

Generating Maths Solutions with ChatGPT



$$\frac{x}{3} - 8 = 6$$
$$\frac{x}{3} - 8 + 8 = 6 + 8$$
$$\frac{x}{3} = 14$$

A yellow sticky note with a red corner, containing three lines of mathematical equations. The first line is $\frac{x}{3} - 8 = 6$. The second line is $\frac{x}{3} - 8 + 8 = 6 + 8$. The third line is $\frac{x}{3} = 14$.

Introduction



Introduction

- More and more students are turning to AI tools like ChatGPT.



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- More and more students are turning to AI tools like ChatGPT.
- Can these tools help students with their maths?



MATH6040 is a second year module for engineers which covers vectors, matrices, differentiation and integration.

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2017 S2 Paper

28 question parts.

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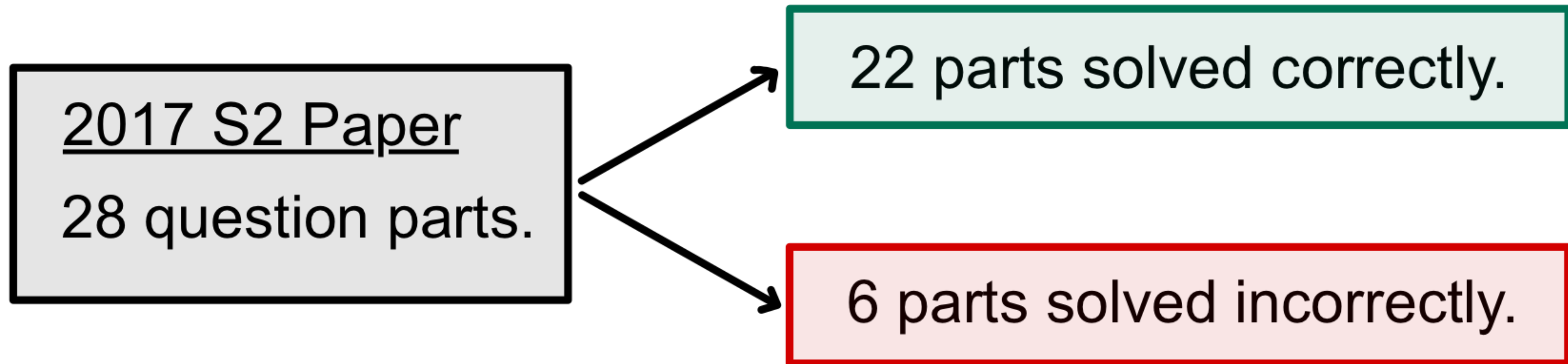
2017 S2 Paper

28 question parts.

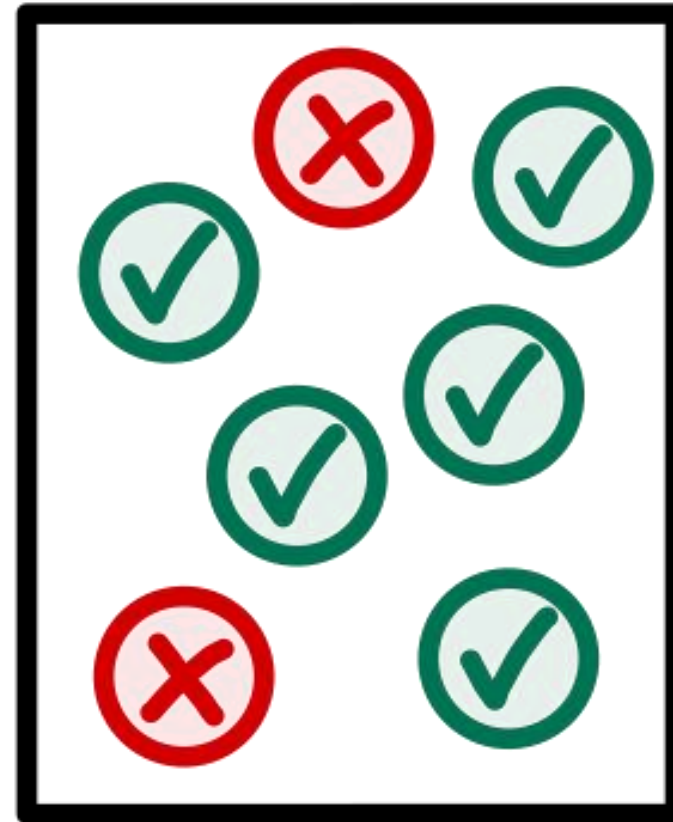
22 parts solved correctly.

