Predicting the Social Media Follower Counts of Singers

Monitoring trends in social media follower counts is crucial, as it offers valuable information about public interest and support on singers. In today's digital world, a singer's social media presence can influence their career opportunities and overall popularity. As a manager of several singers, predicting these trends is essential for making decisions regarding marketing strategies, concert promotions, and public relations.

Imagine you are the manager of several singers, responsible for monitoring their social media follower counts. Your task involves predicting how many followers each singer will have in the future. These predictions will not only help you assess their performance but also facilitate discussions with potential partnerships.

Using mathematical modelling, you will analyse historical follower count data to make predictions and identify patterns across various trends. Get ready to become a professional manager who can leverage social media data for success!

Predicting the social media follower counts of singers

Worksheet 1

Activity 1

To conduct preliminary analysis on the modelling context and make simple predictions.

1. What factors do you think can influence the follower counts of singers on social media?

2. The following table shows the social media follower counts of Singers A and B from January to May.

Singer	Jan	Feb	Mar	Apr	May
Singer A	30	55	80	105	130
Singer B	20	40	80	160	320

   (a) If we can only use this data to predict the social media follower counts of Signers A and B in the coming months, what assumptions should we make?

   (b) With the assumptions in (a), predict the social media follower counts of Singers A and B in June and explain your answer.

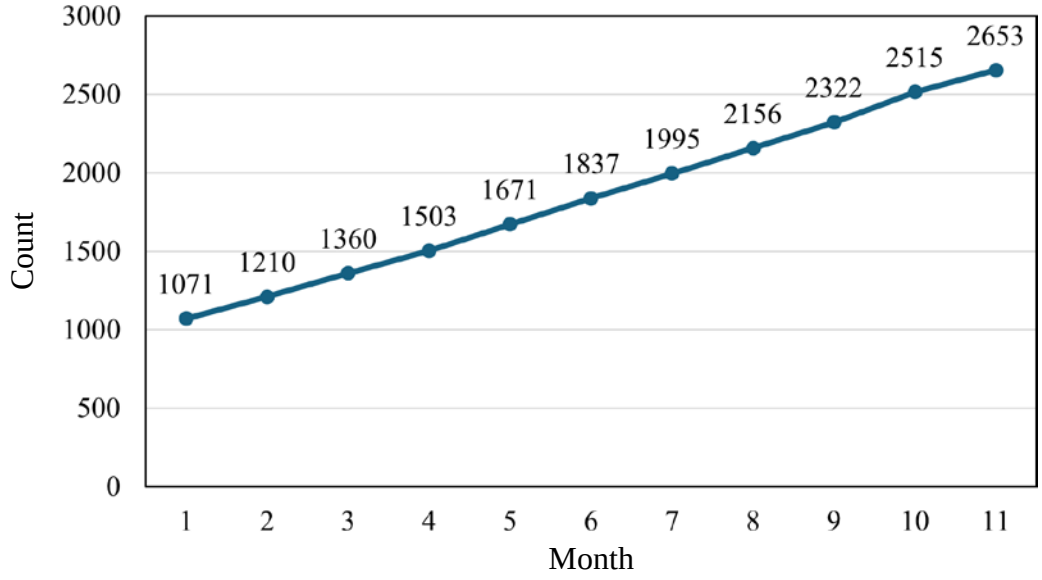
Predicting the social media follower counts of singers

Worksheet 2

Activity 2

To explore modelling approaches applicable to linear trends.

1. The following figure shows the social media follower counts of Singer H from Jan to Nov 2023.



Please suggest some ways to predict Singer H's follower count in Dec 2023.

2. In the following table, calculate the changes in the follower counts between months.

Month	Change
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	Change
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

We can calculate these changes using MS Excel.

Step	Description

i. Input the data to MS Excel as in the following figure.

	A	B	C
1	Month	Counts	Changes
2	1	1071	
3	2	1210	
4	3	1360	
5	4	1503	
6	5	1671	
7	6	1837	
8	7	1995	
9	8	2156	
10	9	2322	
11	10	2515	
12	11	2653	

ii. Column C: Changes

- In Cell C3, input

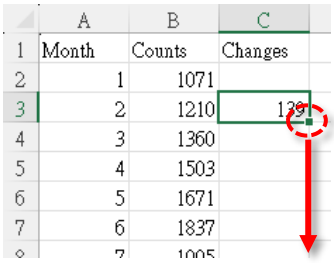
  = B3 – B2

  This means:

  Current count – previous count

- Rest your cursor in the lower-right corner of Cell C3 so that it turns into a “+” sign

- Drag the fill handle to fill Cells C4 to C12 based on Cell C3



The following discuss four possible modelling approaches to predicting Singer H's follower counts in the future.

3. Modelling approach 1:

This approach only considers the change between the most recent two months (i.e., Oct and Nov 2023). It assumes that the change between Nov and Dec 2023 is equal to that between Oct and Nov 2023.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	Change
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 1) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 1?

4. Modelling approach 2:

This approach considers all of the changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). It calculates the mean of these changes to obtain the average change per month and assumes that the change between Nov and Dec 2023 is equal to this average change per month.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	Change
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 2) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 2?

5. Modelling approach 3:

This approach only considers the most recent three changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov). It calculates the mean of these changes during this period to obtain the average change per month and assumes that the change between Nov and Dec 2023 is equal to this average change per month.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	Change
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 3) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 3?

6. What are the common assumption and limitation of Models 1 to 3?

In the following, we attempt to incorporate the concept of "weight" to analyse Models 1 to 3.

7. For example, Model 1 only considers the change between the most recent two months (i.e., Oct and Nov 2023). Therefore, the weight assigned to this change is 1, while the weights for all other changes are set to 0.

