\frac{1}{5}\right)^6\right]^{-2} = \left(\frac{2}{3}\right)^{12} : \left[\left(-\frac{3}{5}\right)^6\right]^{-2} = \left(\frac{2}{3}\right)^{12} : \left(-\frac{3}{5}\right)^{-12} = \left(\frac{2}{3}\right)^{12} : \left(-\frac{5}{3}\right)^{12} = \underbrace{\left(-\frac{2}{5}\right)^{12}}_{\text{exp. par}} = \left(\frac{2}{5}\right)^{12}$$

$$\text{d) } \left[4^4 \cdot \left(-\frac{1}{5}\right)^4\right]^{-2} : \left[\left(\frac{5}{4}\right)^5 : \left(\frac{4}{5}\right)^3\right]^{-1} = \left[\left(-\frac{4}{5}\right)^4\right]^{-2} : \left[\left(\frac{5}{4}\right)^5 : \left(\frac{5}{4}\right)^{-3}\right]^{-1} = \left(-\frac{4}{5}\right)^{-8} : \left[\left(\frac{5}{4}\right)^8\right]^{-1} = \underbrace{\left(-\frac{5}{4}\right)^8}_{\text{exp. par}} : \left(\frac{5}{4}\right)^{-8} = \left(\frac{5}{4}\right)^8 : \left(\frac{5}{4}\right)^{-8} = \left(\frac{5}{4}\right)^{16}$$

$$\text{e) } \left(-\frac{1}{7}\right)^{15} : \left[\left(\frac{2}{3}\right)^3 : \left(\frac{2}{3}\right)^{-2}\right]^3 \cdot \left(\frac{3}{14}\right)^{-14} = -\left(\frac{1}{7}\right)^{15} : \left[\left(\frac{2}{3}\right)^5\right]^3 \cdot \left(\frac{3}{14}\right)^{-14} = -\left(\frac{1}{7}\right)^{15} : \left(\frac{2}{3}\right)^{15} \cdot \left(\frac{3}{14}\right)^{-14} = -\left(\frac{3}{14}\right)^{15} \cdot \left(\frac{3}{14}\right)^{-14} = -\left(\frac{3}{14}\right)^1 = -\frac{3}{14}$$

$$\text{f) } \left(\frac{4}{49}\right)^{12} : \left(\frac{2}{7}\right)^4 \cdot \left[\left(\frac{7}{2}\right)^5 : \left(\frac{7}{2}\right)^{-5}\right]^2 = \left[\left(\frac{2}{7}\right)^2\right]^{12} : \left(\frac{2}{7}\right)^4 \cdot \left[\left(\frac{7}{2}\right)^{10}\right]^2 = \left(\frac{2}{7}\right)^{24} : \left(\frac{2}{7}\right)^4 \cdot \left(\frac{7}{2}\right)^{20} = \left(\frac{2}{7}\right)^{20} \cdot \left(\frac{7}{2}\right)^{20} = \left(\frac{7}{2}\right)^{-20} \cdot \left(\frac{7}{2}\right)^{20} = \left(\frac{7}{2}\right)^0 = 1$$

$$\text{g) } \left(\frac{1}{5}\right)^8 : \left[\left(\frac{2}{3}\right)^2 : \left(\frac{2}{3}\right)^{-2}\right]^2 \cdot \left(\frac{9}{100}\right)^{-5} = \left(\frac{1}{5}\right)^8 : \left[\left(\frac{2}{3}\right)^4\right]^2 \cdot \left[\left(\frac{3}{10}\right)^2\right]^{-5} = \left(\frac{1}{5}\right)^8 : \left(\frac{2}{3}\right)^8 \cdot \left(\frac{3}{10}\right)^{-10} = \left(\frac{3}{10}\right)^8 \cdot \left(\frac{3}{10}\right)^{-10} = \left(\frac{3}{10}\right)^{-2} = \left(\frac{10}{3}\right)^2$$