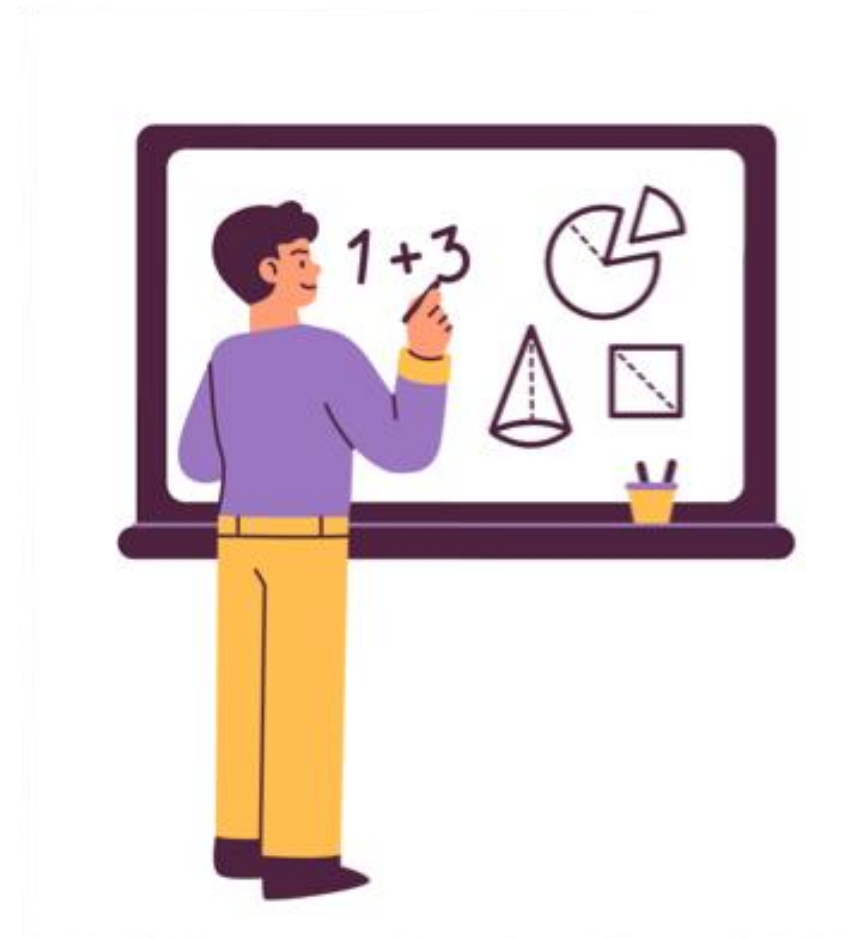
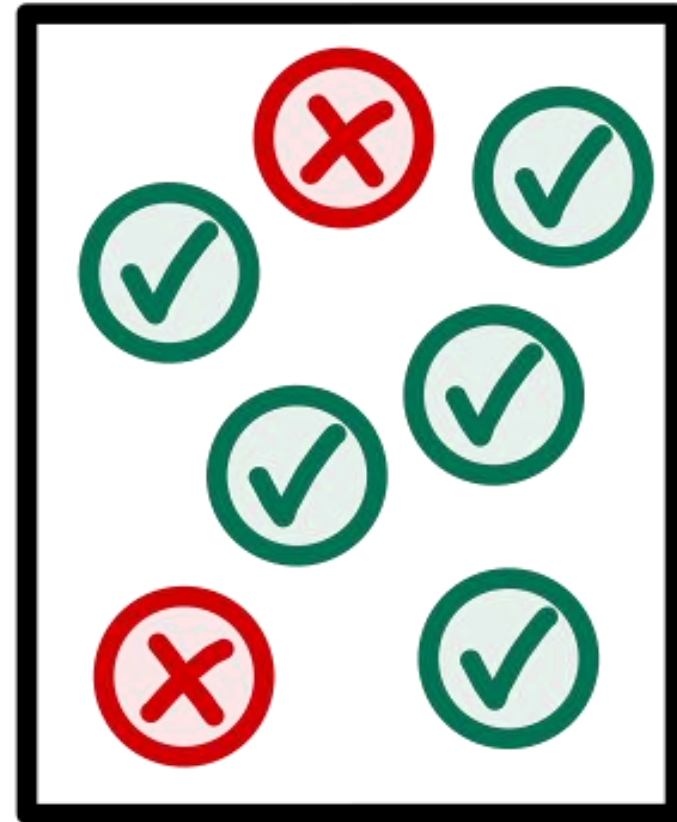
6 parts solved incorrectly.

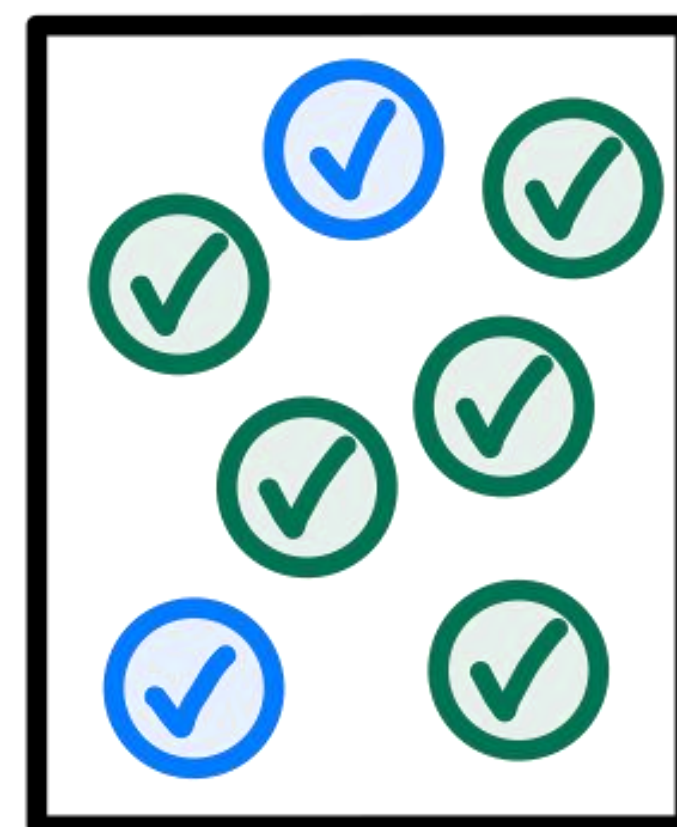
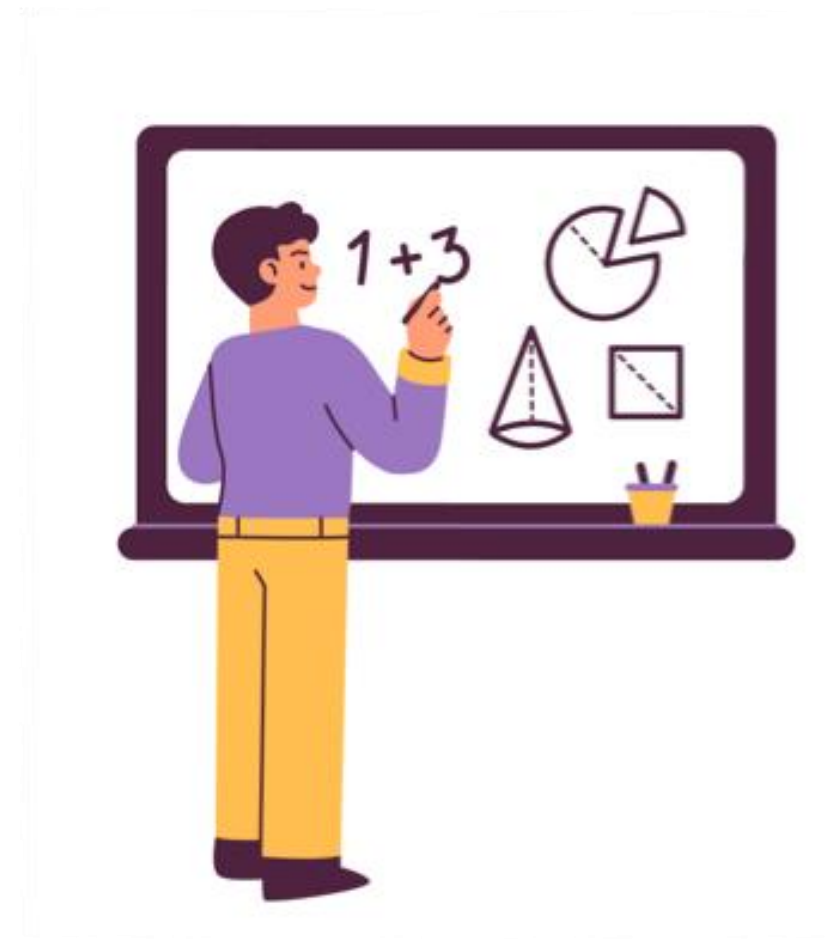
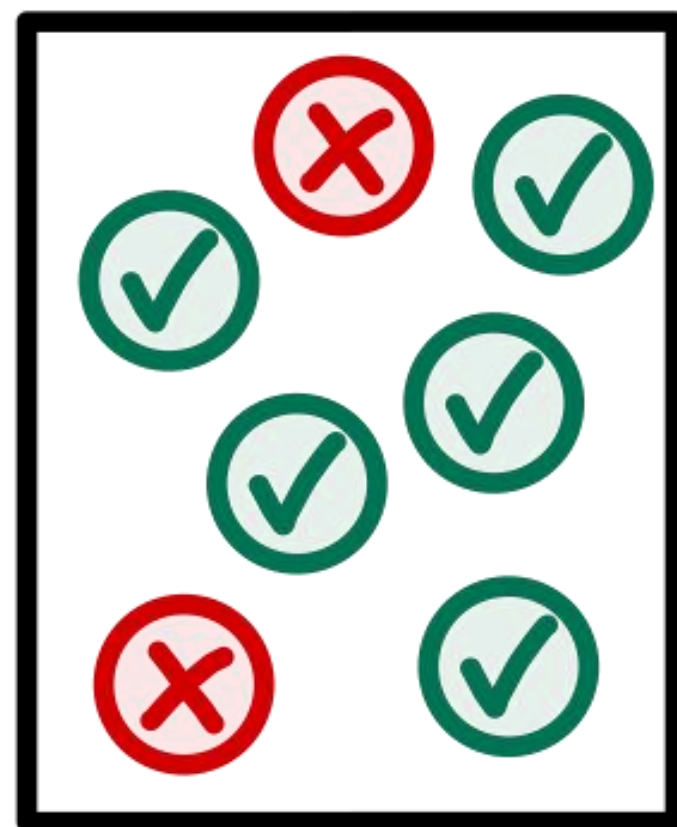
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If I graded the paper it would have scored 86%







