

The Million Dollar Mission

Answer Key

You're sitting in math class, minding your own business, when in walks a Bill Gates kind of guy - the real success story of your school. He's made it big, and now he has a job offer for you. He doesn't give too many details, mumbles something about the possibility of danger. He's going to need you for 30 days, and you'll have to miss school. (Won't that just be too awful?) And you've got to make sure your passport is current. (Get real, Bill, this isn't Paris). But do you ever sit up at the next thing he says:

You'll have your choice of two payment options:

1. One cent on the first day, two cents on the second day, and double your salary every day thereafter for the thirty days; or
2. Exactly \$1,000,000. (That's one million dollars!)

You jump up out of your seat at that. You've got your man, Bill, right here. You'll take that million. You are there. And off you go on this dangerous million-dollar mission.

So how smart was this guy? Did you make the best choice? Before we decide for sure, let's investigate the first payment option. Complete the table for the first week's work.

First Week – First Option

Day No.	Pay for that Day	Total Pay (In Dollars)
1	.01	.01
2	.02	.03
3	.04	.07
4	.08	.15
5	.16	.31
6	.32	.63
7	.64	1.27

So after a whole week you would have only made \$1.27.

That's pretty awful, all right. There's no way to make a million in a month at this rate. Right? Let's check out the second week. Complete the second table.

Second Week – First Option

Day No.	Pay for that Day	Total Pay (In Dollars)
8	1.28	2.55
9	2.56	5.11
10	5.12	10.23
11	10.24	20.47
12	20.48	40.95
13	40.96	81.91
14	81.92	163.83

Well, you would make a little more the second week; at least you would have made \$163.83. But there's still a big difference between this salary and \$1,000,000. What about the third week?

Third Week – First Option

Day No.	Pay for that Day	Total Pay (In Dollars)
15	163.84	327.67
16	327.68	655.35
17	655.36	1,310.71
18	1,310.72	2,621.43
19	2,621.44	5,242.87
20	5,242.88	10,485.75
21	10,485.76	20,971.51

We're getting into some serious money here now, but still nowhere even close to a million. And there's only 10 days left. So it looks like the million dollars is the best deal. Of course, we suspected that all along.

Fourth Week – First Option

Day No.	Pay for that Day	Total Pay (In Dollars)
22	20,971.52	41,943.03
23	41,943.04	83,886.07
24	83,886.08	167,772.15
25	167,772.16	335,544.31
26	335,544.32	671,088.63
27	671,088.64	1,342,177.27
28	1,342,177.28	2,684,354.55

Hold it! Look what has happened. What's going on here? This can't be right. This is amazing. Look how fast this pay is growing. Let's keep going. I can't wait to see what the total will be.

Last 2 Days – First Option

Day No.	Pay for that Day	Total Pay (In Dollars)
29	2,684,354.56	5,368,709.11
30	5,368,709.12	10,737,418.23

In 30 days, it increases from 1 penny to over 10 million dollars. That is absolutely amazing.

Questions to consider:

1. How can you determine how much money he would receive on Day 35?
\$343,597,379.67 is the total amount he will receive on Day 35.
2. How can you determine how much money he would receive on Day 40?
\$10,995,116,149.75 (if my calculations are correct) is the total amount he will receive on Day 40.
3. If you know how much money he receives on a certain day, how can you determine how much money he will receive 2 days later? . . . 10 days later?
By doubling the amount of pay and adding it to the previous amount and repeating that process.
4. Write a sentence that describes how much money the guy receives each day.
Take the previous amount and multiply it by 2.
5. What is the rate of change? Is this a common difference or a common ratio?
The rate of change is 2 and this is a common ratio.
6. Use the words *NOW* and *NEXT* to write a rule to express the pattern for pay for the day.
 $\text{NEXT} = 2 \cdot \text{NOW}$
7. How do the numbers and calculations used in your NOW-NEXT rule express the pattern of change in the first option salary table (number of day, amount of money)?
Multiplying by 2 represents the doubling of the salary for each day.
8. Write a sentence that describes the total amount of money the guy will receive through a certain number of days.
To get the total amount double one day past the needed day and subtract 0.01.
9. Use the words NOW-NEXT to write a rule to describe the total amount of pay for a particular day.
 $\text{NEXT} = 2 \cdot \text{NOW} - 0.01$
10. Test each of your equations to see if they generate the values in the table. Were your algebraic equations correct? If not, modify your equations and test them until you are certain they are correct. Record the changes you make so that you can explain to others how you arrived at your final equations.

11. Graph the first ten days of salary option 1 on the graph to the right. Be sure to label your axes and title your graph. Is this a graph of a linear function or an exponential function?

