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Integrating ”Games” into Mathematics Classroom

Ivan TSUI

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Ivan TSUI

Mathematics Panel Head

United Christian College

- Started Gamifications Learning Circle in 2019
- Started Second Phase Gamifications Learning Circle in 2020

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https://doraemon.fandom.com/wiki/Shizuka_Minamoto

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Content

1. Using existing resources
2. Creating school-based teaching materials
3. Striving for teaching time

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Using Existing Resources

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S.1 Basic Mathematics

Find the value of each of the following expressions. **(7 – 10)**

④ **7.** **(a)** $24 + 38 - 36$ 26 **(b)** $35 - 17 + 14$ 32

(c) $64 \div 8 \times 2$ ~Example 0.2(a) 16 **(d)** $54 \times 3 \div 9$ 18

④ **8.** **(a)** $9 + 5 \times 8$ ~Example 0.2(b) 49 **(b)** $30 - 8 \times 2$ 14

(c) $14 + 16 \div 2$ 22 **(d)** $55 - 35 \div 5$ 48

④ **9.** **(a)** $60 + (32 - 18)$ 74 **(b)** $58 - (25 + 17)$ 16

(c) $15 \times (16 \div 4)$ 60 **(d)** $72 \div (4 \times 3)$ ~Example 0.3(a) 6

④ **10.** **(a)** $(24 + 6) \times 3$ 90 **(b)** $16 \times (20 - 5)$ 240

(c) $(65 - 38) \div 9$ 3 **(d)** $90 \div (12 + 6)$ 5

S.1 Basic Mathematics

https://www.youtube.com/watch?v=dfe7cyXkm1M

S.1 Transformation

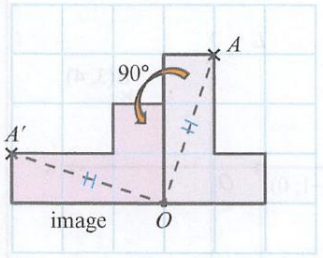
C Rotation

e-Lesson Exemplar

The process of rotating a figure about a fixed point through an angle (in a clockwise direction or in an anti-clockwise direction) is called **rotation**. The image obtained after rotation has the same shape and size as the original figure.

To describe a rotation, we have to specify
1. the direction of rotation, either clockwise or anti-clockwise,
2. the centre of rotation,
3. the angle of rotation.

The following figure shows a block rotating anti-clockwise about O through 90°.



Rotate anti-clockwise about O through 90°.

O is the **centre of rotation** and 90° is the **angle of rotation**.

We can see that the point A on the block is rotated anti-clockwise about O through 90° to image A'.

Every other point on the block and the corresponding point on its image are at the same distance from the centre of rotation.

Let us look at some examples when the block is rotated about O through other angles.