The goal ...

Use ChatGPT to generate maths solutions which are ...

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Correct



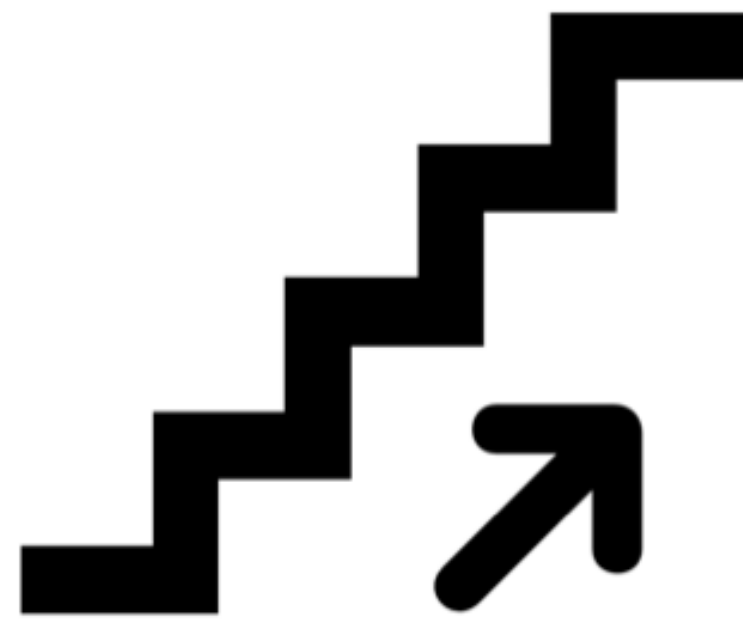
The goal ...

Use ChatGPT to generate maths solutions which are ...

Correct



Well explained



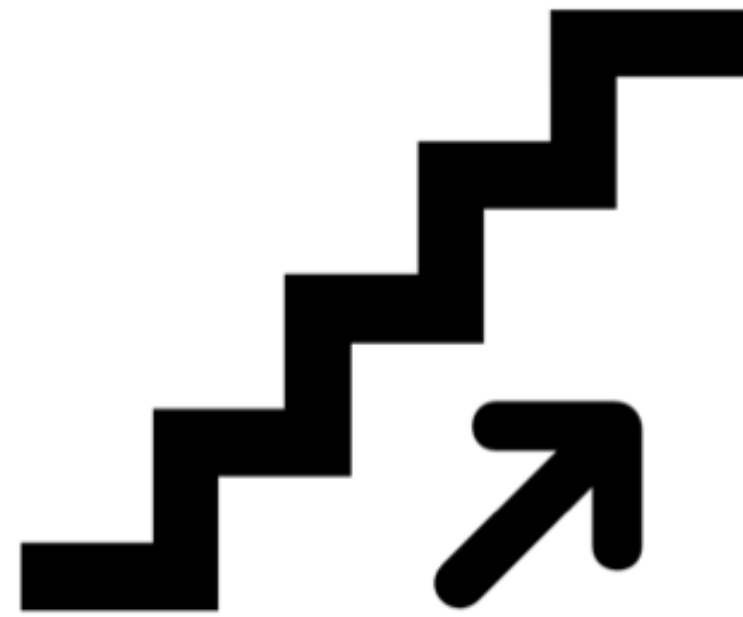
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Nicely formatted



