Name: _____ Date: _____ Hour: ____Alg 1____

Unit 8 Day 1: Introduction to Exponential Functions (The Allowance Problem)

Focus Question: Are all functions linear?

A. Review: Use $5^1 \cdot 2^4$ (which is written in ___**exponential**___ form) to answer the following..

1. What is the base(s)? **2 (+5)**

2. What is the exponent(s)? **4 (+1)**

3. What do exponents tell you? **How many times to use the base as a factor**
   $2^4 = 2 \cdot 2 \cdot 2 \cdot 2$

4. Write the number in expanded form.

5. Show all work using order of operations to write the number in standard form.

GEMS   **$5 \cdot 2^4$**   **$\boxed{80}$**
$5 \cdot 16$

B. The Allowance Problem

Joe's parents usually give him $10 per week for doing his chores. With a new year about to start, Joe went to his parents and asked for the following:

> "The first week, I would like to receive a penny. The 2nd week I would like to get two pennies. The third week I want to get four pennies. The fourth week I'd get 8 pennies. Every week I'd like to get double the number of pennies from the week before."

1. Pre-Work Question (1 minute)
   Do you think Joe is brilliant or crazy for asking for this allowance? Explain

2. Using each plan, complete the table.
   $y = 10$ **$y = 10x + 0$**

$10 Per Week Plan		
Week	$ Received for week	Total $ in the year
1	10	10
2	10	20
3	10	30
4	10	**40**
5	**10**	**50**
6	**10**	**60**
7	**10**	**70**
8	**10**	**80**
9	**10**	**90**
10	**10**	**100**
11	**10**	**110**
12	**10**	**120**

> +10
> +10
> +10

Double Pennies Plan		
Week	$ Received for week	Total $ in the year
1	0.01	0.01
2	0.02	0.03
3	0.04	0.07
4	0.08	**0.15**
5	0.16	**0.31**
6	**0.32**	**0.63**
7	**0.64**	**1.27**
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**

3. Using the **Double Pennies Plan**, graph the <u>weeks</u> as the independent variable and the <u>$ Received for the week</u> as the dependent variable.