Month	Change	Weight
Jan to Feb	139	0
Feb to Mar	150	0
Mar to Apr	143	0
Apr to May	168	0
May to Jun	166	0

Month	Change	Weight
Jun to Jul	158	0
Jul to Aug	161	0
Aug to Sep	166	0
Sep to Oct	193	0
Oct to Nov	138	1

Model 2 considers all of the changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). Therefore, the weights for all changes are set to 1.

Month	Change	Weight
Jan to Feb	139	1
Feb to Mar	150	1
Mar to Apr	143	1
Apr to May	168	1
May to Jun	166	1

Month	Change	Weight
Jun to Jul	158	1
Jul to Aug	161	1
Aug to Sep	166	1
Sep to Oct	193	1
Oct to Nov	138	1

Model 3 only considers the most recent three changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov).

In the following table, write down the weight of each corresponding change.

Month	Change	Weight
Jan to Feb	139	
Feb to Mar	150	
Mar to Apr	143	
Apr to May	168	
May to Jun	166	

Month	Change	Weight
Jun to Jul	158	
Jul to Aug	161	
Aug to Sep	166	
Sep to Oct	193	
Oct to Nov	138	

8. Modelling approach 4:

This approach considers the weights of changes between months. It calculates the weighted mean of these changes to obtain the weighted average change per month.

(a) Propose the weights of these changes and complete the following table. Explain your answers.

Month	Change	Weight
Jan to Feb	139	
Feb to Mar	150	
Mar to Apr	143	
Apr to May	168	
May to Jun	166	

Month	Change	Weight
Jun to Jul	158	
Jul to Aug	161	
Aug to Sep	166	
Sep to Oct	193	
Oct to Nov	138	

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 4) to mathematically express the predicted follower count at the n-th month after Nov 2023.

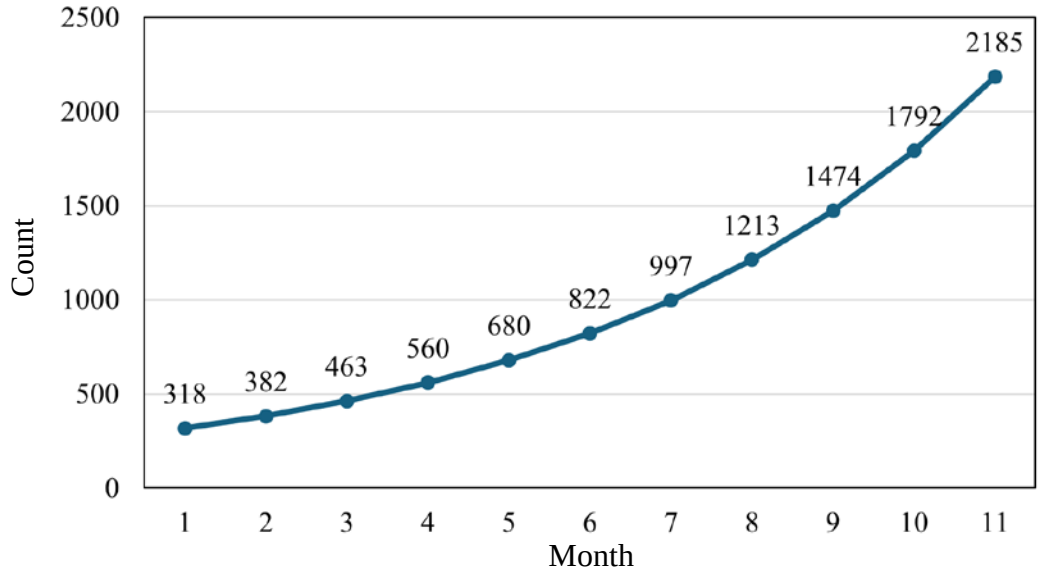
Predicting the social media follower counts of singers

Worksheet 3

Activity 3

To explore modelling approaches applicable to exponential trends.

1. The following figure shows the social media follower counts of Singer K from Jan to Nov 2023.



Is it suitable to use Models 1 to 3 in Activity 2 to predict Singer K's follower count in Dec 2023? Explain your answer.

2. In the following table, calculate the percentage changes in the follower counts between months. Correct your answer to 2 decimal places.

Month	Percentage change
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	Percentage change
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

We can calculate these percentage changes using MS Excel.

Step	Description

i. Input the data to MS Excel as in the following figure.

	A	B	C
1	Month	Counts	% changes
2	1	318	
3	2	382	
4	3	463	
5	4	560	
6	5	680	
7	6	822	
8	7	997	
9	8	1213	
10	9	1474	
11	10	1792	
12	11	2185	

ii. Column C: Percentage changes

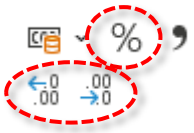
- In Cell C3, input

  = (B3 – B2)/B2

  This means:

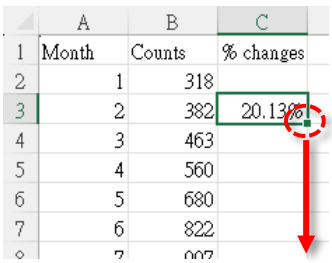
$$\frac{\text{Current count} - \text{previous count}}{\text{Previous count}}$$

- Use the tools under “Home”
  - ✓ Set the format as a percentage
  - ✓ Show two decimal places



- Rest your cursor in the lower-right corner of Cell C3 so that it turns into a “+” sign

- Drag the fill handle to fill Cells C4 to C12 based on Cell C3



The following discuss four possible modelling approaches to predicting Singer K's follower counts in the future.

3. Modelling approach 5:

This approach only considers the percentage change between the most recent two months (i.e., Oct and Nov 2023). It assumes that the percentage change between Nov and Dec 2023 is equal to that between Oct and Nov 2023.

(a) Circle the data used for prediction.

Month	**Percentage change**
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	**Percentage change**
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 5) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 5?

4. Modelling approach 6:

This approach considers all of the percentage changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). It calculates the mean of these percentage changes to obtain the average percentage change per month and assumes that the percentage change between Nov and Dec 2023 is equal to this average percentage change per month.

