**POWERS & EXPONENTS~NOTES**

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| **POWER** | **WORDS** |
| $$2^{1}$$ | 2 to the first power |
| $$2^{2}$$ | 2 to the second power or 2 squared |
| $$2^{3}$$ | 2 to the third power or 2 cubed |
| $$2^{4}$$ | 2 to the fourth power or 2 to the fourth |
| $$2^{n}$$ | 2 to the nth power or 2 to the nth |

**Power** – numbers using an exponent and base

**Base** – the common factor in a power

**Exponent** – the number of times the base is used as a factor

**Write & Evaluate Powers**

*EXAMPLES*

Write each expression using exponents.

1.) $\left(-11\right)\left(-11\right)\left(-11\right)= \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$ 2.) $r∙s∙r∙r∙s∙s∙r∙r= \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$

Evaluate each expression.

3.) $2^{6}$ = \_\_\_\_\_\_\_\_\_\_\_ 4.) $(\frac{1}{7})^{3}$ = \_\_\_\_\_\_\_\_\_\_\_\_\_

5.) Evaluate the expression below if a = 3 and b = 5.

$$a^{2}+ b^{4}$$

**Product of Powers**

Rule: To multiply powers with the same base, add their exponents.

Example: $3^{2}∙3^{4}=\left(3∙3\right)∙\left(3∙3∙3∙3\right)= 3^{6}$

*Simplify using the Laws of Exponents.*

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| --- | --- |
| 1.) $4^{5}∙ 4^{3}$ = | 2.) $-2a\left(3a^{4}\right)= $ |
| 3.) $-3x^{2}∙ 4x^{5}= $ | 4.) $-2m\left(-8m^{5}\right)= $ |

**Quotient of Powers**

Rule: To divide powers with the same base, subtract their exponents.

Example: $\frac{5^{7}}{5^{4}}= \frac{5∙5∙5∙5∙5∙5∙5}{5∙5∙5∙5}= 5^{3}$

NOTE: The difference of the original exponents is the exponent in the final quotient.

*Simplify using the Laws of Exponents.*

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| --- | --- |
| 1.) $\frac{x^{10}}{x^{3}}$ = | 2.) $\frac{12w^{5}}{2w}= $ |
| 3.) $\frac{5^{6}∙ 7^{4}∙ 8^{3}}{5^{4} ∙ 7^{2} ∙ 8^{2}}= $ | 4.) $\frac{(-2)^{5}∙ 3^{4}∙ 5^{7}}{(-2)^{2} ∙ 3 ∙ 5^{3}}=$ |

**Power of a Power**

Rule: To find the power of a power, multiply the exponents.

Example: $(6^{4})^{5}$ (read as, “six to the fourth to the fifth power) = $(6^{4})\left(6^{4}\right)\left(6^{4}\right)\left(6^{4}\right)\left(6^{4}\right)= 6^{20}$

NOTE: The product of the original exponents, 4 and 5, is the final power of 20.

*Simplify using the Laws of Exponents.*

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| --- | --- |
| 1.)$ (2^{5})^{2}$ =  | 2.) $(w^{4})^{6}$ =  |
| 3.) $(4p^{3})^{4} $= | 4.) $(8x^{5}y^{11})^{4}$ =  |

