

余振強紀念中學

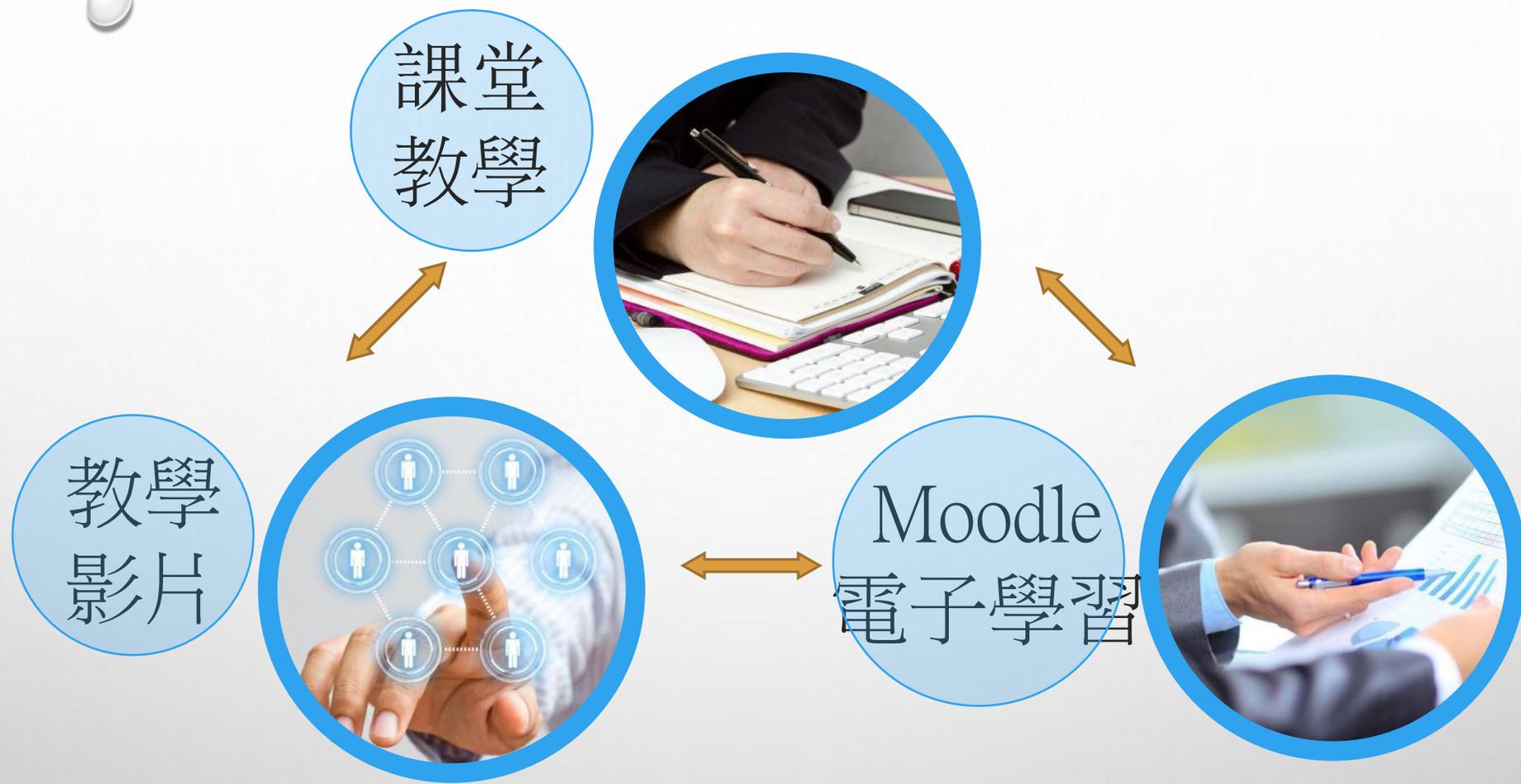
運用電子學習工具促進資優／高能力學生的數學解難技巧

校本經驗分享

邱舜賢老師
(資優教育及學習支援主任、數學副科主任)

資優教育在本校的概念

- 校情背景
- 信念：每級總有能力較高的學生、每班總有能力較高的學生
- IT教學在資優教學擔當重要的角色，不過只是其中一環
(其他部分還有加速課程、課後增益、校外資優課程及比賽)
- IT教學利用MOODLE平台、教學短片



電子學習工具是促進資優／高能力學生學習的其中一環

NAVIGATION

Dashboard

Site home

Site pages

My courses

Math(S5)C5ABC_ReviewF4

Maths(DSE)

Maths M1(DSE)

Maths(TSA)

Maths(S1)A

maths(S1)B,CD1

maths(S1)CD2,3

Math(S2A)

Math(S2B,CD1)

Math(S2CD2,CD3)

More...

