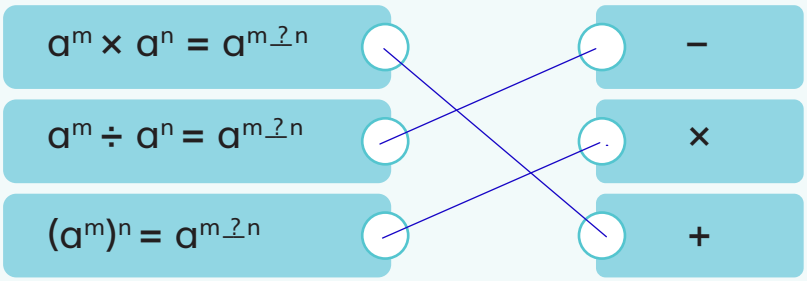
Learning Outcome:
Apply understanding of exponents as repeated multiplication to develop and create equivalent expressions and justify the laws of multiplication and division.
CCSS.MATH.CONTENT.8.EE.A.1

$x+x+1+x+2=45$
$3x+3=45$
$x+1=15$
$x=14$

Now that you have seen how math was instrumental for XLabs to solve the Binate problem, why don't we practice some challenges on exponents and powers?

1 The sum of three consecutive numbers is 45. These numbers are 14, 15, 16.

2 Match the following to the correct operations on the exponents.



3 A box with area 2^6 units is divided into two equal parts.
Write the area of each inside the box below.

Area = 2^6 units → $\frac{2^6}{2} = 2^5$ | 2^5

4 Complete the table given below. We have completed the first one for you.

Problem	Solution	Law of Exponents
$x^3 \times x^6$	x^9	$a^m \times a^n = a^{m+n}$
$12^{20} \div 12^6$	12^{14}	$a^m \div a^n = a^{m-n}$
$(z^3)^5$	z^{15}	$(a^m)^n = a^{m \times n}$

5 Evaluate the following expressions and show the steps in the space given below.
Don't forget to pay attention to the order of operations.

$(25 - 20) \times 5^3$	$2^2 - 2^3 \div 4$	$(14 - 7) \times (7^2)^2 + 7$
5×5^3	$2^2 - 2^3 \div 2^2$	$7 \times 7^4 \div 7$
5^4 (Product Law)	$2^2 - 2 = 2^1$	$7^5 \div 7^1$
		7^4

6 XLabs ordered 42 research kits. These kits come in packets of 3.
Which of the following equation correctly represents x, the number of packets?

☐ $x+3 = 42$ ☑ $3x = 42$ ☐ $\frac{x}{3} = 42$ ☐ $x = \frac{3}{42}$

Learning Outcome:
Apply understanding of exponents as repeated multiplication to develop and create equivalent expressions and justify the laws of multiplication and division.
CCSS.MATH.CONTENT.8.EE.A.1

From several scientific processes to your social media followers, Math is everywhere! When it comes to XLabs' team and binates, it's all about exponents and powers. Based on that, there are a few questions for you. We are sure that you can answer them in a jiffy!

1 On the second day, XLabs' twitter account had 16 more than twice the followers it had on the first day (let's say, x). The expression that correctly gives this follower count is

$2x + 16$

- ☐ 5x - 10
- ☑ 16 + 2x
- ☐ 16x + 2
- ☐ $2x^{16}$

2 XLabs's research team writes 10^3 words everyday for their paper. How many words do they write in 10^2 days?

$10^3 \times 10^2 = 10^5$

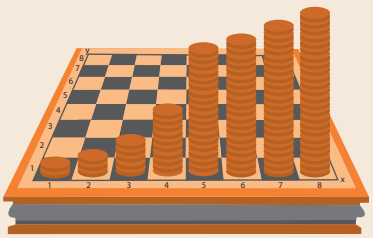
- ☐ 10^6
- ☑ 10^5
- ☐ 10(6)
- ☐ 5^{10}

3 Pennies are stacked in each square of a chessboard, according to the equation below. Fill the given table, if each penny is 0.06 inches thick.