(a) Circle the data used for prediction.

Month	**Percentage change**
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	**Percentage change**
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 6) to mathematically express the predicted follower count at the n-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 6?

5. Modelling approach 7:

This approach only considers the most recent three percentage changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov). It calculates the mean of these percentage changes to obtain the average percentage change per month and assumes that the percentage change between Nov and Dec 2023 is equal to this average percentage change per month.

(a) Circle the data used for prediction.

Month	**Percentage change**
Jan to Feb	
Feb to Mar	
Mar to Apr	
Apr to May	
May to Jun	

Month	**Percentage change**
Jun to Jul	
Jul to Aug	
Aug to Sep	
Sep to Oct	
Oct to Nov	

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 7) to mathematically express the predicted follower count at the n-th month after Nov 2023.

(d) What are the strengths and weaknesses of Model 7?

6. Modelling approach 8:

Similar to Modelling approach 4, this approach considers the weights of percentage changes between months. It calculates the weighted mean of these percentage changes to obtain the weighted average percentage change per month.

(a) Propose the weights of these percentage changes and complete the following table. Explain your answers.

Month	% change	Weight
Jan to Feb	20.13%	
Feb to Mar	21.20%	
Mar to Apr	20.95%	
Apr to May	21.43%	
May to Jun	20.88%	

Month	% change	Weight
Jun to Jul	21.29%	
Jul to Aug	21.66%	
Aug to Sep	21.52%	
Sep to Oct	21.57%	
Oct to Nov	21.93%	

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

(c) Hence, formulate a mathematical model (Model 8) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

7. What are the common assumption and limitation of Models 5 to 8?

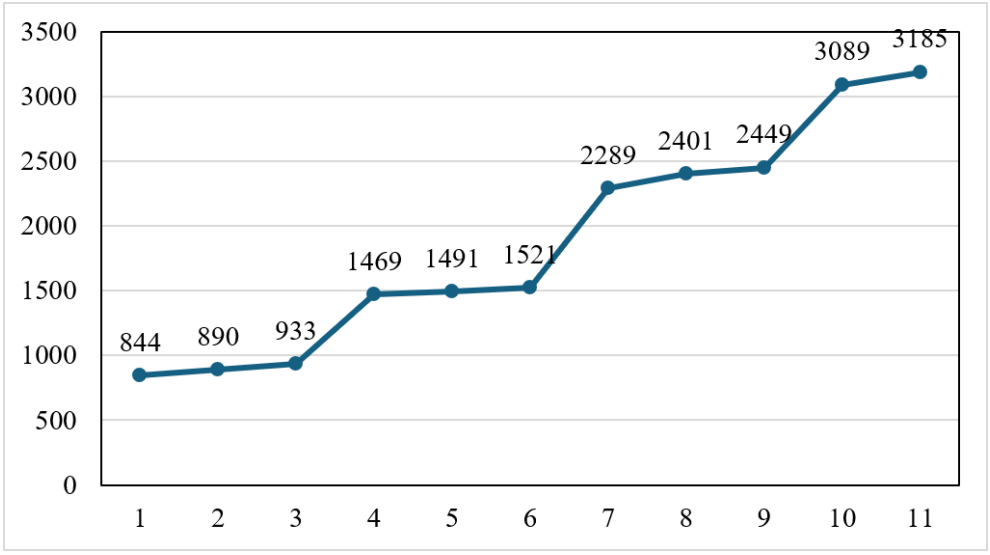
Predicting the social media follower counts of singers

Worksheet 4

Activity 4

To further explore more complicated trends.

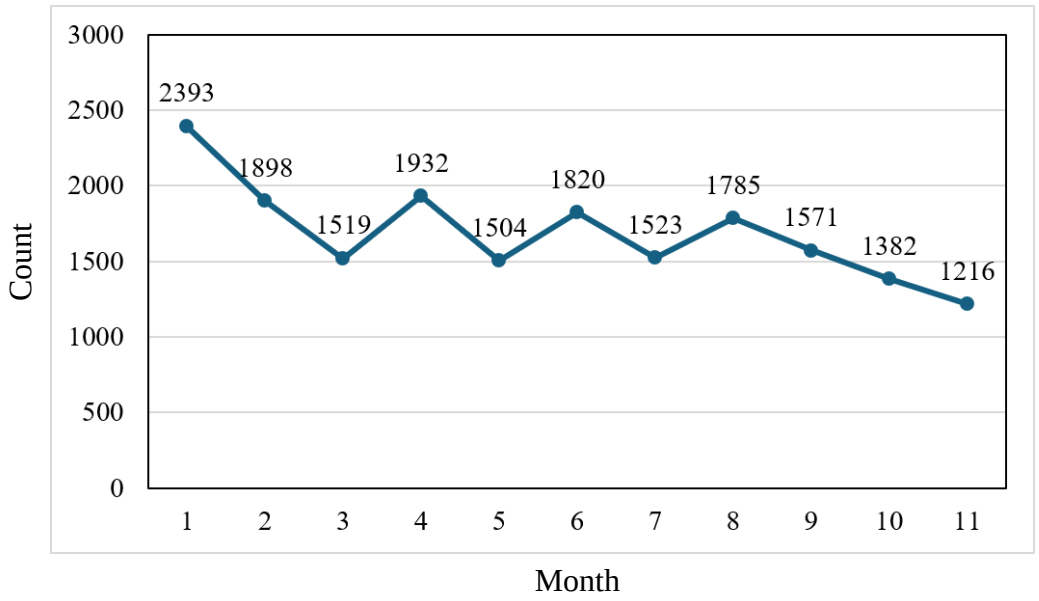
1. The following figure shows the social media follower counts of Singer G from Jan to Nov 2023.



(a) State your observations regarding the above trend.

(b) Hence, make assumptions of modelling and predict Singer G's follower counts in Dec 2023 and Jan 2024.