Courses

S4

English(S4)

1.1 Equation of Straight lines

1.1A - Two point form

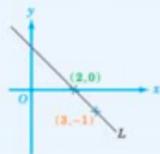
1.1 Equations of Straight Lines

Two-point Form

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}, \text{ where } x_1 \neq x_2$$

Example

In the figure, the straight line L passes through $(2, 0)$ and $(3, -1)$. Find the equation of L .



$$\frac{y-0}{x-2} = \frac{-1-0}{3-2}$$

基本知識
/高階題型影片

- 數學科組於5年前發展Moodle學習平台，
至今各科合共超過13000套教學短片，數學科組佔約5000套。
- 配合各教學影片，會有相應5－10題MC題目作評估
(有相應龐大的題目庫)

迷思1：

能力較高的學生在班中學習得較快，如何處理？

利用MOODLE實行資優教育

(1) 照顧學習差異，尤其能力較高的學生

→ 將知識分類拆碎，
更方便學生自學
也方便老師了解學生掌握情況

將知識分類拆碎

- 配合各課難點來建立題目庫、設計題目庫結構
- 目標：課前較準確地了解學生掌握程度

• E.G.1 : SOLVING EQUATION INVOLVING FRACTION

2.2 Algebraic equations (2)	X	⚙	←	↑	↓	→
2.2.1 Solve equations (0)	X	⚙	←	↓		
2.2.1A One step (Add, Subtract) (6)	X	⚙	←			
One step with negative x (6)	X	⚙	←			
2.2.1B One step (Multiply) (3)	X	⚙	←	↑	↓	→
2.2.1C One step (Divide) (0)	X	⚙	←	↑	↓	→
2.2B.Q1 $-x/a=b$ ANS = $-ab$ (Negative answer) (6)						
2.2B.Q2 $x/a=b$, ANS = ab (Positive Integer) (6)	X					
2.2B.Q3 $ax/b=c$ ANS is an integer (6)	X	⚙	←			
2.2B.Q4 $ax/b=c$ ANS is a fraction (6)	X	⚙	←			
2.2B.Q5 $ax/b=c$ ANS is a negative fraction (5)	X	⚙	←			
2.2.1D $ax+b=c$ (3)	X	⚙	←	↑	↓	→
2.2.1E $(ax+b)/c=d$ (4)	X	⚙	←	↑	↓	→
2.2.9a : With fraction (4)	X	⚙	←			
2.2.1F Three or more steps (10)	X	⚙	←	↑	↓	
2.2B.Q9 : $x/a+b=c$ (6)	X	⚙	←	↑	↓	→
2.2B.Q10 : $ax/b+c=d$ (4)	X	⚙	←	↑	↓	→
2.2D.Q1 $(ax+b)/c=d$ (3)	X	⚙	←	↑	↓	→



Question 3	$\frac{x}{5} = 6$
Not complete	

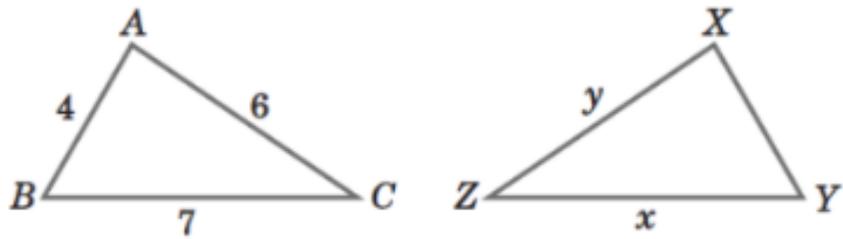
Question 4	$\frac{3x}{2} = 6$
Not complete	