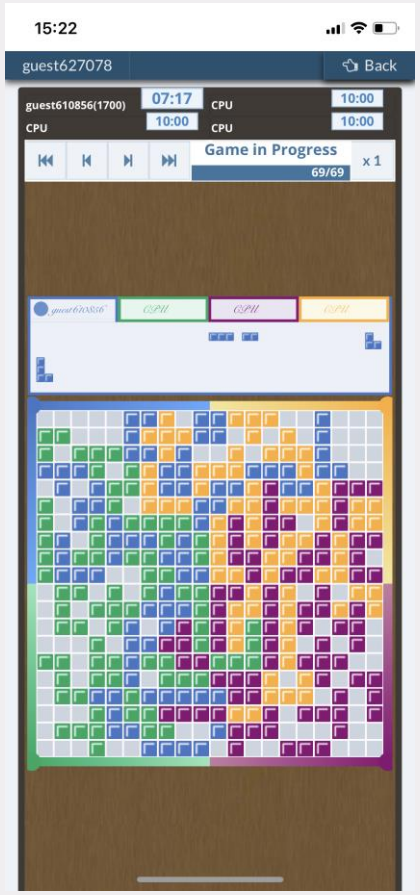
S.1 Transformation

https://www.youtube.com/watch?v=1Z4Usk4to6w&t=61s

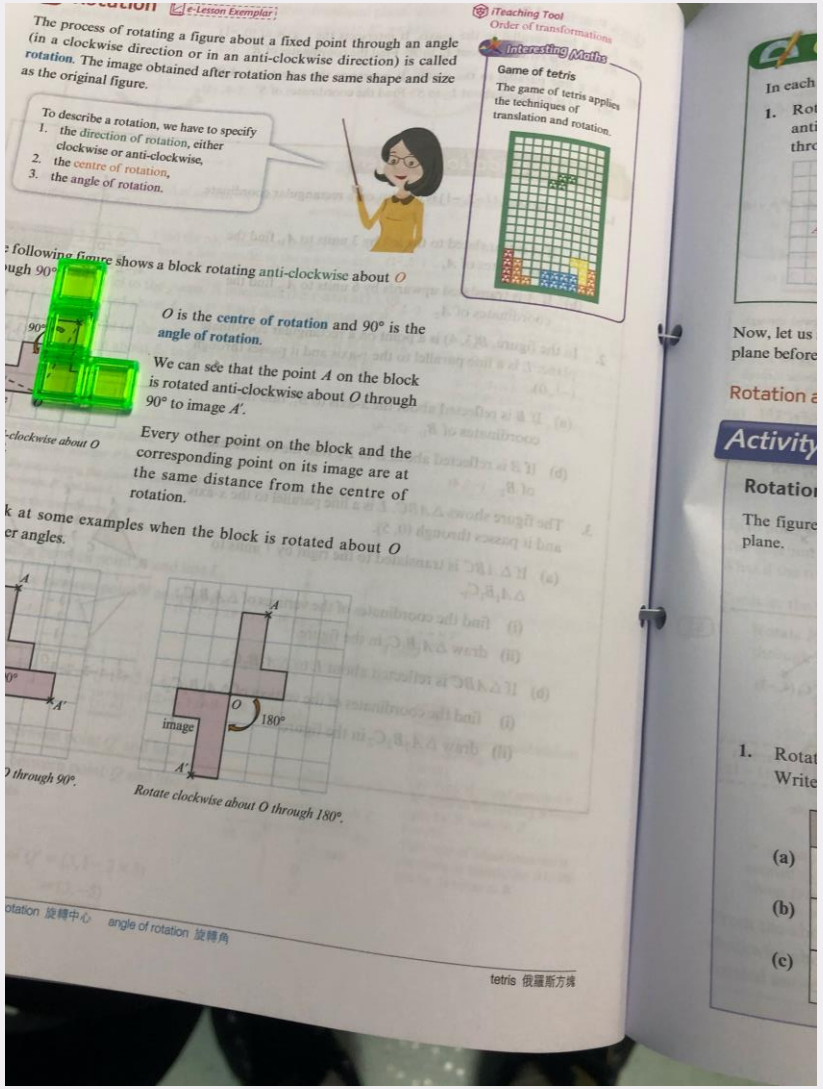
S.1 Transformation

https://www.youtube.com/watch?v=W1EK-xAGy3U&t=9s

S.1 Transformation

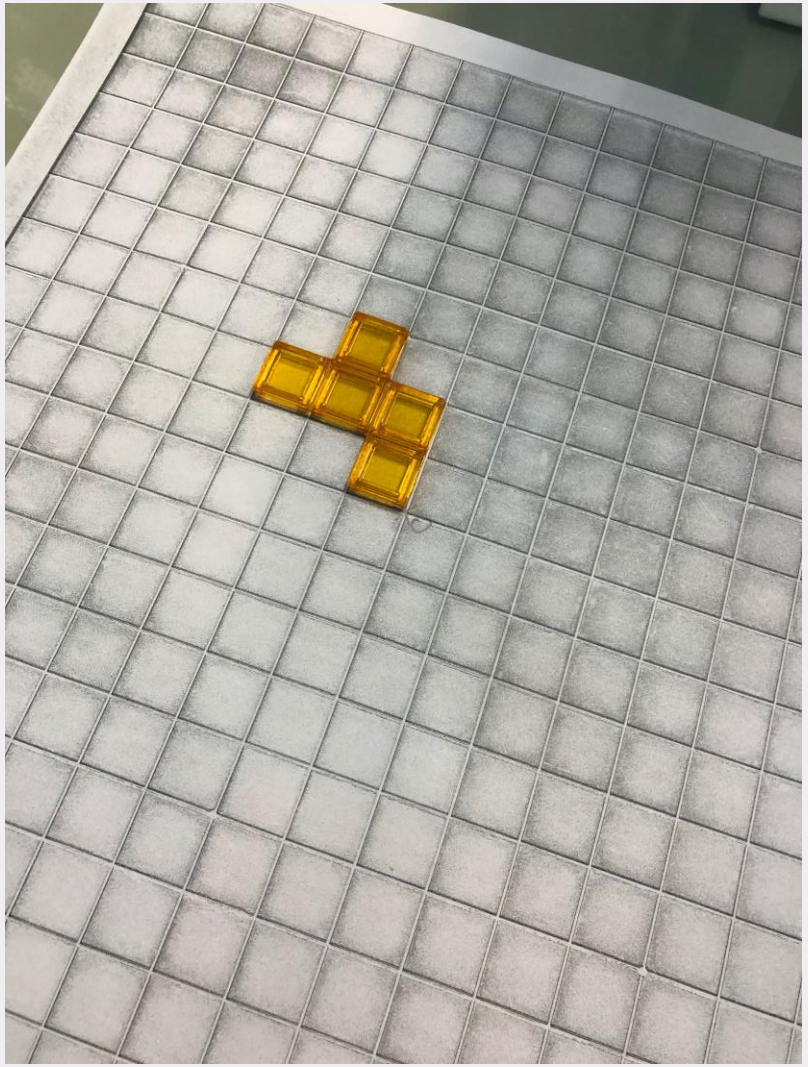


S.1 Transformation



Junior Secondary Mathematics in Action 1B

S.1 Transformation



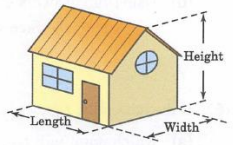
S.3 Geometry

8.3 Further Knowledge on 2-D Representations of 3-D Objects

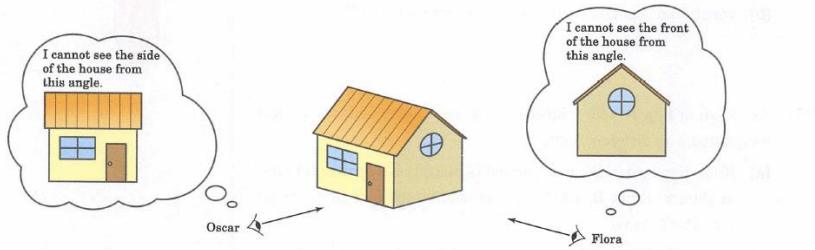
Lesson Worksheet 8C

A Front, Top and Side Views of 3-D Objects

The solid as shown is the model of a house. It occupies space with
N9 3 dimensions: length, width and height. The solid is called a *three-dimensional* object, or simply 3-D object.



Oscar and Flora are observing the model from different views. Each person can only see a partial view of the model.

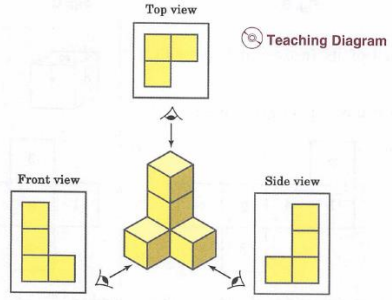


When we observe a 3-D object from a certain angle of view, we can draw a 2-D diagram to show the observed shape. However, the 2-D diagram only represents a certain part of the 3-D object.

N9 Teachers may remind students that a plane figure occupies space with 2 dimensions: length and width (no height or thickness).

