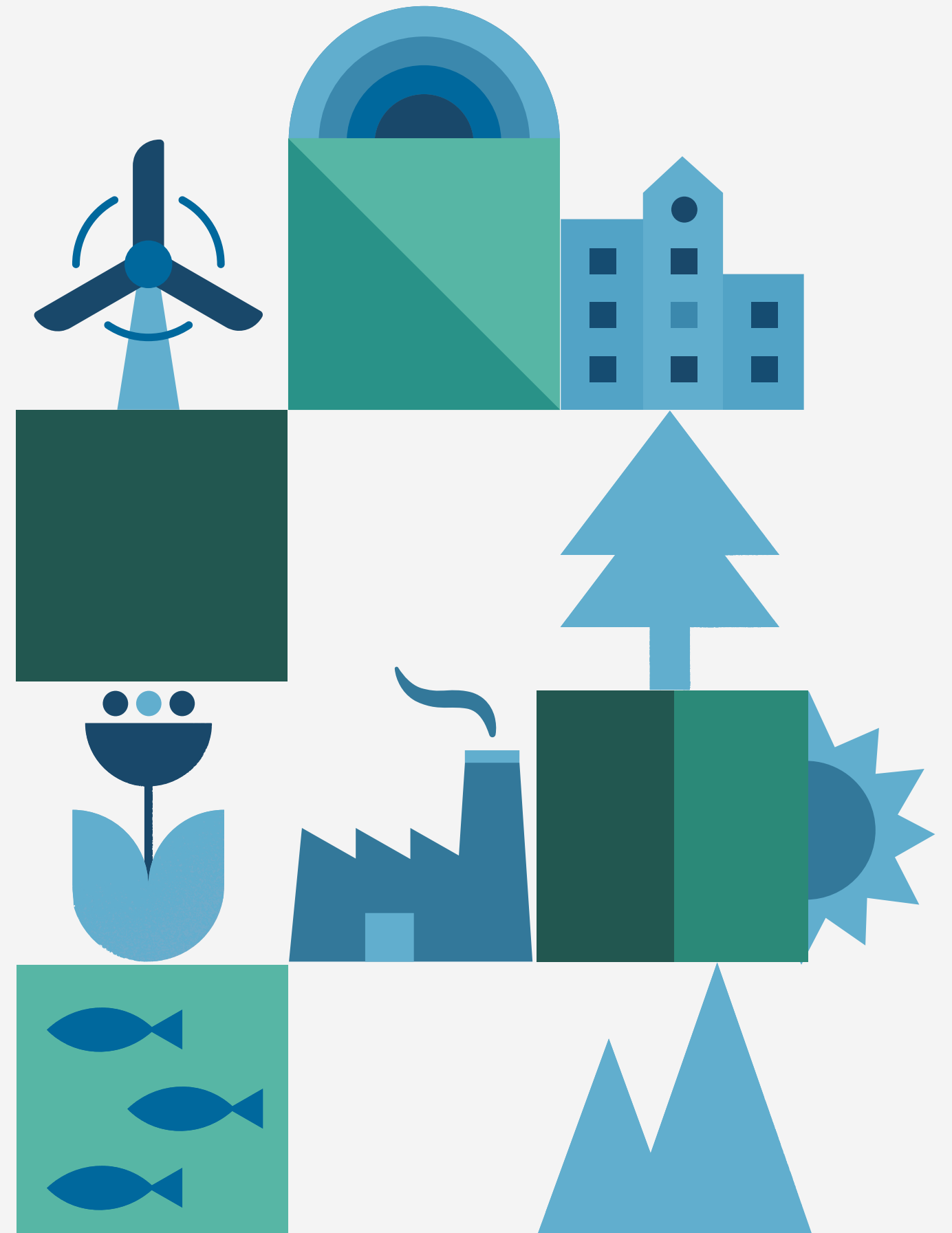




滙基書院

把「遊戲」融入中學 數學課堂之中

徐銘恩老師



分享內容

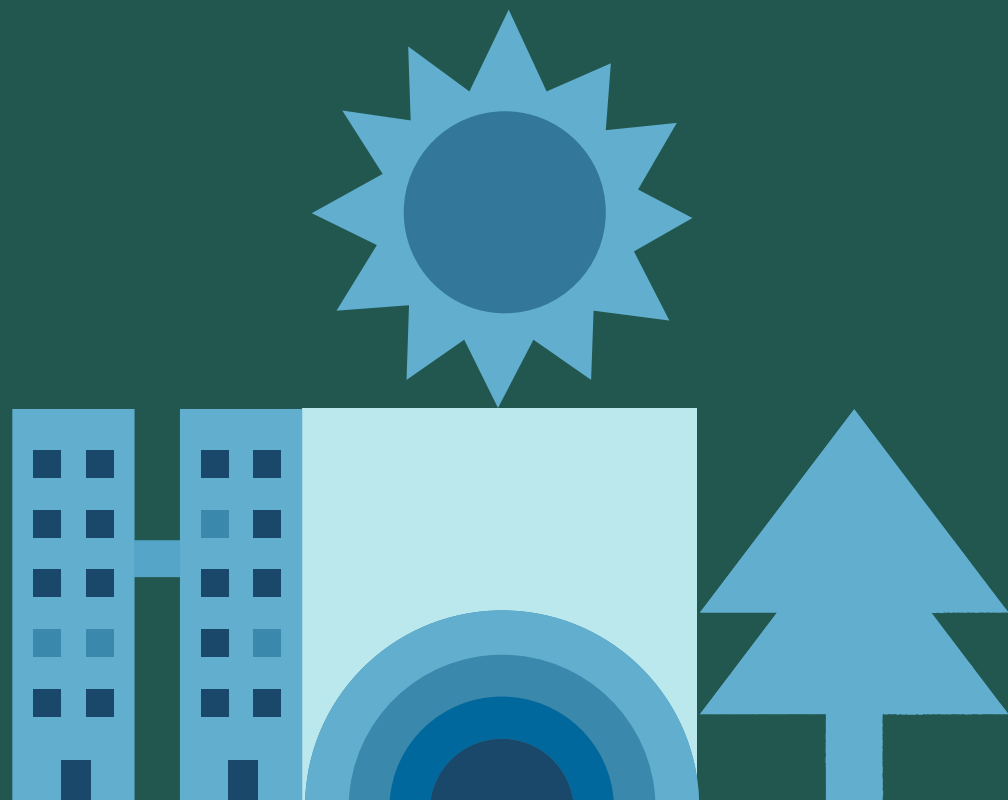
01
背景

02
教學互動遊戲化

03
教學內容遊戲化

04
課堂實施

05
總結





滙基書院

Home > Education System and Policy > Primary and Secondary Education > Applicable to Primary and Secondary Education > IT in Education > Implementing "Bring Your Own Device (BYOD)" in Primary and Secondary Schools

Implementing "Bring Your Own Device (BYOD)" in Primary and Secondary Schools

1. Introduction

The Education Bureau (EDB) has launched the Fourth Strategy on Information Technology in Education in the 2015/16 school year for using IT to enhance the effectiveness of learning and teaching, classroom interaction as well as students' ability in self-directed learning, problem-solving and collaboration. One of the key measures is to establish WiFi campus for all public sector schools to facilitate e-learning using mobile computer devices. Relevant works have been basically completed in the 2017/18 school year.





