

# EXPRESIONES COMPLEJAS

Una expresión es compleja cuando:  
en el numerador o en el denominador  
o en ambas hay operaciones  
indicadas.

Para convertirlas en una fracción  
simple  $\frac{a}{b}$  se resuelven las  
operaciones indicadas, luego se  
divide el numerador entre el  
denominador.

## EJERCICIOS RESUELTOS

$$1) \frac{1}{5^{-2}} = \frac{1}{\left(\frac{1}{5}\right)^2} = \frac{1}{\frac{1}{25}} = \frac{25}{1}$$

$$2) \frac{3^{-4}}{2^{-3}} = \frac{\left(\frac{1}{3}\right)^4}{\left(\frac{1}{2}\right)^3} = \frac{\frac{1}{81}}{\frac{1}{8}} = \frac{8}{81}$$

$$3) \frac{6^{-2}}{3} = \frac{\frac{1}{36}}{\frac{3}{1}} = \frac{1}{108}$$

$$4) \frac{2}{\left(-\frac{3}{4}\right)^{-2}} = \frac{2}{\left(-\frac{4}{3}\right)^2} = \frac{2}{\frac{16}{9}} = \frac{2 \cdot 9}{16} = \frac{18}{16} = \frac{9}{8}$$

*Se simplifica la fracción*

$$5) \frac{\left(-\frac{3}{5}\right)^3}{\left(-\frac{5}{6}\right)^{-2}} = \frac{-\frac{27}{125}}{\frac{36}{25}} = -\frac{\cancel{27}^3 \cdot \cancel{25}^1}{\cancel{36}^4 \cdot \cancel{125}^5} = -\frac{3}{20}$$

$$6) \frac{\left(-\frac{1}{3}\right)^{-2}}{-9} = \frac{\left(-\frac{3}{1}\right)^2}{-9} = \frac{9}{-9} = -1$$

$$7) \frac{\left(-\frac{6}{5}\right)^{-11}}{\left(-\frac{6}{5}\right)^{-9}} = \left(-\frac{6}{5}\right)^{-11 - (-9)} = \left(-\frac{6}{5}\right)^{-11+9} = \left(-\frac{6}{5}\right)^{-2} = \left(-\frac{5}{6}\right)^2 = \frac{25}{36}$$

*Es una división de potencias de igual base se copia la base  $\left(-\frac{6}{5}\right)$  y se restan los exponentes.*

Es una multiplicación de potencias de igual base.

Se copia la base y se suman los exponentes.

Se copia la base y se **restan** los exponentes.

$$8) \frac{\left(-\frac{2}{7}\right)^7 \cdot \left(-\frac{2}{7}\right)^{-5}}{\left(-\frac{2}{7}\right)^4} = \frac{\left(-\frac{2}{7}\right)^{7+(-5)}}{\left(-\frac{2}{7}\right)^4} = \frac{\left(-\frac{2}{7}\right)^2}{\left(-\frac{2}{7}\right)^4} = \left(-\frac{2}{7}\right)^{2-(4)} = \left(-\frac{2}{7}\right)^{-2} = \left(-\frac{7}{2}\right)^2 = \frac{49}{4}$$

Es una división de potencias de igual.

Es una multiplicación de potencias de igual base.

Se copia la base y se suman los exponentes.

Se copia la base y se **restan** los exponentes.

$$9) \frac{\left(-\frac{7}{4}\right)^{-6} \cdot \left(-\frac{7}{4}\right)^{-2}}{\left[\left(-\frac{7}{4}\right)^5\right]^{-2}} = \frac{\left(-\frac{7}{4}\right)^{-6+(-2)}}{\left(-\frac{7}{4}\right)^{5 \cdot (-2)}} = \frac{\left(-\frac{7}{4}\right)^{-6-2}}{\left(-\frac{7}{4}\right)^{-10}} = \frac{\left(-\frac{7}{4}\right)^{-8}}{\left(-\frac{7}{4}\right)^{-10}} = \left(-\frac{7}{4}\right)^{-8-(-10)} = \left(-\frac{7}{4}\right)^{-8+10} = \left(-\frac{7}{4}\right)^2 = \frac{49}{16}$$

Es una potencia de potencia, se copia la base y se multiplican los exponentes.

