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Reform teaching method to improve the teaching ability of young teachers

Zhang Yongming
Department of Mathematics of Beijing Institute of Graphic Communication; No.1 Daxing District, Xinghua Avenue, Beijing, (CHINA)

ABSTRACT

The limitations of traditional use geometric method to construct auxiliary function of the teaching of Lagrange mean value theorem is points out, and the methodology significance of the method using analysis method to construct the auxiliary function of the Lagrange mean value theorem is presented. The methods of constructing auxiliary function belongs to the inquiry teaching method, the analysis teaching method of constructing auxiliary functions can cultivate students' ability to analyze, abstract thinking ability and problem solving ability. Young teachers should improve their teaching ability through the study of teaching methods.

KEYWORDS

Young teacher; Teaching ability; Teaching method.

INTRODUCTION

In recent years, scientific research has objectively to become first baton evaluate teachers in colleges and universities, the main focus of the young teacher's rather than on teaching on scientific research, this cause the phenomenon of attaching importance to scientific research and looking down on teaching. Young teachers put serious shortage of energy into class teaching, outstanding performance is that they don't pay attention to study teaching methods, their teaching is mainly to complete the teaching task, the result is their scientific research ability is raised, but not grow their teaching ability.

With Lagrange theorem teaching methods as an example, introduces how to carry on the teaching method in the teaching of higher mathematics study. Avoid scripted type teaching, so as to improve the teaching ability of young teachers.

GEOMETRIC METHOD TO CONSTRUCT THE AUXILIARY FUNCTION AND ITS LIMITITATIONS

The content of the Lagrange mean value theorem

If the function $f(x)$ conforms to

(1) Continuous on the closed interval $[a,b]$;

(2) Derivable in the open interval (a,b),

Then, there are at least a number ξ in the open interval (a,b) meet

$$f(b)-f(a)=f'(\xi)(b-a)\,. \tag{1}$$

The method by using geometry method to construct the auxiliary function [1]

The following is a process of geometric method to construct the auxiliary function $\varphi(x)$.

Seeing from Figure 1, the value of directed line segment NM is a function of x, which has a close relationship with $f(x)$. When $x=a$ and $x=b$, there is $\varphi(a)=\varphi(b)=0$.

In order to determine the expression of $\varphi(x)$, set the equation of Linear is $y=L(x)$, then

$$L(x)=f(a)+\frac{f(b)-f(a)}{b-a}(x-a)\,, \tag{2}$$

Because the vertical coordinates of M and N are $f(x)$ and $L(x)$, so

$$\varphi(x)=f(x)-f(a)-\frac{f(b)-f(a)}{b-a}(x-a)\,. \tag{3}$$

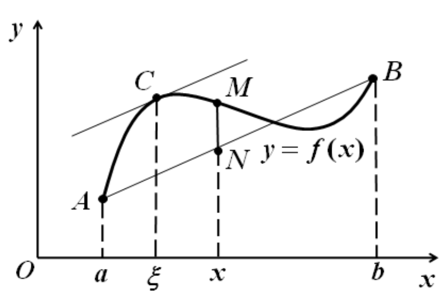

Figure 1 : The method by using geometry method to construct the auxiliary function

The limitations of the Geometric method

Geometric method has the following two limitations:

(1)The student's thinking is too visualizations, which is not conducive to cultivate students' abstract thinking ability and analysis ability;
(2) Geometric method to construct the auxiliary function method can't serve as a general method to promote, students don't know how to solve when they meet similar general problem.

CONCLUSION

ANALYTICAL METHOD OF CONSTRUCTING AUXILIARY FUNCTION AND ITS METHODOLOGICAL SIGNIFICANCE

Analytical method of constructing auxiliary function

Starting from the conclusion $f(b)-f(a)=f'(\xi)(b-a)$, changes ξ to x, we get

$$f'(x)-\frac{f(b)-f(a)}{b-a}=0, \tag{4}$$

So, we can make millions of auxiliary functions

$$\varphi(x)=f(x)-c-\frac{f(b)-f(a)}{b-a}(x-d), \tag{5}$$

Let $c=f(a)$, $d=a$, we can get the auxiliary function constructed by geometric method

$$\varphi(x)=f(x)-f(a)-\frac{f(b)-f(a)}{b-a}(x-a). \tag{6}$$

The thinking of the analytical method is that we get expression (4) by changing ξ to x which is to transform the original problem into proving the existence of equations root, and then we can get expression (5) and (6) by the Rolle theorem swimmingly.

Methodological significance of the analytical method of constructing auxiliary function

The analytical method of constructing auxiliary function has methodological significance, this method is used easily to solve this kind general issues as a general approach, the thinking process of this method is putted in Figure 2.

