Section 2.1a – Exponent Basics and Negative Bases

This booklet belongs to:______Block: _____

<u>Exponents</u>

- Exponents are simply the **short hand** of writing **repeated multiplication**
- Much like multiplication is the same as repeated addition

Example:	$2 + 2 + 2 = 3 \cdot 2$	Three groups of 2	
But	exponents work like this		

 $2 \cdot 2 \cdot 2 = 2^3$ 2 multiplied three times

• Write these out as repeated multiplications.

Example:

 $5^4 = 5 \cdot 5 \cdot 5 \cdot 5$

 $2^3 = 2 \cdot 2 \cdot 2$

 $4^2 = 4 \cdot 4$

Where it gets tricky is with negative bases, it comes down to how the brackets, if any, are used.

 $(-2)^2$ this means that everything inside the brackets is multiplied repeatedly

 $(-2) \cdot (-2)$

This has a profound effect on the final result

• A negative number multiplied an EVEN NUMBER of times will always finish POSITIVE

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

= 4 \cdot 4
= 16

Foundations of Math 9

• When we have an **EVEN POWER**, we can **REWRITE** the statement **without the brackets**:

As a **POSTIVE statement**.

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

This is a big deal

• A negative number multiplied an ODD NUMBER of times will always finish NEGATIVE

$$(-2)^5 = (-2)(-2)(-2)(-2)(-2)$$

= $4 \cdot 4 \cdot (-2)$
= $16 \cdot (-2)$
 -32

• When we have an **ODD POWER**, we can **REWRITE** the statement **without the brackets**: As a **NEGATIVE statement**.

$$(-2)^{5} = -2^{5}$$
This is a big deal
So far, we know this...
$$(-a)^{Even} = a^{Even}$$

$$(-a)^{odd} = -a^{odd} = -1(a^{odd})$$

• But what about when there **are no brackets**?

Example: The negative is a hidden factor of negative 1 \rightarrow -2 = (-1)2

$-2^{3} - (-1)2^{3}$	$-2^4 - (-1)2^4$	
$\Sigma = (-1)\Sigma$	2 - (-1)2	Regardless of the power, even
= (-1) * 2 * 2 * 2	= (-1) * 2 * 2 * 2 * 2	or odd, if the base is negative
-8	-16	answer is ALWAYS NEGATIVE

Summary

• If the negative is in brackets the result depends on the exponents being odd or even.

FOREVER POSITIVE $(-2)^4 = 2^4$ Even exponent, the answer is always POSITIVEFOREVER NEGATIVE $(-2)^5 = -2^5 = (-1)2^5$ Odd exponent, the answer is always NEGATIVE

• If there are NO BRACKETS, the answer is ALWAYS NEGATIVE

FOREVER NEGATIVE	$-2^5 = (-1)2^5$
FOREVER NEGATIVE	$-2^4 = (-1)2^4$

Determining Exponential Form of a Given Number

• Use a factor tree and factor down to only the desired base



Section 2.1a – Practice Questions

EMERGING LEVEL QUESTIONS

Write the following expressions as repeated multiplication, use brackets when/where necessary.



Find the whole number that should be the exponent, use repeated division using the base shown

11.
$$8 = 2^?$$
 12. $81 = 3^?$

13.

$$625 = 5^?$$
 14.
 $64 = 2^?$

 15.
 $216 = 6^?$
 16.
 $1024 = 2^?$

PROFICIENT LEVEL QUESTIONS

Will the following answers end up positive or negative? Why?

17.
$$-a^{30}$$
 18. $(-a)^{30}$



Solve the following.



Answer Key – Section 2.1a

1.	2 • 2 • 2 • 2 • 2	2. (-3)(-3)(-3)(-3)(-3)(-3)(-3)(-3)(-3)(-3)	-3)(-3)	3. 5·5	4. $(-1)2 \cdot 2 \cdot 2 \cdot 2$
5.	(-2)(-2)(-2)(-2)	6. (-3)(-3)(-3)(-3)(-3)	7.	(-1)2 · 2	8. (-1)7·7·7
9.	(-1)(-2)(-2)(-2)	10. $(-1)(-5)(-5)(-5)(-5)(-5)(-5)(-5)(-5)(-5)(-5$	-5)(-5)	11. 3	12. 4
13.	4	14. 6	15	5. 3	16. 10
17.	Negative	18. Positive	19. Negative	2	20. Negative
21.	Positive	22. Negative			
23.	125	24. 216	2564		26. 81
27.	32	2864			

Extra Work Space