

Topic: Logarithm(對數的定義) (數 A 二上)

1. Warm-up (Review)

Calculator practice: Find the 'log' button. Use this button to find the answers to the questions below:

- (1) Find $\log 10$
- (2) Find $\log 100$
- (3) Find $\log 10000000$
- (4) Find $\log 1$

What do you notice?

2. Common logarithm (Review)

If x is a positive number, $x = 10^L$ (x is equal to ten to the power of L), then we can rewrite the equation into $L = \underline{\hspace{2cm}}$.

3. Check these words

English	中文	圖示
exponent		
index		
power		
base		

4. Logarithms



Watch this clip, then finish the following blanks.

Take this for example, $2^3 = 8$, we can rewrite it into $3 = \underline{\hspace{2cm}}$ (We read this equation)

The definition of logarithms is $a = b^x \iff x = \underline{\hspace{2cm}}$, where $a, b \in R^+$ and $b \neq 1$.

5. Express each of the following in logarithmic form.

(1) $2^{10} = 1024$ (2) $8^{\frac{1}{3}} = 2$ (3) $p = q^5$ (4) $10^{-4} = 0.0001$ (5) $x^y = 11$

6. Fill in the blanks.

(1) $\log_3 27 = \underline{\hspace{2cm}}$ (2) $\log_5 25 = \underline{\hspace{2cm}}$ (3) $\log_3 \square = 5$ (4) $\log_2 \square = -\frac{1}{2}$

7. Practice makes perfect

(1) $\log_2 \frac{1}{2} = \underline{\hspace{2cm}}$ (2) $\log_2 \sqrt{2} = \underline{\hspace{2cm}}$ (3) $\log_2 1 = \underline{\hspace{2cm}}$ (4) $\log_2 2 = \underline{\hspace{2cm}}$

(5) $\log_6 216 = \underline{\hspace{2cm}}$ (6) $\log_8 32 = \underline{\hspace{2cm}}$ (7) $\log_{81} \frac{1}{27} = \underline{\hspace{2cm}}$

(8) $\log_{a^n} a^m = \underline{\hspace{2cm}}$ ($a > 0, a \neq 1$)

8. Challenge

Find out $2^{\log_2 3} = ?$

9. Exit ticket

Connect : How are today's learning connected to what you already knew?

Extended: What new ideas did you get that broadened or extended your thinking(or understanding)?

Challenge: What challenges or puzzles emerge for you?

10. 參考資料

a. Oxford Ib Diploma Programme Ib Mathematics: Analysis and Approaches, Higher Level

<https://www.amazon.com/Oxford-Diploma-Programme-Mathematics-Approaches/dp/0198427166>

b. Mathematics for the IB MYP 4 & 5

https://www.amazon.com/-/zh_TW/Rita-Bateson/dp/1471841529/ref=sr_1_8?crid=2HUUE1YHNFB8U&keywords=myp+mathematics&qid=1662901398&s=books&sprefix=MYP+%2Cstripbooks-intl-ship%2C312&sr=1-8

C. 泰宇課本

Topic: Logarithm(對數的定義) (數 A 二上) 使用建議

1. Warm-up(Review)

a. Calculator practice: Find the 'log' button. Use this button to find the answers to the questions below:

(1) Find $\log 10$

(2) Find $\log 100$

(3) Find $\log 10000000$

(4) Find $\log 1$

What do you notice?

[教學活動安排]

利用操作計算機讓學生能回想起高一所學過的內容。

[參考答案]

(1) Find $\log 10 = 1$

(2) Find $\log 100 = 2$

(3) Find $\log 10000000 = 7$

(4) Find $\log 1 = 0$

What do you notice? *the power of ten / the exponent*

b. Common logarithm

If x is a positive number, $x = 10^L$ (x is equal to ten to the power of L), then we can rewrite the equation into $L = \underline{\hspace{2cm}}$.

[教學活動安排]

利用操作計算機讓學生能回想起高一所學過的內容。

[可參考的英文問句/提問/開場]

Today we are going to learn about logarithms. We learned a little on this topic last year which is the common logarithm. Let's start by doing this calculator practice to help us recall what we have learned.

Please take out your calculator, finish part a and b on your own. I will pick a few students to share with the class in a few minutes. (or in 3 minutes).

[參考答案]

2. Common logarithm (Review)

If x is a positive number, $x = 10^L$ (x is equal to ten to the power of L), then we can rewrite the equation into $L = \underline{\log x}$.

3. Check these words

English	中文	圖示
exponent		
index		
power		
base		

[教學活動安排]

教師可利用這個表上已經有列的單字複習之前指數學過的單字但我們後續課堂上會用到的。

[可參考的英文問句/提問/開場]

Before we start today's topic, let's review some words we have learned before. I want to make sure that we are all familiar with them. Let's fill in the table together.

What does index mean in Chinese?

4. Logarithms



Watch this clip, then finish the following blanks.

Take this for example, $2^3 = 8$, we can rewrite it into $3 = \underline{\hspace{2cm}}$ (We read this equation)

The definition of logarithms is $a = b^x \iff x = \underline{\hspace{2cm}}$, where $a, b \in \mathbb{R}^+$ and $b \neq 1$

[教學活動安排]

讓學生觀看影片從中練習在全英文的語境中學習數學概念。影片長7分鐘，教師可以自行評估是否分段播放，並於分段中利用提問確認學生是否聽懂。教師亦可切慢播放速度或是播放兩遍。

[可參考的英文問句/提問/開場]

Now we are ready to start today's topic – logarithms! Let's watch this clip together.