2. The following figure shows the social media follower counts of Singer Q from Jan to Nov 2023.



(a) State your observations regarding the above trend.

(b) Hence, make assumptions of modelling and predict Singer Q's follower counts in Dec 2023 and Jan 2024.

Predicting the Social Media Follower Counts of Singers

Monitoring trends in social media follower counts is crucial, as it offers valuable information about public interest and support on singers. In today's digital world, a singer's social media presence can influence their career opportunities and overall popularity. As a manager of several singers, predicting these trends is essential for making decisions regarding marketing strategies, concert promotions, and public relations.

Imagine you are the manager of several singers, responsible for monitoring their social media follower counts. Your task involves predicting how many followers each singer will have in the future. These predictions will not only help you assess their performance but also facilitate discussions with potential partnerships.

Using mathematical modelling, you will analyse historical follower count data to make predictions and identify patterns across various trends. Get ready to become a professional manager who can leverage social media data for success!

Predicting the social media follower counts of singers

Worksheet 1

Activity 1

To conduct preliminary analysis on the modelling context and make simple predictions.

1. What factors do you think can influence the follower counts of singers on social media?

[Examples for reference]

- Factors related to the singer themselves, such as the singer's age, personal charisma, and frequency of public appearances.
- Factors related to social media, such as the quality of posts, posting frequency, interaction with fans on social media, and social media algorithms.

2. The following table shows the social media follower counts of Singers A and B from January to May.

Singer	Jan	Feb	Mar	Apr	May
Singer A	30	55	80	105	130
Singer B	20	40	80	160	320

(a) If we can only use this data to predict the social media follower counts of Signers A and B in the coming months, what assumptions should we make?

(b) With the assumptions in (a), predict the social media follower counts of Singers A and B in June and explain your answer.

(a) Assumptions:

1. The primary governing factor is the previous numbers of followers.
2. Consistent growth patterns.
3. Linear growth for Singer A, while exponential growth for Singer B.

(b) For Singer A, the follower count of each month is greater than that of its previous month by 25.

The social media follower count of Singer A in June $= 130 + 25$

$= 155$

For Singer B, the follower count of each month is double that of its previous month.

The social media follower count of Singer B in June $= 320 \times 2$

$= 640$

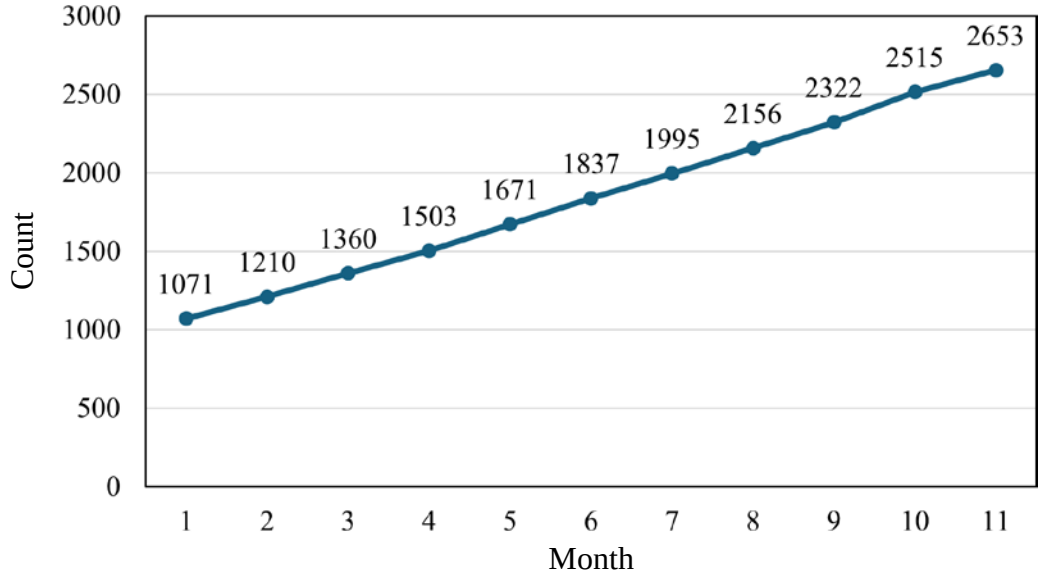
Predicting the social media follower counts of singers

Worksheet 2

Activity 2

To explore modelling approaches applicable to linear trends.

1. The following figure shows the social media follower counts of Singer H from Jan to Nov 2023.



Please suggest some ways to predict Singer H's follower count in Dec 2023.

[Examples for reference]

1. Consider the change for the last two months; and then use this change to predict the follower count in December.
2. Consider the changes from month to month and calculate an average; and then use this average to predict the follower count in December.

2. In the following table, calculate the changes in the follower counts between months.

Month	Change
Jan to Feb	139
Feb to Mar	150
Mar to Apr	143
Apr to May	168
May to Jun	166

Month	Change
Jun to Jul	158
Jul to Aug	161
Aug to Sep	166
Sep to Oct	193
Oct to Nov	138

We can calculate these changes using MS Excel.

Step	Description

i. Input the data to MS Excel as in the following figure.

	A	B	C
1	Month	Counts	Changes
2	1	1071	
3	2	1210	
4	3	1360	
5	4	1503	
6	5	1671	
7	6	1837	
8	7	1995	
9	8	2156	
10	9	2322	
11	10	2515	
12	11	2653	

ii. Column C: Changes

- In Cell C3, input

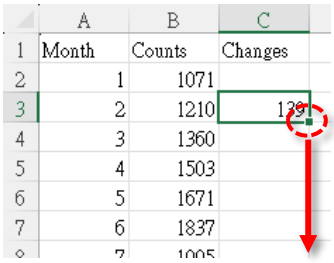
  = B3 – B2

  This means:

  Current count – previous count

- Rest your cursor in the lower-right corner of Cell C3 so that it turns into a “+” sign

- Drag the fill handle to fill Cells C4 to C12 based on Cell C3



The following discuss four possible modelling approaches to predicting Singer H's follower counts in the future.

