



# 113年度師資培育之大學領域 教學研究中心成果交流

## 數學領域【中學組】

計畫主持人：陳界山特聘教授

計畫共同主持人：鄭章華副教授、王婷瑩副教授

執行單位：國立臺灣師範大學理學院

執行期間：113年1月1日至114年12月31日

# 簡報項目

- 特色議題
- 經費執行情形
- 計畫各項內容執行成果
- 未來發展與檢討

## 特色 議題

### Part1 數學雙語教育

- \*中學數學雙語教學工作坊
- \*中學數學雙語教學演示觀摩工作坊
- \*中學數學雙語教材與試題

### Part2 STEM跨領域



- \*舞動數學
- \*生成式AI即時問答(App: 數學自主學習小幫手)
- \*數感實驗室與領域中心整合資源(規劃中)

## 經費執行情況

項目		補助計畫經費			
		總核定金額	累計已執行金額	餘額	執行率%
經常門	人事費	703,032	184,394	518,638	26.23%
	業務費	2,088,153	141,584	1,946,569	6.78%
	行政管理費	208,815	0	208,815	0.00%
小計		3,000,000	325,978	2,674,022	10.87%

截止記錄日期: 2024/9/20



## 2024中學數學雙語教學工作坊



講師: 蕭弘玫 Berri Hsiao  
Clackamas Community College, Oregon, USA

Berri 老師的專長為中學數學雙語教學，出身台灣並受教育至高中結束後，即前往美國奧瑞岡州繼續大學和碩士學位，現為美國奧瑞岡大學的數學講師。在教學現場長達20餘年的教學工作經驗，Berri老師能夠體會學生學習數學遇到的問題，善於鼓勵學生並建立信心，大家一起來努力！

2030 bilingual blue print

"There is nothing like a dream to create the future. Utopia today, flesh and blood tomorrow."

— Victor Hugo, Les Misérables

## 初階工作坊(國高中混合):

日期、時間: 10/19(六), 9:00~12:00

內容: 國中、高中數學雙語教學



## 進階工作坊(國中):

日期、時間: 10/26(六), 9:00~12:00

內容: 國中數學雙語教學



## 進階工作坊(高中):

日期、時間: 11/9(六), 9:00~12:00

內容: 高中數學雙語教學



報名QR-code:

人數限制30人，考慮維持線上互動品質的最佳人數



中學數學領域教學研究中心

Secondary School Mathematics Education Research Center

<https://www.math.ntnu.edu.tw/merc/>

Meet連結: 網址將另行公布

聯絡人: 李承翰 助理 | 電話: 0963-325-571 | email: kevinmath@ntnu.edu.tw

## 113年底前預計辦理三場工作坊

講師: 蕭弘玫(Berri Hsiao)

美國Clackamas Community College

## 場次:

## 1. 初階工作坊(國高中混合):

\*基礎數學英文單字及發音練習。

\*課室英文及數學教法。

日期、時間: 10/19(六), 9:00~12:00

## 2. 進階工作坊(國中):

\*依照不同年級的數學內容給予更加深入的雙語教學指引

日期、時間: 10/26(六), 9:00~12:00

## 3. 進階工作坊(高中):

\*依照不同年級的數學內容給予更加深入的雙語教學指引

日期、時間: 11/9(六), 9:00~12:00

# Part I



## 中學數學雙語教學工作坊【講義】

### 數學雙語教育

Group A (Beginning of class)

Teacher: Good morning class!

Student: Hello! Teacher (Mr. Liu/ Ms. Chen)

Teacher: Welcome to period 1.

Please take out your homework from the last class.  
We'll go over the answers for a few minutes.  
Raise your hand if you have a question.  
Who has the answer for (to) question # 3?

Student: I do (me)! The answer is  $x + 3$  (or make up anything)

Teacher: Do you all agree?