In order to understand a 3-D object, we should observe it from different angles.

e.g. **(i)**



Teaching Diagram

three-dimensional 三維

New Century Mathematics (Second Edition) 3A

S.3 Geometry

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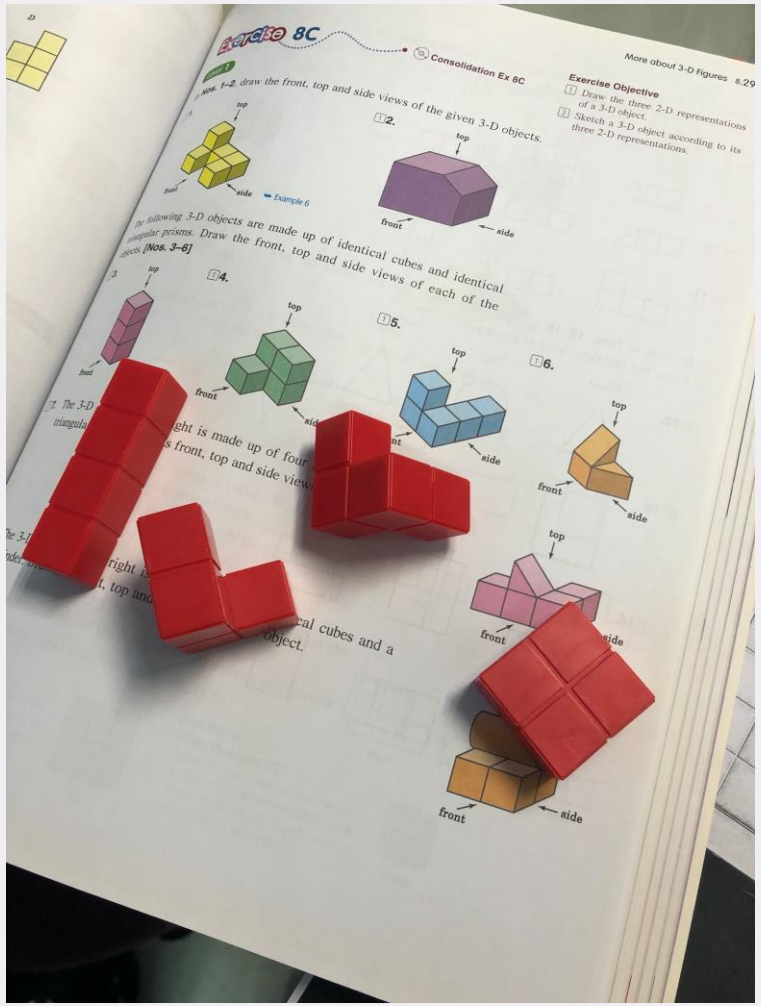
S.3 Geometry



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Promoting Learning Atmosphere

Promoting Learning Atmosphere

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Promoting Learning Atmosphere

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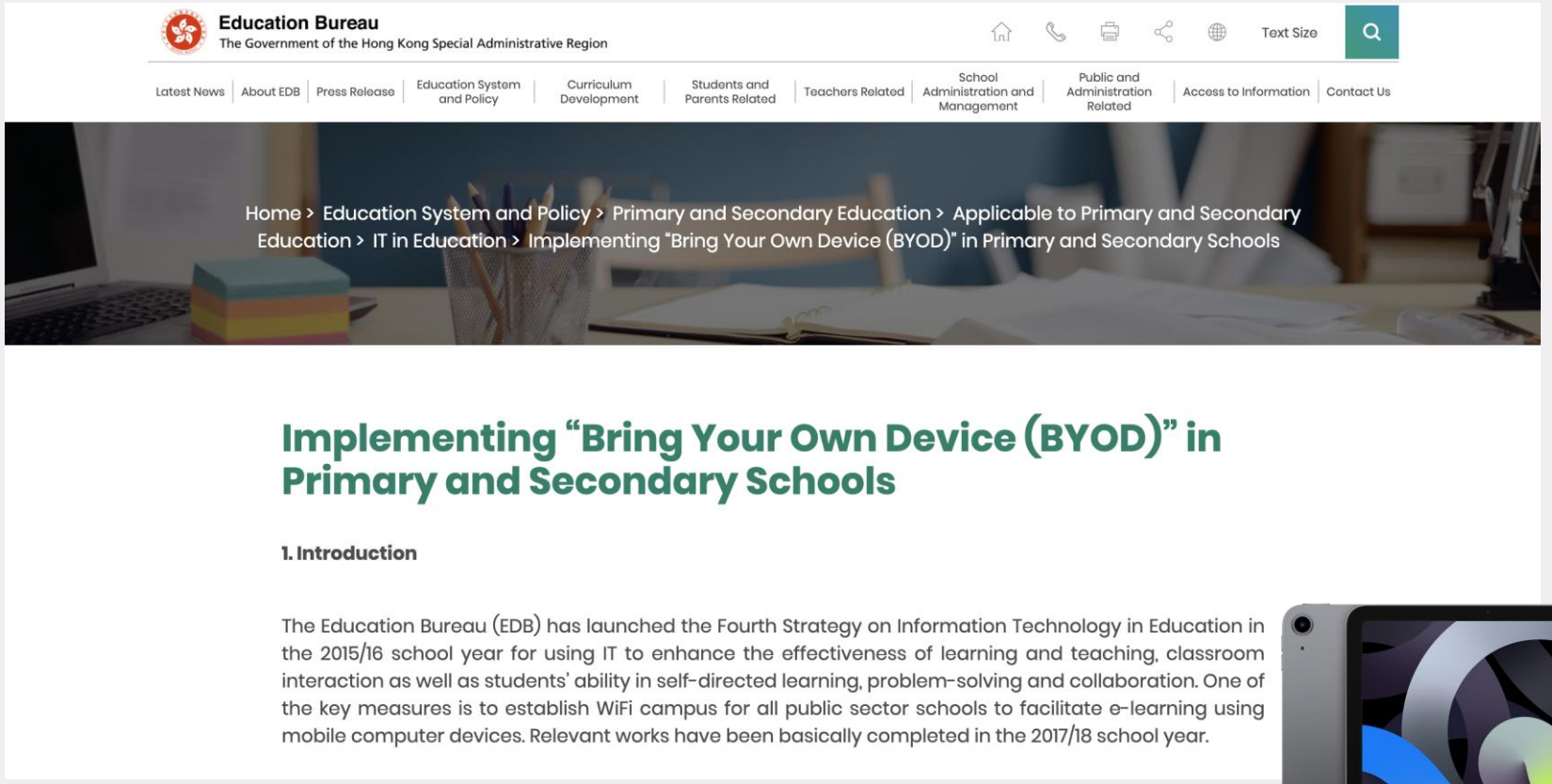
Opportunity



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Kahoot!

