

根式的運算-3 根式的加減(+、-)

Operations with Square Roots-3(+、-)

☆1 合併同類方根 Combine like radicals.

T: 我們已經學了根號的乘法、除法與化簡，今天我們學習如何進行根號的加法與減法？舉例來說， $\sqrt{2} + \sqrt{3}$ 、 $\sqrt{3} + \sqrt{3}$ 、 $\sqrt{3} + \sqrt{27}$ ，你們覺得這三個式子誰可以寫成更簡單的形式？

T: We have already learned multiplication, division, and simplification of square roots. Today, we are going to learn how to perform addition and subtraction with square roots. For example, $\sqrt{2} + \sqrt{3}$, $\sqrt{3} + \sqrt{3}$, and $\sqrt{3} + \sqrt{27}$. Which of these three expressions can be simplified?

T: $\sqrt{3} + \sqrt{3}$ 很容易，因為兩個都是 $\sqrt{3}$ 所以相加起來就會是兩倍的 $\sqrt{3}$ 。也就是 $\sqrt{3} + \sqrt{3} = 2\sqrt{3}$ 。

$\sqrt{3} + \sqrt{3}$ is easy because both are $\sqrt{3}$, so when you add them together, it will be two times $\sqrt{3}$. $\sqrt{3} + \sqrt{3} = 2\sqrt{3}$

T: 那想想看 $\sqrt{3} + \sqrt{27}$ 可以怎麼做呢？

So, let's think about how to simplify $\sqrt{3} + \sqrt{27}$.

T: 根據我們學過的根式的化簡，其實 $\sqrt{3} + \sqrt{27}$ 可以寫成 $\sqrt{3} + 3\sqrt{3}$ ，那麼 $\sqrt{3} + 3\sqrt{3} = 4\sqrt{3}$ 。

Based on what we've learned about simplifying radicals, in fact, $\sqrt{3} + \sqrt{27}$ can be written as $\sqrt{3} + 3\sqrt{3}$, the radical part is the same in each term, so I can do this addition. $\sqrt{3} + 3\sqrt{3} = 4\sqrt{3}$.

補充合併同類項

Like Terms are terms whose variables and their exponents are the same. In other words, terms that are "like" each other.

Example: $7x$, x , $3x$ are like terms because the variables are all x .

You can add like terms together to make one term:

$$7x + x + 3x = 11x$$

T: 那 $\sqrt{2} + \sqrt{3}$ 有辦法寫成更簡單的形式嗎？(其實是不行的)

Is there a way to express $\sqrt{2} + \sqrt{3}$ in a simpler form? (Actually, there isn't.)

請學生觀察上述三式的不同，引導出合併同類項

T：其實可以發現只要兩項都可以整理成根號內的數字一樣，就可以進行加減。
Actually, you can observe that as long as both terms can be simplified to have the same number inside the square root, you can perform addition or subtraction.

T：這個在數學上有一個詞，叫做合併同類項，現在，讓我們談一下什麼是同類項，同類項是具有相同根次（次方根）和根內的數字的項。
This concept has a mathematical term; it's called "combining like terms." Now, let's talk about what like terms are. Like terms are terms that have the same root index (root degree) and the same number inside the root symbol

T：若 a 、 b 為正數，將 \sqrt{a} 和 \sqrt{b} 化為最簡根式後，如果根號內的數相同，則 \sqrt{a} 和 \sqrt{b} 稱為同類方根。

If a and b are positive numbers, after simplifying both \sqrt{a} and \sqrt{b} into their simplest radical form, if the numbers inside the square roots are the same, then \sqrt{a} and \sqrt{b} are referred to like radicals.

T：例如 $\sqrt{3}$ 、 $\sqrt{27}$ 是同類方根 $\sqrt{3}$ 、 $\sqrt{2}$ 則不是。
For example, $\sqrt{3}$ and $\sqrt{27}$ are like radicals (both have $\sqrt{3}$), while $\sqrt{3}$ and $\sqrt{2}$ are not like radicals.

T：如同多項式的加減運算，應合併同類項；計算根式的加減時，應將同類方根合併，不是同類的方根則不能合併。
Just as in polynomial addition and subtraction, like terms should be combined; when performing operations with radicals, like radicals should be merged, and dissimilar square roots cannot be combined.

Q1. Add and subtract square roots.

a. $4\sqrt{3} + 2\sqrt{3}$

b. $3\sqrt{3} - 2\sqrt{3}$

c. $\sqrt{50} + \sqrt{2}$

d. $3\sqrt{50} + 2\sqrt{8}$

e. $\sqrt{27} - 2\sqrt{3}$

f. $5\sqrt{12} - \sqrt{75}$

☆2 根式的四則運算

The four arithmetic operations with square roots.

Q1. Add and subtract square roots.

a. $4\sqrt{3} \times \sqrt{2} + 2\sqrt{6}$

b. $2\sqrt{3} - 2\sqrt{3} \times \sqrt{3}$

c. $\sqrt{5} + \sqrt{2} \times \sqrt{10}$

d. $3\sqrt{20} + 2\sqrt{8} - 3\sqrt{2}$

e. $\frac{\sqrt{27}}{2\sqrt{3}} - 2$

f. $5\sqrt{12} \div 6\sqrt{18}$

參考資料來源

1. 111 國中數學翰林版課本
2. Into Math Advanced2
3. <https://byjus.com/maths/radical/>

☆老師們可以自己從中選擇以做出适合自己學生程度的學習單或是在課堂中適時補充這些英文。

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