部份同學上課時的表現

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







Play or Game?

遊戲式學習



教學互動遊戲化

1. 使用遊戲化作為互動工具
2. 與認知學習無關
3. 例子



教學內容遊戲化

1. 把教學內容以遊戲化呈現
2. 與認知學習有關
3. 例子



分享內容

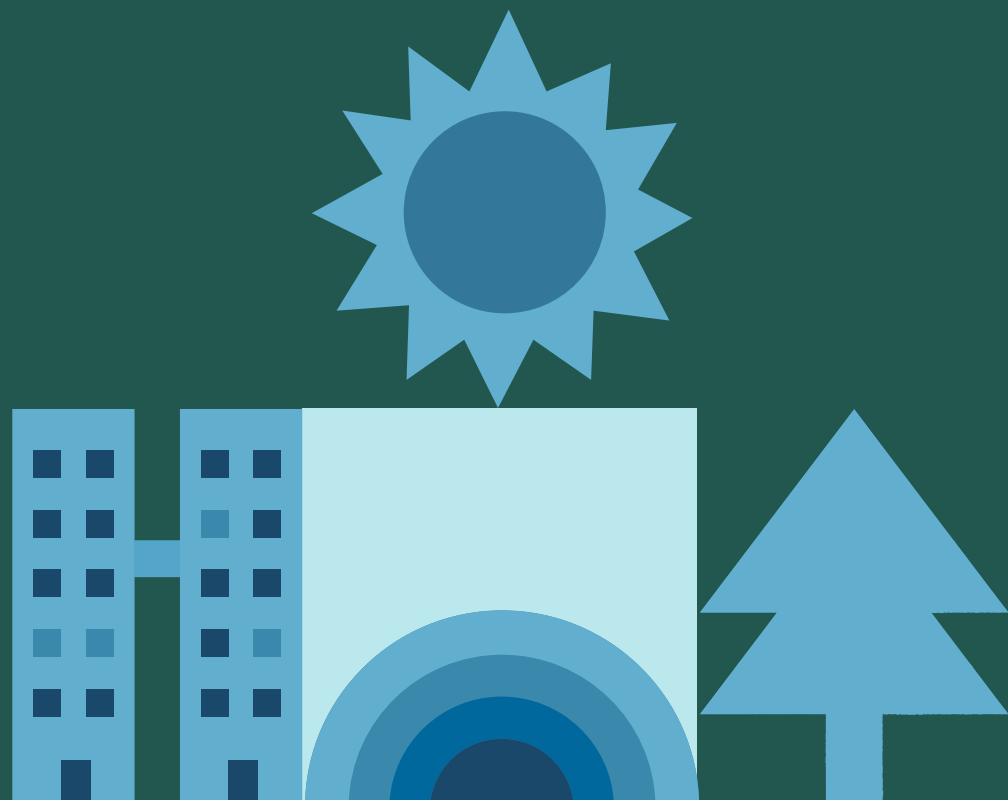
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Kahoot!

2 of 12



Quiz



Desmos (Teacher)

Interface of Desmos Teacher showing a lesson titled "S1-CH5-Introduction to Geometry" by "TWYGDN". The interface includes a navigation bar with buttons for "截图" (Screenshot), "总结" (Summary), "教师" (Teacher), and "学生" (Student). Below the navigation bar, there are icons for "匿名" (Anonymous), "进度" (Progress), and "暂停" (Pause), along with a student count of "1个学生" (1 student) and a time input field "输入的时间" (Input time).

The main content area displays a question: "Classify the solid figures." The question is on page 6 of 6. Below the question, there are two tabs: "回答" (Answer) and "概述" (Overview). The "回答" tab is active, showing a grid of 15 gray squares arranged in three rows (5 in the first row, 5 in the second, and 5 in the third). The name "TMY" is visible above the grid.



ClassDojo

Students Groups

 Whole Class	 2C01陳智軒	 2C02鄒珀尚	 2C03鄭志軍	 2C04鄭展熙	 2C05張昊言	 2C06周悅	 2C07朱詠琳	 2C08馮媽
 2C09夏子...	 2C10何梓鏞	 2C11黎仲賢	 2C12黎瀛晞	 2C13林卓倫	 2C14林鎧迪	 2C15劉楚瑤	 2C16劉俊熙	 2C17劉書寧
 2C18李思婷	 2C19李達榮	 2C20梁璟園	 2C21林嘉晞	 2C22廖曉恩	 2C23羅婉晴	 2C24伍皓安	 2C25潘嘉俊	 2C26蘇正朗
 2C27蘇朗源	 2C28蘇奕欣	 2C29戴慧旋	 2C30曾惠欣	 2C31王藍婷	 2C32文振宇	 2C33黃俊泰	 2C34謝思源	 Add students



