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Exploration of the Second Important Limit Teaching under the Background of Information Teaching

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Abstract: The second important limit is the key content of advanced mathematics. Because of the complex formula, students are easily confused, which becomes a difficult point in teaching. Through the classroom teaching design of the second important limit, this paper builds a continuous compound interest calculation model, and guides students to independently form the image representation of the exponential function model; In the process of exploration, the psychological representation of important limit formulas is further formed; historical reappearance, mathematics master comprehension and application models are integrated, so that students can experience mathematics; clever thinking and expansion, cultivate students' innovative awareness and application ability, and achieve teaching goals.

1. Current situation of teaching

There are two important limits in the limit part of advanced mathematics, namely $\lim_{x\to 0}\frac{\sin x}{x}=1$, $\lim_{x\to\infty}(1+\frac{1}{x})^x=e$, which play a pivotal role in limit calculation. Among them, the first important limit $\lim_{x\to 0}\frac{\sin x}{x}=1$ is easy to remember, the application is relatively simple, and the students are highly accepted. In contrast, the second most important limit $\lim_{x\to\infty}(1+\frac{1}{x})^x=e$ formula is difficult to memorize, and it is also difficult for students to apply it in practice. Some students use rote memorization methods to memorize, and they are especially prone to make mistakes because of the confusion of the two forms.

Based on the above situation, this paper organically integrates the history of mathematics, mathematical thinking methods and mathematical cultural background in the process of teaching mathematics knowledge : by designing life-like situations, creating a strong atmosphere of inquiry to guide students to consciously immerse themselves in teaching activities Make full use of modern information technology, design dynamic mathematical experiments, enhance students' participation and cooperation, and let students feel in the operation; embed mathematical history and application examples in life, so that students can appreciate and appreciate in the experience , In this way, a

good teaching effect can be achieved.

2. Instructional Design Ideas

The author will give the teaching process of the second important limit according to his actual teaching in the following:

2.1. Introduction from Daily Life

The story of loan interest: Qian Jin, a cheapskate, encountered troubles. He lent his neighbor Lao Wang 1,000 yuan and Lao Wang did not repay it for three days. During the account collection, Qian Jin found that he received interest from 100% once a month to 50% twice a month. Interest, 1/3 interest is collected three times, the income is more and more, and the power index function is constructed by Qian Jin's dream of making a fortune.

2.2. Experimental Exploration and Historical Reappearance

Using the mathematical software GeoGebra to conduct a mathematical experiment, the change trend of the x power index function, the students in the experiment found that with the increase of the value of the power index function , the value of the power index function began to increase rapidly, but the change became smaller and smaller, and infinitely approached a value between 2 and 3.

At the same time, the teacher explained the mathematical history of mathematicians Jacob Bernoulli and Euler's discovery of the irrational number e, and affirmed the students' research work, so that students can understand the process of math masters discovering important limits.

3. Calculation and Application

Give the core content of this lesson: the second important limit, and take advantage of the situation to solve the problem of loan interest at the beginning. The animation gives the equivalent form of the formula, and enters three example questions:

Example 1 Which function' limit value in the following of the is equal to e( )

$A.\ \lim\limits_{x\to\infty}(1+\frac{3}{x})^{3}$

$B.\ \lim\limits_{x\to 0}(1+\tan x)$

$C.\ \lim\limits_{x\to\infty}(1+\frac{3}{x})^{x}$

Use the equivalent form of the formula to summarize the form of the last two options $(1+\text{Infinitesimal})^{\text{Infinity}}$, and then further analyze the options B and C to find that infinitesimal and infinite in the above formula should be reciprocals of each other, lock the answer B, and use C as an introduction for example 2 .

Example 2 $\lim\limits_{x\to\infty}(1+\frac{3}{x})^{x}$

$$= \lim_{x\to\infty}[(1+\frac{3}{x})^{\frac{x}{3}}]^3$$

$$= e^3$$

When explaining Example 2, the problem-solving process is written on the blackboard, guides students to construct formula features, and explains the key to solving the problem: ① Determine the $(1+\text{Infinitesimal})^{\text{Infinity}}$ type (1^∞ type) , ② Do the identity deformation.

Example 3 $\lim_{x\to0}(1-2x)^{\frac{1}{x}}$

First, give the wrong problem solving process:

$$\lim_{x\to0}(1-2x)^{\frac{1}{x}}$$

$$= \lim_{x\to0}(1-2x)^{\frac{1}{2x}\cdot2}$$

$$= \lim_{x\to0}[(1-2x)^{\frac{1}{2x}}]^2$$

$$= e^2$$

Then compare the formulas to find out the reason for the error: find the wrong infinitesimal, and match the overall thinking in mathematics. Then give the correct solution process:

$$\lim_{x\to0}(1-2x)^{\frac{1}{x}}$$

$$= \lim_{x\to0}[1+(-2x)]^{\frac{1}{-2x}\cdot(-2)}$$

$$= \lim_{x\to0}\{[1+(-2x)]^{\frac{1}{-2x}}\}^{-2}$$

$$= e^{-2}$$

Summary the key to using the second important limit formula to solve the problem: ①. Determine the type, ②. Do the identity deformation.

4. Thinking to improve

Use the knowledge of this course to solve the borrowing interest problem introduced in the course successfully, and deepen the understanding of the mathematical model. Taking《Guessing Technique》as the background, design exercises on continuous compound interest, and do extended training: Generally, if the principal of the savings deposit is A_0, the annual interest rate is r, and the interest is recorded in one-year installments n, then the interest rate for each installment is 1,000,000 $\frac{r}{n}$. The sum of the profit $A_0(1+\frac{r}{n})^n$ after k the year, the sum of the profit after the year

is $A_0(1+\frac{r}{n})^{nk}$. If the interest accrual period is infinitely shortened ($n \to \infty$), and the continuous compound interest is calculated, k the continuous compound interest after one year is $\lim_{n\to\infty} A_0(1+\frac{r}{n})^{nk} = ?$

Through this exercise, we respond to the situation introduced in the course, deepen the understanding of the model; design deformation exercises, extend the training, and promote the sublimation and innovation of students' thinking.

5. Knowledge summary

The second important limit formula:

$$\lim_{x\to\infty}(1+\frac{1}{x})^{x} = \lim_{x\to 0}(1+x)^{\frac{1}{x}} = e$$

The key to using the important limit formula to solve the problem:

① Judgment type

② Do a good job of isomorphic deformation .

6. Application extension

Show the pictures of the suspension cables of Nanjing Yangtze River Bridge and the spider webs attached to the water droplets, explain the application of e in life, and feel the beauty of mathematics.

7. Summarize

Through the full application of multimedia animation and mathematical software simulation in advanced mathematics, an intuitive and life-like teaching method not only simplifies the original boring reasoning process, but also deepens students' understanding of the second important limit formula, improving learning efficiency and learning. The effect reflects the principle of "necessary and sufficient" in higher vocational mathematics teaching.

At the same time, through the introduction of life-like examples such as borrowing money and repaying debts in life, a formula teaching class will not be very abrupt, but it will be closer to the students' study and life, and the students' acceptance is high. Interspersed with the teaching is the historical example of Jacob Bernoulli 's calculation of continuous compound interest, so that students understand the origin and application of the second important limit, and realize that it is not just a boring formula, it has a deep historical background and Rich application examples. The above-mentioned teaching design has been tried by the author in actual teaching. Compared with the previous teaching effect, most of the higher vocational students can firmly grasp the second important limit formula and apply it simply.

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