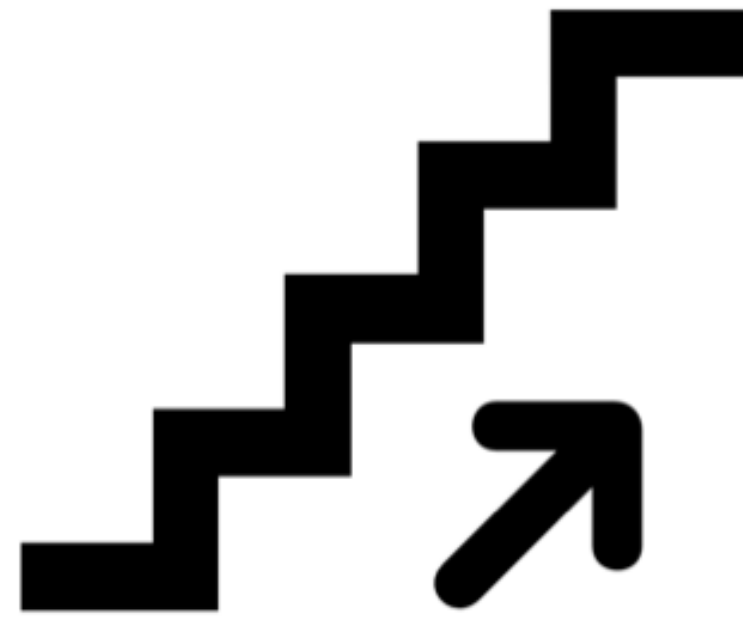
The goal ...

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Correct



Well explained



Nicely formatted



Many **challenges** were encountered.

Challenge 1: Calculation Errors

ChatGPT 3.5



You

Calculate 0.72 to the power of 5





ChatGPT

$0.72^5 \approx 0.248832$


Challenge 1: Calculation Errors

ChatGPT 3.5

 **You**
Calculate 0.72 to the power of 5

 **ChatGPT**
 $0.72^5 \approx 0.248832$


 **You**
Calculate 0.72 to the power of 5

 **ChatGPT**
0.72 to the power of 5 is approximately 0.29498.


Challenge 1: Calculation Errors

ChatGPT 3.5


D You
Calculate 0.72 to the power of 5

 **ChatGPT**
 $0.72^5 \approx 0.248832$

D You
Calculate 0.72 to the power of 5

 **ChatGPT**
0.72 to the power of 5 is approximately 0.29498.

D You
Calculate 0.72 to the power of 5

 **ChatGPT**
0.72 to the power of 5 equals approximately 0.32768.

Challenge 1: Calculation Errors

ChatGPT 4



You

Calculate 0.72 to the power of 5



ChatGPT

0.72 raised to the power of 5 equals approximately 0.1935. [\[-\]](#)

Challenge 1: Calculation Errors

ChatGPT 4



You

Calculate 0.72 to the power of 5



ChatGPT

0.72 raised to the power of 5 equals approximately 0.1935. [\[>-\]](#)

```
Analysis ✕  
python Copy code  
# Calculating 0.72 raised to the power of 5  
0.72 ** 5  
  
Result  
0.19349176319999997
```

Challenge 1: Calculation Errors

ChatGPT 4



You

Calculate 0.72 to the power of 5



ChatGPT

0.72 raised to the power of 5 equals approximately 0.1935. [\[>-\]](#)

```
Analysis ✕  
python Copy code  
# Calculating 0.72 raised to the power of 5  
0.72 ** 5  
  
Result  
0.19349176319999997
```

My Solution: Use ChatGPT 4.0

Challenge 2: Inputting Questions

Maths: Solve for x in the equation $\frac{x^3}{6} = 288$

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Prompt: Solve for x in the equation $x^3 / 6 = 288$

Challenge 2: Inputting Questions

Maths:

Evaluate $\int_2^5 \int_{-3}^3 \int_1^2 x^2 y^3 z^4 dz dy dx$

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.....

Challenge 2: Inputting Questions

Maths:

Evaluate $\int_2^5 \int_{-3}^3 \int_1^2 x^2 y^3 z^4 dz dy dx$

Prompt:

.....

My Solution: Upload screenshots of questions

Challenge 3: Incorrect Answers

D

You

Solve the simultaneous equations $3x + 2y = 18$ and $2x - 5y = -26$

Challenge 3: Incorrect Answers



You

Solve the simultaneous equations $3x + 2y = 18$ and $2x - 5y = -26$



ChatGPT

• • •

Thus, the solution is $x = \frac{83}{57}$ and $y = \frac{44}{19}$.

Challenge 3: Incorrect Answers

D

You

Solve the simultaneous equations $3x + 2y = 18$ and $2x - 5y = -26$

Challenge 3: Incorrect Answers



You

Solve the simultaneous equations $3x + 2y = 18$ and $2x - 5y = -26$



ChatGPT

• • •

Thus, the solution is $x = 2$ and $y = 6$

Challenge 3: Incorrect Answers



You

Solve the simultaneous equations $3x + 2y = 18$ and $2x - 5y = -26$



ChatGPT

• • •

Thus, the solution is $x = 2$ and $y = 6$

My Solution: Ask again (and again!)

Challenge 4: Incorrect Workings

Task: Calculate $\det(A)$

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & 1 \\ -2 & 1 & -2 \end{bmatrix}$$

Challenge 4: Incorrect Workings

Task: Calculate $\det(A)$

Correct Answer: $\det(A) = 0$

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$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & 1 \\ -2 & 1 & -2 \end{bmatrix}$$

$$\det(A) = aei + bfg + cdh - ceg - bdi - afh$$

Challenge 4: Incorrect Workings

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Correct Answer: $\det(A) = 0$

$$A = \begin{bmatrix} 1a & 1b & 1c \\ 1d & -2e & 1f \\ -2g & 1h & -2i \end{bmatrix}$$

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$$\det(A) = (1)(-2)(-2) + (1)(1)(1) + (1)(1)(-2) - (1)(1)(-2) - (1)(-2)(1) - (1)(1)(1)$$

$$\det(A) = 4 + 1 - 2 - 2 - 1 - 1$$

$$\det(A) = 0$$

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Correct Answer: $\det(A) = 0$

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$$\det(A) = 0 \qquad = -1$$

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$$\det(A) = 4 + 1 - 2 - 2 - 1 - 1$$

$$\det(A) = 0 \quad = -1$$

My Solution:

Check every line of workings.