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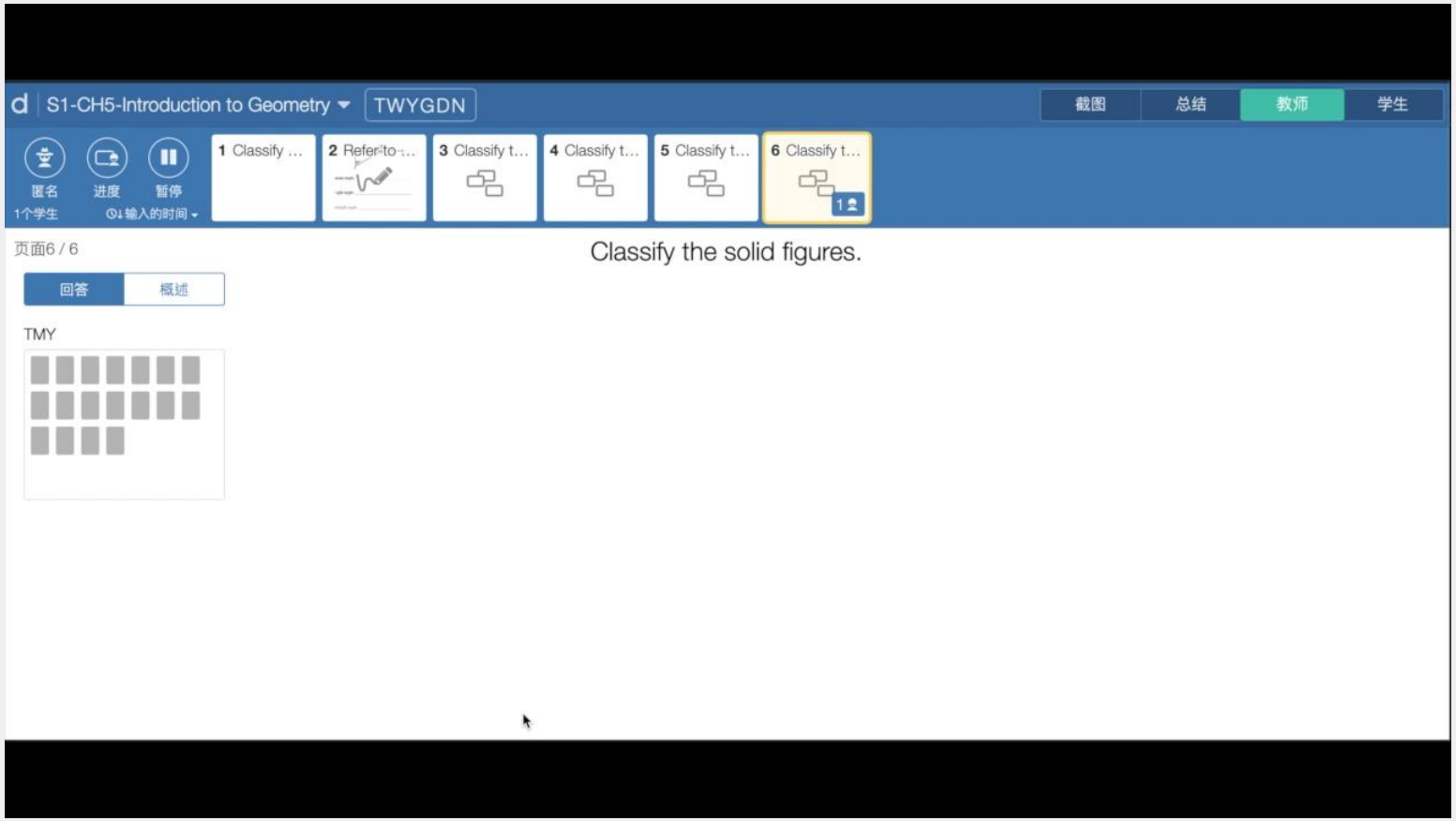
Desmos (Teacher)



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Creating School-Based Teaching Materials

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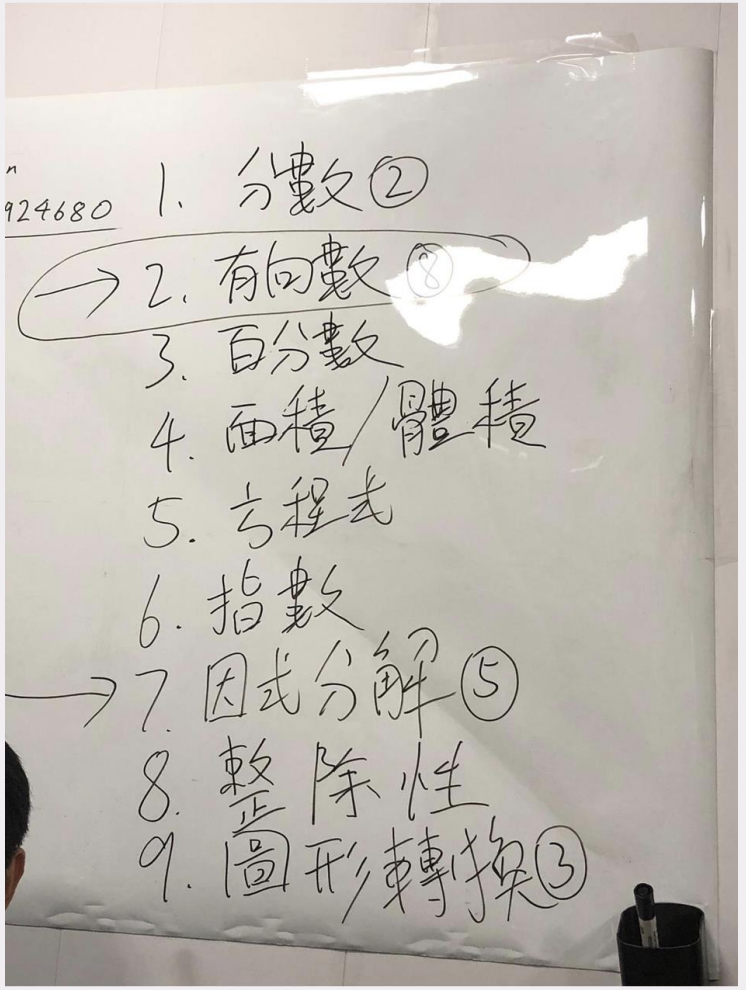
Game Design

