131 Exponents Worksheet

The Basics

(1) Simplify. Remember the difference between a negative *number* as the base and a negative *exponent*.   So $\dfrac{-2x}{y}$

does not become $\dfrac{x}{2y}$.

a) $2^5 =$ _____

b) $(-4)^2 =$ _____

c) $\dfrac{3a}{-15b} =$ _____

d) $-5^2 =$ _____

e) $(-7)^{-2} =$ _____

f) $\left(\dfrac{2}{7}\right)^{-2} =$ _____

(2) Express the following with only positive exponents. <u>Factors</u> which have <u>negative exponents</u> can "cross the fraction
bar" to make the exponent positive. The exponent only applies to the part of the expression right next to it, so $8x^{-2}$
would be $\dfrac{8}{x^2}$ not $\dfrac{1}{8x^2}$. We cannot apply this shortcut to *terms*, only *factors*.

a) $3x^{-6}y^5 =$ _____

b) $-12^{-2}x^8y^{-4} =$ _____

c) $\dfrac{-8a^3b^{-9}}{7c^{-4}d^4e^{-1}} =$ _____

d) $\dfrac{3^{-1}+5^{-1}}{2} =$ _____

(3) Multiply. Recall $x^m x^n = x^{m+n}$. To multiply expressions with the same base we *add* exponents.

a) $\left(4ab^3\right)\left(-3a^2b^7\right) =$ _____

b) $\left(-7m^{13}n^{-5}\right)\left(-8m^{-9}n^{-8}\right) =$ _____

(4) Exponentiate. Recall $(x^m)^n = x^{mn}$ and $(xy)^m = x^m y^m$ and $\left(\dfrac{x}{y}\right)^m = \dfrac{x^m}{y^m}$

To exponentiate expressions *multiply* exponents. If you are applying an exponent to a product or a quotient, the power
is applied to each factor. Remember to apply the exponent to the numerical part also. If the outer exponent is
negative, you can apply it to the numbers directly OR first make it positive be taking the reciprocal of what's inside and
then applying it. (If there is a number inside the parenthesis, this usually a better option).

a) $\left(5x^7y^3z\right)^2 =$ _____

b) $\left(-2a^{-4}b^8\right)^4 =$ _____

c) $\left(5m^{-2}n^8\right)^{-2} =$ _____

d) $\left(\dfrac{-9x}{y^3}\right)^2 =$ _____

e) $\left(\dfrac{3a^2}{b^8}\right)^{-3} =$ _____

f) $\left(\dfrac{m^2n^{-8}}{2p^{-3}}\right)^{-4} =$ _____

(5) Add/Subtract. To add/subtract exponential expressions, combine like terms. Just add the coefficients. Leave the
variable part alone

a) $3xy^3 + 7xy^3 =$ _____

b) $4a^7 - 3a^3 + 7a^3 - 15a^7 =$ _____

c) $\left(7x^5\right)\left(4x^5\right) =$ _____

(6) Simplify these fractions containing exponents. Recall $\dfrac{x^m}{x^n} = x^{m-n}$. We discussed other ways of simplifying this type of problem also. Make sure to reduce the numerical part also.

a) $\dfrac{12x^6 y^3 z}{18x^5 y^3 z^9}$ = _____

b) $\dfrac{3^{-2} xy^{-5} z^{-2}}{x^8 y^{-3} z^9}$ = _____

c) $\dfrac{-35a^{-8} b^{-4} c}{20ab^{-7}}$ = _____

AFTER you've mastered the basics, try…..putting it all together.

(7)

a) $\left(3w^2 z^3\right)\left(7w^{-8} z\right)$ = _____

b) $\left(\dfrac{-3a^2 b^7}{6a^4 b^{-8}}\right)^4$ = _____

Hint: It is less work if you simplify inside of the parenthesis before applying the outer exponent.

c) $\left(-4x^4 y^{-2} z^6\right)^3 \left(2x^{-9} y^4 z\right)$ = _____

d) $\left(\dfrac{18a^{-12} b^{-10} c^{-2}}{48a^{-2} b^4 c^{-2}}\right)^{-3}$ = _____

e) $\dfrac{\left(5y^{-2} z^5\right)^2 \left(4yz^{-1}\right)}{\left(y^2 z^{-7}\right)}$ = _____

f) $\dfrac{\left(3x^4 y^5\right)}{\left(3x^5 y\right)}$ = _____

Answers

(1) a) 32 b) 16 c) $\dfrac{-a}{5b}$ d) -25 e) $\frac{1}{49}$ f) $\frac{49}{4}$

(2) a) $\dfrac{3y^5}{x^6}$ b) $\dfrac{-x^8}{144y^4}$ c) $\dfrac{-8a^3 c^4 e}{7b^9 d^4}$ d) $\frac{4}{15}$

(3) a) $-12a^3 b^{10}$ b) $\dfrac{56m^4}{n^{13}}$ (4) a) $25x^{14} y^6 z^2$ b) $\dfrac{16b^{32}}{a^{16}}$ c) $\dfrac{m^4}{25n^{16}}$ d) $\dfrac{81x^2}{y^6}$ e) $\dfrac{b^{24}}{27a^6}$ f) $\dfrac{16n^{32}}{m^8 p^{12}}$

(5) a) $10xy^3$ b) $-11a^7 + 4a^3$ c) $28x^{10}$ (6) a) $\dfrac{2x}{3z^8}$ b) $\dfrac{1}{9x^7 y^2 z^{11}}$ c) $\dfrac{-7b^3 c}{4a^9}$

(7) a) $567z^{13}$ b) $\dfrac{b^{60}}{16a^8}$ c) $\dfrac{-y^{14}}{16x^{30} z^{16}}$ d) $\dfrac{512a^{30} b^{42}}{27}$ e) $\dfrac{16z^{44}}{25y^{10}}$ f) $\dfrac{y^{10}}{9x^{13}}$