Challenge 5: Overcomplicated Images

D

You

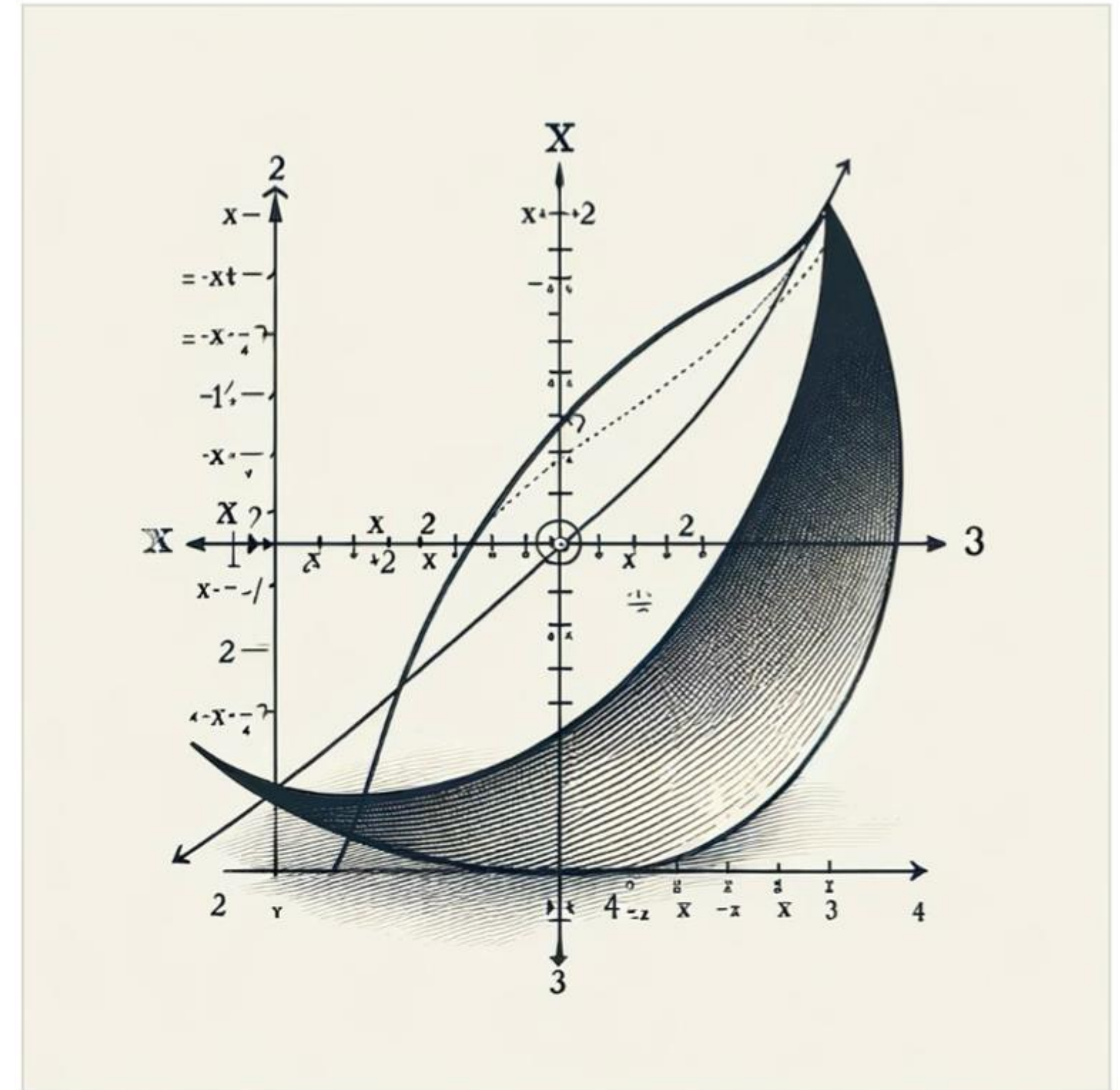
Sketch the curve $y = x^2$ and $y = 2x + 3$ on the same set of axes.

Challenge 5: Overcomplicated Images

D

You

Sketch the curve $y = x^2$ and $y = 2x + 3$ on the same set of axes.