Question 5	$-\frac{x}{3} = 2$
Not complete	

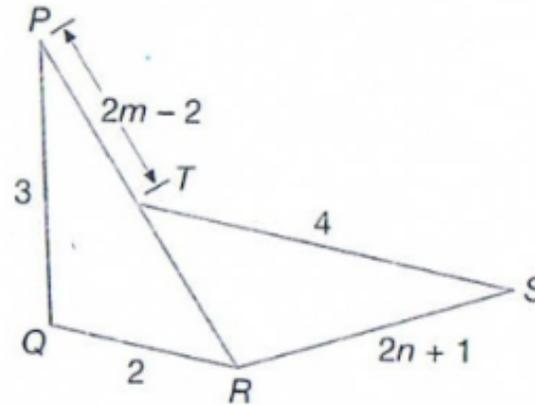
• E.G. 2: CONGRUENT TRIANGLES

Q1

Reflection



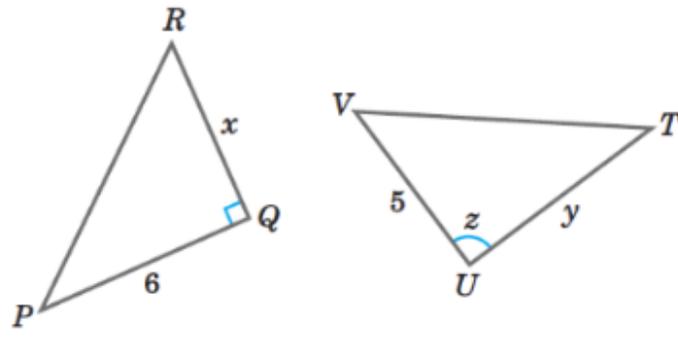
In the figure, $\triangle PQR \cong \triangle SRT$, find the values of m and n .



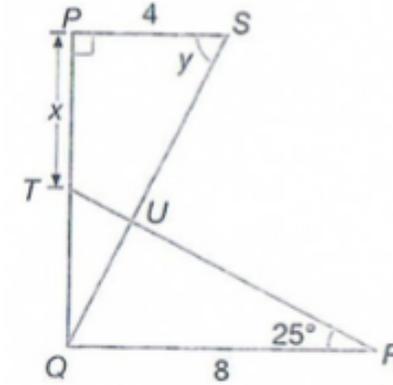
Connection

Q3

Rotation



In the figure, $\triangle SPQ \cong \triangle TQR$, find the values of x and y .



Overlapping

利用MOODLE實行資優教育

(2) **ASSESSMENT AS LEARNING**

ASSESSMENT AS LEARNING

A straight line passes through (-6, -2), and the slope is -5, find the equation of the straight line.

- $x = -5y - 32$
- $x = 5y - 32$
- $y = -5x - 32$
- $y = 5x - 32$

Your answer is incorrect.

Common Linear Equation(2) : Point slope Form

$$\frac{y - y_1}{x - x_1} = m$$

Equation of the straight line

$$\frac{y - (-2)}{x - (-6)} = -5$$

$$y + 2 = -5(x + 6)$$

$$y + 2 = -5x - 30$$

$$y = -5x - 32$$

The correct answer is: $y = -5x - 32$

- 能力較高的學生：

動機較高、求知慾較強、
較想即時知結果、更需要即時回饋

- MOODLE：

傳統紙本功課，??天改完、寫重覆的回饋
“FEEDBACK” 而非 “SOLUTION”

(2) ASSESSMENT AS LEARNING

Factorize $x^2 - y^2 + 10x + 25$

- $(x + y - 5)(x - y + 5)$
- $(x + y + 5)(x - y + 5)$
- $(x + y + 5)(x - y - 5)$
- $(x + y - 5)(x - y - 5)$

- 能力較高的學生：

多角度思考

有否其他、或更快的方法處理

Your answer is incorrect.

$$\begin{aligned} & x^2 - y^2 + 10x + 25 \\ &= x^2 + 10x + 25 - y^2 \quad \text{先移項} \\ &= (x + 5)^2 - y^2 \\ &= (x + 5 + y)(x + 5 - y) \\ &= (x + y + 5)(x - y + 5) \end{aligned}$$

MC 技巧，只乘個別項數

<http://video.yckmc.edu.hk/embed/16095/>

MC 技巧，代數字

<http://video.yckmc.edu.hk/embed/16096/>

The correct answer is: $(x + y + 5)(x - y + 5)$

- MOODLE :

“FEEDBACK” 而非 “SOLUTION”

利用MOODLE實行資優教育

(3) 學會學習 LEARNING TO LEARN

根據能力較高的學生，
利用平台製訂協助學生自學的方案

(3) LEARNING TO LEARN

9.2B Solve Simultaneous equations algebraically (Discriminant)