3. <u>Modelling approach 1:</u>

This approach only considers the change between the most recent two months (i.e., Oct and Nov 2023). It assumes that the change between Nov and Dec 2023 is equal to that between Oct and Nov 2023.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	139
Feb to Mar	150
Mar to Apr	143
Apr to May	168
May to Jun	166

Month	Change
Jun to Jul	158
Jul to Aug	161
Aug to Sep	166
Sep to Oct	193
Oct to Nov	138

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

Dec 2023: $2653 + 138 = 2791$

Jan 2024: $2653 + 138 \times 2 = 2929$

(c) Hence, formulate a mathematical model (Model 1) to mathematically express the predicted follower count at the n-th month after Nov 2023.

The predicted follower count at the n-th month after Nov 2023 = $2653 + 138n$

(d) What are the strengths and weaknesses of Model 1?

Strengths:

1. This model is easy to comprehend.
2. This model can reflect the singer's current popularity.

Weaknesses:

1. This model overlooks the overall trend that includes earlier months.
2. The change between the most recent two months can be unusually high or low due to specific events, which can result in overestimation or underestimation.
3. This model assumes that the follower counts change according to a single pattern.

4. Modelling approach 2:

This approach considers all of the changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). It calculates the mean of these changes to obtain the average change per month and assumes that the change between Nov and Dec 2023 is equal to this average change per month.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	139
Feb to Mar	150
Mar to Apr	143
Apr to May	168
May to Jun	166

Month	Change
Jun to Jul	158
Jul to Aug	161
Aug to Sep	166
Sep to Oct	193
Oct to Nov	138

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

Average change $= \frac{139+150+\cdots+138}{10} = 158$

Dec 2023: 2653 + 158 = 2811

Jan 2024: 2653 + 158×2 = 2969

(c) Hence, formulate a mathematical model (Model 2) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

The predicted follower count at the *n*-th month after Nov 2023 = 2653 + 158*n*

(d) What are the strengths and weaknesses of Model 2?

Strengths:

1. This model considers changes between months over a longer period, providing a more comprehensive analysis of the overall trend.
2. Considering a longer time frame can mitigate the influence of short-term fluctuations.

Weaknesses:

1. Because this model relies on historical data over a longer period, it may not fully reflect the signer's current popularity.
2. This model assumes that the follower counts change according to a single pattern.

5. Modelling approach 3:

This approach only considers the most recent three changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov). It calculates the mean of these changes during this period to obtain the average change per month and assumes that the change between Nov and Dec 2023 is equal to this average change per month.

(a) Circle the data used for prediction.

Month	Change
Jan to Feb	139
Feb to Mar	150
Mar to Apr	143
Apr to May	168
May to Jun	166

Month	Change
Jun to Jul	158
Jul to Aug	161
Aug to Sep	166
Sep to Oct	193
Oct to Nov	138

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

Average change $= \frac{166+193+138}{3} = 166$

Dec 2023: 2653 + 166 = 2819

Jan 2024: 2653 + 166×2 = 2985

(c) Hence, formulate a mathematical model (Model 3) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

The predicted follower count at the *n*-th month after Nov 2023 = 2653 + 166*n*

(d) What are the strengths and weaknesses of Model 3?

Strengths:

1. Considering the most recent changes can reflect the singer's current popularity.
2. Considering the average change over a four-month time frame can mitigate the influence of short-term fluctuations.

Weaknesses:

1. The rationale for considering the three most recent changes is not clear.
2. This model assumes that the follower counts change according to a single pattern.

6. What are the common assumption and limitation of Models 1 to 3?

Assumption: These models assume that changes in follower counts are of a single pattern and follow a linear pattern.
Limitation: These models do not take into account important factors, such as the singer's posting frequency and public appearances.

In the following, we attempt to incorporate the concept of "weight" to analyse Models 1 to 3.

7. For example, Model 1 only considers the change between the most recent two months (i.e., Oct and Nov 2023). Therefore, the weight assigned to this change is 1, while the weights for all other changes are set to 0.

Month	Change	Weight
Jan to Feb	139	0
Feb to Mar	150	0
Mar to Apr	143	0
Apr to May	168	0
May to Jun	166	0

Month	Change	Weight
Jun to Jul	158	0
Jul to Aug	161	0
Aug to Sep	166	0
Sep to Oct	193	0
Oct to Nov	138	1

Model 2 considers all of the changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). Therefore, the weights for all changes are set to 1.

Month	Change	Weight
Jan to Feb	139	1
Feb to Mar	150	1
Mar to Apr	143	1
Apr to May	168	1
May to Jun	166	1

Month	Change	Weight
Jun to Jul	158	1
Jul to Aug	161	1
Aug to Sep	166	1
Sep to Oct	193	1
Oct to Nov	138	1

Model 3 only considers the most recent three changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov).
In the following table, write down the weight of each corresponding change.

Month	Change	Weight
Jan to Feb	139	0
Feb to Mar	150	0
Mar to Apr	143	0
Apr to May	168	0
May to Jun	166	0

Month	Change	Weight
Jun to Jul	158	0
Jul to Aug	161	0
Aug to Sep	166	1
Sep to Oct	193	1
Oct to Nov	138	1

8. Modelling approach 4:

This approach considers the weights of changes between months. It calculates the weighted mean of these changes to obtain the weighted average change per month.

(a) Propose the weights of these changes and complete the following table. Explain your answers.

Month	Change	Weight
Jan to Feb	139	0
Feb to Mar	150	0
Mar to Apr	143	0
Apr to May	168	0
May to Jun	166	0

Month	Change	Weight
Jun to Jul	158	0
Jul to Aug	161	0
Aug to Sep	166	1
Sep to Oct	193	2
Oct to Nov	138	3

To reflect the extent of influence that more recent data has on the predictions, the most recent change is assigned the highest weight of 3.
The second and third most recent changes are given weights of 2 and 1, respectively, indicating their lesser extent of influence.
Changes other than these months are assigned a weight of 0, as they are considered no longer relevant.