Phrases for Classroom Management	Encouraging Words
Please have your attention on <u>me</u> .	You are doing great!
I need everyone's attention please.	You are the star of the class!
Eyes on me please.	That was a job well done.
Please settle down.	That was a good effort! (good try!)
I need everyone to be quiet for a few minutes.	You do such good work!
I need you to stay after class please.	You have made such an improvement.

Place Values:

billions			millions			thousands			ones			decimals		
hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones	hundreds	tens	ones

Fractions: A number of the form  $\frac{a}{b}$  where  $a$  and  $b$  are numbers is called a *fraction*. The number  $a$  is called the *numerator* of the fraction, while the number  $b$  is called the *denominator* of the fraction.

Proper way to say a fraction:

$\frac{1}{2}$ : One half	$\frac{3}{4}$ : three halves	$\frac{1}{3}$ : one third	$\frac{2}{3}$ : two thirds
$\frac{1}{4}$ : one quarter (or one fourth)	$\frac{5}{4}$ : five quarters (or five fourths)		

Common way to say a fraction:

$\frac{2}{5}$ : two over five	$\frac{x^3}{y}$ : x cubed over y to the negative one
$2\frac{1}{7}$ : two and one seventh	$\frac{1-x}{\sqrt{x}+2}$ : one minus x over square root of x plus 2

TRANSLATING KEY WORDS AND PHRASES INTO ALGEBRAIC EXPRESSIONS

The table below lists some key words and phrases that are used to describe common mathematical operations. To write algebraic expressions and equations, assign a variable to represent the unknown number. In the table below, the letter "x" is used to represent the unknown. In translation problems, the words *sum*, *total*, *difference*, *product* and *quotient* imply at least two parts - one parentheses when a *sum* or *difference* is multiplied. For example, the phrase "the sum of three times a number and five" translates to  $3x + 5$ , while the phrase "three times the sum of a number and five" translates to  $3(5 + x)$ .

OPERATION	KEY WORDS/PHRASES	EXAMPLE	TRANSLATION
Addition (+)	plus	A number plus three	$x + 3$
	more than	Two more than a number	$x + 10$
	the sum of	The sum of a number and five	$x + 5$
	the total of	The total of six and some number	$6 + x$
	increased by	A number increased by ten	$x + 2$
Subtraction (-)	minus	Eleven added to a number	$x + 11$
	less than	A number minus seven	$x - 7$
	the difference of	Four less than a number	$x - 4$
	less	The difference of a number and three	$x - 3$
	decreased by	Nine less a number	$9 - x$
Multiplication (x)	subtracted from	A number decreased by twelve	$x - 12$
	times	Six subtracted from a number	$x - 6$
	the product of	Eight times a number	$8x$
	twice, double	The product of fourteen and a number	$14x$
	multiplied by	Twice a number, double a number	$2x$
Division (÷)	of	A number multiplied by negative six	$-6x$
	the quotient of	Three fourths of a number	$\frac{3}{4}x$
	divided by	The quotient of a number and seven	$\frac{x}{7}$
The ratio of		Ten divided by a number	$\frac{10}{x}$
		The ratio of a number to fifteen	$\frac{x}{15}$

工作坊教學講義-1

工作坊教學講義-2

工作坊教學講義-3

課室英文用語GroupA~GroupF

(Everyday Classroom English Activity - Role Play Activity - Whole Sheet)

<https://docs.google.com/document/d/1mWTFI-9oNh4zKYIZS6VRol3JJJaBN6cW9lCxoQq2xw8s/edit?usp=sharing>

數學課本pdf內含英文單字註解:

<https://drive.google.com/drive/folders/1I5sDG4WBPecOfZJR8hQiW3uMKCBn0tgd>



## 2024中學數學雙語教學演示 觀摩工作坊

### Bilingual Math Education Symposium

December 14 (Saturday), 2024

S101, Gong-Guan Campus, NTNU

Meeting link: TBD

報名qr-code: TBD

### Schedule of the Symposium

09:00 - 9:50	Berri Hsiao	Calckamas Community College, Oregon, USA
09:50-10:40	Session 1	2 teachers share lesson plan design process
10:40-11:00	Tea Break	Tea Break
11:00-11:55	Session 2	2 teachers share how to use the resources
12:00-13:00	Lunch	Lunch
13:00-13:50	Session 3	2 teachers demo-teach
13:50-14:40	Session 4	other topic
14:40-15:00	Tea Break	Tea Break
15:00-15:50	Panel Discussion	Conclutions and Comments