9.2B Solve Simultaneous equations

If the following simultaneous equations have **only one real solution**, find the value of k .

$$\begin{cases} y = x^2 + 3x & \dots\dots\dots (1) \\ y = 2x + k & \dots\dots\dots (2) \end{cases}$$
$$x^2 + 3x = 2x + k$$
$$x^2 + x - k = 0$$
$$\Delta = 0$$
$$1^2 - 4(1)(-k) = 0$$
$$1 + 4k = 0$$
$$k = -\frac{1}{4} //$$


• 不同的學習方式

- 預習

(翻轉教室、加速課程、
資優學生可嘗試更難題型、甚至越級)

Grading method: Highest grade

Preview quiz now

(3) LEARNING TO LEARN

- 不同的學習方式

Mathematics(F4) / Maths 4D / M_4S(Eng) (2020-23) / Topic 1 : Equation

1.1 Equations of Straight Lines

1.1A - Two point form

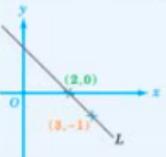
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Example

In the figure, the straight line L passes through $(2, 0)$ and $(3, -1)$. Find the equation of L .



$$\frac{y-0}{x-2} = \frac{-1-0}{3-2}$$

0:00 / 0:00

$$7 \times 2^{10} + 2^8 + 5 \times 2^3 - 2^3 =$$

Select one:

- 1111000010000₂ ✘
- 111010100000₂
- 1110100100000₂
- 111100010000₂

- 文字、圖像

- 影片解題

Your answer is incorrect.

2014 DSE Qu.34

$$7 \times 2^{10} + 2^8 + 5 \times 2^3 - 2^3$$

A. 1111000010000₂

B. 111010100000₂

C. 111100010000₂

D. 1110100100000₂

12+1=13

0:00 / 0:00

(3) LEARNING TO LEARN

Finished	4 January 2021 8:44 PM	4 January 2021 8:50 PM	6 mins 19 secs	9.00	✓ 1.00	✓ 1.00	✗ -	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00
Finished	5 January 2021 12:32 AM	5 January 2021 12:54 AM	22 mins 22 secs	10.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00
Finished	5 January 2021 10:06 PM	5 January 2021 10:23 PM	16 mins 59 secs	7.00	✓ 1.00	✓ 1.00	✓ 1.00	✗ 0.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00
Finished	5 January 2021 10:23 PM	5 January 2021 10:39 PM	15 mins 39 secs	7.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✗ 0.00	✓ 1.00

- 不同的學習方式

- 日間 / 夜間

- - 平日 / 週末假期

(3) LEARNING TO LEARN

- 無限嘗試, 隨機題目, **CALCULATED QUESTIONS(RANDOM NUMBERS)**

Page 1

1	⊗⚙	Random (2.2.1A One step (Add, Subtract)) (See questions)
2	⊗⚙	Random (One step with negative x) (See questions)
3	⊗⚙	Random (2.2B.Q2 $x/a=b$, ANS = ab (Positive Integer)) (See questions)
4	⊗⚙	Random (2.2B.Q3 $ax/b=c$ ANS is an integer) (See questions)
5	⊗⚙	Random (2.2B.Q1 $-x/a=b$ ANS = $-ab$ (Negative answer)) (See questions)
6	⊗⚙	Random (2.2B.Q4 $ax/b=c$ ANS is a fraction) (See questions)
7	⊗⚙	Random (2.2B.Q5 $ax/b=c$ ANS is a negative fraction) (See questions)

Page 2

8	⊗⚙	Random (2.2.1D $ax+b=c$) (See questions)
9	⊗⚙	Random (2.2B.Q9 : $x/a+b=c$) (See questions)
10	⊗⚙	Random (2.2B.Q10 : $ax/b+c=d$) (See questions)

(3) LEARNING TO LEARN

- **CORRECTION QUIZ** (根據能力較高的學生的學習進度)

Topic 1 : Equations of Straight Lines

- ✓ 1.1 Equations of Straight Lines
- ✓ 1.2 Number of Points of Intersection of Two Straight Lines
- Using Calculator to Solve Simultaneous Equations
- ✓ Ch.1 Correction Quiz

Topic 2 : Basic Knowledge of Functions

- ✓ 2.1 Definition, Domain and Co-domain
- ✓ 2.2 Values of Function
- ✓ Ch.2 Correction Quiz

