# Concept: The Meaning of Exponents

**Name:**

## Warm Up

Complete the following. Show all your steps.

(a) $2 \times 2 \times 2 \times 2 = \mathbf{16}$

(b) $2 \times 2 \times 2 = \mathbf{8}$

(c) $2 \times 2 \times 2 \times 2 \times 2 = \mathbf{32}$

(d) $2 \times 2 \times 2 \times 2 \times 2 \times 2 = \mathbf{64}$

## COMPUTER COMPONENT

**Instructions:** In UMATH X follow the **Content Menu** path:

**Exponents** > **The Meaning of Exponents**

Work through all Sub Lessons of the following Lessons **in order**:

- *Introduction… The Money Game*
- *Introduction… Bacteria Doubling*
- *Introduction… Paper Folding*

NOTE: You will not be finishing the entire section before stopping to complete some **OFF COMPUTER EXERCISES**.

*Additional Required Materials:* *Pencil crayons*
*Rice*

As you work through the computer exercises, you will be prompted to make notes in your notebook/math journal.

When you reach the end of the lesson *Introduction… Paper Folding* on the computer, move on to the **OFF COMPUTER EXERCISES** below**.**

## The Chess Board

1. On square 1, place a grain of rice.
2. On square 2, place 2 grains of rice.
3. On square 3, place 4 grains of rice.
4. Continue to double the number.

Task 1:
Complete the patterns as far as you can. Write the number of grains in the square.

Task 2:
At the end of each row, indicate the kind of container that you would use to hold the rice. For example, at the end of the first row (square 8), a spoon might be used.

| | | | | | | | | **Container** |
|---|---|---|---|---|---|---|---|---|
| **1**<br>**1** | **2**<br>**2** | **3**<br>**4** | **4**<br>**8** | **5**<br>**16** | **6**<br>**32** | **7**<br>**64** | **8**<br>**128** | **Spoon** |
| **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | |
| **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | |
| **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | |
| **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | |
| **49** | **50** | **51** | **52** | **53** | **54** | **55** | **56** | |
| **57** | **58** | **59** | **60** | **61** | **62** | **63** | **64** | |

**NOTES**

Fill in the following Chart. (The Money Games)

| Day Number | Prize A ($100 per day) | Prize B ($ 0.01 per day, double each day) |
|---|---|---|
| 1 | **$100** | **$0.01** |
| 2 | **$200** | **$0.02** |
| 3 | **$300** | **$0.04** |
| 4 | **$400** | **$0.08** |
| 5 | **$500** | **$0.16** |
| 6 | **$600** | **$0.32** |
| 7 | **$700** | **$0.64** |
| 8 | **$800** | **$1.28** |
| 9 | **$900** | **$2.56** |
| 10 | **$1000** | **$5.12** |
| 11 | **$1100** | **$10.24** |
| 12 | **$1200** | **$20.48** |
| 13 | **$1300** | **$40.96** |
| 14 | **$1400** | **$81.92** |
| 15 | **$1500** | **$163.84** |
| 16 | **$1600** | **$327.68** |
| 17 | **$1700** | **$655.36** |
| 18 | **$1800** | **$1310.72** |
| 19 | **$1900** | **$2621.44** |
| 20 | **$2000** | **$5242.88** |
| 21 | **$2100** | **$10485.76** |

Graph the results from the above chart. Place **Day** on the horizontal axis and **Money** on the vertical axis. (*Use different colored pencils for each Prize*)

Fill in the banks.

- According to my graph, on day ***19*** the value of Prize B exceeds the value of Prized A.

- Write an algebraic expression to represent how money (M) is related to days (D) for Prize A.

$$M = 21 \times \$100$$

- Write an algebraic expression to represent how money (M) is related to days (D) for Prize B.

$$M = 2^{20}$$

- Do the graphs for Prize A and Prize B represent linear or non-linear relationships? *Justify your answer.*

***Prize A- Linear*** ***Prize B- Non-Linear***

**F**ill in the following Chart. (Paper Folding)

| Number of folds | Number of Rectangles | Pattern |
|---|---|---|
| 1 | 2 | 1x2 |
| 2 | 4 | 1x2x2 |
| 3 | 8 | 1x2x2x2 |
| 4 | 16 | 1x2x2x2x2 |
| 5 | 32 | 1x2x2x2x2x2 |
| 6 | 64 | 1x2x2x2x2x2x2 |
| 7 | 128 | 1x2x2x2x2x2x2x2 |
| 8 | 256 | 1x2x2x2x2x2x2x2x2 |
| 9 | 512 | 1x2x2x2x2x2x2x2x2x2 |
| 10 | 1024 | 1x2x2x2x2x2x2x2x2x2 |
| 11 | 2048 | 1x2x2x2x2x2x2x2x2x2x2 |
| 12 | 4096 | 1x2x2x2x2x2x2x2x2x2x2x2 |
| 13 | 8192 | 1x2x2x2x2x2x2x2x2x2x2x2 |
| 14 | 16384 | 1x2x2x2x2x2x2x2x2x2x2x2x2 |
| 15 | 32768 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 16 | 65536 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 17 | 131072 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 18 | 262144 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 19 | 524288 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 20 | 1048576 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |
| 21 | 2097152 | 1x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2x2 |

Graph the results from the above chart. Place **Day** on the horizontal axis and **Money** on the vertical axis. (*Use different colored pencils for each Prize*)

Fill in the blanks.

- If we could fold the paper 50 times, the height would be $2^{50}$ **or** **1125899907000000** layers high.

- If 100 sheets of paper are 1 cm high and each is folded 50 times, how high would the pile be?

$$\text{Pile} = \frac{1125899907000000}{100} x100 \text{ or } \frac{2^{50}}{100} x100$$

$$= 1125899907000000 \text{ cm or } 11258999070000 \text{ m or } 1125899907000 \text{ km}$$

**OFF COMPUTER EXERCISES**

1. Jamie was washing his cement patio. He used a bucket of soapy water to soak the area. As he dumped the first bucket, he noticed that every 2 seconds the area covered was doubled. At 20 seconds, the whole patio was covered with the solution. How long did it take to cover half of Jamie's patio? (*A chart/graph would help you answer this question.*)

***It took 18 seconds to cover half of Jamie's patio because the area would be doubled every two seconds.***