4 little trees



分享內容

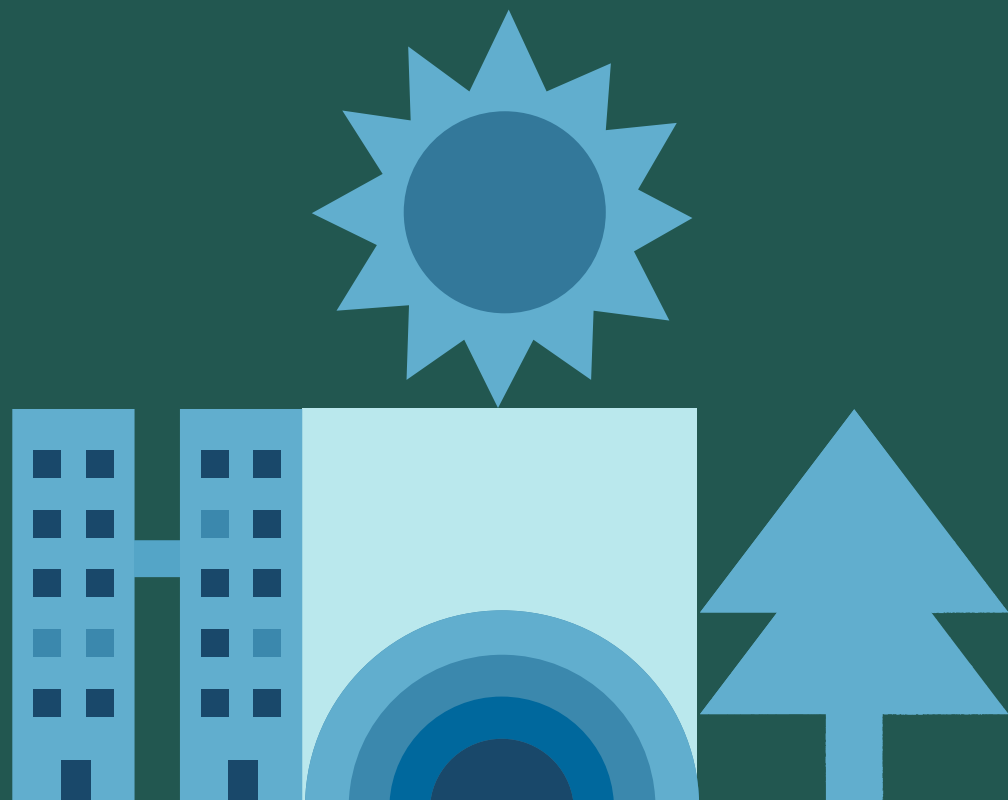
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中一數學

有向數

7食9



2 Directed Numbers and the Number Line

Adding a negative number

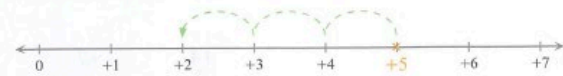
Consider $(+5) + (-3)$. ◀ Adding a negative number (-3)

Since the order is not important in addition (e.g. $2 + 4 = 4 + 2$), we have

$$(+5) + (-3) = (-3) + (+5)$$

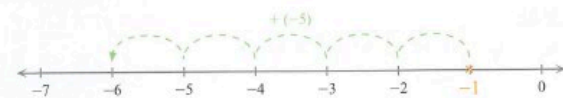
On the previous page, we get $(-3) + (+5) = +2$, so $(+5) + (-3) = +2$.

Consider the number line below.



We can see that starting from the number $+5$ on the number line, the result $+2$ can be obtained by moving 3 units to the left.

Now, consider $(-1) + (-5)$. ◀ Adding a negative number (-5)



Starting from -1 on the number line, we move 5 units to the left. The result is -6 . Therefore, $(-1) + (-5) = -6$.

In general, on a horizontal number line,

when adding a negative number to a directed number, move to the left of the given directed number.

However, the order is important in subtraction. e.g. $0 - 3$ is NOT equal to $3 - 0$.

Think further

Amy and Harry start at the same position:

⊙ Amy moves 5 m to the right and then 3 m to the left.

⊙ Harry moves 3 m to the left and then 5 m to the right.

After the movements ⊙ and ⊙, are the final positions of Amy and Harry the same? **yes**

When adding a negative number, the result is always smaller than the given directed number.



Example 2.4 Adding a negative number by using a number line

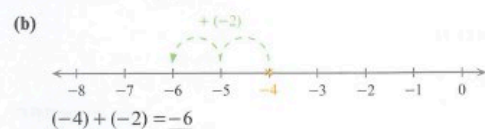
LEVEL 1
With the help of a number line, find the values of the following expressions.

- (a) $(+3) + (-3)$ (b) $(-4) + (-2)$

Solution



◀ From $+3$, move 3 units to the left and we get 0.



◀ From -4 , move 2 units to the left and we get -6 .

Ex. 2B Q2

Teaching Example 2.4
With the help of a number line, find the values of the following expressions.
(a) $(+4) + (-6)$
(b) $(-5) + (-5)$
[Ans.: (a) -2 (b) -10]

中一數學

變換

C Rotation e-Lesson Exemplar

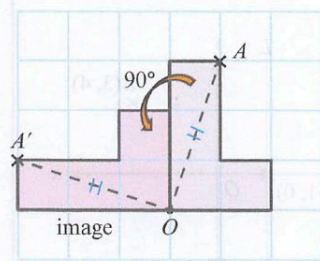
The process of rotating a figure about a fixed point through an angle (in a clockwise direction or in an anti-clockwise direction) is called **rotation**. The image obtained after rotation has the same shape and size as the original figure.

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° .

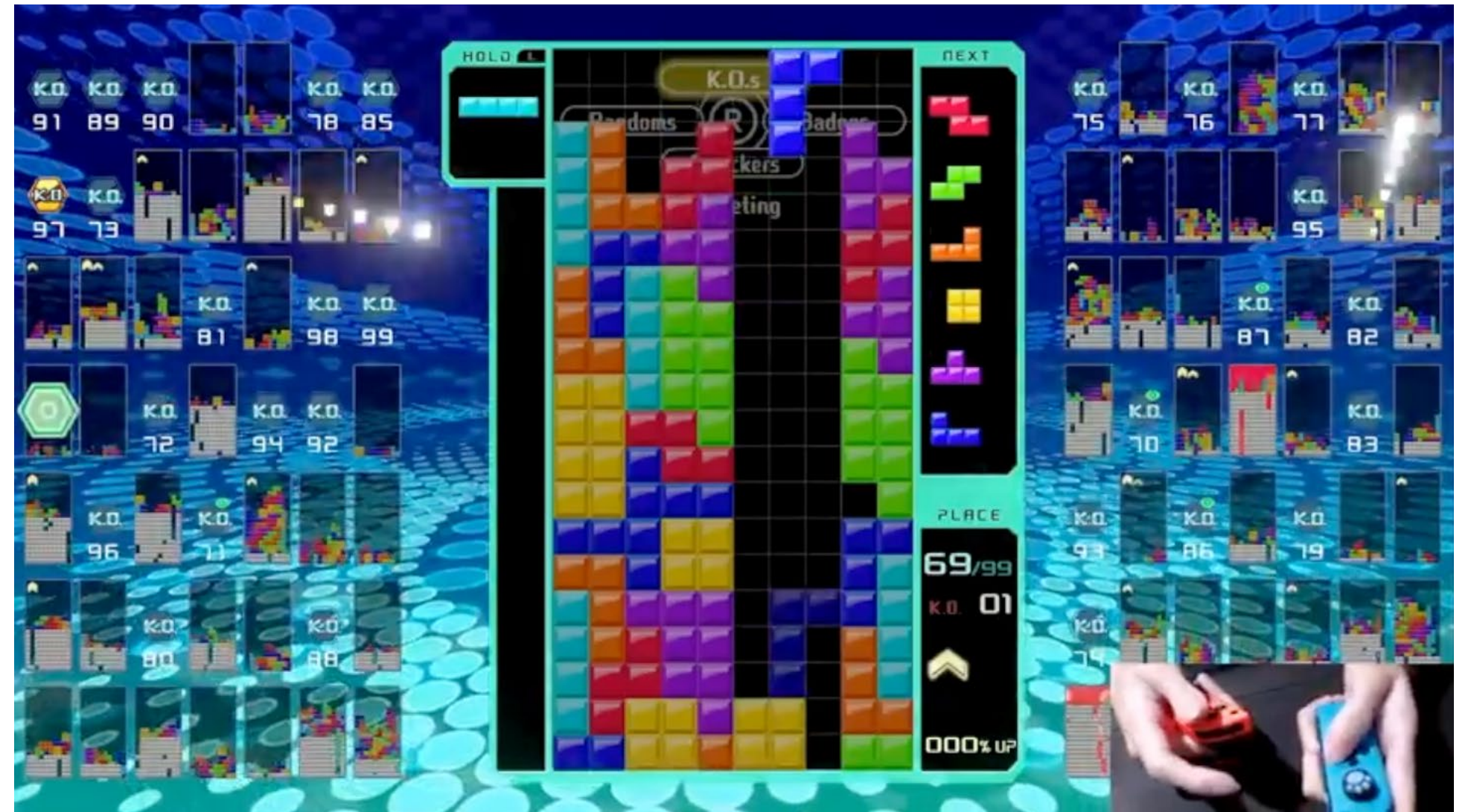
O is the **centre of rotation** and 90° is the **angle of rotation**.