Topic 3 : Exponential Functions

- ✓ 3.1 Indices
- ✓ 3.2 & 3.3 Exponential Functions and Applications
- ✓ Ch.3 Correction Quiz

學生實例

First name / Surname	State	Time taken	Grade/10.00	Q. 1 /1.00	Q. 2 /1.00	Q. 3 /1.00	Q. 4 /1.00	Q. 5 /1.00	Q. 6 /1.00	Q. 7 /1.00	Q. 8 /1.00	Q. 9 /1.00	Q. 10 /1.00
	Finished	11 mins 33 secs	10.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00
	Finished	1 hour 3 mins	8.00	✗ 0.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✗ 0.00	✓ 1.00
	Finished	52 mins 24 secs	9.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✗ 0.00
	Finished	44 mins 3 secs	9.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✗ 0.00
	Finished	24 mins 12 secs	10.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00	✓ 1.00

能力差異

課堂前分析

學生實例

QUIZ NAVIGATION

1 2 3 4 5 6 7 8
9 10

Show one page at a time
Finish review

預期之外
課堂加以解釋

Attempts	1, 2, 3, 4, 5, 6, 7, 8
Started on	Friday, 7 September 2018, 4:41 PM
State	Finished
Completed on	Friday, 7 September 2018, 4:45 PM
Time taken	3 mins 55 secs
Grade	6.00 out of 10.00 (60%)

Topic:
Definition of function,
domain, range

QUIZ NAVIGATION

1 2 3 4 5 6 7 8
9 10

Show one page at a time
Finish review

Attempts	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Started on	Monday, 10 September 2018, 7:35 AM
State	Finished
Completed on	Monday, 10 September 2018, 7:52 AM
Time taken	16 mins 37 secs
Grade	5.00 out of 10.00 (50%)

QUIZ NAVIGATION

1 2 3 4 5 6 7 8
9 10

Show one page at a time
Finish review

Attempts	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29
Started on	Friday, 7 September 2018, 5:37 PM
State	Finished
Completed on	Friday, 7 September 2018, 5:40 PM
Time taken	2 mins 11 secs
Grade	8.00 out of 10.00 (80%)

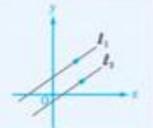
學生實例

1.2A Number of intersection points

1.2 Intersection points
Number of intersection point

Case 2

$l_1: 3x - y - 2 = 0$
 $l_2: 9x - 3y + 2 = 0$



$m_1 = m_2, b_1 \neq b_2$

0

$y = mx + b$

1.2B Coordinates of intersection points

1.2 Intersection points
Coordinates of intersection point

Two straight lines $L_1: 3x - 4y = 22$ and $L_2: y = 4 - 4x$ intersect at the point P .

(a) Find the coordinates of P .

(b) The straight line L_3 passes through P . If L_3 is perpendicular to the straight line $L_4: x - 5y = 0$, find the equation of L_3 .

b) $L_4: 5y = x$
 $y = \frac{1}{5}x$

a) $\begin{cases} 3x - 4y = 22 \\ y = 4 - 4x \end{cases}$
 $\begin{cases} 3x - 4y = 22 \\ 4x + y = 4 \end{cases}$
 $x = 2, y = -4$
 $P(2, -4)$

較容易

1. Find the number of intersection point of the following straight lines. If there is only one intersection point, find its coordinates.
 - (a) $\begin{cases} L_1: 2x - 6y = 5 \\ L_2: 15y = 5x - 7 \end{cases}$
 - (b) $\begin{cases} L_3: 2x + 6y - 5 = 0 \\ L_4: 15y - 5x - 7 = 0 \end{cases}$
 - (c) $\begin{cases} L_5: 6x + 2y - 8 = 0 \\ L_6: 5y = 20 - 15x \end{cases}$

學生實例

較難

Topic 2: Functions

 2.1 Definition, domain and co-domain

 2.2 Values of function

Quiz 7

1. $f(x) = \frac{2-x}{2x-1}$

(a) Find $f(-\frac{3}{2})$.

(b) Find $f(2-x)$.

2. $g(4-x) = x^2 - 8x - 7$. Find $g(3)$ and $g(x)$.