Penny count = $2^x \cdot 2^y$

x - Row number
y - Column number

Row no.	Col no.	Penny count	Stack height
4	1	$2^4 \cdot 2^1 =$	
8	8	$2^8 \cdot 2^8 =$	3932.16



4 A research team has found that the weight of an adult blue whale is 81 times that of a newborn whale calf. If the weight of an adult blue whale is 3^{11} kilograms, then the newborn calf weighs ☐ kilograms

5 The hashtag #binategrowth saw $2^4 \times 3 \times 5^3$ tweets per second. If there are $2^8 \times 3^4 \times 5^2$ seconds in 6 days, what were the number of tweets during this period?

$2^4 \times 3 \times 5^3 \times (1 \text{ second}) \times 6 \text{ days}$
$= 2^4 \times 3 \times 5^3 \times 24 \times 6 \times 60 \times 60$

$= 2^4 \times 3 \times 5^3 \times 2^3 \times 3 \times 2 \times 3 \times 2^2 \times 3^2 \times 2^2 \times 5^2 \times$
$= 2^{12} \times 5^5 \times 3^5$

Learning Outcome:
Apply understanding of exponents as repeated multiplication to develop and create equivalent expressions and justify the laws of multiplication and division.
CCSS.MATH.CONTENT.8.EE.A.1

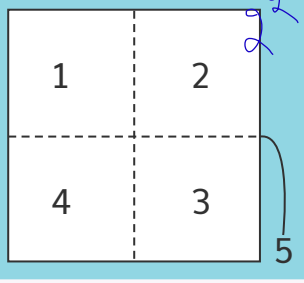
After their ground-breaking discovery, it's fun time for the team at XLabs! The lead mathematician from XLabs (disguised as an origami artist) organized a simple paper folding activity. At the end of this activity, the team discovered something that they couldn't believe! Why don't you find out what they discovered?

Take a piece of square paper (a paper from your notebook could be cut out into a square). A notebook paper is approximately 0.1 mm thick.

Step 1

Fold the square paper into half 2 times and unfold it.

This is how the paper looks after unfolding



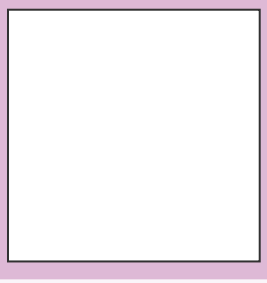
What is the thickness of the paper after **2** folds? $2^2 \times 0.01 = 0.04$

After unfolding, how many squares can you count? 5

Step 2

Now, fold it into half 4 times and unfold it. Draw the pattern that you see below.

This is how the paper looks after unfolding



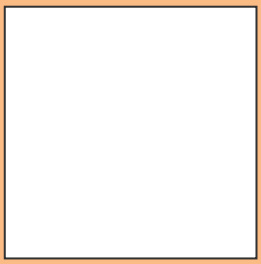
What is the thickness of the paper after **4** folds? $16 \times 0.01 = 0.16$

After unfolding, how many squares can you count? (It is NOT 16) 30

Step 3

Now, try to fold it 8 times. Was it easy to fold? _____. If this paper was folded 8 times and then unfolded, how would the pattern look like?

This is how the paper looks after unfolding



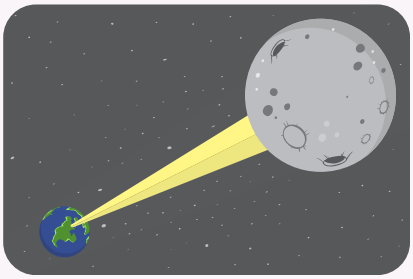
What is the thickness of the paper after **8** folds? 2.56

After unfolding, how many squares can you count? 204

Try to see the pattern that is forming with each fold and fill the table given below:

Psst..! Try using exponent representation here

No. of folds	Thickness of the paper (in mm) after folding	No. of squares after unfolding
2	$2^2 \times 0.01$	$2^2 + 1 = 5$
4	$2^4 \times 0.01$	$4^2 + 3^2 + 2^2 + 1 = 30$
6	$2^6 \times 0.01$	$6^2 + 5^2 + 4^2 + 3^2 + 2^2 + 1 = 91$
8	$2^8 \times 0.01$	$8^2 + \ldots 1 = 204$
44	$2^{44} \times 0.01$	$44^2 + \ldots = 29370$
46	$2^{46} \times 0.01$	$46^2 + \ldots = 33511$



Fun fact

The distance between Earth and the Moon is approximately 3.8×10^{11} mm, which is *less than* 2^{45} mm!