Challenge 5: Overcomplicated Images

D

You

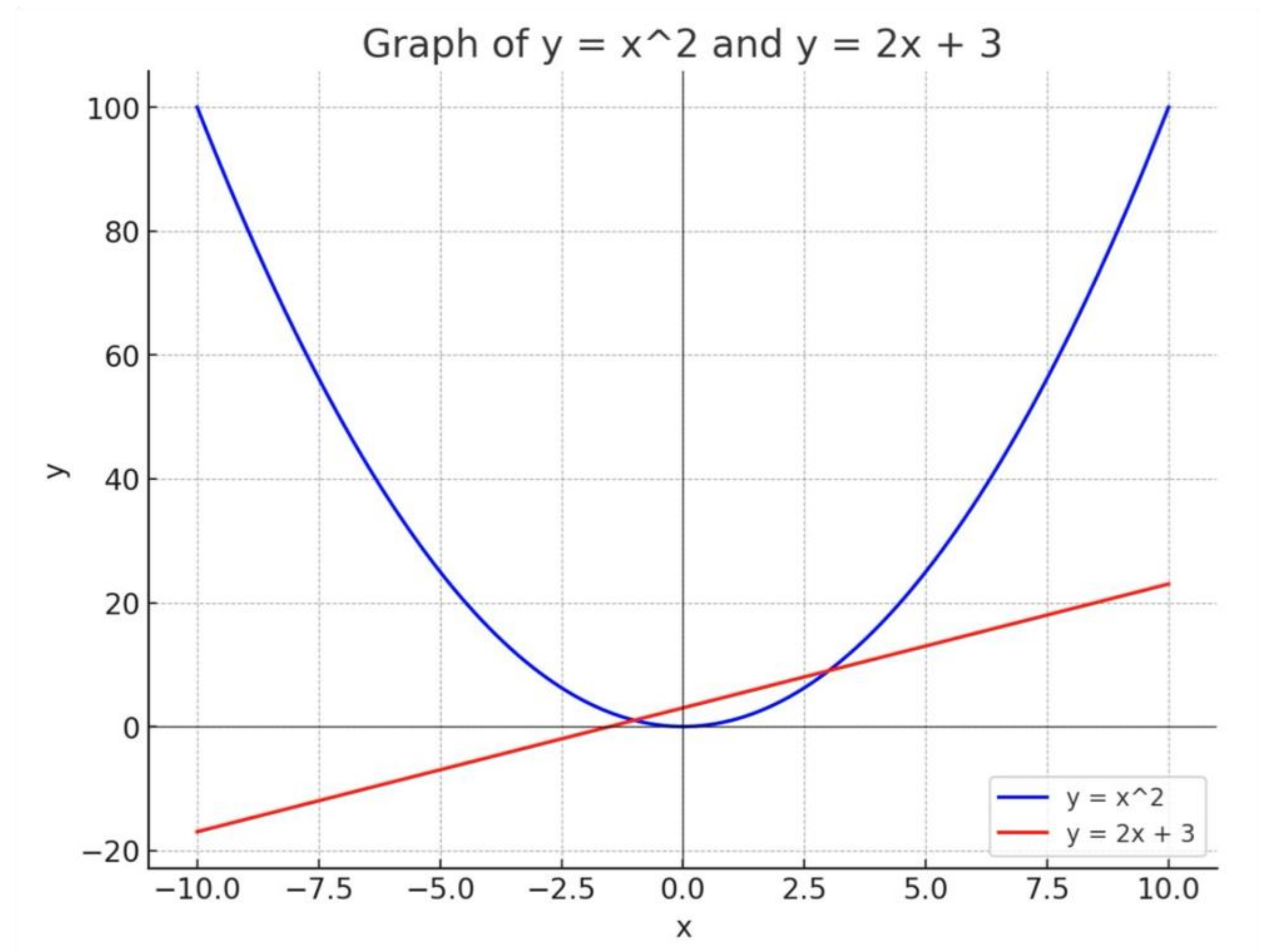
Sketch the curve $y = x^2$ and $y = 2x + 3$ on the same set of axes. Use the matplotlib library in python.

Challenge 5: Overcomplicated Images

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Sketch the curve $y = x^2$ and $y = 2x + 3$ on the same set of axes. Use the matplotlib library in python.