學生實例



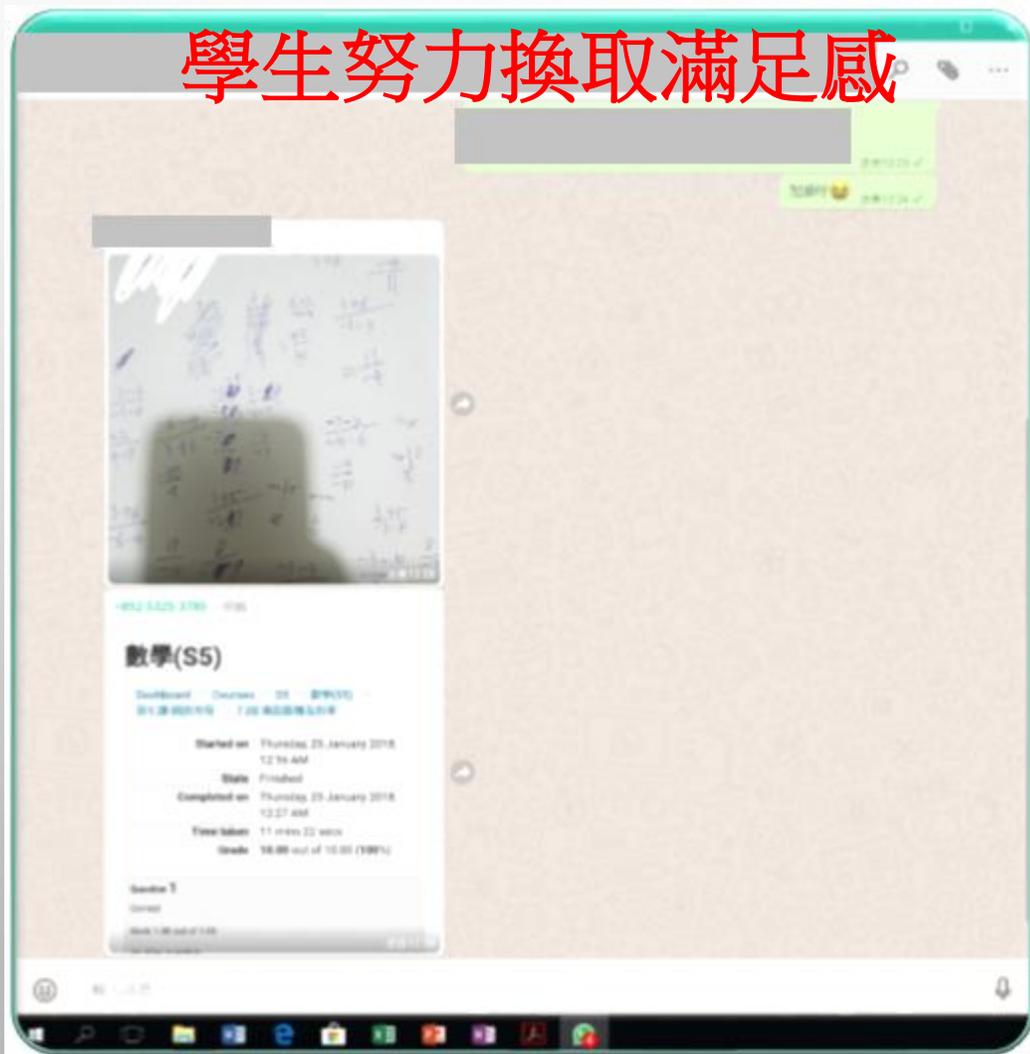
跨級
學習

學生實例

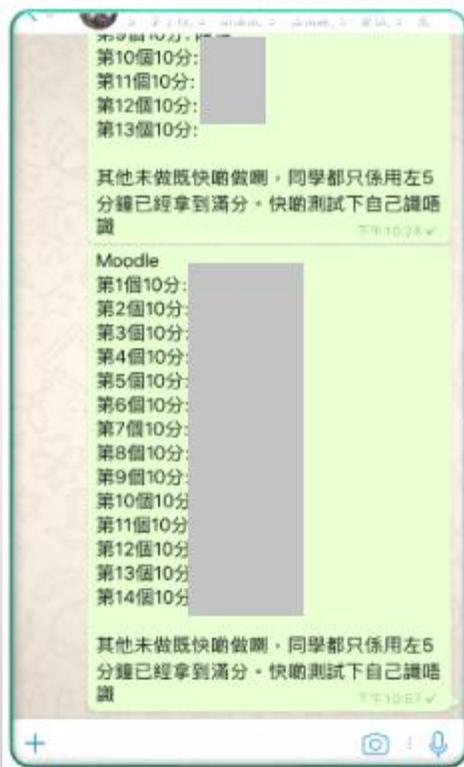


學生實例

學生努力換取滿足感



優越感
學生良性競爭



即時回饋



- **延展學時**
- 課時內滿足不到的知識求知慾，可利用**MOODLE**平台
- 上課前已掌握學生大致學得如何
- 上課首**5－10**分鐘小測**再次確認**學生掌握情況，
老師才有信心上課以處理高階題目為主

利用MOODLE實行資優教育

(4) 教學經驗承傳 KNOWLEDGE MANAGEMENT

(4) KNOWLEDGE MANAGEMENT

Maths 1A, 1B

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- 學生學習難點
- 教學技巧

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Teachers Read Me

Moodle的各課題都分為5個Level:

Lv1: 背誦式或直接代入公式，或者TSA題目

Lv2: 不能直接出結果，需要2步或以上的運算才能得出結果

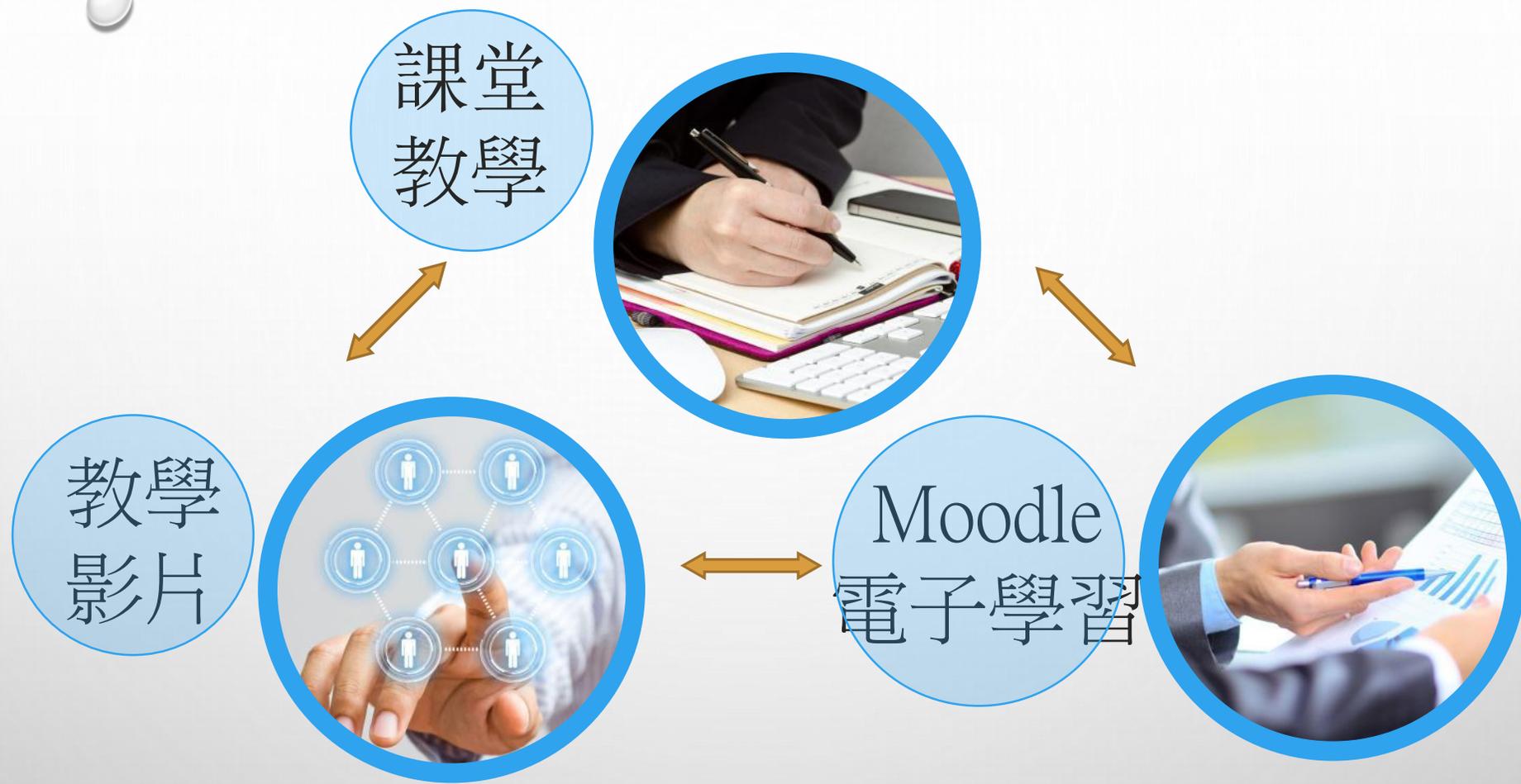
Lv3: 逆向式計算或者需要列方程

Lv4: TSA

Lv5: 公開試題目

Lv6: 奧數題型

1. Moodle的練習需以預習為主，輔上預習片段，練習題型也只應以Lv1及Lv2為主。
2. 如有需要作課後練習，可加開練習並以Lv2或以上的題型為主。
3. 科任老師宜把任教時所得到的心得或困難寫在該課題的**教學重點**中，方便以後再跟進學生問題。
4. Quiz可以無限試做，但Chapter TEST只可以做一次，並用作計算平時分。
5. TSA 及校內試題或公開試題部分建議學生最少做一次，而過去3年的校內試的試題也會放在公開試題部分。



電子學習工具是促進資優／高能力學生學習的其中一環

迷思2：

精英班比其他班的學習進度較快，又如何處理？

加速課程：重新規劃高中課程及配合M1教學

F.4S – F.6S Mathematics Teaching Schedule

F.4S				
UT1	1	F.4	Ch.2	Equation of Straight lines
	2	F.4	Ch.4	Functions
	3	F.4	Ch.7	Exponential Functions
	4	F.4	Ch.8	Logarithmic Functions
1X	5	F.4	Ch.1	Number system
	6	F.4	Ch.3	Quadratic equations in one unknown
	7	F.4	Ch.5	Quadratic Functions
	8	F.4	Ch.12	Trigonometric Functions and equations
	9	F.5	Ch.1	More equations
UT2	10	F.5	Ch.2	Inequalities in one unknown
	11	F.6	Ch.3	Inequalities in two unknowns and Linear Programming
	12	F.5	Ch.3	Graphs of functions (Eq. and Ineq.)
	13	F.5	Ch.9	Solving Triangles
	14	F.5	Ch.10	Trigonometry 3-D
1X	15	F.4	Ch.6	Polynomials
	16	F.4	Ch.9	Rational Functions