### 113年度規劃:

中學數學雙語教學演示觀摩  
工作坊日期: 113/12/14(六)

### 講者:

三位國中數學教師  
三位高中數學教師  
新加坡中學教師





目標: 開發60份國中數學雙語教材、60份高中數學雙語教材

### 進行中業務

六位中學數學教師隔雙週(二)進行教材研發會議

### 已完成業務

已完成國中數學雙語教材3份、國中數學雙語試題3份、高中數學雙語教材3份、高中數學雙語試題3份

### 規劃中業務

113年底前六位研發教師前往台師大、高師大、彰師大進行主題演講

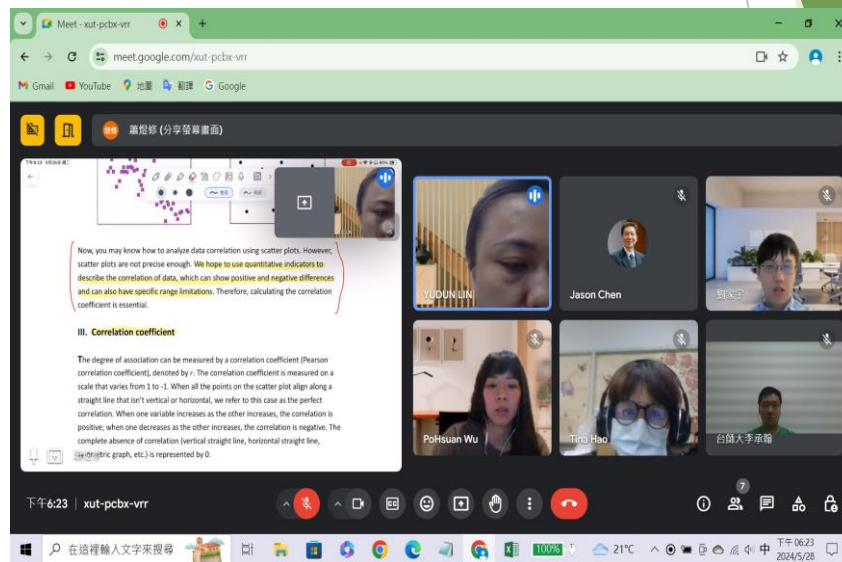
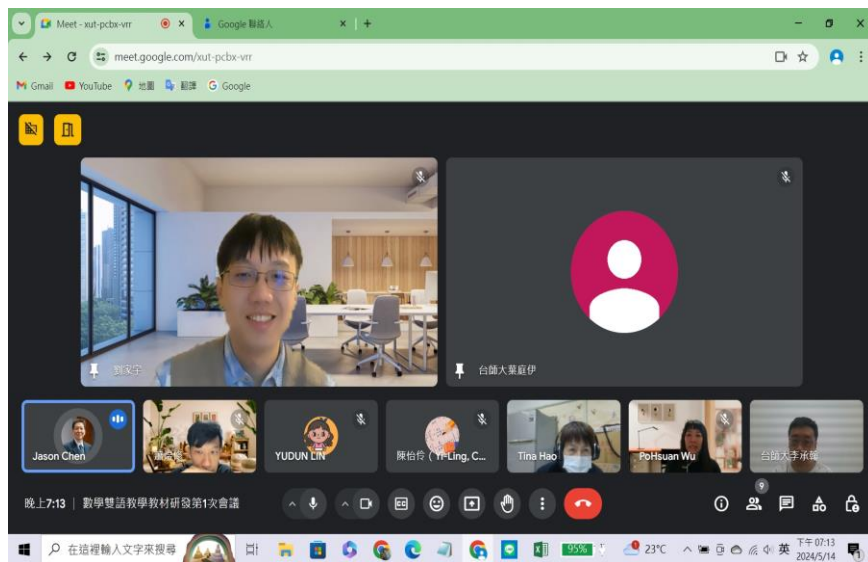