$ Received (y-axis)
weeks (x-axis)
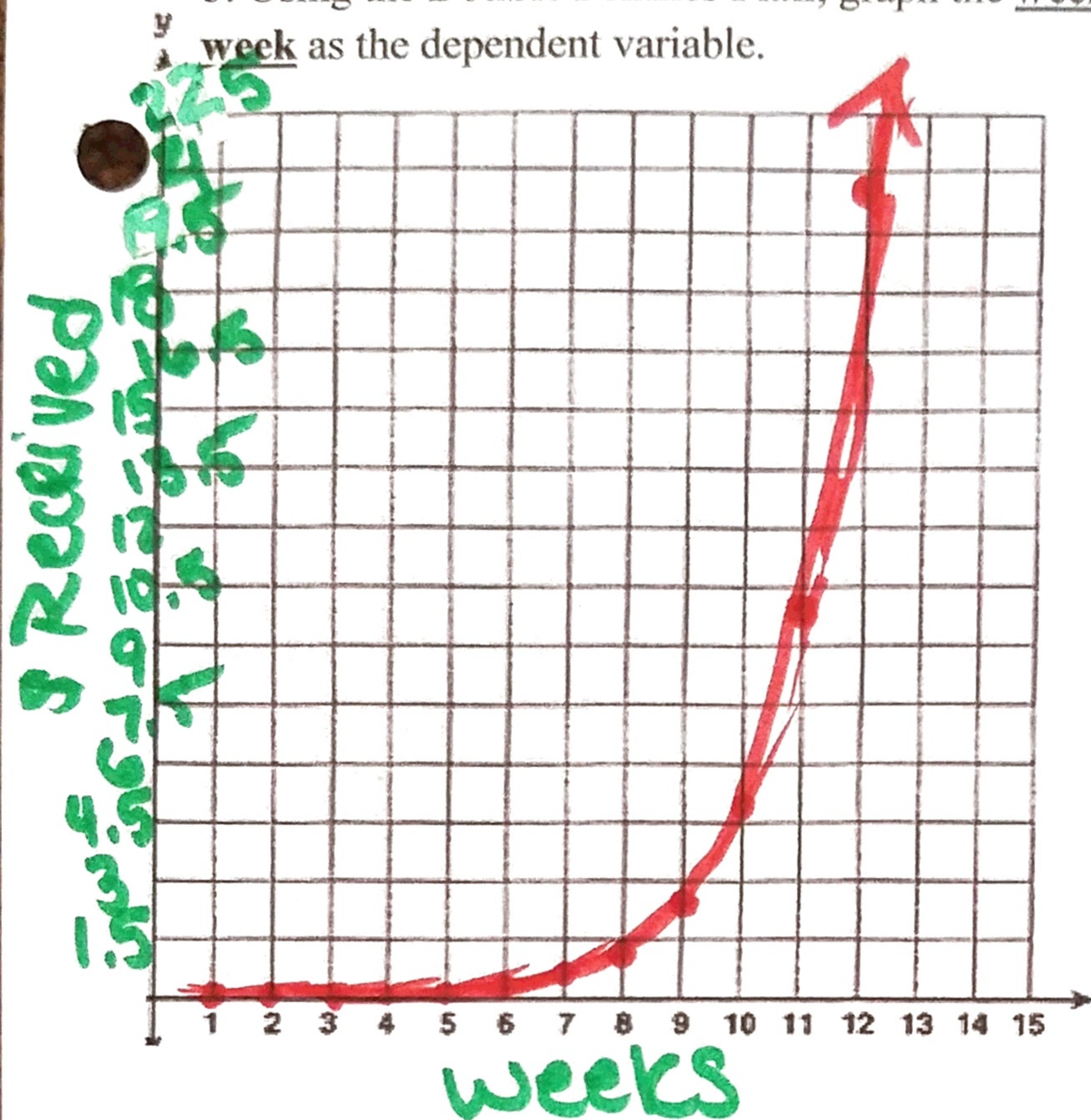
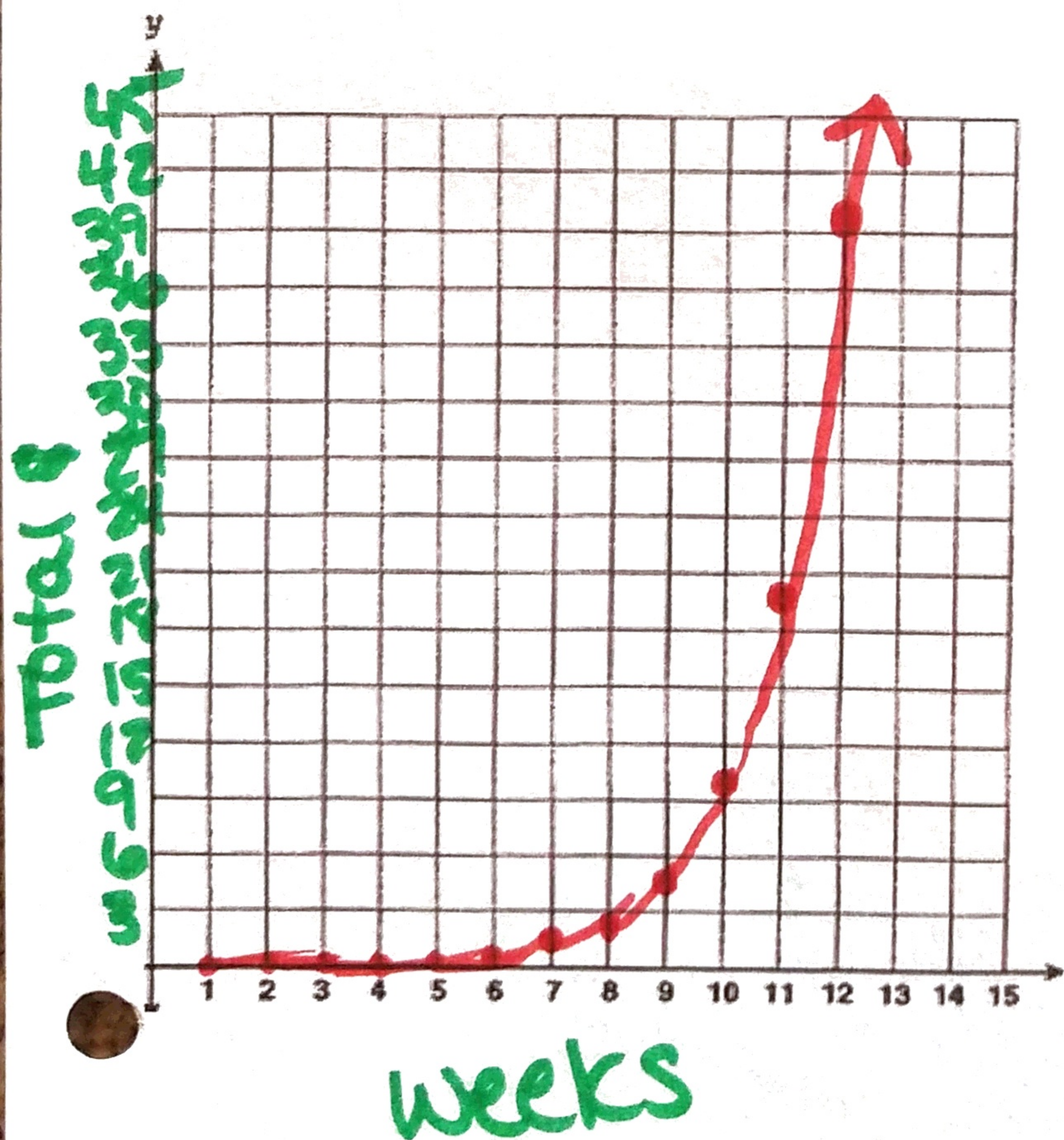4. Is this graph linear or non-linear? Explain.

