

## ESPRESSIONI NUMERICHE e PROPRIETÀ DELLE POTENZE

$$\begin{aligned}
 1. \quad & \frac{\left[ \left( \frac{1}{3} \right)^5 \cdot \left( \frac{1}{9} \right)^7 \right]^3 : \left( \frac{1}{27} \right)^3}{3^4 : 3^7} = \\
 & = \frac{\left\{ \left( \frac{1}{3} \right)^5 \cdot \left[ \left( \frac{1}{3} \right)^2 \right]^7 \right\}^3 : \left[ \left( \frac{1}{3} \right)^3 \right]^3}{3^{-3}} = \frac{\left[ \left( \frac{1}{3} \right)^5 \cdot \left( \frac{1}{3} \right)^{14} \right]^3 : \left( \frac{1}{3} \right)^9}{\left( \frac{1}{3} \right)^3} = \\
 & = \frac{\left[ \left( \frac{1}{3} \right)^{19} \right]^3 : \left( \frac{1}{3} \right)^9}{\left( \frac{1}{3} \right)^3} = \frac{\left( \frac{1}{3} \right)^{57} : \left( \frac{1}{3} \right)^9}{\left( \frac{1}{3} \right)^3} = \frac{\left( \frac{1}{3} \right)^{48}}{\left( \frac{1}{3} \right)^3} = \left( \frac{1}{3} \right)^{45}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & \frac{(-12)^4 : (-36)^8}{\left( \frac{2}{9} \right)^{-3} \cdot \frac{18^3}{12^2}} = \\
 & = \frac{(2^2 \cdot 3)^4 : (2^2 \cdot 3^2)^8}{\left( \frac{2}{2^2 \cdot 3} \right)^{-3} \cdot \frac{(2 \cdot 3^2)^3}{(2^2 \cdot 3)^2}} = \frac{2^8 \cdot 3^4 : 2^{16} \cdot 3^{16}}{\left( \frac{3^2}{2} \right)^3 \cdot \frac{2^3 \cdot 3^6}{2^4 \cdot 3^2}} = \frac{2^{-8} \cdot 3^{-12}}{\frac{3^6}{2^3} \cdot \frac{2^3 \cdot 3^6}{2^4 \cdot 3^2}} = \frac{2^{-8} \cdot 3^{-12}}{\frac{3^{10}}{2^4}} = 2^{-8} \cdot 3^{-12} \cdot \frac{2^4}{3^{10}} = 2^{-4} \cdot 3^{-22}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & \frac{\left[ \left( \frac{3}{5} \right)^{-3} \right]^{-2} : \left( \frac{3}{5} \right)^{-8}}{\left[ \left( \frac{3}{5} \right)^{-1} \cdot \left( \frac{3}{5} \right)^{-14} \right]^2} = \\
 & = \frac{\left( \frac{3}{5} \right)^6 : \left( \frac{3}{5} \right)^{-8}}{\left[ \left( \frac{3}{5} \right)^{-15} \right]^2} = \frac{\left( \frac{3}{5} \right)^{14}}{\left( \frac{3}{5} \right)^{-30}} = \left( \frac{3}{5} \right)^{14} : \left( \frac{3}{5} \right)^{-30} = \left( \frac{3}{5} \right)^{44}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & \frac{-2^8 : \left(-\frac{1}{3}\right)^{-7}}{(12^{-5} : 8^{-4})^{-3} : (-36)^{-4}} = \\
 & = \frac{-2^8 : (-3)^7}{(12^{15} : 8^{12}) \cdot (-36)^4} = \frac{2^8 : 3^7}{(2^2 \cdot 3)^{15} : (2^3)^{12} \cdot (2^2 \cdot 3^2)^4} = \frac{2^8 : 3^7}{2^{30} \cdot 3^{15} : 2^{36} \cdot 2^8 \cdot 3^8} = \frac{2^8 : 3^7}{2^2 \cdot 3^{23}} = 2^6 \cdot 3^{-30}
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \frac{\left[\left(-\frac{2}{3}\right)^{-7} \cdot \left(-\frac{3}{2}\right)^{-4} : \left(\frac{3}{2}\right)^{-2}\right] \cdot \frac{2^4}{3^5}}{-3^2 \cdot \frac{1}{81} : \left(1 - \frac{5}{6}\right)^2 + \frac{2^3 : 2^5}{2^{-3}}} = \\
 & = \frac{\left[\left(-\frac{3}{2}\right)^7 \cdot \left(-\frac{3}{2}\right)^{-4} : \left(\frac{3}{2}\right)^{-2}\right] \cdot \frac{2^4}{3^5}}{-3^2 \cdot \frac{1}{3^4} : \left(\frac{1}{6}\right)^2 + \frac{2^{-2}}{2^{-3}}} = \frac{\left(-\frac{3}{2}\right)^5 \cdot \frac{2^4}{3^5}}{-\frac{1}{3^2} : \left(\frac{1}{2 \cdot 3}\right)^2 + 2} = \frac{-\frac{3^5}{2^5} \cdot \frac{2^4}{3^5}}{-\frac{1}{3^2} \cdot 2^2 \cdot 3^2 + 2} = \frac{-\frac{1}{2}}{-2^2 + 2} = -\frac{1}{2} : (-2) = \frac{1}{4}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & \left[\frac{2^{-3} : 2^{-8}}{8^{-1} : 32^{-3}} \cdot 2^7 + \left(\frac{3^{-5} \cdot 9^4}{27^4 : 3^{-11}}\right)^{-1} \cdot 3^{-20}\right]^5 = \\
 & = \left[\frac{2^5}{2^{-3} : 2^{-15}} \cdot 2^7 + \left(\frac{3^{-5} \cdot 3^8}{3^{12} : 3^{-11}}\right)^{-1} \cdot 3^{-20}\right]^5 = \left[\frac{2^5}{2^{12}} \cdot 2^7 + \left(\frac{3^3}{3^{23}}\right)^{-1} \cdot 3^{-20}\right]^5 = \left[1 + (3^{-20})^{-1} \cdot 3^{-20}\right]^5 = [1 + 1]^5 = 32
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & \frac{144^{20} \cdot 18^{11} : 12^4}{36^5} = \\
 & = \frac{(2^4 \cdot 3^2)^{20} \cdot (2 \cdot 3^2)^{11} : (2^2 \cdot 3)^4}{(2^2 \cdot 3^2)^5} = \frac{2^{80} \cdot 3^{40} \cdot 2^{11} \cdot 3^{22} : (2^8 \cdot 3^4)}{2^{10} \cdot 3^{10}} = \frac{2^{83} \cdot 3^{58}}{2^{10} \cdot 3^{10}} = 2^{73} \cdot 3^{48}
 \end{aligned}$$