You can jot down some notes while you watch the video.

After students watched the video, we can ask them: Did you see why the common log is just a part of the logarithms?

Let's now do some practice-- fill in the blanks below.

[參考答案]

Take this for example, $2^3 = 8$, we can rewrite it into $3 = \frac{\log_2 8}{\log_2 2}$ (We read this equation _____) *three equals to log base two of eight.*

The definition of logarithms is $a = b^x \iff x = \frac{\log_b a}{\log_b b}$, where $a, b \in R^+$ and $b \neq 1$

5. Express each of the following in logarithmic form.

(1) $2^{10} = 1024$ (2) $8^{\frac{1}{3}} = 2$ (3) $p = q^5$ (4) $10^{-4} = 0.0001$ (5) $x^y = 11$

[教學活動安排]

先練習熟悉從指數等式切換成對數等式

[可參考的英文問句/提問/開場]

Let's do question five to get familiar with the definition of the logarithm. Have a go!

[參考答案]

5. Express each of the following in logarithmic form.

(1) $2^{10} = 1024$ (2) $8^{\frac{1}{3}} = 2$ (3) $p = q^5$ (4) $10^{-4} = 0.0001$ (5) $x^y = 11$

$\log_2 1024 = 10$ $\log_8 2 = \frac{1}{3}$ $\log_q p = 5$ $\log_{10} 0.0001 = -4$ $\log_x 11 = y$

6. Fill in the blanks.

(1) $\log_3 27 = \underline{\quad}$ (2) $\log_5 25 = \underline{\quad}$ (3) $\log_3 \square = 5$ (4) $\log_2 \square = -\frac{1}{2}$

[教學活動安排]

練習熟悉對數的概念

[可參考的英文問句/提問/開場]

Let's do question six to get familiar with the concept of the logarithm. Have a go! (or give it a try!)

[參考答案]

6. Fill in the blanks.

(1) $\log_3 27 = \underline{3}$ (2) $\log_5 25 = \underline{2}$ (3) $\log_3 \square = 5$ (4) $\log_2 \square = -\frac{1}{2}$
 $\square = 3^5 = 243$ $\square = 2^{-\frac{1}{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

7. Practice makes perfect

(1) $\log_2 \frac{1}{2} = \underline{\quad}$ (2) $\log_2 \sqrt{2} = \underline{\quad}$ (3) $\log_2 1 = \underline{\quad}$ (4) $\log_2 2 = \underline{\quad}$
(5) $\log_6 216 = \underline{\quad}$ (6) $\log_8 32 = \underline{\quad}$ (7) $\log_{81} \frac{1}{27} = \underline{\quad}$
(8) $\log_{a^n} a^m = \underline{\quad}$ ($a > 0, a \neq 1$)

[教學活動安排]

更多的練習。

[可參考的英文問句/提問/開場]

Let's do question seven. Practice makes perfect! Have a go!

[參考答案]

7. Practice makes perfect

(1) $\log_2 \frac{1}{2} = \underline{-1}$ (2) $\log_2 \sqrt{2} = \underline{\frac{1}{2}}$ (3) $\log_2 1 = \underline{0}$ (4) $\log_2 2 = \underline{1}$
(5) $\log_6 216 = \underline{3}$ (6) $\log_8 32 = \underline{\frac{5}{3}}$ (7) $\log_{81} \frac{1}{27} = \underline{-\frac{3}{4}}$
(8) $\log_{a^n} a^m = \underline{\frac{m}{n}}$ ($a > 0, a \neq 1$)

8. Challenge

Find out $2^{\log_2 3} = ?$

[教學活動安排]

如果一節課來不及上到這裡，這個挑戰教師可以考慮當成回家作業，請學生用對數的定義概念去想！下節課的內容可以從這裡開始！

[可參考的英文問句/提問/開場]

Now I think most of you are very familiar with the concept of the logarithm. So, here is a challenge for you, try to think what the key concept of the logarithm is! Have a go!

[參考答案]

8. Challenge

Find out $2^{\log_2 3} = ?$ 3

9. Exit ticket

Connect : How is today's learning connected to what you already knew?

Extended: What new ideas did you get that broadened or extended your thinking(or understanding)?

Challenge: What challenges or puzzles emerge for you?

[教學活動安排]

讓學生回答這三個提問去為這堂課的做個總結。教師也可透過學生對這三個提問回答的作為這堂教學的回饋。

[可參考的英文問句/提問/開場]

Before I dismiss the class (or before we end the class), please finish answering the questions on the Exit Ticket. These three questions can help you sum up what we learned today.

[參考資料]

這三個提問來自 <http://www.pz.harvard.edu/thinking-routines>

有關網站的介紹我簡短地寫了一篇文章，請參閱 <https://docs.google.com/document/d/1BryeeWO69OZBQj7fazvcXFDxjM3-tQ2EhEiQelNkjAg/edit?usp=sharing>

10. 參考資料

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