Non-linear b/c its curved

5. Is this graph a member of the quadratic family? Explain.

No its not a parabola

6. On what week will Joe receive about $10 under this plan?

Week 11 he gets $10.24

7. Using the **Double Pennies Plan**, graph the <u>weeks</u> as the independent variable and the <u>TOTAL $ Received</u> as the dependent variable.

Total $ (y-axis)
weeks (x-axis)

8. Is this graph linear or non-linear? Explain.

Non-linear (curves)

9. Is this graph a member of the quadratic family? Explain

No not a parabola

10. On what week will Joe have close to $520 (which was the total amount received on the $10 per week plan)?

wk	total $
12	40.95
13	82
14	164

| 15 | 358 |
| 16 | 7..... |

11. Does it belong to the same family as the previous graph? Explain.

Yes, they have the same shape

C. Summary Questions

1) If you were Joe's parents, **would you agree to his request**? You should support your answer with mathematics.

No!

week 1-10 he gets less than $10 per week

week 11-52 he gets more than $10 per wk

2) When you look at the tables for the Double Pennies plan (which are below in #3 so you don't have to look back), how can you tell that the tables are not linear and not quadratic?

3) Is there still a pattern to the tables? Explain how the pattern is different from a linear table.

Week	# Pennies
1	1 ·2
2	2 ·2
3	4 ·2
4	8 ·2
5	16

+1 +1
+2 +2
+4 +2
+8 +4

Week	Total Pennies
1	1
2	3
3	7
4	15
5	31

+2 +2
+4 +4
+8 +8
+16

rate is multiplication ←

·2 then +1

4) How would you describe the shape of the graph of the money received on the double pennies plan? (Do **not** just say non-linear!)

J

These two graphs and tables belong to what is called the **exponential family**.

- You can table a table is exponential if __*it has a multiplication constant*__

- You can tell a graph is exponential if __*it is J shape*__ (Just like a parabola can flip upside down and still be a quadratic, a J can flip backwards and still be exponential)