(b) Predict Singer H's follower counts in Dec 2023 and Jan 2024.

Average change $= \dfrac{166\times1+193\times2+138\times3}{1+2+3} = 161$

Dec 2023: 2653 + 161 = 2814

Jan 2024: 2653 + 161×2 = 2975

(c) Hence, formulate a mathematical model (Model 4) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

The predicted follower count at the *n*-th month after Nov 2023 = 2653 + 161*n*

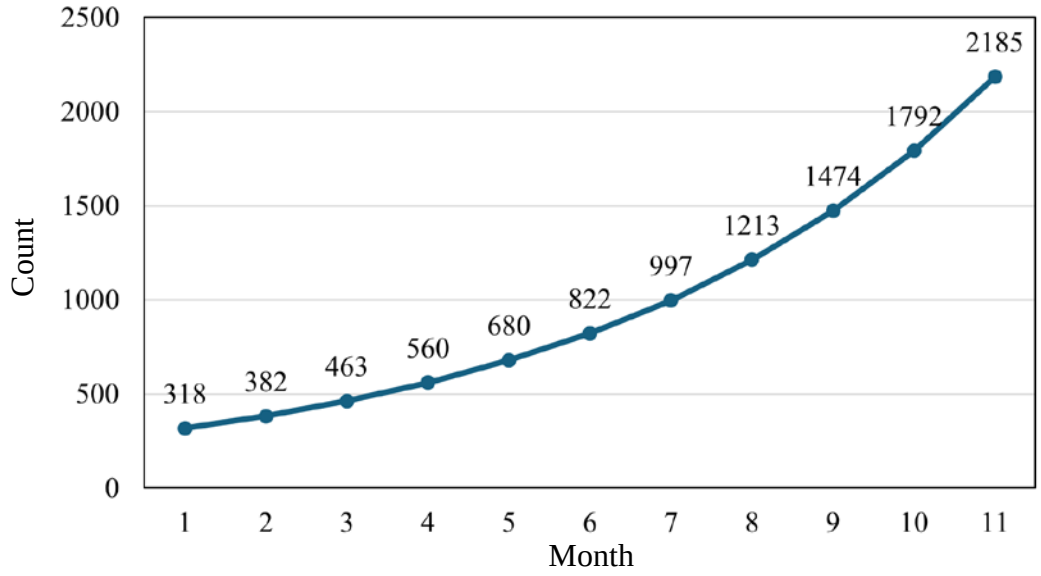
Predicting the social media follower counts of singers

Worksheet 3

Activity 3

To explore modelling approaches applicable to exponential trends.

1. The following figure shows the social media follower counts of Singer K from Jan to Nov 2023.



Is it suitable to use Models 1 to 3 in Activity 2 to predict Singer K's follower count in Dec 2023? Explain your answer.

> Unlike the data in Activity 2, the monthly changes in Singer K's follower counts are clearly inconsistent. Furthermore, the graph shows an accelerating growth in the follower counts.
> Given this non-linear trend, Models 1 to 3 may not be suitable for prediction.

2. In the following table, calculate the percentage changes in the follower counts between months. Correct your answer to 2 decimal places.

Month	Percentage change
Jan to Feb	20.13%
Feb to Mar	21.20%
Mar to Apr	20.95%
Apr to May	21.43%
May to Jun	20.88%

Month	Percentage change
Jun to Jul	21.29%
Jul to Aug	21.66%
Aug to Sep	21.52%
Sep to Oct	21.57%
Oct to Nov	21.93%

We can calculate these percentage changes using MS Excel.

Step	Description

i. Input the data to MS Excel as in the following figure.

	A	B	C
1	Month	Counts	% changes
2	1	318	
3	2	382	
4	3	463	
5	4	560	
6	5	680	
7	6	822	
8	7	997	
9	8	1213	
10	9	1474	
11	10	1792	
12	11	2185	

ii. Column C: Percentage changes

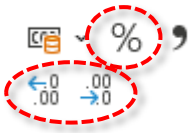
- In Cell C3, input

  = (B3 – B2)/B2

  This means:

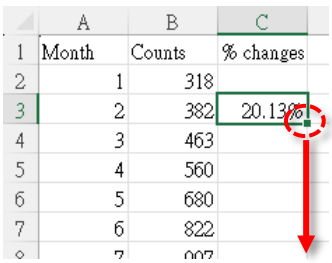
$$\frac{\text{Current count} - \text{previous count}}{\text{Previous count}}$$

- Use the tools under “Home”
  - ✓ Set the format as a percentage
  - ✓ Show two decimal places



- Rest your cursor in the lower-right corner of Cell C3 so that it turns into a “+” sign

- Drag the fill handle to fill Cells C4 to C12 based on Cell C3



The following discuss four possible modelling approaches to predicting Singer K's follower counts in the future.

3. Modelling approach 5:

This approach only considers the percentage change between the most recent two months (i.e., Oct and Nov 2023). It assumes that the percentage change between Nov and Dec 2023 is equal to that between Oct and Nov 2023.

(a) Circle the data used for prediction.

Month	Percentage change
Jan to Feb	20.13%
Feb to Mar	21.20%
Mar to Apr	20.95%
Apr to May	21.43%
May to Jun	20.88%

Month	Percentage change
Jun to Jul	21.29%
Jul to Aug	21.66%
Aug to Sep	21.52%
Sep to Oct	21.57%
Oct to Nov	21.93%

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

Dec 2023: $2185(1 + 21.93\%) = 2664$

Jan 2024: $2185(1 + 21.93\%)^2 = 3248$

(c) Hence, formulate a mathematical model (Model 5) to mathematically express the predicted follower count at the n-th month after Nov 2023.