# Part I



## 中學數學雙語教材與試題【研發會議】

### 數學雙語教育



目前已進行之會議日期:

5/14, 5/28, 6/11, 6/25, 7/9, 7/23, 8/6, 8/20, 9/10, 9/24



## Probability

◇ Words

Some words have special meaning in Probability:

英文	中文	意義
Probability	機率	Describes how likely an event is to occur.
Trial	試驗	Each repetition of an experiment.
Outcome	結果	Each result of a trial.
Event	事件	A set of one or more possible outcomes for a trial.
Sample space	樣本空間 <sup>*</sup>	The set of all possible outcomes for an experiment.
Theoretical probability	理論機率 <sup>*</sup>	If all possible outcomes are equally likely, the theoretical probability of an event is the ratio of the number of possible outcomes in the event to the total number of possible outcomes in the sample space.

<sup>\*</sup>本教材的機率相關用詞有部分屬於臺灣高中才會介紹的內容，而國外有許多教材則會在國中階段即介紹這些用詞，老師們可以斟酌使用。

◇ Definition

**Probability 機率**

If an experiment has  $n$  possible outcomes, and each outcome is equally likely to occur, we say that the probability of each outcome happening is  $\frac{1}{n}$ . The probability of an event is written as  $P(\text{event})$ .

Since the number of possible outcomes for any event must be less than or equal to the total number of possible outcomes in the experiment, the probability  $P(\text{event})$  of any event satisfies  $0 \leq P(\text{event}) \leq 1$ .

It can be written as a fraction, a decimal, or a percent.

$$P(\text{event}) = \frac{\text{number of equally likely outcomes in the event}}{\text{total number of equally likely outcomes in the sample space}}$$

單元:

\*機率

\*相似形

## G9-Probability-Test

Multiple Choice (5 points each)

- What is the probability of flipping a coin and landing on heads?  
(A)  $\frac{1}{2}$   
(B)  $\frac{1}{3}$   
(C)  $\frac{1}{4}$   
(D)  $\frac{2}{4}$
- A bag contains 4 red, 3 blue, and 2 green balls. What is the probability of drawing a red ball?  
(A)  $\frac{2}{9}$   
(B)  $\frac{1}{3}$   
(C)  $\frac{4}{9}$   
(D)  $\frac{1}{2}$
- In a deck of cards, what is the probability of drawing a spade?  
(A)  $\frac{1}{4}$   
(B)  $\frac{1}{2}$   
(C)  $\frac{1}{13}$   
(D)  $\frac{1}{8}$

單元:

\*機率

\*相似形

雙語教學主題(國中八年級下學期教材):三角形全等

Topic: Triangle congruence theorems

Vocabulary

CPCTC		兩全等三角形的對應邊和對應角都對應相等	
stands for corresponding parts of the congruent triangles are congruent		Triangle congruence theorem	
Triangle congruence theorem		全等三角形全等性質(定理)	
corresponding sides	對應邊	corresponding angles	對應角
congruent sides	等邊	Congruent angles	等角
included side	夾邊	included angle	夾角

(我個人很喜歡這個 CPCTC 的表示法，否則要寫很多中文字...)

老師們好，內容儘量呈現教學時可能用到的英語，供老師們參考，可以自行篩選需要的段落或語句使用，也希望老師們建議和指正，祝教學愉快！

We have learned that when two figures on a plane are overlapped perfectly, these two figures are congruent. That is when triangle ABC is translated, reflected, or rotated to triangle DEF and they are overlapped completely, these two triangles are congruent. It's noted as:  $\triangle ABC \cong \triangle DEF$ .