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.

俄羅斯方塊



中一數學

變換

C Rotation e-Lesson Exemplar

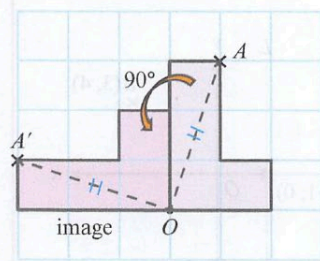
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To describe a rotation, we have to specify

1. the **direction of rotation**, either clockwise or anti-clockwise,
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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' .

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

Blokus



中一數學

變換

Blokus

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.

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

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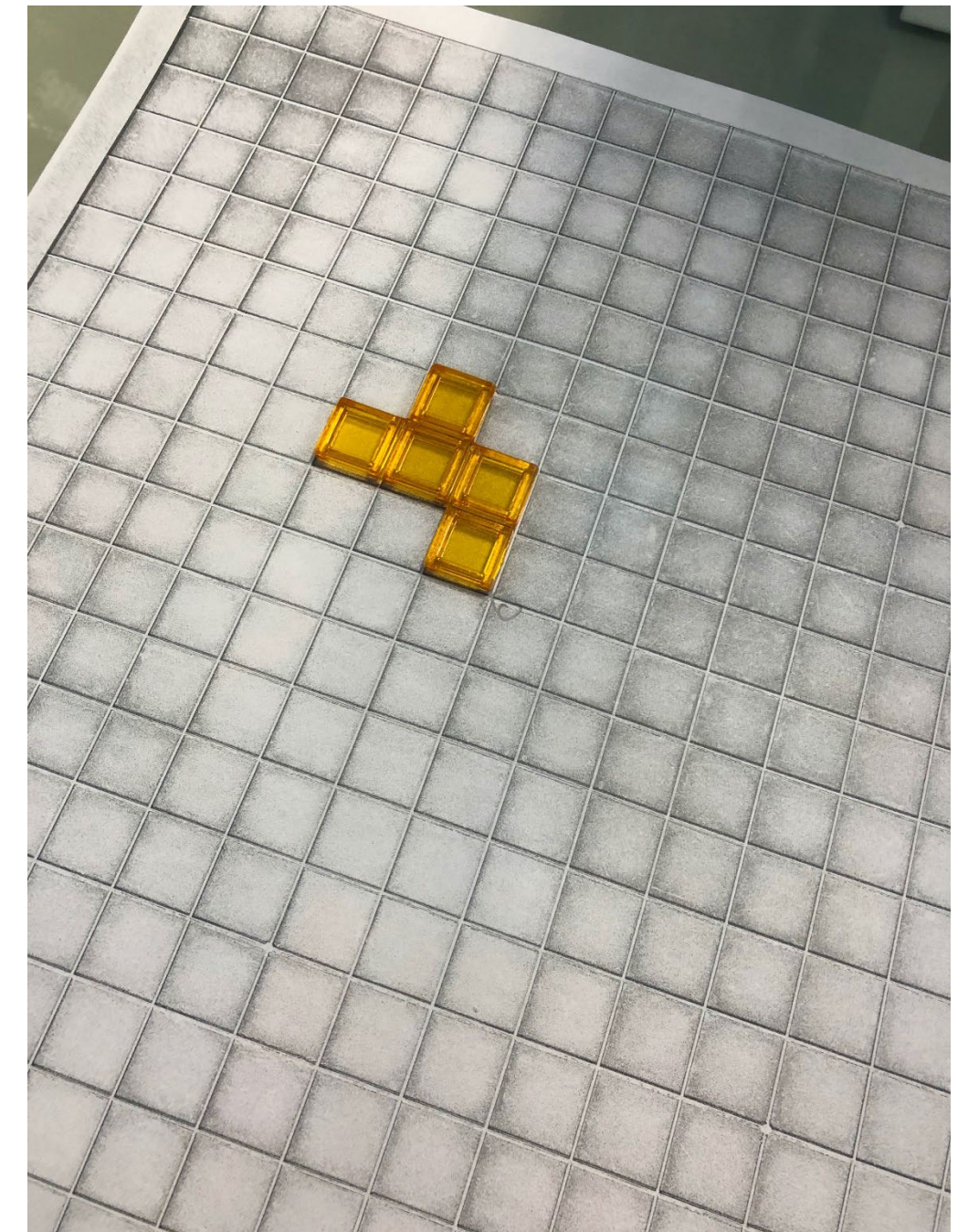
We can see that the point A on the block is rotated anti-clockwise about O through 90° to image A' .

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

Look at some examples when the block is rotated about O through other angles.

Rotate clockwise about O through 180° .

tetris 俄羅斯方塊



中一數學

變換

C Rotation e-Lesson Exemplar

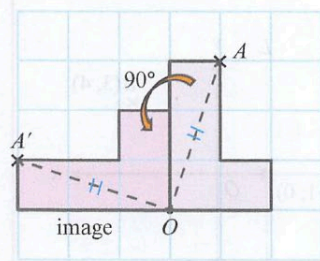
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The following figure shows a block rotating anti-clockwise about O through 90° .



Rotate anti-clockwise about O through 90° .