The predicted follower count at the n-th month after Nov 2023

$= 2185(1 + 21.93\%)^n$

(d) What are the strengths and weaknesses of Model 5?

Strengths:

1. This model is easy to comprehend.
2. This model can reflect the singer's current popularity.

Weaknesses:

1. This model overlooks the overall trend that includes earlier months.
2. The percentage change between the most recent two months can be unusually high or low due to specific events, which can result in overestimation or underestimation.
3. This model assumes that the follower counts change according to a single pattern.

4. Modelling approach 6:

This approach considers all of the percentage changes between months (i.e., Jan to Feb, Feb to Mar, …, and Oct to Nov). It calculates the mean of these percentage changes to obtain the average percentage change per month and assumes that the percentage change between Nov and Dec 2023 is equal to this average percentage change per month.

(a) Circle the data used for prediction.

Month	Percentage change
Jan to Feb	20.13%
Feb to Mar	21.20%
Mar to Apr	20.95%
Apr to May	21.43%
May to Jun	20.88%

Month	Percentage change
Jun to Jul	21.29%
Jul to Aug	21.66%
Aug to Sep	21.52%
Sep to Oct	21.57%
Oct to Nov	21.93%

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

Average percentage change $= \dfrac{20.13\% + 21.20\% + \cdots + 21.93\%}{10} = 21.26\%$

Dec 2023: $2185(1 + 21.26\%) = 2650$

Jan 2024: $2185(1 + 21.26\%)^2 = 3213$

(c) Hence, formulate a mathematical model (Model 6) to mathematically express the predicted follower count at the n-th month after Nov 2023.

The predicted follower count at the n-th month after Nov 2023

$= 2185(1 + 21.26\%)^n$

(d) What are the strengths and weaknesses of Model 6?

Strengths:

1. This model considers percentage changes between months over a longer period, providing a more comprehensive analysis of the overall trend.
2. Considering a longer time frame can mitigate the influence of short-term fluctuations.

Weaknesses:

1. Because this model relies on historical data over a longer period, it may not fully reflect the signer's current popularity.
2. This model assumes that the follower counts change according to a single pattern.

5. Modelling approach 7:

This approach only considers the most recent three percentage changes between months (i.e., Aug to Sep, Sep to Oct, and Oct to Nov). It calculates the mean of these percentage changes to obtain the average percentage change per month and assumes that the percentage change between Nov and Dec 2023 is equal to this average percentage change per month.

(a) Circle the data used for prediction.

Month	Percentage change
Jan to Feb	20.13%
Feb to Mar	21.20%
Mar to Apr	20.95%
Apr to May	21.43%
May to Jun	20.88%

Month	Percentage change
Jun to Jul	21.29%
Jul to Aug	21.66%
Aug to Sep	21.52%
Sep to Oct	21.57%
Oct to Nov	21.93%

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

$$\text{Average percentage change} = \frac{21.52\% + 21.57\% + 21.93\%}{3} = 21.67\%$$

Dec 2023: $2185(1 + 21.67\%) = 2658$

Jan 2024: $2185(1 + 21.67\%)^2 = 3235$

(c) Hence, formulate a mathematical model (Model 7) to mathematically express the predicted follower count at the n-th month after Nov 2023.

The predicted follower count at the n-th month after Nov 2023

$= 2185(1 + 21.67\%)^n$

(d) What are the strengths and weaknesses of Model 7?

Strengths:

1. Considering the most recent percentage changes can reflect the singer's current popularity.
2. Considering the average percentage change over a four-month time frame can mitigate the influence of short-term fluctuations.

Weaknesses:

1. The rationale for considering the three most recent percentage changes is not clear.
2. This model assumes that the follower counts change according to a single pattern.

6. Modelling approach 8:

Similar to Modelling approach 4, this approach considers the weights of percentage changes between months. It calculates the weighted mean of these percentage changes to obtain the weighted average percentage change per month.

(a) Propose the weights of these percentage changes and complete the following table. Explain your answers.

Month	% change	Weight
Jan to Feb	20.13%	0
Feb to Mar	21.20%	0
Mar to Apr	20.95%	0
Apr to May	21.43%	0
May to Jun	20.88%	0

Month	% change	Weight
Jun to Jul	21.29%	0
Jul to Aug	21.66%	0
Aug to Sep	21.52%	1
Sep to Oct	21.57%	2
Oct to Nov	21.93%	3

To reflect the extent of influence that more recent data has on the predictions, the most recent percentage change is assigned the highest weight of 3.
The second and third most recent percentage changes are given weights of 2 and 1, respectively, indicating their lesser extent of influence.
Percentage changes other than these months are assigned a weight of 0, as they are considered no longer relevant.

(b) Predict Singer K's follower counts in Dec 2023 and Jan 2024.

Average percentage change $= \dfrac{21.52\% \times 1 + 21.57\% \times 2 + 21.93\% \times 3}{1 + 2 + 3} = 21.74\%$

Dec 2023: $2185(1 + 21.74\%) = 2660$

Jan 2024: $2185(1 + 21.74\%)^2 = 3238$

(c) Hence, formulate a mathematical model (Model 8) to mathematically express the predicted follower count at the *n*-th month after Nov 2023.

The predicted follower count at the *n*-th month after Nov 2023
$= 2185(1 + 21.74\%)^n$

7. What are the common assumption and limitation of Models 5 to 8?

Assumption: These models assume that changes in follower counts are of a single pattern and follow an exponential trend.
Limitation: These models do not take into account important factors, such as the singer’s posting frequency and public appearances.