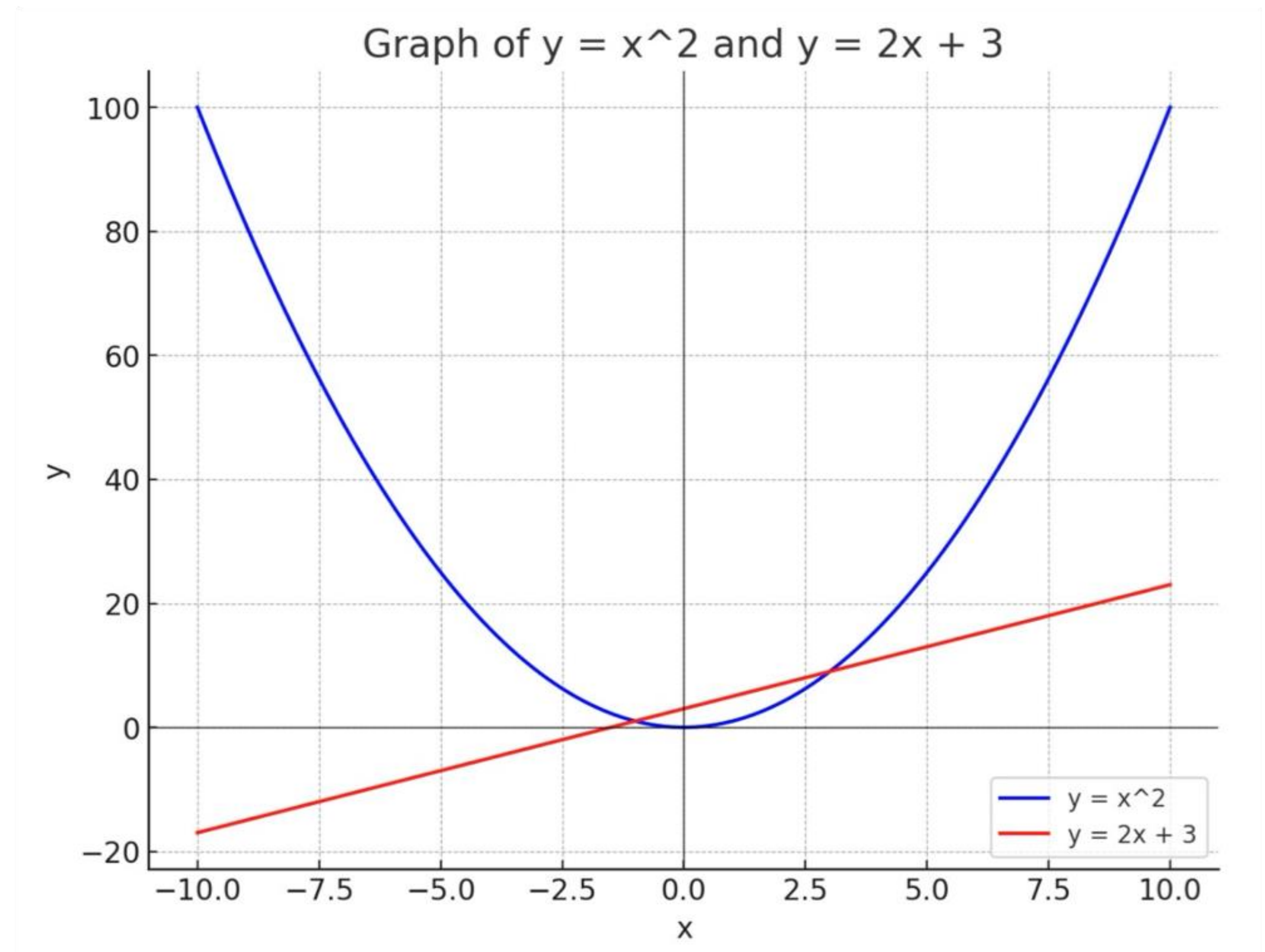
Challenge 5: Overcomplicated Images

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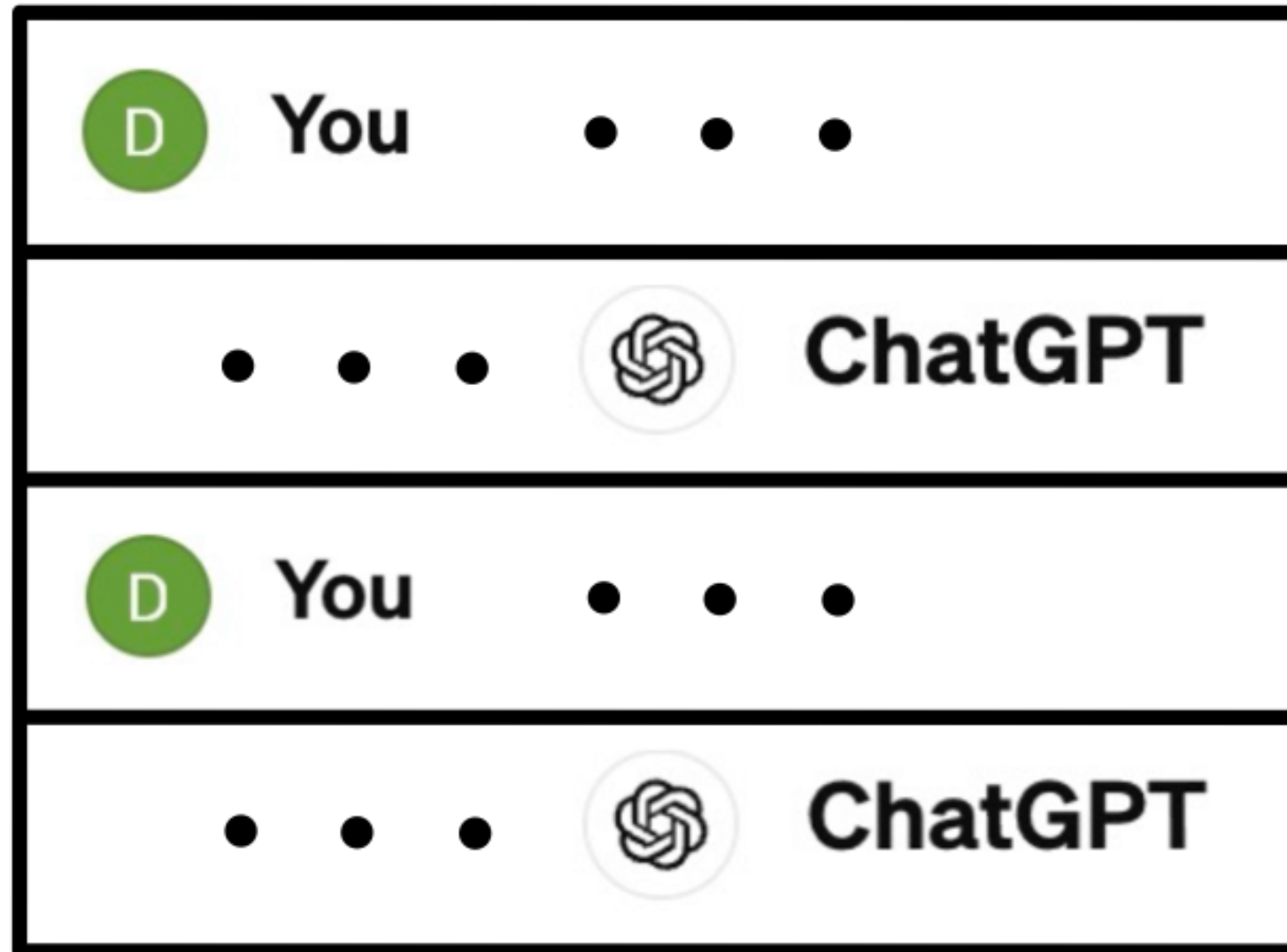
You

Sketch the curve $y = x^2$ and $y = 2x + 3$ on the same set of axes. Use the matplotlib library in python.

