**How Much Rice?**

Chess is a universal game played in hundreds of countries. Historical records show that chess was played thousands of years ago in India. Let’s suppose that an Indian mathematician showed the game to an Indian king and the King was so impressed with the game that he asked the mathematician to name his reward. The mathematician would be awarded anything he desired.

**The mathematician loved rice, so he considered the following two options:**

Option 1: He receives one cup of rice every day for the rest of his life.

Option 2: He receives one grain of rice for the first square on the chessboard. The next day he receives 2 grains of rice for the second square on the chessboard. The day after that he receives 4 grains of rice for the third square on the chessboard. This pattern continues for every square on the chessboard. After the last square, he receives no more rice.

1. Which option do you think will result in more rice?
2. What additional information do you need to figure this out?
3. Let’s analyze these two options. Fill in the tables to see how much rice the mathematician would get in each case.

**Option 1:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Grains of rice received this day** |  |  |  |  |  |  |  |  |
| **Total number of grains of rice received** |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| **Grains of rice received this day** |  |  |  |  |  |  |  |  |
| **Total number of grains of rice received** |  |  |  |  |  |  |  |  |

**Option 2:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **Grains of rice received this day** |  |  |  |  |  |  |  |  |
| **Total number of grains of rice received** |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| **Grains of rice received this day** |  |  |  |  |  |  |  |  |
| **Total number of grains of rice received** |  |  |  |  |  |  |  |  |

1. Graph the total number of grains of rice received over time from the two tables on the same coordinate plane. Use different colors or shapes for the two data sets so you can distinguish them. Choose your scale carefully to make sure you can plot all the data from the tables. Be sure to include titles and labels.



1. Describe the graphs. Do you notice anything interesting or unusual about them? Was there anything that made the graphs difficult to create?

1. What do you think the graphs would look like if you plotted data for an entire month?

Let’s now determine the amount of rice that the mathematician would obtain in each option.

1. Let’s assume that there are 6000 grains of rice in a cup of rice. The total amount of rice received in **Option 1** can be modeled as $f(x)=6000x$.
	1. What does *x* represent in this equation?
	2. What does *f*(*x*) represent in this equation?
	3. What does the coefficient "6000" mean in the context of the problem?
	4. Use this equation to find the total rice received after 1 full year.
2. The amount of rice received each day, starting at day 0, in **Option 2** can be modeled as $g(x)=1∙2^{x}$.
3. What does *x* represent in this equation?
4. What does *g*(*x*) represent in this equation?
5. What does the "2" in the equation mean in the context of the problem?
6. Use this equation to find the amount of rice received on day 20, day 25, and day 30.
7. Which option is better? Explain your reasoning using your work from the previous questions.