$$\begin{aligned}
 \text{h)} \quad & \left(\frac{25}{49}\right)^6 : \left[ \left(-\frac{1}{5}\right)^8 : \left(\frac{1}{7}\right)^8 \right]^{-1} = \\
 & = \left[ \left(\frac{5}{7}\right)^2 \right]^6 : \left[ \left(-\frac{7}{5}\right)^8 \right]^{-1} = \left(\frac{5}{7}\right)^{12} : \underbrace{\left(-\frac{7}{5}\right)^{-8}}_{\substack{\text{exponente} \\ \text{par}}} = \left(\frac{5}{7}\right)^{12} : \left(\frac{7}{5}\right)^{-8} = \left(\frac{5}{7}\right)^{12} : \left(\frac{5}{7}\right)^8 = \left(\frac{5}{7}\right)^4
 \end{aligned}$$

$$\begin{aligned}
 \text{i)} \quad & \underbrace{\left(-\frac{2}{3}\right)^7}_{\text{exp. impar}} : \left( \left(-\frac{3}{2}\right)^{-5} \right)^2 \cdot \left(-\frac{9}{4}\right)^6 = \\
 & = -\left(\frac{2}{3}\right)^7 : \underbrace{\left(-\frac{3}{2}\right)^{-10}}_{\text{exp. par}} \cdot \left(\frac{9}{4}\right)^6 = -\left(\frac{3}{2}\right)^{-7} : \left(\frac{3}{2}\right)^{-10} \cdot \left[\left(\frac{3}{2}\right)^2\right]^6 = -\left(\frac{3}{2}\right)^3 \cdot \left(\frac{3}{2}\right)^{12} = -\left(\frac{3}{2}\right)^{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{j)} \quad & \left[ \left(\frac{1}{11}\right)^5 : \left(\frac{1}{6}\right)^5 \right]^{-1} : \underbrace{\left(-\frac{121}{36}\right)^{-6}}_{\substack{\text{exponente} \\ \text{par}}} = \\
 & = \left[ \left(\frac{6}{11}\right)^5 \right]^{-1} : \left(\frac{121}{36}\right)^{-6} = \left(\frac{6}{11}\right)^{-5} : \left[ \left(\frac{11}{6}\right)^2 \right]^{-6} = \left(\frac{11}{6}\right)^5 : \left(\frac{11}{6}\right)^{-12} = \left(\frac{11}{6}\right)^{17}
 \end{aligned}$$

$$\begin{aligned}
 \text{k)} \quad & \underbrace{\left(-\frac{4}{81}\right)^{10}}_{\text{exp. par}} : \left(\frac{9}{2}\right)^{-2} \cdot \left[ \left(\frac{3}{2}\right)^4 : \left(\frac{3}{2}\right)^{-5} \right]^2 = \\
 & = \left(\frac{4}{81}\right)^{10} : \left(\frac{2}{9}\right)^2 \cdot \left[ \left(\frac{3}{2}\right)^9 \right]^2 = \left[ \left(\frac{2}{9}\right)^2 \right]^{10} : \left(\frac{2}{9}\right)^2 \cdot \left(\frac{3}{2}\right)^{18} = \left(\frac{2}{9}\right)^{20} : \left(\frac{2}{9}\right)^2 \cdot \left(\frac{3}{2}\right)^{18} = \left(\frac{2}{9}\right)^{18} \cdot \left(\frac{3}{2}\right)^{18} = \left(\frac{1}{3}\right)^{18}
 \end{aligned}$$

$$\begin{aligned}
 \text{l)} \quad & \left(\frac{1}{3}\right)^{12} \cdot \left[ \left(\frac{3}{2}\right)^4 : \left(\frac{3}{2}\right)^{-2} \right]^{-2} : \left(\frac{81}{4}\right)^{-10} = \\
 & = \left(\frac{1}{3}\right)^{12} \cdot \left[ \left(\frac{3}{2}\right)^6 \right]^{-2} : \left[ \left(\frac{9}{2}\right)^2 \right]^{-10} = \left(\frac{1}{3}\right)^{12} \cdot \left(\frac{3}{2}\right)^{-12} : \left(\frac{9}{2}\right)^{-20} = \left(\frac{1}{3}\right)^{12} \cdot \left(\frac{2}{3}\right)^{12} : \left(\frac{9}{2}\right)^{-20} = \left(\frac{2}{9}\right)^{12} : \left(\frac{2}{9}\right)^{20} = \left(\frac{2}{9}\right)^{-8} = \left(\frac{9}{2}\right)^8
 \end{aligned}$$