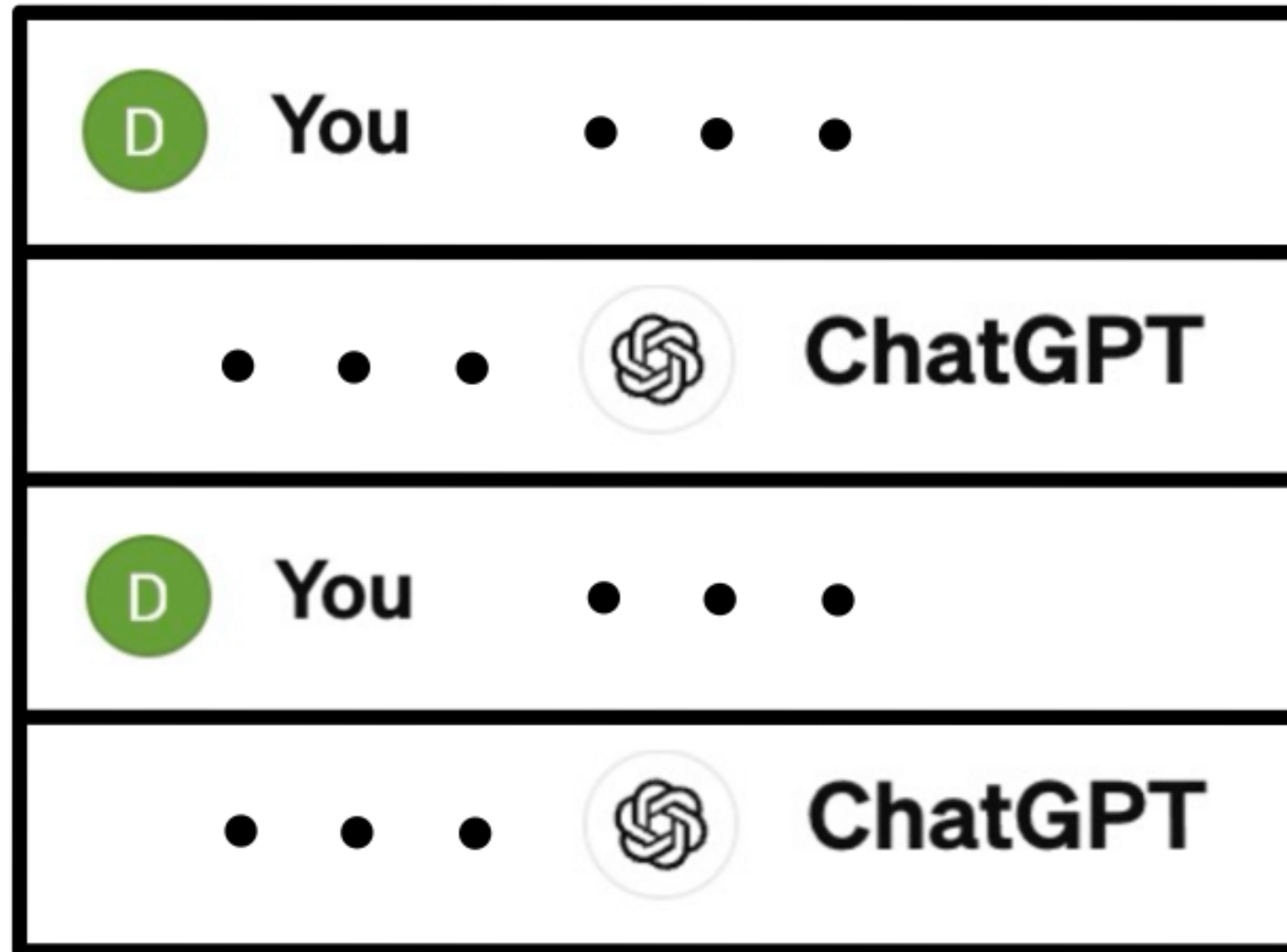
My Solution:
Ask that matplotlib is used.



Challenge 6: Formatting Solutions

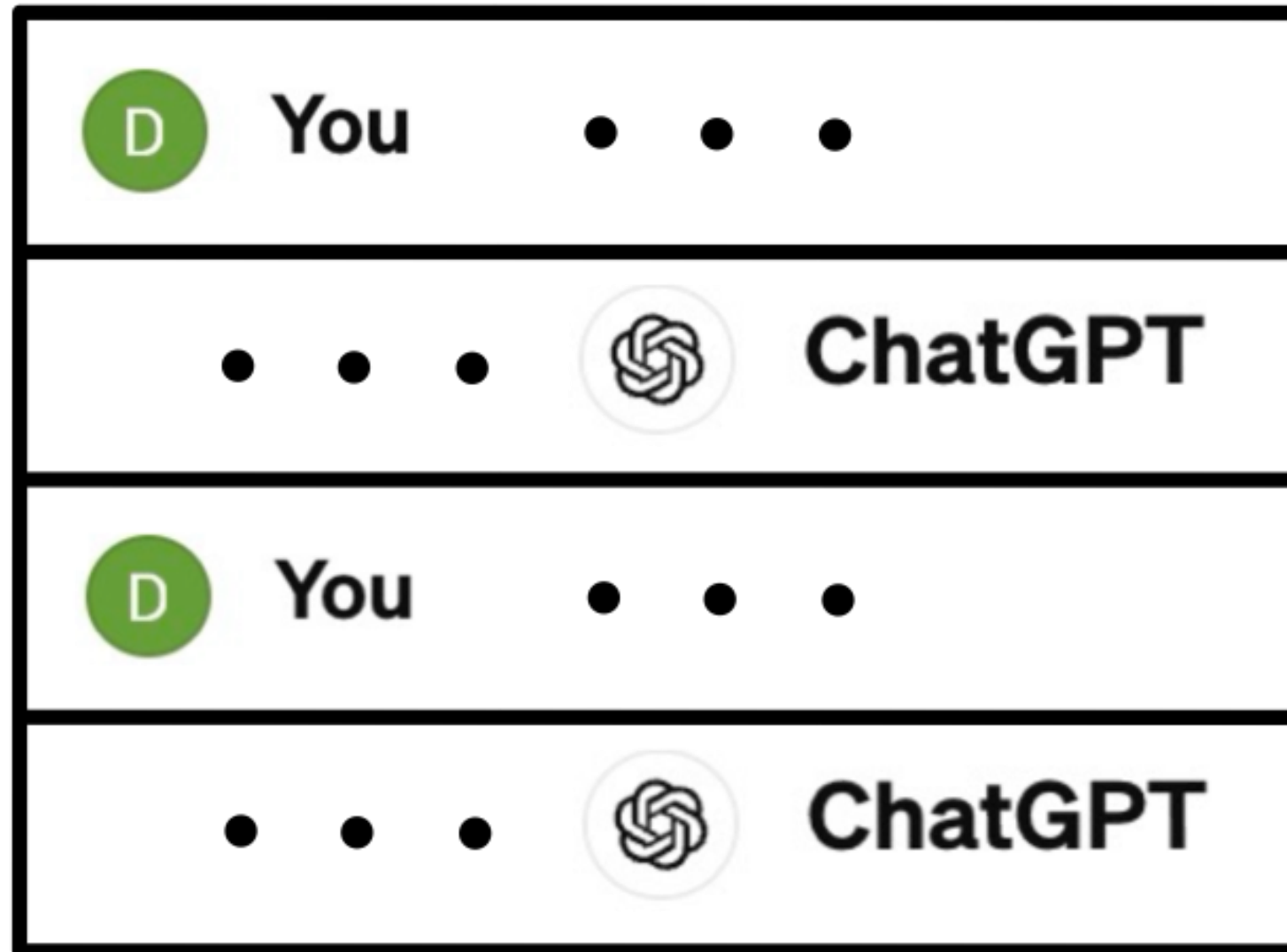


Challenge 6: Formatting Solutions



Solution 1: Take Screenshots and manually compile.

Challenge 6: Formatting Solutions



[Solution 1:](#) Take Screenshots and manually compile.

[Solution 2:](#) Ask for the answers in latex.