1. Set Goal



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Game Design

1. Set Goal

依照道具分類

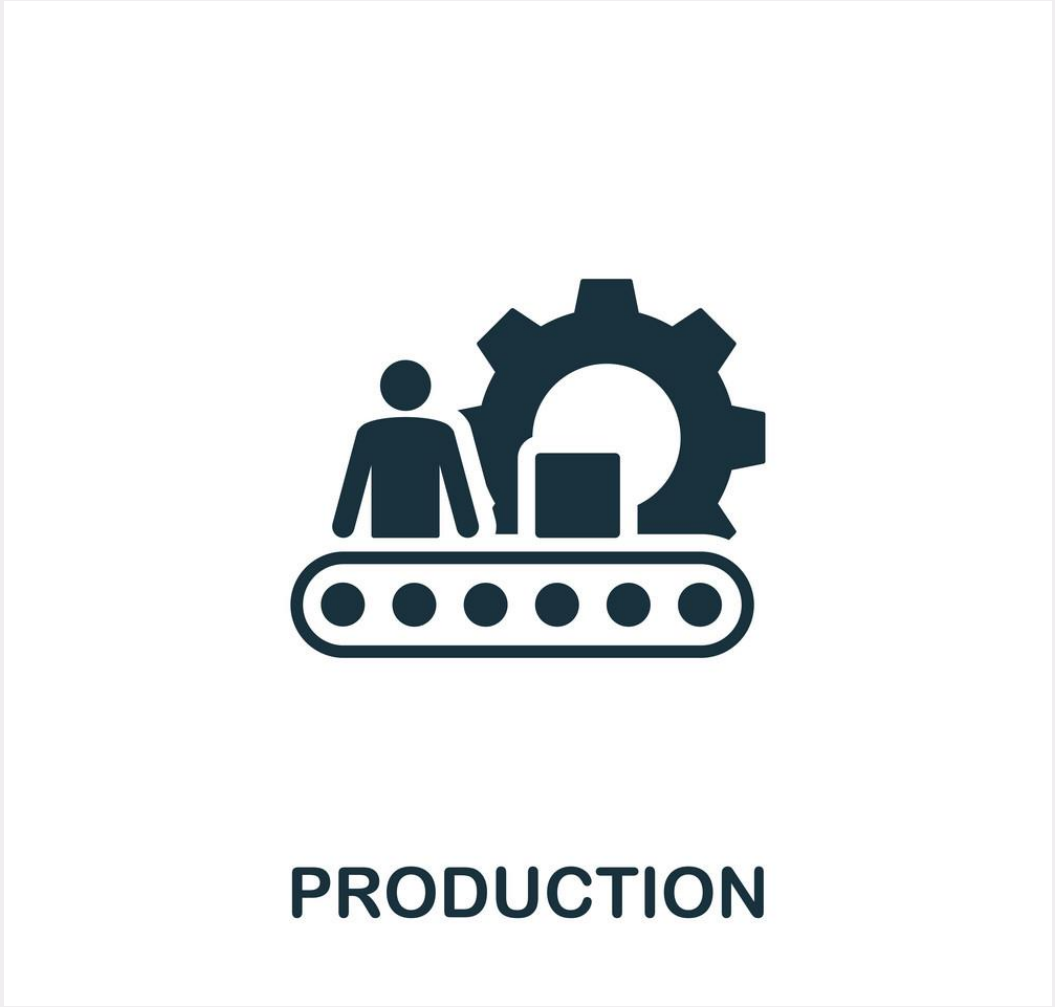
圖板遊戲(包含棋類)、卡片遊戲、骰子遊戲、紙筆遊戲

依照機會元素分類

	完全資訊	部分資訊
確定性的	黑白棋	陸軍棋
隨機的	大富翁	麻將

Game Design

1. Set Goal



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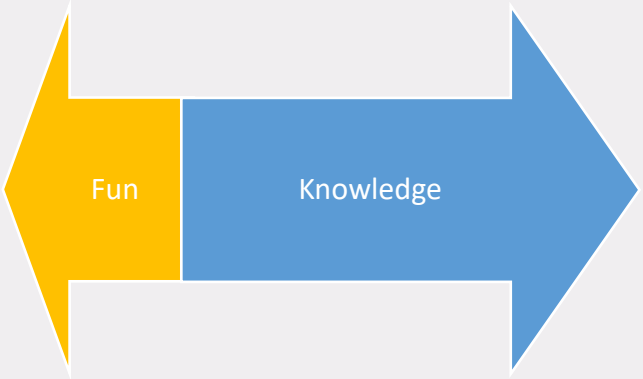
Game Design

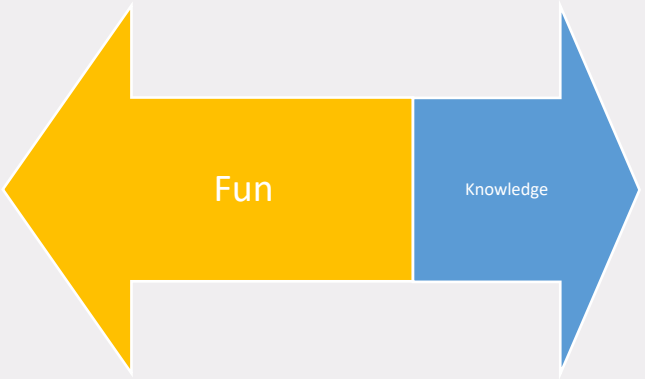
2. Balance



$\sin 60^{o}$	$\sin 30^{o}$	$\frac{\sqrt{3}}{2}$
$\tan 45^{o}$	$\cos 30^{o}$	1
$\cos 60^{o}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$