**Ejercicio 7** Simplifica las siguientes expresiones y después calcula:

$$a) \frac{(-10)^{25} : 5^{25}}{(8^3 \cdot 2^4)^2 \cdot 32^{-1}} = \frac{\overbrace{(-2)^{25}}^{\text{exp. impar}}}{\left[(2^3)^3 \cdot 2^4\right]^2 \cdot (2^5)^{-1}} = \frac{-2^{25}}{(2^9 \cdot 2^4)^2 \cdot 2^{-5}} = \frac{-2^{25}}{2^{26} \cdot 2^{-5}} = \frac{-2^{25}}{2^{21}} = -2^4 = -16$$

$$b) \frac{(2^{-5} \cdot 16^2)^3 \cdot (-6)^9}{(3^5)^2 \cdot [(-4)^7 : (-4)^{-3}]} = \frac{\left[2^{-5} \cdot (2^4)^2\right]^3 \cdot (-6)^9}{3^{10} \cdot (-4)^{10}} = \frac{(2^{-5} \cdot 2^8)^3 \cdot (-6)^9}{(-12)^{10}} = \frac{(2^3)^3 \cdot (-6)^9}{(-12)^{10}} = \frac{2^9 \cdot (-6)^9}{(-12)^{10}} = \frac{(-12)^9}{(-12)^{10}} = (-12)^{-1} = \left(-\frac{1}{12}\right)^1 = -\frac{1}{12}$$

$$c) \frac{30^5 : (-3)^5 \cdot (-10)^3}{(25^4 : 5^5)^5 : 125^{-1} \cdot 5^{-10}} = \frac{(-10)^5 \cdot (-10)^3}{\left[(5^2)^4 : 5^5\right]^5 : (5^3)^{-1} \cdot 5^{-10}} = \frac{(-10)^8}{(5^8 : 5^5)^5 : 5^{-3} \cdot 5^{-10}} = \frac{(-10)^8}{(5^3)^5 : 5^{-3} \cdot 5^{-10}} = \frac{(-10)^8}{5^{15} : 5^{-3} \cdot 5^{-10}} = \frac{(-10)^8}{5^{18} \cdot 5^{-10}} = \frac{(-10)^8}{5^8} = (-2)^8 = 256$$

$$d) \frac{\overbrace{(-45)^4}^{\text{exp. par}} \cdot 27^{-3}}{\underbrace{(-125)^3}_{\text{exp. impar}} \cdot 225^{-2} \cdot 729} = -\frac{45^4 \cdot 27^{-3}}{125^3 \cdot 225^{-2} \cdot 729} = -\frac{45^4 \cdot 225^2}{125^3 \cdot 729 \cdot 27^3} = -\frac{(3^2 \cdot 5)^4 \cdot (3^2 \cdot 5^2)^2}{(5^3)^3 \cdot 3^6 \cdot (3^3)^3} = -\frac{3^8 \cdot 5^4 \cdot 3^4 \cdot 5^4}{5^9 \cdot 3^6 \cdot 3^9} = -\frac{3^{12} \cdot 5^8}{3^{15} \cdot 5^9} = -\frac{1}{3^3 \cdot 5} = -\frac{1}{135}$$

$$e) \frac{\overbrace{(-6)^3}^{\text{exp. impar}} \cdot \overbrace{(-12)^4}^{\text{exp. par}} \cdot 8^{-2}}{\underbrace{(-27)^3}_{\text{exp. impar}} \cdot 36^{-1} \cdot 64} = (-) \cdot (-) \frac{6^3 \cdot 12^4 \cdot 8^{-2}}{27^3 \cdot 36^{-1} \cdot 64} = \frac{6^3 \cdot 12^4 \cdot 36}{27^3 \cdot 64 \cdot 8^2} = \frac{(2 \cdot 3)^3 \cdot (2^2 \cdot 3)^4 \cdot 2^2 \cdot 3^2}{(3^3)^3 \cdot 2^6 \cdot (2^3)^2} = \frac{2^3 \cdot 3^3 \cdot 2^8 \cdot 3^4 \cdot 2^2 \cdot 3^2}{3^9 \cdot 2^6 \cdot 2^6} = \frac{2^{13} \cdot 3^9}{2^{12} \cdot 3^9} = \frac{2}{1} = 2$$

