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Abstract:
This article presents a new method for solving some equations and inequalities, which is important for students to learn differential calculus. The application of differential calculus allows for simple solutions of complex equations and inequalities, and this method can also be used to solve some geometric problems.

Keywords
Equation, critical inequality, attempt

Introduction

Using trial equations in proving inequalities

Students who have mastered differential calculus will have some convenience in proving inequalities. We will solve several problems below that confirm that the problem of finding the trial equation is a critical point of solution.

1. We are given real numbers a,b,c,d, and let a+b+c+d=1.

∆ **We prove the following inequality:**

$6\,(a^3+b^3+c^3+d^3) \geq a^2+b^2+c^2+d^2+\frac{1}{8}$

Proof: from the condition of the problem it is known that 0<a, b, c, d < 1, $6x^3-x^2$ we get f(x) = . In inequality (1), $\frac{1}{4}$we find the equation of the product at the point a=d=b=c= in the equation, $x_0=\frac{1}{4}$ we find the equation of the product at the point in this equation. This is $x_0=\frac{1}{4}$equal to in Eq.

So:$y=f(x_0)+f'(x_0)(x-x_0)\Rightarrow$

$$f(x)=6x^3-x^2;\quad f(x_0)=6\cdot\left(\frac{1}{4}\right)^3-\left(\frac{1}{4}\right)^2=\frac{6}{64}-\frac{1}{16}=\frac{2}{64}=\frac{1}{32}$$

$$f'(x)=18x^2-2x;\quad f(x_0)=18\cdot\left(\frac{1}{4}\right)^2-2\left(\frac{1}{4}\right)=\frac{18}{16}-\frac{1}{2}=\frac{18-8}{16}=\frac{5}{8}$$

$$y=\ f(x_0)+\ f'(x_0)\,(x-x_0)=\frac{1}{32}+\frac{5}{8}\left(x-\frac{1}{4}\right)=\frac{1}{32}-\frac{5}{8}x-\frac{5}{32}=\frac{5x-1}{8}$$

We found $y=\ \frac{5x-1}{8}$ in this equation .

Now we show that the graph of the test at (0;1) lies below the graph of f(x).

x is ∈at (0;1) $6x^3-\ x^2\geq\frac{5x-1}{8}$.

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$6x^3 - x^2 \geq \frac{5x-1}{8}$the inequality $48x^3 - 8x^2 - 5x + 1 \geq 0$is strong equal to , where greater than zero x less than 1 the inequality is always valid, since$\forall x \in (0;1)$
$6x^3 - x^2 \geq \frac{5x-1}{8}$It follows that the inequality is valid. If we substitute a, b, c, d in place of x.
$6(a^3 + b^3 + c^3 + d^3) - a^2 - b^2 - c^2 - d^2 \geq \frac{5(a+b+c+d)-4}{8}$we get.
The last inequality is that a+b+c+d=1. $6(a^3 + b^3 + c^3 + d^3) \geq a^2 + b^2 + c^2 + d^2 + \frac{1}{8}$ ga teng kuchli, masala isbotlandi. Δ

2. If a,b,c >are 0, prove the following inequality: [2]

$$\frac{(2a+b+c)^2}{2a^{2+}(b+c)^2} + \frac{(2b+a+c)^2}{2b^2+(a+c)^2} + \frac{(2c+a+b)^2}{2c^2+(a+b)^2} \leq 8. \quad [2]$$

Proof : We can define as follows.
a'= $\frac{a}{a+b+c}$; b'= $\frac{b}{a+b+c}$; c'= $\frac{c}{a+b+c}$.
Substituting this into (2) gives

$$\frac{(2a'+b'+c')^2}{2a'^2+(b'+c')^2} + \frac{(2b'+a'+c')^2}{2b'^2+(a'+c')^2} + \frac{(2c'+a'+b')^2}{2c'^2+(a'+b')^2} \leq 8 \quad (3)$$

looks like It can be seen that inequalities (2) and (3) are the same, only (a',b',c') are replaced by (a,b,c) in (2) in (3).
So, without harming the generality, we can take a+b+c=1, where 0 <a,b,c <1. If we put the designations in their place and simplify, we get the following:

$$\frac{(a+1)^2}{2a^2+(1-a)^2} + \frac{(b+1)^2}{2b^2+(1-b)^2} + \frac{(c+1)^2}{2c^2+(1-c)^2} \leq 8 \quad (4)$$