$$8. \frac{\left[\left(\frac{1}{5}\right)^{-2}\right]^{-3} : \frac{1}{25}}{\left(\frac{1}{25}\right)^{-2} : \left(\frac{1}{5}\right)^{-1}} =$$

$$= \frac{\left(\frac{1}{5}\right)^6 : \left(\frac{1}{5}\right)^2}{\left(\frac{1}{5}\right)^{-4} : \left(\frac{1}{5}\right)^{-1}} = \frac{\left(\frac{1}{5}\right)^4}{\left(\frac{1}{5}\right)^{-3}} = \left(\frac{1}{5}\right)^4 : \left(\frac{1}{5}\right)^{-3} = \left(\frac{1}{5}\right)^7$$

$$9. \frac{[0,(6)]^4 \cdot \left[\left(-\frac{2}{3}\right)^{-2} : \left(-\frac{4}{81}\right)^{-4}\right]^{-3}}{12^{-3} : 18^{-4}} =$$

$$= \frac{\left(\frac{2}{3}\right)^4 \cdot \left[\left(\frac{2}{3}\right)^{-2} : \left(\frac{2^2}{3^4}\right)^{-4}\right]^{-3}}{(2^2 \cdot 3)^{-3} \cdot (2 \cdot 3^2)^4} = \frac{\left(\frac{2}{3}\right)^4 \cdot \left[\frac{3^2 \cdot 2^8}{2^2 \cdot 3^{16}}\right]^{-3}}{2^{-6} \cdot 3^{-3} \cdot 2^4 \cdot 3^8} = \frac{\left(\frac{2}{3}\right)^4 \cdot \left[\frac{2^6}{3^{14}}\right]^{-3}}{2^{-2} \cdot 3^5} = \frac{2^4 \cdot 3^{42}}{3^4 \cdot 2^{18}} = \frac{2^4}{2^{-2} \cdot 3^5} = 2^{-12} \cdot 3^{33}$$

$$10. \frac{6^{-3} : 24^{-4} \cdot [0,(8)]^3}{\left[\left(-\frac{8}{9}\right)^{-4} : \left(-\frac{3}{16}\right)^{-2}\right]^{-2}} =$$

$$= \frac{2^{-3} \cdot 3^{-3} : (2^3 \cdot 3)^{-4} \cdot \left(\frac{8}{9}\right)^3}{\left[\left(\frac{2^3}{3^2}\right)^{-4} : \left(\frac{3}{2^4}\right)^{-2}\right]^{-2}} = \frac{2^{-3} \cdot 3^{-3} : (2^{-12} \cdot 3^{-4}) \cdot \left(\frac{2^3}{3^2}\right)^3}{\left[\frac{3^8 \cdot 3^2}{2^{12} \cdot 2^8}\right]^{-2}} = \frac{2^{18} \cdot 3^{-5}}{3^{-20} \cdot 2^{40}} = 2^{-22} \cdot 3^{15}$$

$$11. \frac{(4^{-3} : 16^{-2})^{-8} : \left[\left(\frac{1}{27}\right)^2\right]^3 : \left[\left(\frac{1}{3}\right)^{-2}\right]^{-4}}{\left[\left(\frac{1}{32}\right)^3\right]^2 : \left[\left(\frac{1}{2}\right)^{-2}\right]^{-4}} =$$