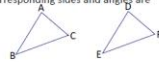
$\triangle ABC \cong \triangle DEF$  means all the corresponding parts from both triangles are congruent. From the figure shown, all the corresponding sides and angles are congruent.

That is:

 $AB = DE$  (corresponding sides) $BC = EF$  (corresponding sides) $AC = DF$  (corresponding sides)

(segment AB is congruent to segment DE...)

And,

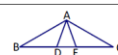
 $\angle A = \angle D$  (corresponding angles) $\angle B = \angle E$  (corresponding angles)

Q 2:

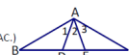
Please fill in the blanks according to the information shown in the figure.

In  $\triangle ABD$  and  $\triangle CBD$ , $AB = \underline{\hspace{1cm}}$  (Given) $\angle BAD = \underline{\hspace{1cm}} = 90^\circ$  (Given) $BD = \underline{\hspace{1cm}}$  (Reflexive property)So  $\triangle ABD \cong \triangle CBD$  ( )**ANSWER:**In  $\triangle ABD$  and  $\triangle CBD$ , $AB = \underline{CB}$  (Given) $\angle BAD = \underline{\angle BCD} = 90^\circ$  (Given) $BD = \underline{BD}$  (Reflexive property)So  $\triangle ABD \cong \triangle CBD$  ( RHS )

Q 3:

In isosceles triangle ABC,  $\overline{AB} = \overline{AC}$ , $\overline{AD}$  and  $\overline{AE}$  trisect  $\angle BAC$ .Prove that  $\triangle ABE \cong \triangle ACD$ **ANSWER:**

Pf:

(1) Let  $\angle BAD = \angle 1$ ,  $\angle DAE = \angle 2$ , and  $\angle CAE = \angle 3$ .Then  $\angle 1 = \angle 2 = \angle 3$  ( $\overline{AD}$  and  $\overline{AE}$  trisect  $\angle BAC$ .)In  $\triangle ABE$  and  $\triangle ACD$ , $AB = AC$  (Given) $\angle BAE = \angle 1 + \angle 2$ 



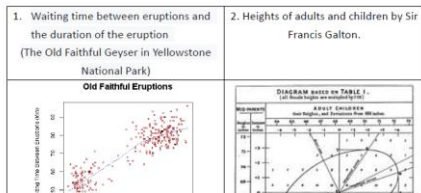
## Two-Dimensional Data Analysis

### I. Key mathematical terms

Terms	Symbol	Chinese translation
Scatter plot/diagram		
Independent variable		
Dependent variable		
Correlation coefficient		
Least square method		
Regression line		

### II. Scatter plot

Scatter plot is a graphical representation of data points. It can show the relationship between two variables. In the diagram, each point represents values for both variables. Here are some examples that occur in our daily lives.



單元:

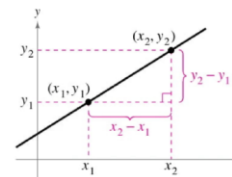
- \*二維數據分析
- \*直線與斜率

### Finding the slope of a line by using two points.

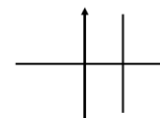
On a line  $L$ , choose any two distinct points  $A(x_1, y_1)$  and  $B(x_2, y_2)$ .

If  $L$  is not a vertical line, then  $x_1 \neq x_2$ .

The slope  $m$  of  $L$  is defined as  $m = \frac{y_2 - y_1}{x_2 - x_1}$ .



Division by 0 is undefined, so the slopes of vertical lines is undefined.



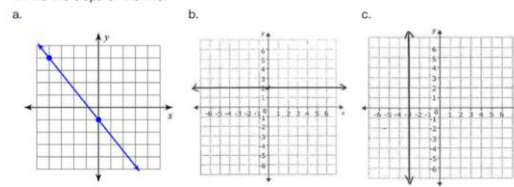
### Slope of a line-Test

Part A: Fill in the blanks.