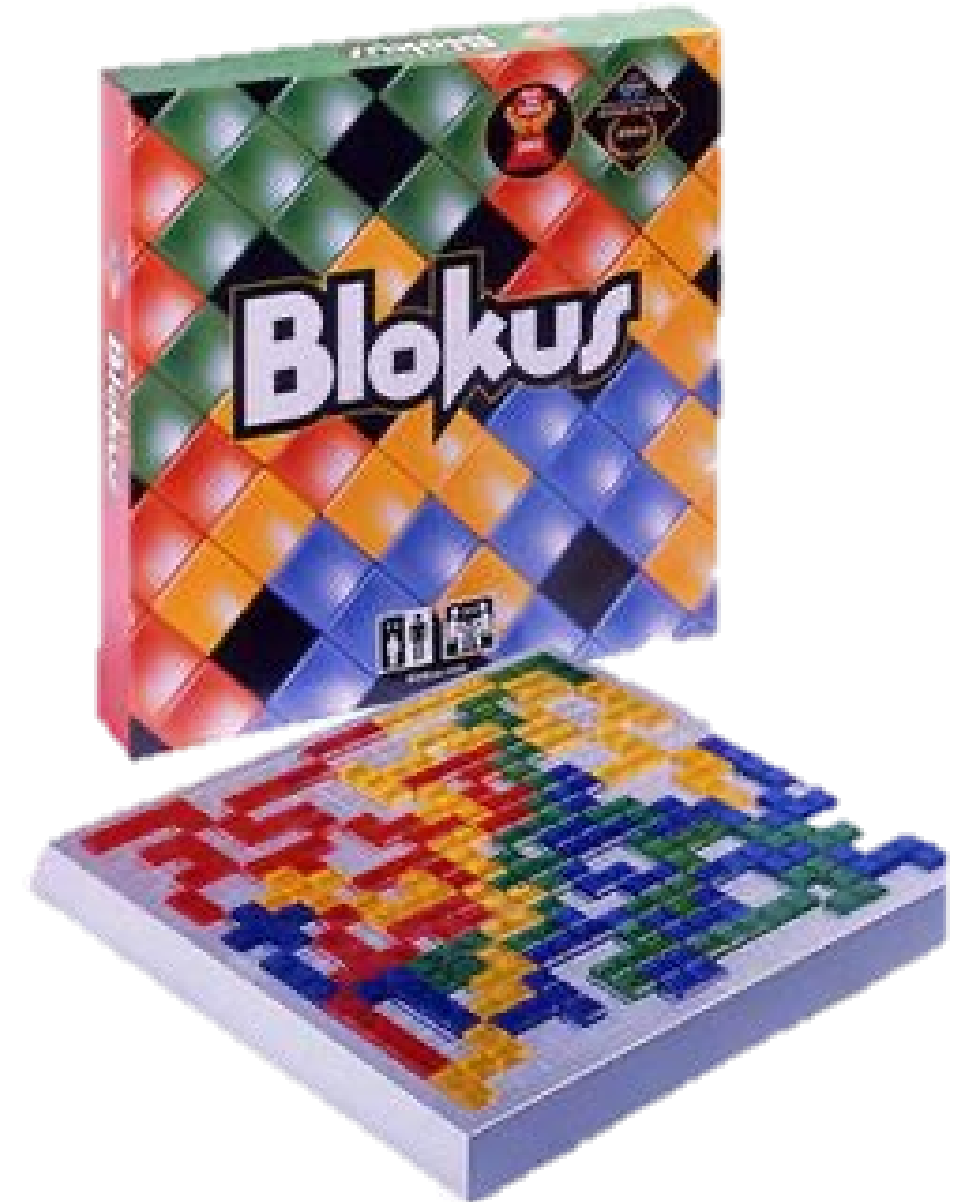
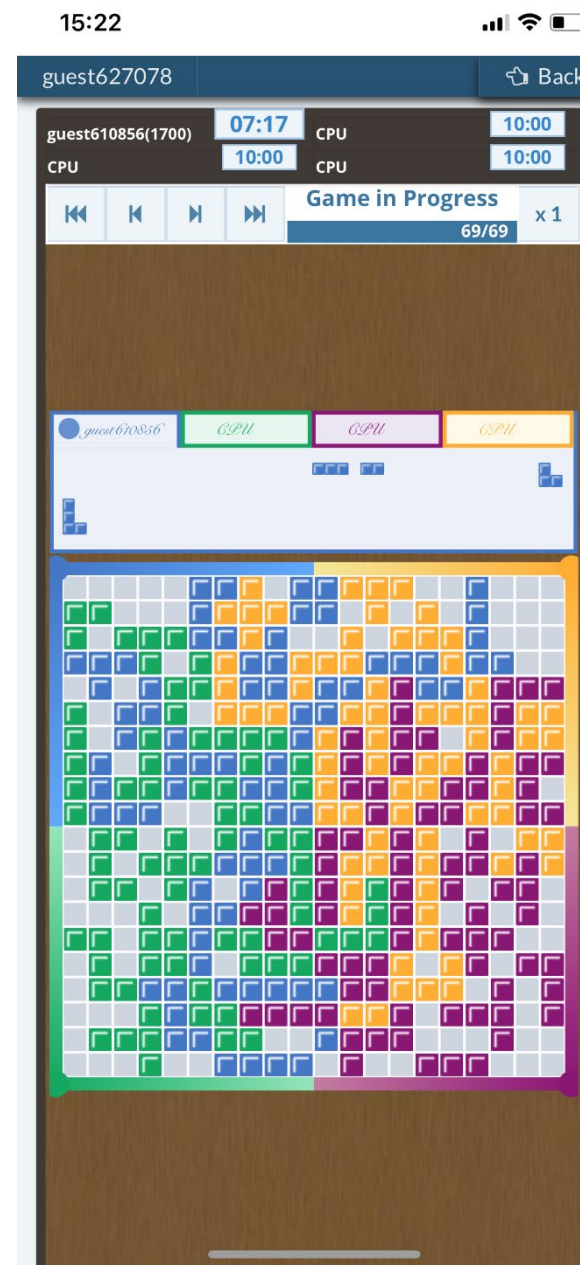
O is the **centre of rotation** and 90° is the **angle of rotation**.

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.

Blokus



中三數學

立體

3D Blokus

8.22 Chapter 8

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 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.

I cannot see the side of the house from this angle.

I cannot see the front of the house from this angle.

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.