$$= \frac{(2^{-6} : 2^{-8})^{-8} : \left[\left(\frac{1}{3}\right)^6\right]^3 : \left(\frac{1}{3}\right)^8}{\left[\left(\frac{1}{2}\right)^{15}\right]^2 : \left(\frac{1}{2}\right)^8} = \frac{(2^2)^{-8} : \left(\frac{1}{3}\right)^{18} : \left(\frac{1}{3}\right)^8}{\left(\frac{1}{2}\right)^{30} : \left(\frac{1}{2}\right)^8} = \frac{2^{-16} : \left(\frac{1}{3}\right)^{10}}{\left(\frac{1}{2}\right)^{22} : \frac{3^{-10}}{3^{12}}} = \frac{2^{-16}}{2^{-22}} : \frac{3^{-10}}{3^{12}} = 2^6 \cdot 3^{22}$$

$$12. \left( \frac{12^3 : 18^{-2}}{6^{-4}} - \frac{24^6 \cdot 3^5}{2^3} \right)^0 =$$

$$= \left( \frac{(2^2 \cdot 3)^3 \cdot (2 \cdot 3^2)^2}{2^{-4} \cdot 3^{-4}} - \frac{(2^3 \cdot 3)^6 \cdot 3^5 \cdot 1}{2^3} \right)^0 = \left( \frac{2^6 \cdot 3^3 \cdot 2^2 \cdot 3^4}{2^{-4} \cdot 3^{-4}} - \frac{2^{18} \cdot 3^6 \cdot 3^5}{2^6} \right)^0 = (2^{12} \cdot 3^{11} - 2^{12} \cdot 3^{11})^0 = 0^0$$

che non ha alcun significato...

$$13. \frac{-4^2 \cdot \left(-\frac{1}{4}\right)^{-3} : (-4)^5 + \left(1 - \frac{3}{2}\right)^2 \cdot \left(2 - \frac{2}{5}\right)}{\left[\left(\frac{3}{4}\right)^{-8} \cdot \left(-\frac{4}{3}\right)^6 : \left(-\frac{3}{4}\right)^{-11}\right] \cdot \frac{3}{4}} =$$

$$= \frac{-4^2 \cdot (-4)^3 : (-4)^5 + \left(-\frac{1}{2}\right)^2 \cdot \left(\frac{8}{5}\right)}{\left[\left(\frac{3}{4}\right)^{-8} \cdot \left(\frac{3}{4}\right)^{-6} : \left(-\frac{3}{4}\right)^{-11}\right] \cdot \frac{3}{4}} = \frac{-(-4)^0 + \frac{1}{2^2} \cdot \frac{2^3}{5}}{\left(\frac{3}{4}\right)^{-3} \cdot \frac{3}{4}} = \frac{-1 + \frac{2}{5}}{\left(\frac{3}{4}\right)^{-2}} = -\frac{3}{5} \cdot \frac{9}{16} = \frac{27}{80}$$

$$14. \frac{[(-0,3)^4 : (0,5)^8]^3 \cdot \left(\frac{32}{81}\right)^2}{\left[\left(\frac{2}{3}\right)^{-2}\right]^{-4} : \left(\frac{2}{3}\right)^{-3}} \cdot (1,5)^{16} =$$

$$= \frac{\left[\frac{1}{3^4} : \frac{1}{2^8}\right]^3 \cdot \left(\frac{2^5}{3^4}\right)^2}{\left(\frac{2}{3}\right)^8 : \left(\frac{2}{3}\right)^{-3}} \cdot \left(\frac{3}{2}\right)^{16} = \frac{2^{24} \cdot 2^{10}}{3^{12} \cdot 3^8} \cdot \left(\frac{3}{2}\right)^{16} = \frac{2^{34}}{3^{20}} : \frac{2^{11}}{3^{11}} \cdot \frac{3^{16}}{2^{16}} = 2^7 \cdot 3^7 = 6^7$$

$$15. \left\{ \frac{\left[\left(-\frac{1}{2}\right)^6 : \left(-\frac{1}{2}\right)^{-12}\right] \cdot \frac{2^{45}}{3^{31}}}{\left(\frac{27}{4}\right)^3 : \left(\frac{8}{81}\right)^{-12} : \left(\frac{2}{9}\right)^4} - 3 \right\}^{157} =$$

$$= \left\{ \frac{\left(\frac{1}{2}\right)^{18} \cdot \frac{2^{45}}{3^{31}}}{\left(\frac{3^3}{2^2}\right)^3 : \left(\frac{2^3}{3^4}\right)^{-12} : \left(\frac{2}{3^2}\right)^4} - 3 \right\}^{157} = \left\{ \frac{\frac{2^{27}}{3^{31}}}{\frac{3^9}{2^6} \cdot \frac{2^{36}}{3^{48}} \cdot \frac{3^8}{2^4}} - 3 \right\}^{157} = \left\{ \frac{\frac{2^{27}}{3^{31}}}{\frac{2^{26}}{3^{31}}} - 3 \right\}^{157} = (2 - 3)^{157} = -1$$