- For a line, the ratio of the change in  $y$  to the change in  $x$  is the \_\_\_\_\_ of the line.
- The gradient of a line is  $\frac{3}{2}$ . This means that for every 1 unit moved horizontally, the line moves \_\_\_\_\_ units upwards.
- The gradient of a line is  $-2$ . This means that for every 1 unit moved horizontally, the line moves \_\_\_\_\_ units downwards.

Part B: Short-answer questions.

- Find the slope of the line.



- Find the slope of a line that passes through the given points.

- (2, -2) and (5, 7)
- (8, 3) and (8, 6)
- (2, -7) and (-1, 6)

PH Wu

### Ch1. Real Numbers I - Test

Class: \_\_\_\_\_ Number: \_\_\_\_\_ Name: \_\_\_\_\_

#### Part A: True/False (10 pts each)

Instruction: Mark "T" for true or "F" for false.

- 1.414 is an irrational number.
- There is no integer that has a reciprocal that is an integer.

#### Part B: Multiple Choice (10 pts each)

Instruction: Select the best answer from the provided options. There is at least one correct answer for each question.

- Let  $a$  and  $b$  be rational numbers, and  $c$  and  $d$  be irrational numbers. Which of the following statements is correct?
  - $a + c$  is an irrational number.
  - $c + d$  is an irrational number.
  - $ac$  is an irrational number.
  - $cd$  is an irrational number.
  - If  $a = 0$ , then  $\frac{b}{a}$  is a rational number.
- Let  $a$  and  $b$  be real numbers, with  $2 \leq a \leq 5$  and  $-3 \leq b \leq 4$ . Which of the following statements is correct?
  - $-1 \leq a + b \leq 9$

單元:

- \*二維數據分析
- \*直線與斜率

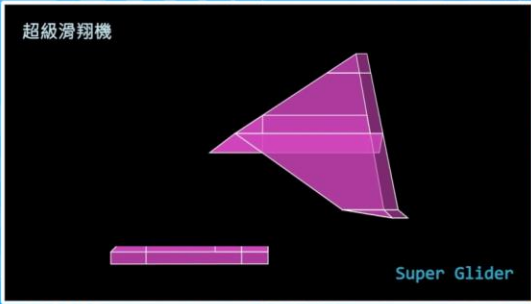


Animated Math 舞動數學 [首頁](#) [高中數學](#) [國中數學](#)

新增媒體

- 3的倍數判定法 (2022-01-11)
- 無理數的發現 (2022-01-10)
- 拋物線圖形 (2021-12-28)
- 正弦函數的水平伸縮 (2021-12-27)
- 正弦函數的水平伸縮 (2021-12-27)
- 正弦函數的鉛直伸縮 (2021-12-27)
- 橢圓圖形 (2021-03-21)
- 摺扇構造 (2021-11-25)
- 向量線性組合 (2021-09-29)
- 克拉氏公式的幾何意義 (2021-07-08)

超級滑翔機



Super Glider

在數位科技的時代，運用各種計算工具與科技軟體來輔助教學與學習是一個趨勢。

【舞動數學】網站的成立即希望設計各種視覺化的呈現與動態效果來幫助學生學習抽象的數學概念，或加深理解數學內容。在數學教學方面也可增加課堂互動性的機會，融入數學教學活動。

