

1. Simplify. Write each expression with positive exponents only.

a. 4^{-3}
 $\frac{1}{4^3} = \frac{1}{64}$

i. $7x^{-3}$
 $\frac{7}{x^3}$

q. $(-3)^{-4}$
 $\frac{1}{(-3)^4} = \frac{1}{81}$

b. $\left(\frac{1}{2}\right)^{-5}$
 $\left(\frac{1}{32}\right)^{-1} = 32$

j. $\left(-\frac{1}{4}\right)^{-3}$
 $(-4)^3 = -64$

r. $3^{-1} + 5^{-1}$
 $\frac{1}{3} + \frac{1}{5} = \frac{5}{15} + \frac{3}{15} = \frac{8}{15}$

c. $\frac{1}{p^{-3}}$
 p^3

k. $\frac{x^{-2}}{x}$
 $\frac{1}{x^2 \cdot x} = \frac{1}{x^3}$

s. $3^{-2} + 3^{-1}$
 $\frac{1}{9} + \frac{1}{3} = \frac{1}{9} + \frac{3}{9} = \frac{4}{9}$

d. $-\frac{1}{y^{-6}}$
 $-y^6$

l. $-2^0 - 3^0$
 $-1 - 1 = -2$

t. $\frac{z^{-4}}{z^{-7}}$
 $\frac{z^7}{z^4} = z^3$

e. $(x^5 z^5)^{-3}$
 $x^{-15} z^{-15} = \frac{1}{x^{15} z^{15}}$

m. $\frac{(x^2)^3}{x^{10}}$
 $\frac{x^6}{x^{10}} = \frac{1}{x^4}$

u. $\frac{-6m^4}{-2m^3}$
 $3m$

f. $(-5a^4 b^7)(-a^4 b^3)$
 $5a^8 b^{10}$

n. $(a^{-5} b^2)^{-6}$
 $a^{30} b^{-12} = \frac{a^{30}}{b^{12}}$

v. $\frac{7ab^{-4}}{7^{-1}a^{-3}b^2}$
 $\frac{7 \cdot 7^1 a a^3}{b^4 \cdot b^2} = \frac{49a^4}{b^6}$

g. $\frac{(xy^3)^5}{(xy)^{-4}}$
 $x^5 y^{15} \cdot x^4 y^4 = x^9 y^{19}$

o. $\left(\frac{r^{-2} s^{-3}}{r^{-4} s^{-3}}\right)^{-3}$
 $\frac{r^6 s^9}{r^{12} s^9} = \frac{1}{r^6}$

w. $a^{4m+1} \cdot a^4$
 a^{4m+5}

h. $\frac{(-2xy^{-3})^{-3}}{(xy^{-1})^{-1}}$
 $\frac{(-2)^3 x^3 y^9}{x^{-1} y^1} = \frac{x y^9}{(-2)^3 x^3 y} = \frac{y^8}{-8x^2}$

p. $\frac{(a^4 b^{-7})^{-5}}{(5a^2 b^{-1})^{-2}}$
 $= \frac{a^{-20} b^{35}}{5^{-2} a^{-4} b^2} = \frac{5^2 a^4 b^{35}}{a^{20} b^2} = \frac{25 b^{33}}{a^{16}}$

2. Write each number in scientific notation.

a. 78,000

$$7.8 \times 10^4$$

c. 9,300,000,000

$$9.3 \times 10^9$$

d. 0.00000167

$$1.67 \times 10^{-6}$$

b. 0.00194

$$1.94 \times 10^{-3}$$

3. Write each number in standard notation.

a. 8.673×10^{-10}

$$0.0000000008673$$

e. 2.032×10^4

$$20320$$

b. $(1.2 \times 10^{-3})(3 \times 10^{-2})$

$$3.6 \times 10^{-5} = 0.000036$$

$$f. \frac{8 \times 10^{-1}}{16 \times 10^5} = \frac{1}{2} \times 10^{-6} = .5 \times 10^{-6}$$

$$= 5 \times 10^{-7} = 0.0000005$$

c. 3.3×10^{-2}

$$.033$$

g. 9.07×10^{10}

$$90,700,000,000$$

d. $(4 \times 10^{-10})(7 \times 10^{-19})$

$$28 \times 10^{-29} = 2.8 \times 10^{-30}$$

$$h. \frac{4 \times 10^5}{2 \times 10^{11}} = 2 \times 10^{-6} = 0.000002$$

$$0.0000000000000000000000000000000028$$

4. Translate the following calculator forms into proper scientific notation, and then into standard form.

3.168603459E-5

a. $3.1686... \times 10^{-5} = 0.000031686...$

2.411123563E18

d. $2.41... \times 10^{18} \approx 2,410,000,000,000,000,000$

1.29E-12

b. $1.29 \times 10^{-12} = 0.00000000000129$

d. $= 2,411,235,63,000,000,000$

b.

e. $72 | 1.9E-4 | 1.9 \times 10^{-4} = 0.00019$

c. X=451.51515

Y=4.9052E-6

$$4.9052 \times 10^{-6} =$$

$$0.0000049052$$

f. Minimum X=1.9999992

Y=2.869E-12

$$2.869 \times 10^{-12} =$$

$$0.000000000002869$$