Game Design

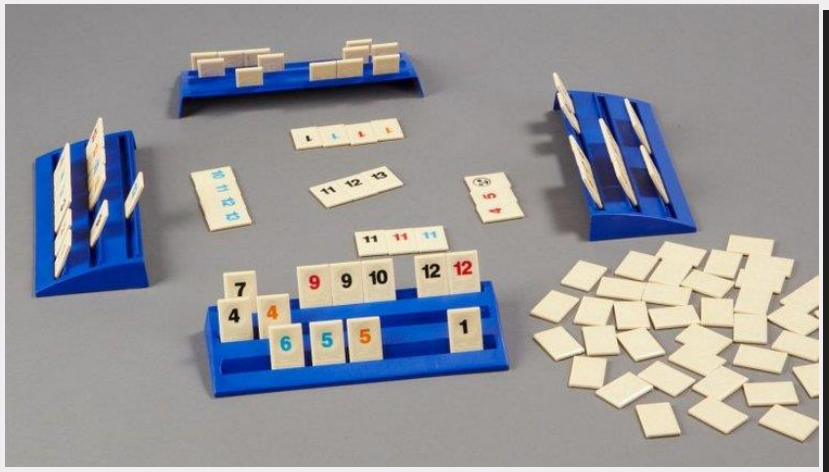
2. Balance

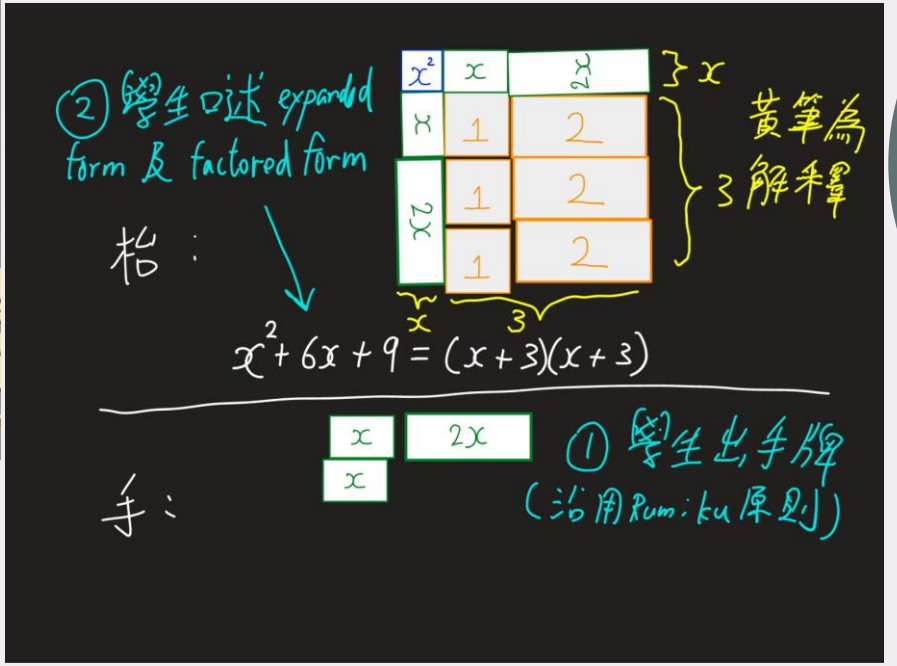


$\sin 60^o$	$\sin 30^o$	$\frac{\sqrt{3}}{2}$
$\tan 45^o$	$\cos 30^o$	1
$\cos 60^o$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$

Game Design

2. Balance





https://www.gamesforyoungminds.com/

Game Design

3. Focus

Math Talk

https://www.youtube.com/results?search_query=%E4%B8%8D%E8%A6%81%E5%81%9A%E6%8C%91%E6%88%B0+%E6%A1%8C%E9%81%8A+%E8%AC%9B%E6%9D%B1%E8%A9%B1

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Product

Target: S.1 Students
Topic: Direct Number
Type: Card Game

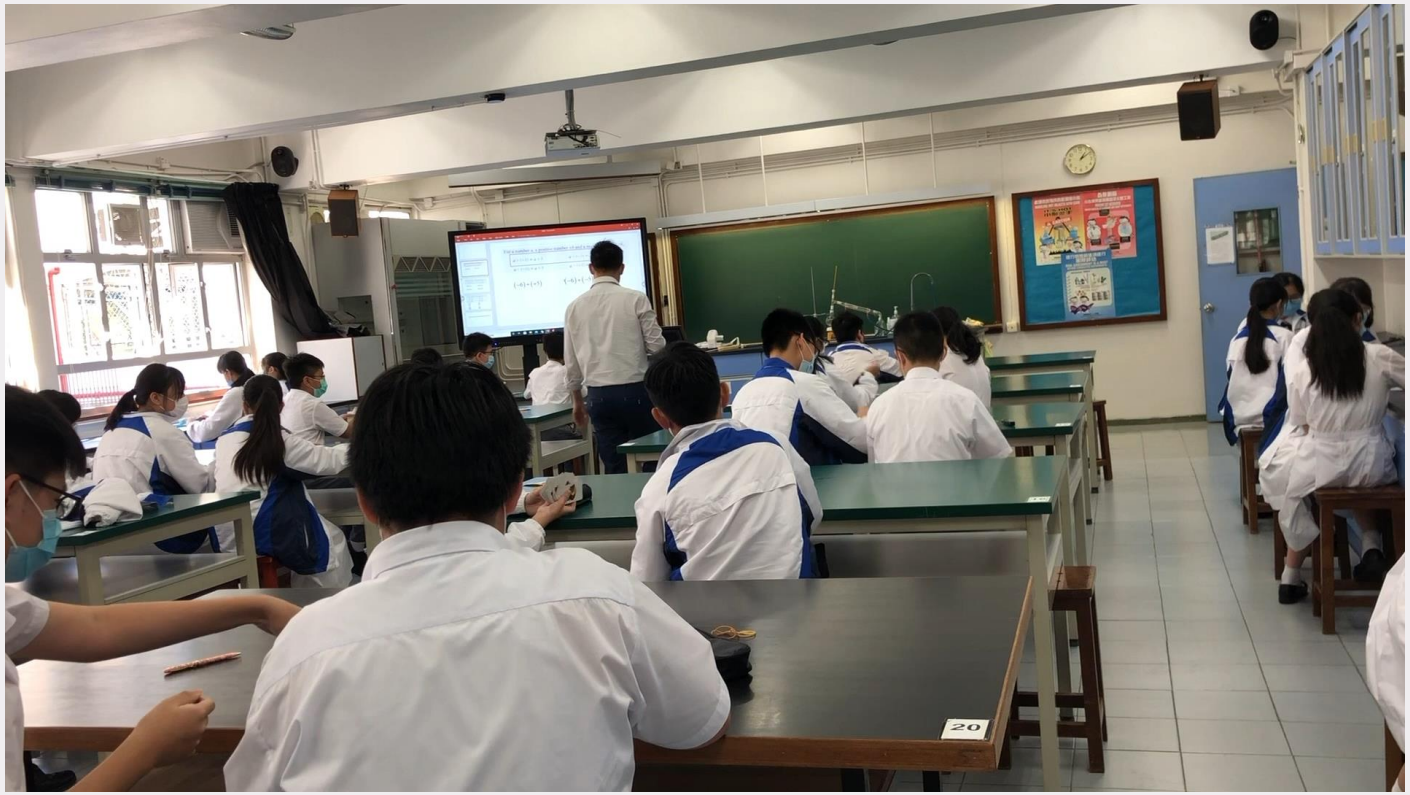
https://www.youtube.com/watch?v=OqcLdldYuho