$$10) \frac{4^{-2}}{2^{-3}} - \frac{2}{\left(-\frac{2}{5}\right)^2} + \frac{(-2)^2}{(-3)^{-1}} = \frac{\left(\frac{1}{4}\right)^2}{\left(\frac{1}{2}\right)^3} - \frac{2}{\frac{4}{25}} + \frac{4}{-\frac{1}{3}} = \frac{\frac{1}{16}}{\frac{1}{8}} - \frac{2}{\frac{4}{25}} + \frac{4}{-\frac{1}{3}} = \frac{50^{25}}{4_2} - \frac{12}{1} = \frac{1}{2} - \frac{25}{2} - \frac{12}{1} = \frac{1-25-24}{2} = -\frac{48}{2} = -24$$

$$11) \frac{\left(-\frac{3}{2}\right)^{-2}}{\left(-\frac{9}{2}\right)^{-3}} - \frac{\left(1-\frac{1}{3}\right)^{-1}}{\left(2+\frac{1}{2}\right)^{-2}} = \frac{\left(-\frac{2}{3}\right)^2}{\left(-\frac{2}{9}\right)^3} - \frac{\left(\frac{3-1}{3}\right)^{-1}}{\left(\frac{4+1}{2}\right)^{-2}} = \frac{\frac{4}{9}}{\frac{8}{729}} - \frac{\left(\frac{2}{3}\right)^{-1}}{\left(\frac{5}{2}\right)^{-2}} = \frac{\frac{4}{9}}{\frac{8}{729}} - \frac{\frac{3}{2}}{\frac{4}{25}} =$$

Se simplifica la fracción

$$\frac{4^1 \cdot 729^{24} \cdot 3^{81}}{8_2 \cdot 9_{3^2}} - \frac{3 \cdot 25}{2 \cdot 4} = \frac{81}{2} - \frac{75}{8} = \frac{324-75}{8} = \frac{249}{8}$$

Se simplifica la fracción

$$12) \frac{\frac{4}{3} + \frac{1}{3^2} + \frac{1}{3^3}}{\frac{1}{3^4}} = \frac{\frac{4}{3} + \frac{1}{9} + \frac{1}{27}}{\frac{1}{81}} = \frac{\frac{36+3+1}{27}}{\frac{1}{81}} = \frac{\frac{40}{27}}{\frac{1}{81}} = \frac{40 \cdot \cancel{81}^3}{\cancel{27}^3 \cdot 1} = \frac{120}{1} = 120$$

Se simplifica la fracción

$$13) \frac{2 + 2^0 + 2^{-1}}{2^{-2} + 2^{-3} + 2^{-4}} = \frac{2 + 1 + \frac{1}{2}}{\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^4} = \frac{\frac{4+2+1}{2}}{\frac{1}{4} + \frac{1}{8} + \frac{1}{16}} = \frac{\frac{7}{2}}{\frac{4+2+1}{16}} = \frac{\frac{7}{2}}{\frac{7}{16}} = \frac{\cancel{7}^1 \cdot \cancel{16}^8}{\cancel{2}_4 \cdot \cancel{7}_1} = 8$$

$$14) (4^{-1} - 3^{-1})^{-1} = \left(\frac{1}{4} - \frac{1}{3}\right)^{-1} = \left(\frac{3-4}{12}\right)^{-1} = \left(-\frac{1}{12}\right)^{-1} = -\frac{12}{1} = -12$$

$$15) \frac{\left(\frac{3}{2} + \frac{1}{2^2} - \frac{1}{2^3}\right)}{\frac{1}{2^4}} - \frac{2 - \frac{3}{4}}{\left(-2 + \frac{2}{3}\right)^{-1}} =$$

$$\frac{\frac{3}{2} + \frac{1}{4} - \frac{1}{8}}{\frac{1}{16}} - \frac{\frac{8-3}{4}}{\left(\frac{-6+2}{3}\right)^{-1}} = \frac{\frac{12+2-1}{8}}{\frac{1}{16}} - \frac{\frac{5}{4}}{\left(-\frac{4}{3}\right)^{-1}} = \frac{\frac{13}{8}}{\frac{1}{16}} - \frac{\frac{5}{4}}{\frac{-3}{4}} = \frac{13 \cdot \cancel{16}^2}{\cancel{8}_1 \cdot 1} + \frac{\cancel{20}^5}{\cancel{4}_3} =$$

$$\frac{26}{1} + \frac{5}{3} = \frac{78+5}{3} = \frac{83}{3}$$