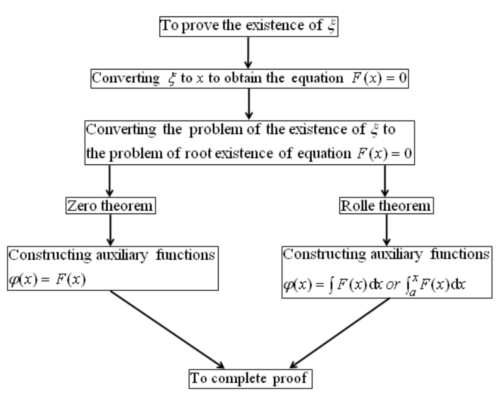

Figure : 2 Thinking process of the analytical method of constructing auxiliary function

THE ANALYTICAL METHOD OF CONSTRUCTING AUXILIARY FUNCTIONS IN SOLVING GENERAL ABSTRACT PROBLEMS

Example 1

If the function $f(x)$ is derivable on $[a,b]$, and $f'(a) \neq f'(b)$, then $\forall \mu$, which is between $f'(a)$ and $f'(b)$, there is one number ξ in (a,b) at least, which conforms to $f'(\xi) = \mu$.

Proof Set $\varphi(x) = f(x) - \mu x$. By known conditions, $\varphi(x)$ is derivable on $[a,b]$.
Let's assume $f'(a) < \mu < f'(b)$.

If $\varphi(a) = \varphi(b)$, we can know by the Rolle theorem that there is one number ξ in (a,b) at least, which conforms to $\varphi'(\xi) = 0$, that is to say $f'(\xi) - \mu = 0$, i.e. $f'(\xi) = \mu$.

If $\varphi(a) \neq \varphi(b)$, set $\varphi(a) < \varphi(b)$. Because $\varphi'(a) = f'(a) - \mu < 0$, there is $\eta \in (a,b)$ conforms to $\varphi(\eta) < \varphi(a)$ by the properties of limit, and because $\varphi(a) < \varphi(b)$,

So

$$\varphi(\eta) < \varphi(a) < \varphi(b).$$

By the intermediate value theorem of continuous function on a closed interval, there is $\varsigma \in (\eta, b) \subset (a,b)$, which conforms to $\varphi(\varsigma) = \varphi(a)$. And then, there is one number $\xi \in (a,\varsigma) \subset (a,b)$ at least, which conforms to $\varphi'(\xi) = 0$ by the Rolle theorem, i.e. $f'(\xi) = \mu$.

Example 2

If an odd function $f(x)$ has a second derivative on $[-1,1]$, and $f(1) = 1$, then

(1) There is $\xi \in (0,1)$, which conforms to $f'(\xi) = 1$;

(2) There is $\eta \in (-1,1)$, which conforms to $f''(\eta) + f'(\eta) = 1$.

Proof (1) Set $\varphi(x) = f(x) - x$, then $\varphi(x)$ is derivable on $[0,1]$.

Because $f(x)$ is an odd function, we know that $f(-x) = -f(x)$, and then we know $f(0) = 0$.

So

$$\varphi(0) = f(0) - 0 = 0.$$

And because $f(1) = 1$, we know

$$\varphi(1) = f(1) - 1 = 0.$$

By the Rolle theorem, there is $\xi \in (0,1)$, which conforms to $\varphi'(\xi) = 0$, i.e. $f'(\xi) = 1$.

(2) Set $\varphi(x) = f'(x) + f(x) - x$, then $\varphi(x)$ is derivable on $[-1,1]$.

Because the derivative function of an odd function is even function, we know $f'(-1) = f'(1)$.

And because $f(1) = 1$, we get

$$\varphi(-1) = f'(-1) + f(-1) + 1 = f'(1) - f(1) + 1 = f'(1),$$

$$\varphi(1) = f'(1) + f(1) - 1 = f'(1).$$

So

$$\varphi(-1) = \varphi(1).$$

By the Rolle theorem, there is $\eta \in (-1,1)$, which conforms to $\varphi'(\eta)=0$,i.e. $f''(\eta)+f'(\eta)=1$.

Example 3

If $f(x)$ is continuous on $[a,b]$,and $\int_a^b f(x)\mathrm{d}x=0$,then there is one number $\xi \in (a,b)$ at least, which conforms to $f(\xi)=0$.

Proof Set $\varphi(x)=\int_a^x f(x)\mathrm{d}x$,then $\varphi(x)$ is continuous and derivable on $[a,b]$, and $\varphi(a)=0=\varphi(b)$.

By the Rolle theorem, there is one number $\xi \in (a,b)$ at least, which conforms to $\varphi'(\xi)=0$.

And because $\varphi'(x)=[\int_a^x f(x)\mathrm{d}x]'=f(x)$,

So

$f(\xi)=0$.

Example 4

If $f(x)$ is continuous on $[a,b]$,and $f(a)<a$, $f(b)>b$,then there is one number $\xi \in (a,b)$ at least, which conforms to $f(\xi)=\xi$.

Proof Set $F(x)=f(x)-x$,then $F(x)$ is continuous on $[a,b]$,and $F(a)<0$, $F(b)>0$.

By the zero theorem of a continuous function on $[a,b]$,we know that there is one number $\xi \in (a,b)$ at least, which conforms to $F(\xi)=0$,

So

$f(\xi)=\xi$.

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