Exponents Name ________________

We have three ways to think about exponents and their properties:

1. As repeated multiplication.
2. As stretching and shrinking machines.
3. In terms of our rules:
   a. $a^x a^y = a^{x+y}$
   b. $a^x b^x = (ab)^x$
   c. $a^x \div a^y$ or $\frac{a^x}{a^y} = a^{x-y}$

When you look at a problem, decide which of these approaches is most helpful to you in that case.

For example, for $2^{50} \cdot (\frac{1}{2})^{47}$ thinking about how many times an object is stretched and then shrunk by the same amount is helpful.

For $9^{28} \cdot 9^{17}$, you can think about how many times 9 is repeated as a factor (approach number 1 above), or note that the bases are the same so rule 3a applies.

Simplify. For each of the following, find a final answer with a single base and exponent (b^x) for each variable, if possible. **Think intentionally about the possibilities discussed above.**

A) $7^8 \cdot 7^{14}$

B) $x^9 \cdot 3$

C) $x^9 \cdot 3x$

D) $7^8 \cdot 2^8$

E) $(1/3)^8 \cdot 3^{11}$

F) $4x^4 + 3x^4$

G) $x^5 \cdot x^8$

H) $x^5 \cdot y^5$

I) $4x^4 + 3x^3$

J) $x^8 \cdot x^8$

K) $2m^9 \cdot m^2$

L) $x^3 \cdot 3^x$

M) $x^5 \cdot x^8$

N) $4x^4 \cdot 3x^3$

O) $16^4 \cdot (1/4)^6$

P) $11a^4 \cdot 3b^3 \cdot 2a$

Q) $(ab)^3(ab)^6$

R) $(ab)^3(ab)^6$

S) $s^w \cdot x^w$

T) $w^y \cdot w^z$

Challenge. Go as far as possible with: $2^{10} \cdot 2^5 \cdot 3^{15} \cdot 6^2$

Exponents Answers **Name ________________**

A) $7^8 \cdot 7^{14}$

7^{22}

B) $x^9 \cdot 3$

$3x^9$

C) $x^9 \cdot 3x$

$3x^{10}$

D) $7^8 \cdot 2^8$

14^8

E) $(1/3)^8 \cdot 3^{11}$

3^3 or 27

F) $4x^4 + 3x^4$

$7x^4$

G) $x^5 \cdot x^8$

x^{13}

H) $x^5 \cdot y^5$

$(xy)^5$

I) $4x^4 + 3x^3$

Nothing to do with this one

J) $x^8 \cdot x^8$

x^{16} or $(x^2)^8$ which becomes x^{16}

K) $2m^9 \cdot m^2$

$2m^{11}$

L) $x^3 \cdot 3^x$

Nothing to do with this one

M) $x^5 \cdot x^8$

x^{13}

N) $4x^4 \cdot 3x^3$

$12x^7$

O) $16^4 \cdot (1/4)^6$

$(1/4)^2$

P) $11a^4 \cdot 3b^3 \cdot 2a$

$66a^5b^3$

Q) $(ab)^3(ab)^6$

R) Same as R).

$(ab)^9$ or a^9b^9

S) $s^w \cdot x^w$

$(sx)^w$

T) $w^y \cdot w^z$

w^{y+z}