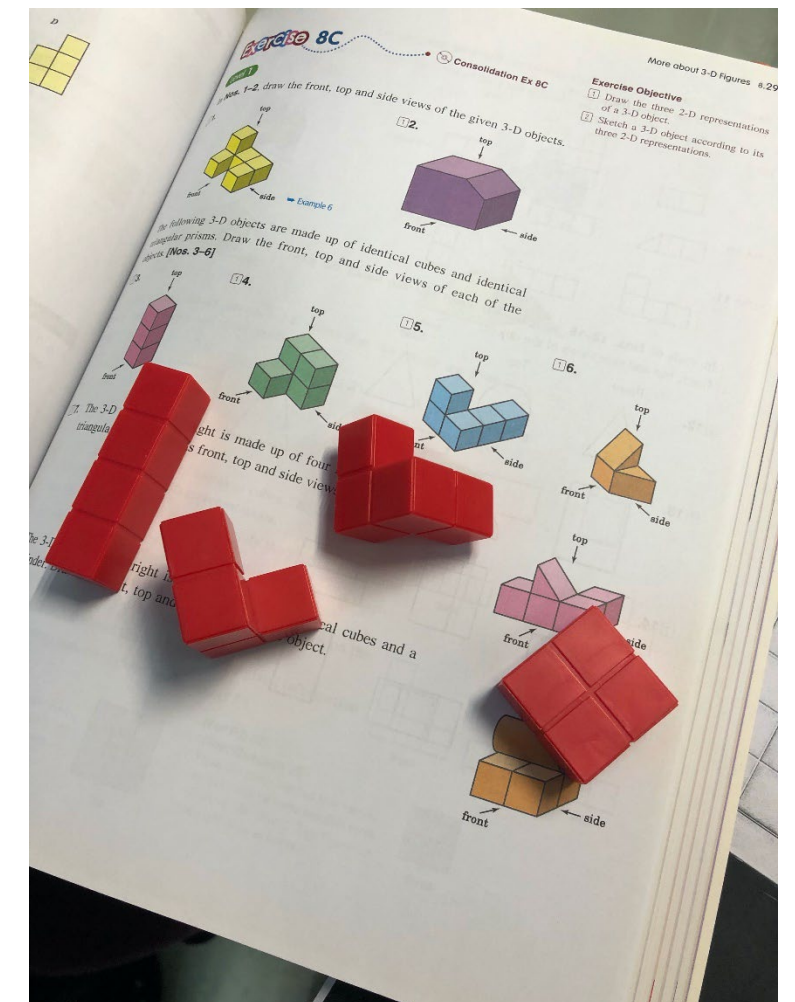
(N9) Teachers may remind students that a plane figure occupies space with 2 dimensions: length and width (no height or thickness).

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

e.g. (i)

Teaching Diagram

three-dimensional 三維



設計入門三部曲

步驟1: 體驗

步驟2: 分析

步驟3: 設計

遊戲式學習： 啟動自學 X 喜樂協作，一起玩中學！

作者：侯惠澤
出版社：親子天下



設計入門三部曲

步驟1: 體驗

步驟2: 分析

步驟3: 設計



試玩與數學及非數學相關的遊戲

設計入門三部曲

步驟1: 體驗

步驟2: 分析

步驟3: 設計

參考問題:

1. 我是否容易理解遊戲規則？
2. 剛剛的遊戲，我是否專注投入且深感興趣？
3. 剛剛的遊戲，對我的學科學習是否有幫助？
4. 對學科知識的了解，透過遊戲是否比傳統講解或是單純的討論活動，來得更有動機或成效？
5. 我可以完全不靠學科知識就能完成遊戲的挑戰嗎？

設計入門三部曲

步驟1: 體驗

步驟2: 分析

步驟3: 設計

1. 目標

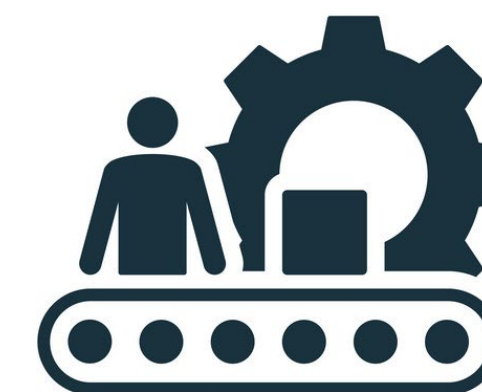
依照道具分類

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

遊戲目的 = 學習目的



PRODUCTION

設計入門三部曲

步驟1: 體驗

步驟2: 分析

步驟3: 設計

1. 目標
2. 內容

Math Talk



✘ 不宜太多學習目標

設計入門三部曲

步驟1: 體驗

步驟2: 分析

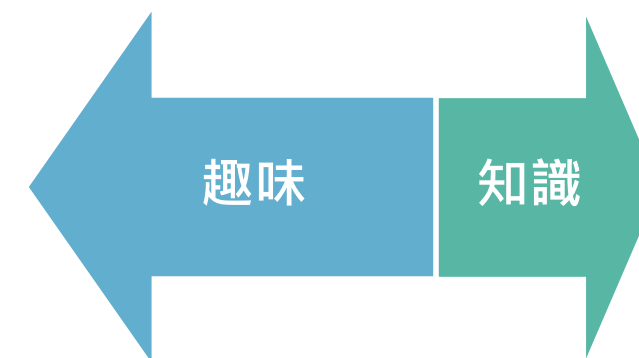
步驟3: 設計

1. 目標
2. 內容
3. 遊戲平衡

咕牌配對



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



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

中一數學

有向數

2 Directed Numbers and the Number Line

Adding a negative number

Consider $(+5) + (-3)$. ◀ Adding a negative number (-3)

Since the order is not important in addition (e.g. $2 + 4 = 4 + 2$), we have
 $(+5) + (-3) = (-3) + (+5)$

On the previous page, we get $(-3) + (+5) = +2$, so $(+5) + (-3) = +2$.

Consider the number line below.

We can see that starting from the number $+5$ on the number line, the result $+2$ can be obtained by moving 3 units to the left.

Now, consider $(-1) + (-5)$. ◀ Adding a negative number (-5)

Starting from -1 on the number line, we move 5 units to the left. The result is -6 . Therefore, $(-1) + (-5) = -6$.

In general, on a horizontal number line,

when adding a negative number to a directed number, move to the left of the given directed number.

Example 2.4 Adding a negative number by using a number line

LEVEL 1
 With the help of a number line, find the values of the following expressions.

(a) $(+3) + (-3)$ (b) $(-4) + (-2)$

Solution

(a)

$(+3) + (-3) = 0$

(b)

$(-4) + (-2) = -6$

Teaching Example 2.4
 With the help of a number line, find the values of the following expressions.
 (a) $(+4) + (-6)$
 (b) $(-5) + (-5)$
 [Ans.: (a) -2 (b) -10]

However, the order is important in subtraction. e.g. $0 - 3$ is NOT equal to $3 - 0$.