$$f) \frac{\overbrace{(-54)^4}^{\text{exp. par}} \cdot \overbrace{(-30)^3}^{\text{exp. impar}} \cdot 25}{125^3 \cdot 18^7 \cdot 5^{-3}} = -\frac{54^4 \cdot 30^3 \cdot 25}{125^3 \cdot 18^7 \cdot 5^{-3}} = -\frac{54^4 \cdot 30^3 \cdot 25 \cdot 5^3}{125^3 \cdot 18^7} = -\frac{(2 \cdot 3^3)^4 \cdot (2 \cdot 3 \cdot 5)^3 \cdot 5^2 \cdot 5^3}{(5^3)^3 \cdot (2 \cdot 3^2)^7} = -\frac{2^4 \cdot 3^{12} \cdot 2^3 \cdot 3^3 \cdot 5^3 \cdot 5^2 \cdot 5^3}{5^9 \cdot 2^7 \cdot 3^{14}} = -\frac{2^7 \cdot 3^{15} \cdot 5^8}{2^7 \cdot 3^{14} \cdot 5^9} = -\frac{3}{5}$$



$$g) \frac{(a \cdot b^{-2})^4}{a^4 \cdot (b^{-3})^3 \cdot c^5} \cdot \left(\frac{1}{c}\right)^{-5} = \frac{a^4 \cdot b^{-8}}{a^4 \cdot b^{-9} \cdot c^5} \cdot c^5 = \frac{a^4 \cdot b^9 \cdot c^5}{a^4 \cdot b^8 \cdot c^5} = b$$

$$h) \frac{8^2 \cdot \overbrace{(-5)^0}^1}{\left(-\frac{1}{7}\right)^{-12} \cdot \left(\frac{49}{8}\right)^{-4} \cdot 14^{-5}} = \frac{(2^3)^2}{\underbrace{(-7)^{12}}_{\text{exp. par}} \cdot \left(\frac{2^3}{7^2}\right)^4 \cdot (2 \cdot 7)^{-5}} = \frac{2^6}{7^{12} \cdot \frac{2^{12}}{7^8} \cdot 2^{-5} \cdot 7^{-5}} = \frac{2^6}{7^{12} \cdot 2^{12} \cdot 7^{-8} \cdot 2^{-5} \cdot 7^{-5}} =$$

$$= \frac{2^6}{2^7 \cdot 7^{-1}} = \frac{2^6 \cdot 7}{2^7} = \frac{7}{2}$$

$$i) \frac{\left(\frac{1}{5}\right)^{-2} \cdot \overbrace{(-7)^3}^{\text{exp. impar}} \cdot \frac{1}{21} \cdot \overbrace{(-20)^{-1}}^{\text{exp. impar}}}{14 \cdot \frac{7}{2^3} \cdot \underbrace{(-3)^{-4}}_{\text{exp. par}} \cdot \underbrace{\left(\left(\frac{3}{7}\right)^{-2}\right)^0}_1} = (-) \cdot (-) \frac{5^2 \cdot 7^3 \cdot 21^{-1} \cdot 20^{-1}}{14 \cdot 7 \cdot 2^{-3} \cdot 3^{-4}} = \frac{5^2 \cdot 7^3 \cdot 2^3 \cdot 3^4}{14 \cdot 7 \cdot 21 \cdot 20} = \frac{5^2 \cdot 7^3 \cdot 2^3 \cdot 3^4}{2 \cdot 7 \cdot 7 \cdot 3 \cdot 7 \cdot 2^2 \cdot 5} =$$

$$= \frac{2^3 \cdot 3^4 \cdot 5^2 \cdot 7^3}{2^3 \cdot 3 \cdot 5 \cdot 7^2} = \frac{3^3 \cdot 5}{1} = 135$$