	17	F.5	Ch.6	Variations
	18	F.6	Ch.1	Arithmetic Sequence (A.S.)
	19	F.6	Ch.2	Geometric Sequence (G.S.)

F.5S

暑	20	F.5	Ch.4	Permutation & Combination
UT1	21	F.5	Ch.5	Probabilities
	22	F.5	Ch.11	Dispersion
	23	F.5	Ch.12	More Dispersion
1X	24	F.4	Ch.10	Circle
	25	F.4	Ch.11	More circles
	26	F.5	Ch.7	Eq. of circles
	27	F.5	Ch.8	Locus

F.4S – F.6S M1 Teaching Schedule

F.4S			
UT1	M1A	Ch.1	Binomial Theorem
	M1A	Ch.2	Exponential and Logarithmic Functions
1X	M1A	Ch.3	Limits and Derivatives
	M1A	Ch.4	Differentiation
UT2	M1A	Ch.5	Applications of differentiation
	M1A	Ch.6	Indefinite integrals
2X	M1A	Ch.7	Definite integrals
	M1A	Ch.8	Applications of definite integrals

F.5S

暑	M1B	Ch.9	Further Probability
UT1	M1B	Ch.10	Discrete random variable
	M1B	Ch.11	Binomial distribution
	M1B	Ch.12	Geometric distribution
1X	M1B	Ch.13	Poisson Distribution
	M1B	Ch.14	Normal distribution
	M1B	Ch.15	Sampling distribution and point estimates
	M1B	Ch.16	Confidence intervals

• 獨立試卷！

迷思3：

如何推動同工配合？

推動同工配合

- 作先鋒
- 校長、副校長、科主任確認方向及推動
- 三年發展計劃，營造團隊氣氛、共同目標
- 名義教節，減輕工作量
- 共同備課節，只談IT教學，當中包括資優教學部分；定期及持續檢討

謝謝！