Implementation

課堂學習

	時間	教學活動細節說明	使用教材
1.	5 分鐘	利用教科書，重溫有向數加法的法則	教科書（見丁部）
2.	5 分鐘	老師講解「數極」卡片遊戲的規則，以及「數極」卡片遊戲與有向數的加法之間的關係	「數極」卡片遊戲介紹影片 (時間：0:36 - 1:19) 使用 80 隻數字牌（不使用功能牌）（見丁部）
3.	10 分鐘	四人一組，試玩「數極」卡片遊戲兩回合 第一熱身回合，令學生熟習「棄寶潛逃」相關規則。 第二回合，認真進行一回合的比賽，優勝同學將會進入勝利組再進入下一輪的比賽。	使用 80 隻數字牌（不使用功能牌）（見丁部）
4.	5 分鐘	利用教科書，重溫有向數乘法及除法法的法則	教科書（見丁部）
5.	5 分鐘	老師講解「數極」卡片遊戲 12 隻乘除功能牌的規則，以及講解「棄寶潛逃」遊戲與有向數的乘除法之間的關係。	「數極」卡片遊戲介紹影片 (時間：1:20 - 2:11) 使用 92 隻版本（數字牌及乘除功能牌）（見丁部）
6.	10 分鐘	四人一組，勝利組的同學會在同一組，其他同學重新分組。 第一熱身回合，令學生熟習「數極」卡片遊戲 92 隻版本的相關規則。 第二回合，認真進行一回合的比賽。	使用 92 隻版本（數字牌及乘除功能牌）（見丁部）

Implementation



Publication

1. Violation of Copyright
2. Board Game Design
3. Production

Tips

1. Set your goal before you start
2. Form a pilot group with your colleagues and expert
3. Play more board games before creating one
4. Take published games as reference on the game design and mechanism (e.g. the number of cards in UNO and Poker Card)
5. Play the trial version with students
6. Think of how to integrate the game into your teaching

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Find the L.C.M. by prime factorization

We can find the L.C.M. of two numbers by first expressing them as products of prime factors.

For example, the following shows the steps to find the L.C.M. of 18 and 60 by prime factorization.

$18 = 2 \times 3 \times 3$
$60 = 2 \times 2 \times 3 \times 5$

Step 1 Express each number as a product of prime factors.

$\text{L.C.M.} = 2 \times 2 \times 3 \times 3 \times 5$
$= \underline{\underline{180}}$

Step 2 Multiply all the **common** prime factors and also the **remaining** factors of the two numbers. Then, the product is the required L.C.M.

We can also use index notation to express the above prime factorization.

$18 = 2 \times 3^2$
$60 = 2^2 \times 3 \times 5$
$\text{L.C.M.} = 2^2 \times 3^2 \times 5$
$= \underline{\underline{180}}$

$18 = 2 \times 3^2$
$60 = 2^2 \times 3 \times 5$
$2^2 \quad 3^2 \quad 5$

For **each prime factor**, take the one with a larger index to find the L.C.M.

11

Since the L.C. and 60, the L. $2 \times 3 \times 3$ and 2 its prime facto

Prime factors of

2
3 3

Example 1.6 Find the L.C.M. of 2 numbers by prime factorization

LEVEL 1

Find the L.C.M. of 56 and 70 by prime factorization.

Solution

$56 = 2^3 \times 7$
$70 = 2 \times 5 \times 7$
$\text{L.C.M.} = 2^3 \times 5 \times 7$
$= \underline{\underline{280}}$

Compare 2^3 and 2, 2^3 has a larger index.

Rough Work

2) 56	2) 70
2) 28	5) 35
2) 14	7
7	

Example 1.7 Find the L.C.M. of 3 numbers by prime factorization

LEVEL 2

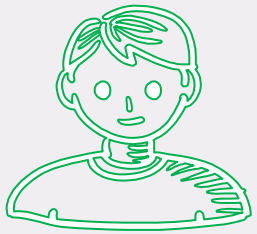
Find the L.C.M. of 40, 48 and 100 by prime factorization.

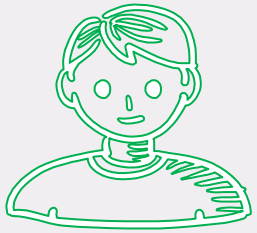
Solution

$40 = 2^3 \times 5$
$48 = 2^4 \times 3$
$100 = 2^2 \times 5^2$
$\text{L.C.M.} = 2^4 \times 3 \times 5^2$
$= \underline{\underline{1200}}$