Think further
 Amy and Harry start at the same position:
 ⓐ Amy moves 5 m to the right and then 3 m to the left.
 ⓑ Harry moves 3 m to the left and then 5 m to the right.
 After the movements ⓐ and ⓑ, are the final positions of Amy and Harry the same? **yes**

When adding a negative number, the result is always smaller than the given directed number.

2.19

數極

#Mr_Board

一款透過 $+$ $-$ \times \div 去展現策略

中一數學

變換

變換大作戰

C Rotation

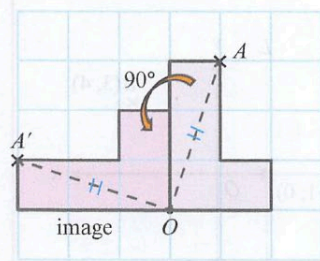
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Let us look at some examples when the block is rotated about O through other angles.

遊戲目的

分享內容

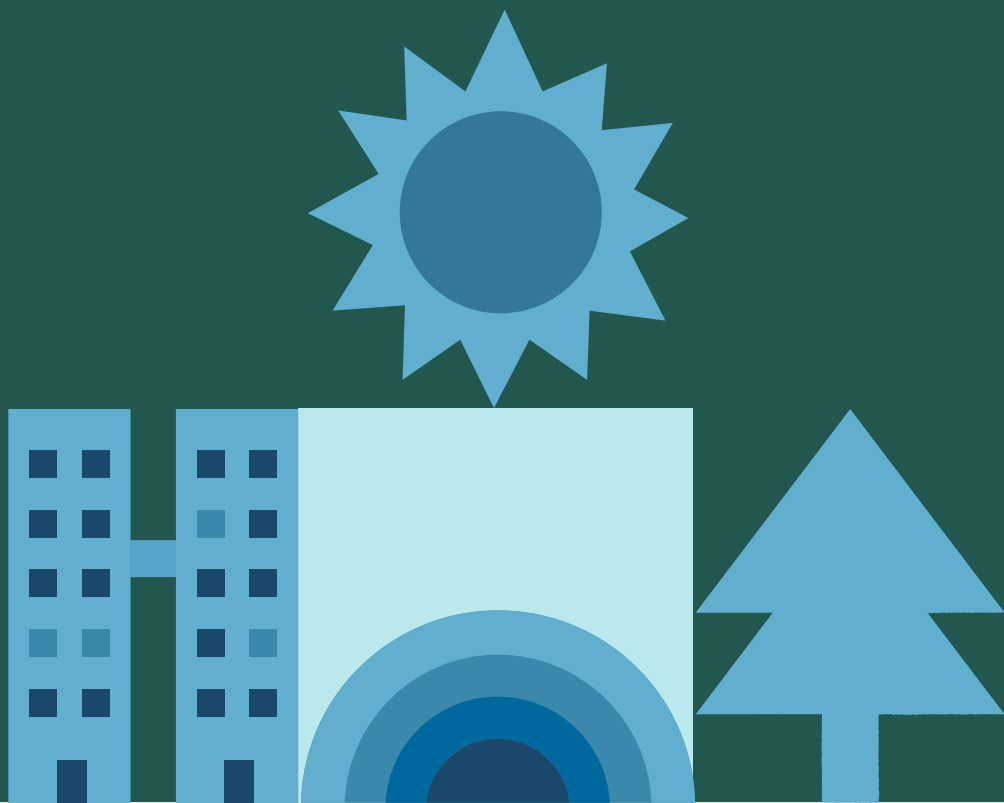
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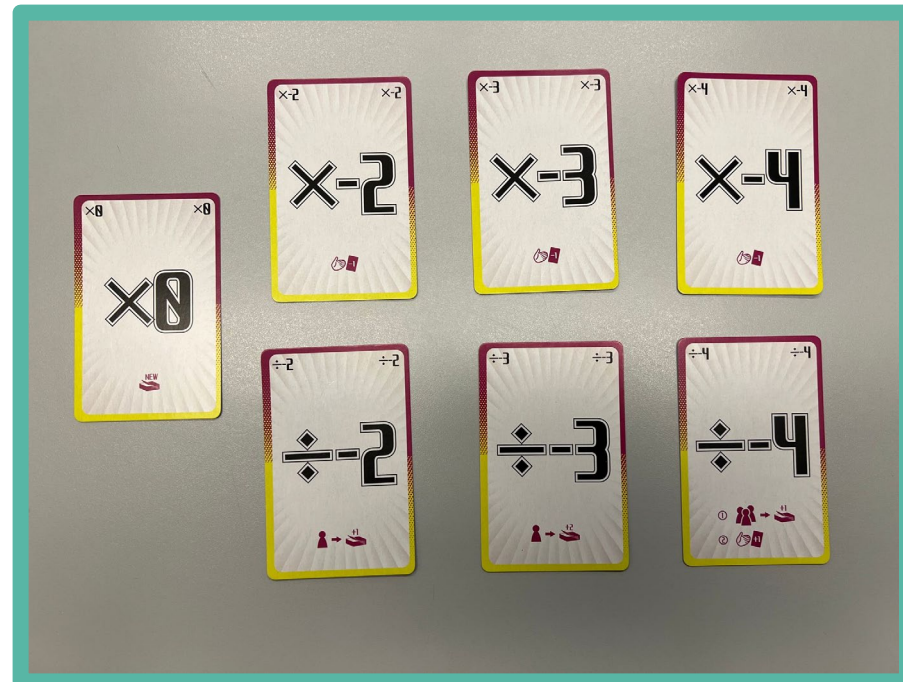
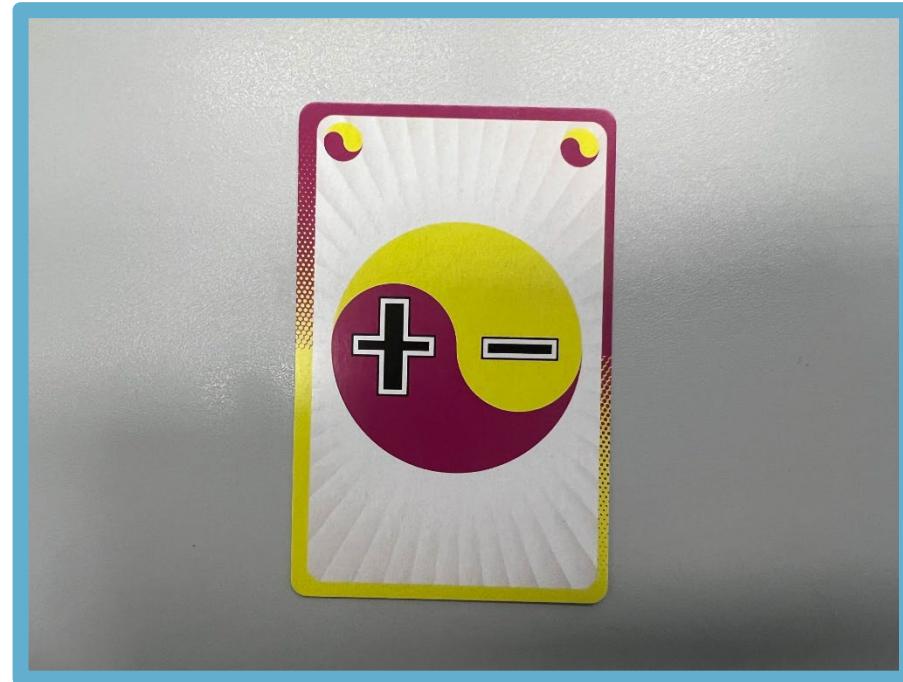
04
課堂實施