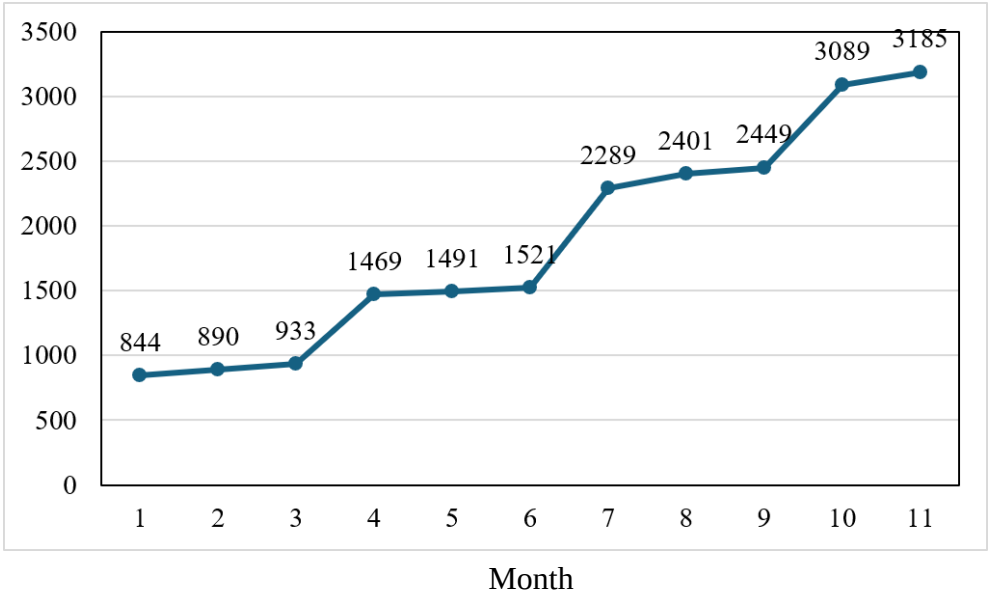
Predicting the social media follower counts of singers

Worksheet 4

Activity 4

To further explore more complicated trends.

1. The following figure shows the social media follower counts of Singer G from Jan to Nov 2023.



(a) State your observations regarding the above trend.

(b) Hence, make assumptions of modelling and predict Singer G's follower counts in Dec 2023 and Jan 2024.

[Examples for reference]

(a) Observations: Singer G's follower counts would experience a significant increase after every three months of relatively small growth.

(b) Assumptions: The trend follows patterns observed in the past, and more recent data has higher importance (weight).

Consider:

Change from Mar to Apr = 1469 – 933 = 536

Change from Jun to Jul = 2289 – 1521 = 768

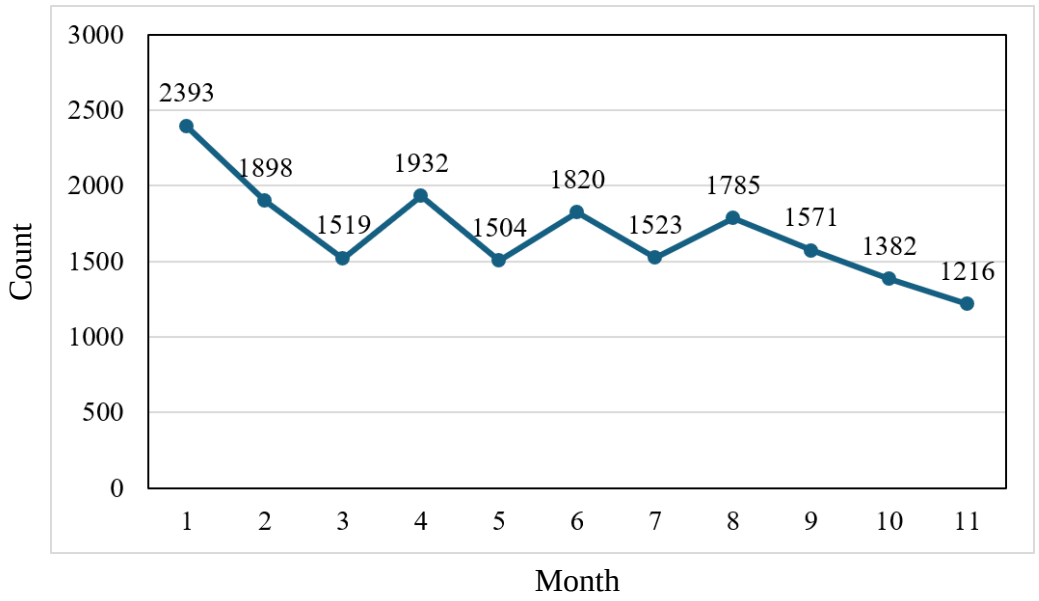
Change from Sep to Oct = 3089 – 2449 = 640

Change from Oct to Nov = 3185 – 3089 = 96

Dec 2023: 3185 + 96 = 3281

Jan 2024: $3281+\frac{536\times1+768\times2+640\times3}{1+2+3}=3946$

2. The following figure shows the social media follower counts of Singer Q from Jan to Nov 2023.



(a) State your observations regarding the above trend.

(b) Hence, make assumptions of modelling and predict Singer Q's follower counts in Dec 2023 and Jan 2024.

[Examples for reference]

(a) Observations: From Jan to Aug, Singer Q's follower counts show a downward trend but do not exhibit a clear pattern. However, starting from Aug, the follower counts decline following an exponential trend.

(b) Assumptions: Due to the lack of a clear pattern in the changes from Jan to Aug, we exclude these data when formulating the model. Then, we assume that the follower counts will continue to decrease according to the pattern observed after Aug.

Consider:

Percentage change from Aug to Sep $= \frac{1571-1785}{1785} \times 100\% = -12.0\%$

Percentage change from Sep to Oct $= \frac{1382-1571}{1571} \times 100\% = -12.0\%$

Percentage change from Oct to Nov $= \frac{1216-1382}{1382} \times 100\% = -12.0\%$

Dec 2023: $1216(1 - 12.0\%) = 1070$

Jan 2024: $1216(1 - 12.0\%)^2 = 942$