

Name: _____

Date: _____

1. (a) 14^{-6}
 (b) 6^{21}
 (c) $\frac{((2^{-1})^{-1})^{-1} \times 6^4}{2^9 \times 3^{10}} = \frac{2^{-1} \times 2^4 \times 3^4}{2^9 \times 3^{10}} = 6^{-6}$
 (d) $\frac{3}{2}$
2. (a) $2^{20} = 2^{10} \times 2^{10} \approx 1000 \times 1000 = 1,000,000$, so it will take 7 digits to write. $\boxed{7}$
 (b) $4^{250} \cdot 5^{500} = 2^{500} \cdot 5^{500} = 10^{500}$. This number has 500 zeros and one 1 digit. There are $\boxed{501}$ digits.
3. $6 \times 6 \times 6 \times 6 \times \dots$. No matter how many times you multiply 6 by 6, the units digit is always $\boxed{6}$.
4. (a) $4a^3 \times 3a^{-4} \div 9a^{-6} = \frac{4a^3 \times 3a^{-4}}{9a^{-6}} = \frac{4 \times 3 \times a^3 \times a^6}{9a^4} = \frac{12a^9}{9a^4} = \frac{3}{2}a^5$
 (b) $8(x^{-2}y^3)^4 \times (2xy^2)^{-2} = 8(x^{-8}y^{12}) \times (2^{-2}x^{-2}y^{-4}) = \frac{8y^{12}}{x^8 2^2 x^2 y^4} = \frac{2y^8}{x^{10}}$
 (c) $\frac{1}{2}x^6y^{-3}$
 (d) $\frac{3}{4m^2}$
5. $\frac{2^{1000}}{2^n} = 2^{1000-n}$ and $\frac{1}{16} = 2^{-4}$. Set the exponents equal to each other: $1000 - n = -4$.
 $\boxed{n=1004}$
6. $\boxed{14}$
7. make the bases the same, then set them equal to each other:
 (a) $3^{-x} = 81 = 3^4$. So $-x = 4$. $\boxed{x = -4}$
 (b) $(3x)^{-2} = 9 \Rightarrow \frac{1}{(3x)^2} = 9 \Rightarrow 1 = 9 \times (3x)^2 \Rightarrow 1 = 81x^2 \Rightarrow x^2 = \frac{1}{81} \Rightarrow x = \frac{1}{9}$
 (c) $27^x = 9^{x-1} \Rightarrow 3^{3x} = 3^{2(x-1)}$. Set the exponents equal: $3x = 2(x-1)$. $\boxed{x = -2}$
8. (a) $5^{12^3 4^5} = 5^{1^{big\#}} = 5^1 = \boxed{5}$ (b) $5^{0^{12^3 4^5}} = 5^0 = \boxed{1}$
9. $\boxed{7}$
10. $r = \frac{1}{5}$