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中一數學

有向數



教案設計(鷹架理論)

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)

中一數學

有向數

課堂實施



教學內容

數學概念

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.

$$\begin{array}{l} 18 = 2 \times 3 \times 3 \\ 60 = 2 \times 2 \times 3 \times 5 \\ \hline \text{L.C.M.} = 2 \times 2 \times 3 \times 3 \times 5 \\ = 180 \end{array}$$

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

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.

$$\begin{array}{l} 18 = 2 \times 3^2 \\ 60 = 2^2 \times 3 \times 5 \\ \hline \text{L.C.M.} = 2^2 \times 3^2 \times 5 \\ = 180 \end{array}$$

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

Prime factors of 18: 2, 3, 3
Prime factors of 60: 2, 2, 3, 5

教學例子 (程度1)

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

$$\begin{array}{l} 56 = 2^3 \times 7 \\ 70 = 2 \times 5 \times 7 \\ \hline \text{L.C.M.} = 2^3 \times 5 \times 7 \\ = 280 \end{array}$$

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

Rough Work

$$\begin{array}{r} 2 \overline{) 56} \quad 2 \overline{) 70} \\ 2 \overline{) 28} \quad 5 \overline{) 35} \\ 2 \overline{) 14} \quad 7 \\ \quad 7 \end{array}$$

教學例子 (程度2)

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.

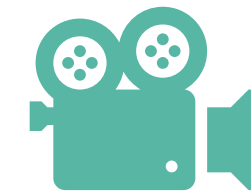
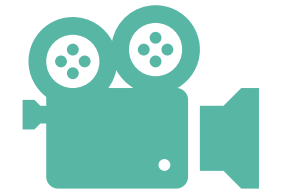
Solution

$$\begin{array}{l} 40 = 2^3 \times 5 \\ 48 = 2^4 \times 3 \\ 100 = 2^2 \times 5^2 \\ \hline \text{L.C.M.} = 2^4 \times 3 \times 5^2 \\ = 1200 \end{array}$$

Rough Work

$$\begin{array}{r} 2 \overline{) 40} \quad 2 \overline{) 48} \quad 2 \overline{) 100} \\ 2 \overline{) 20} \quad 2 \overline{) 24} \quad 2 \overline{) 50} \\ 2 \overline{) 10} \quad 2 \overline{) 12} \quad 5 \overline{) 25} \\ \quad 5 \quad 2 \overline{) 6} \quad 5 \\ \quad \quad 3 \end{array}$$

反轉教學設計



問卷調查結果

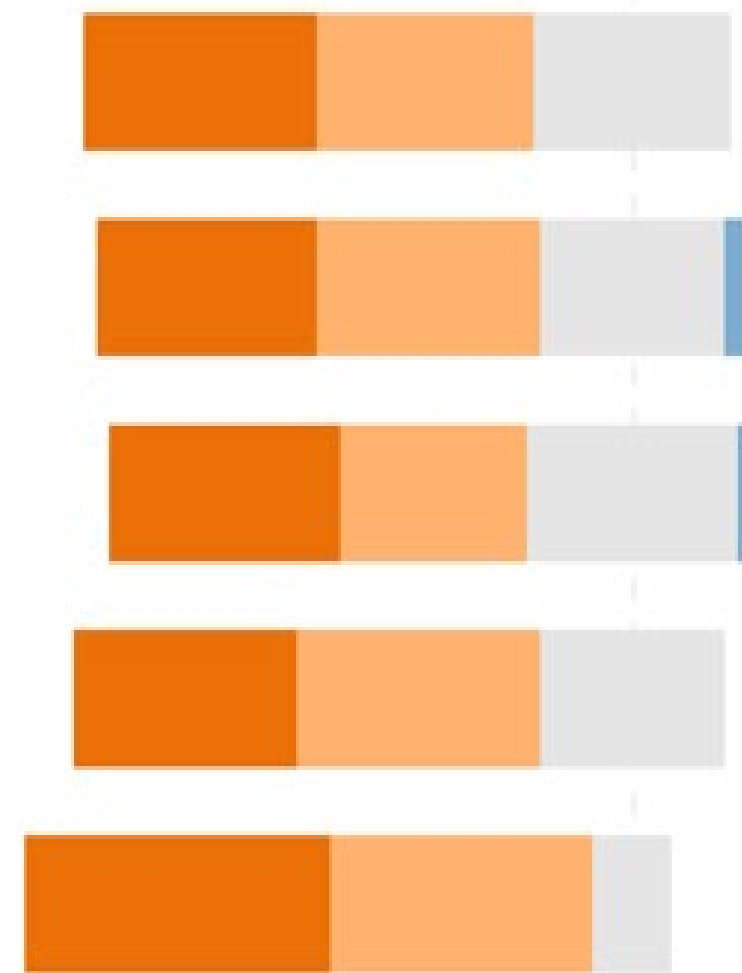
我喜歡透過「數極」(咕牌遊戲)來學習數學

「數極」(咕牌遊戲)有助我學習數學

我喜歡透過影片來學習數學

老師預備的影片有助我學習數學

老師預備的影片有助我重溫數學科學習內容



■ 十分同意 ■ 同意 ■ 中立 ■ 不同意 ■ 十分不同意

分享內容

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背景

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教學互動遊戲化

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教學內容遊戲化

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05
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總結

教學互動遊戲化

1.以科技來配合遊戲化學習

教學內容遊戲化

1.以現有的桌遊來嘗試推行遊戲化學習

2.先訂立目標

3.集合不同同事或專家，一起合作

4.試玩不同類形的遊戲

5.以不同的桌遊來作參考(例如：UNO, 撲克)

6.思考如何運用到教學之中

多謝各位!

tmy@ucc.edu.hk