**Ejercicio 8** Calcula dando el resultado en notación científica:

<p>a) <math>250000000 \cdot (5,4 \cdot 10^5) : (0,00000003)^2 =</math>  <math>= (2,5 \cdot 10^8) \cdot (5,4 \cdot 10^5) : (3 \cdot 10^{-8})^2 =</math>  <math>= (2,5 \cdot 10^8) \cdot (5,4 \cdot 10^5) : (9 \cdot 10^{-16}) =</math>  <math>= (1,35 \cdot 10^{14}) : (9 \cdot 10^{-16}) =</math>  <math>= 0,15 \cdot 10^{30} = 1,5 \cdot 10^{29}</math></p>	<p>b) <math>(1,34 \cdot 10^{-6}) + (0,0000000045 : 0,009) =</math>  <math>= (1,34 \cdot 10^{-6}) + [(4,5 \cdot 10^{-9}) : (9 \cdot 10^{-3})] =</math>  <math>= (1,34 \cdot 10^{-6}) + (0,5 \cdot 10^{-6}) =</math>  <math>= 1,84 \cdot 10^{-6}</math></p>
<p>c) <math>(3 \cdot 10^{-4})^2 \cdot 5000000 : (1,5 \cdot 10^{10}) =</math>  <math>= (3 \cdot 10^{-4})^2 \cdot (5 \cdot 10^6) : (1,5 \cdot 10^{10}) =</math>  <math>= (9 \cdot 10^{-8}) \cdot (5 \cdot 10^6) : (1,5 \cdot 10^{10}) =</math>  <math>= (4,5 \cdot 10^{-1}) : (1,5 \cdot 10^{10}) =</math>  <math>= 3 \cdot 10^{-11}</math></p>	<p>d) <math>\frac{(1,45 \cdot 10^{-3} + 3 \cdot 10^{-5}) \cdot (2 \cdot 10^9)}{4 \cdot 10^8} =</math>  <math>= \frac{(1,45 \cdot 10^{-3} + 0,03 \cdot 10^{-3}) \cdot (2 \cdot 10^9)}{4 \cdot 10^8} =</math>  <math>= \frac{(1,48 \cdot 10^{-3}) \cdot (2 \cdot 10^9)}{4 \cdot 10^8} =</math>  <math>= \frac{2,96 \cdot 10^6}{4 \cdot 10^8} =</math>  <math>= 0,74 \cdot 10^{-2} = 7,4 \cdot 10^{-3}</math></p>
<p>e) <math>(2 \cdot 10^{-4})^2 \cdot 5000000 : (1,6 \cdot 10^{10}) =</math>  <math>= (4 \cdot 10^{-8}) \cdot (5 \cdot 10^6) : (1,6 \cdot 10^{10}) =</math>  <math>= (2 \cdot 10^{-1}) : (1,6 \cdot 10^{10}) =</math>  <math>= 1,25 \cdot 10^{-11}</math></p>	<p>f) <math>\frac{(2,1 \cdot 10^8 - 4 \cdot 10^6) : (2 \cdot 10^{-19})}{(2 \cdot 10^{-15})^2} =</math>  <math>= \frac{(2,1 \cdot 10^8 - 0,04 \cdot 10^8) : (2 \cdot 10^{-19})}{4 \cdot 10^{-30}} =</math>  <math>= \frac{(2,06 \cdot 10^8) : (2 \cdot 10^{-19})}{4 \cdot 10^{-30}} =</math>  <math>= \frac{1,03 \cdot 10^{27}}{4 \cdot 10^{-30}} =</math>  <math>= 0,2575 \cdot 10^{57} = 2,575 \cdot 10^{56}</math></p>
<p>g) <math>(3,4 \cdot 10^{-9}) - \frac{(0,0003)^2}{750000000 \cdot 0,0000024} =</math>  <math>= (3,4 \cdot 10^{-9}) - \frac{(3 \cdot 10^{-4})^2}{(7,5 \cdot 10^8) \cdot (2,4 \cdot 10^{-6})} =</math>  <math>= (3,4 \cdot 10^{-9}) - \frac{(9 \cdot 10^{-8})}{(18 \cdot 10^2)} =</math>  <math>= (3,4 \cdot 10^{-9}) - (5 \cdot 10^{-11}) =</math>  <math>= (3,4 \cdot 10^{-9}) - (0,05 \cdot 10^{-9}) =</math>  <math>= 3,35 \cdot 10^{-9}</math></p>	<p>h) <math>\frac{(1,58 \cdot 10^{-3} - 8 \cdot 10^{-5}) : (300000000)}{(0,0000002)^3} =</math>  <math>= \frac{(1,58 \cdot 10^{-3} - 0,08 \cdot 10^{-5}) : (3 \cdot 10^8)}{(2 \cdot 10^{-7})^3} =</math>  <math>= \frac{(1,5 \cdot 10^{-3}) : (3 \cdot 10^8)}{8 \cdot 10^{-21}} =</math>  <math>= \frac{5 \cdot 10^{-12}}{8 \cdot 10^{-21}} =</math>  <math>= 0,625 \cdot 10^9 = 6,25 \cdot 10^8</math></p>