【舞動數學】網站的內容由熱心的中學老師自主開發，希冀拋磚引玉，歡迎引用並運用於數學教學現場。

贊助單位: 教育部數學領域教學研究中心、臺灣師範大學數學系

**研發成員:**

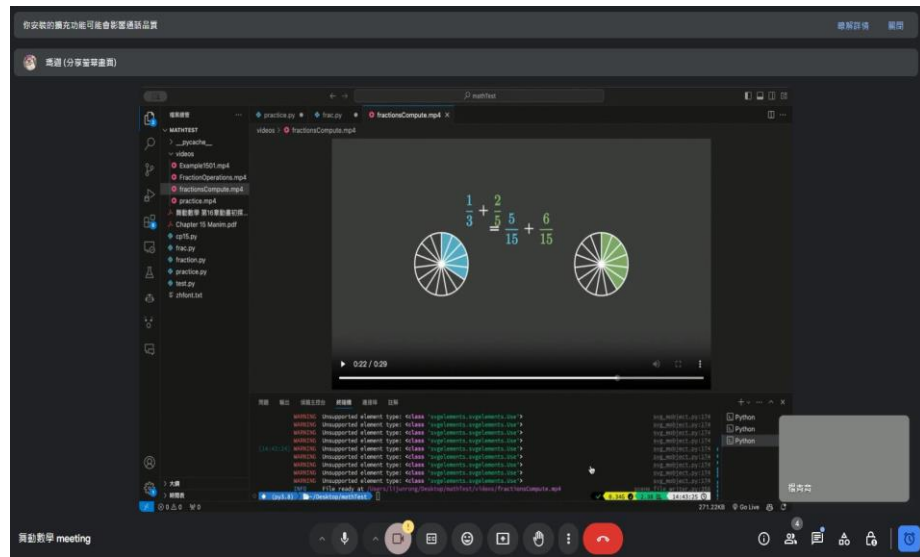
師大數學: 楊青育講師

師大數學: 林宇星同學

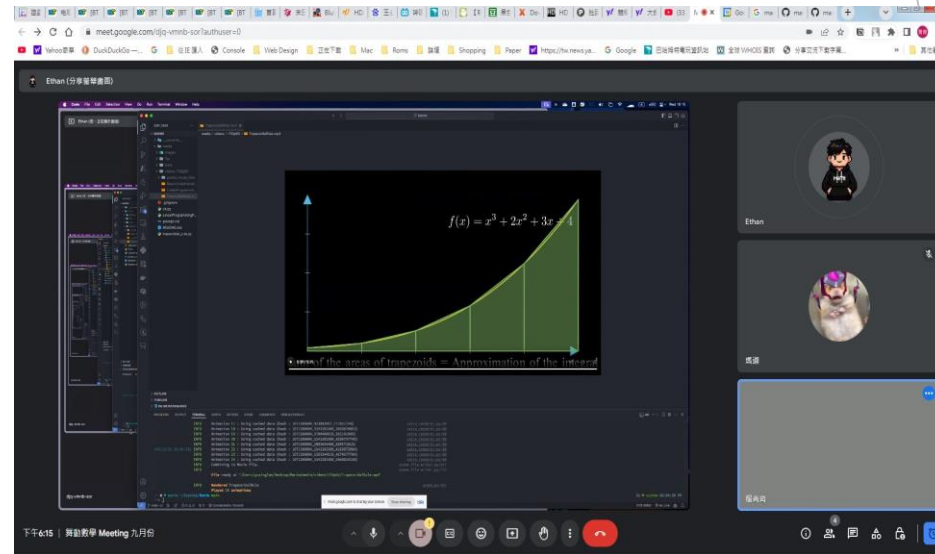
師大數學: 李俊融同學

**舞動數學網站連結**[https://www.math.ntnu.edu.tw/workshop/animated\\_math/index.php](https://www.math.ntnu.edu.tw/workshop/animated_math/index.php)





影片示例1



影片示例2



共同主持人鄭章華教授團隊進行的「生成式AI即時問答」，App 名稱為「數學自主學習小幫手」，圖為目前的初步成果。



# 未來發展與檢討



## 1. 數學雙語教材持續研發

針對目前熱門的新興雙語教育議題，持續邀請專家學者與老師給予建議回饋，帶動整體數學雙語教育學習氣氛。



## 2. STEM跨領域應用於現場教學

將跨領域的成果應用於教材及現場教學。從專題製作的探索過程，將數理知識、原理做出一些應用和作品呈現。





謝謝聆聽!^^!