Rough Work

2) 40	2) 48	2) 100
2) 20	2) 24	2) 50
2) 10	2) 12	5) 25
5	2) 6	5
	3	





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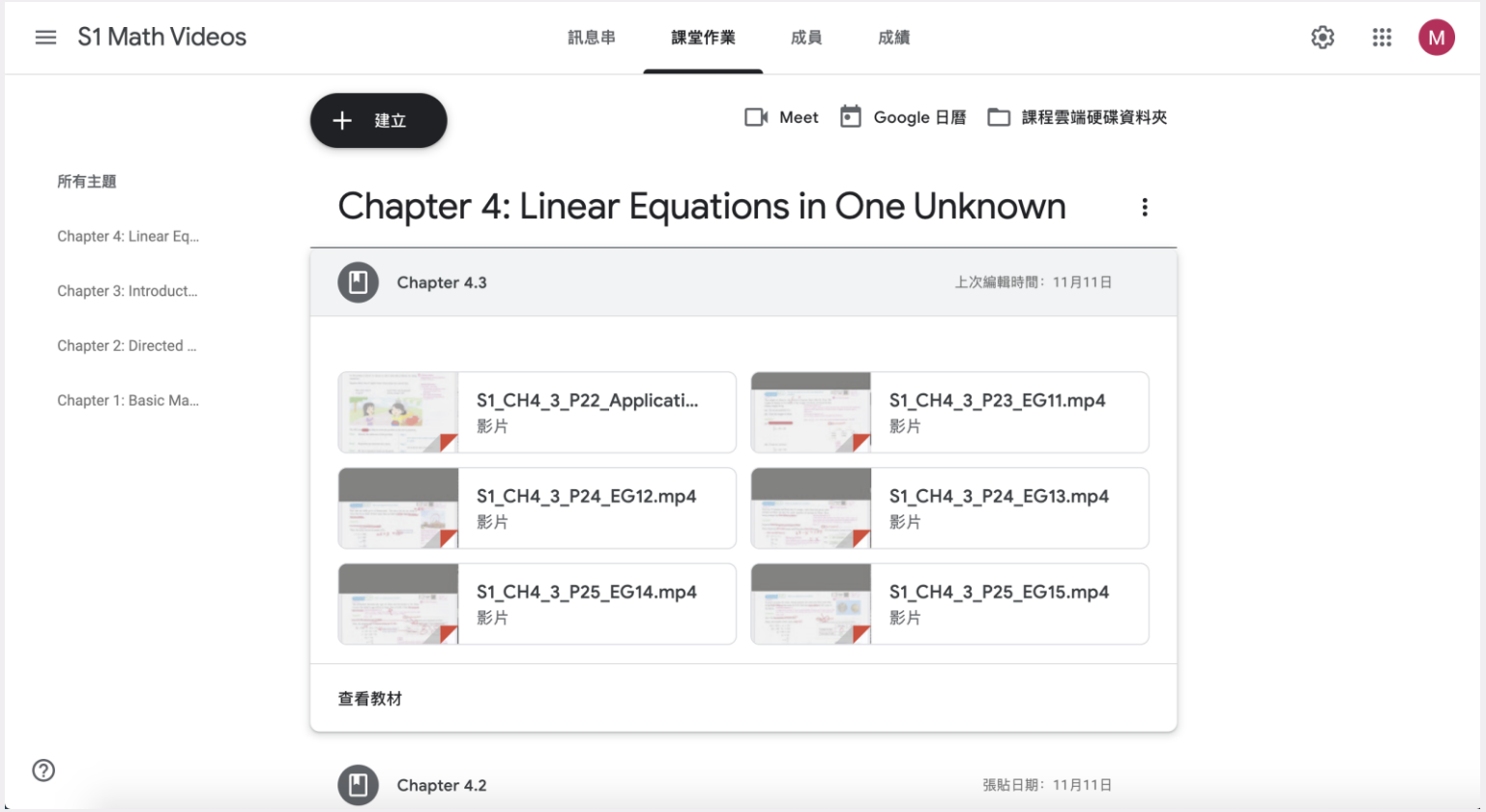
Video



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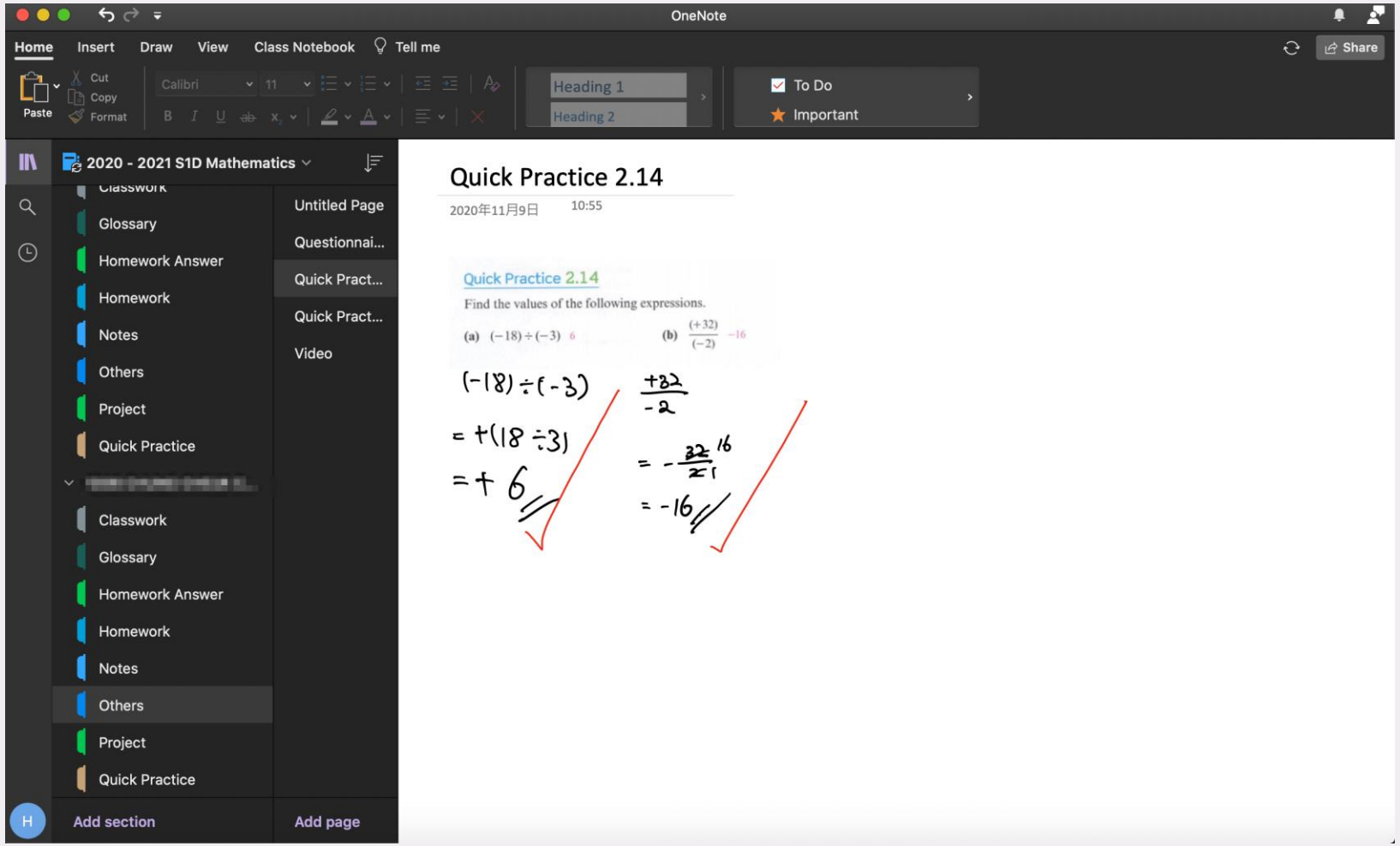
Classwork



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Commitment

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Thank You!

tmy@ucc.edu.hk