We can write it in form, looking at f(x) as a function:
F(x) =$\frac{(x+1)^2}{2x^2+(1-x)^2} + \frac{(x^2+2x+1)}{2x^2+(1-x)^2} = \frac{(x^2+2x+1)}{3x^2-2x+1}$;
Equality (4) holds $\frac{1}{3}$at a=b=c=. We find the trial equation of f(x) $x_0 = \frac{1}{3}$at the point. It is not difficult to see that the equation y = $\frac{12x+4}{3}$.
Now we prove that the graph of the test at (0;1) lies above the graph of f(x). It suffices to show that f(x) = at ∀x ∈(0;1) $\frac{12x+4}{3}$. $\frac{x^2+2x+1}{3x^2-2x+1} \leq \frac{12x+4}{3}$ tengsizlik $36x^3 + 15x^2$-2x+1 ≥ is equivalent to 0, where $0 < x < 1$is , and always true. From this∀x ∈ (0; 1) da $\frac{(x+1)^2}{2x^2+(1-x^2)} \leq \frac{12x+4}{3}$it follows that the inequality is reasonable, if we add a, b, c instead of x, $\frac{(a+1)^2}{2a^2+(1-a)^2} + \frac{(b+1)^2}{2b^2+(1-b)^2} + \frac{(c+1)^2}{2c^2+(1-c)^2} \leq \frac{12(a+b+c)+12}{3}$; we will have . Since a+b+c=1, the last inequality (4) is equally strong, the problem is proved. Δ

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3. If a,b,c >are 0, prove the following inequalities.

$$\frac{(b+c-a)^2}{(b+c)^2+a^2}+\frac{(c+a-b)^2}{(c+a)^2+b^2}+\frac{(a+b-c)^2}{(a+b)^2+c^2}\geq\frac{3}{5} \quad (5)$$

Proof : Same as in Problem 2 without loss of generality

We can take a+b+c=1, where 0 $< a,b,c <$ 1, From this inequality (5) is the following:

$$\frac{(1-2a)^2}{(1-a)^2+a^2}+\frac{(1-2b)^2}{(1-b)^2+b^2}+\frac{(1-2c)^2}{(1-c)^2+c^2}\geq\frac{3}{5}$$

we write in the form. Now $\frac{(1-2a)^2}{(1-a)^2+a^2}=2-\frac{2}{1+(1-2a)^2}$ from reality

if we use the last inequality.

If we simplify $2-\frac{2}{1+(1-2a)^2}+2-\frac{2}{1+(1-2b)^2}+2-\frac{2}{1+(1-2c)^2}\geq\frac{3}{5}$

$$\frac{1}{1+(1-2a)^2}+\frac{1}{1+(1-2b)^2}+\frac{1}{1+(1-2c)^2}\leq\frac{27}{10} (6)$$

looks like We can define as follows:

1-2a $=x_1$

1-2b $=x_2$

1-2c $=x_3$

From this (6) follows:

$$\frac{1}{1+x_1^2}+\frac{1}{1+x_2^2}+\frac{1}{1+x_3^2}\leq\frac{27}{10} \quad [7]$$

It follows that and = 1 and -1 $< x_1, x_2, x_3 <$ 1are equal . $x_1+x_2+x_3$As in the above issues:

F(x) = $\frac{1}{1+x^2}$and its $x_0=\frac{1}{3}$test at a point. [5]

From this trial equation, it is not difficult to find that y = $\frac{27(-x+2)}{50}$ Now we show that the graph of the trial lies above the graph of f(x) at (-1;1). For this, the following inequality,

$\frac{1}{1+x^2}\leq\frac{-27(x-2)}{50}$it is sufficient to prove that , where -1 $< x <$ 1, and that

$(3x-1)^2$(4-3x) ≥ 0. And the last inequality $< x < 1$ is valid because it is -1, so f(x) $\leq\frac{27(-x+2)}{50}$inequality is appropriate. If we substitute s for x in this inequality .x_1, x_2, x_3

F($x_1)+f(x_2)+f(x_3)\leq\frac{27(-x_1-x_2-x_3+6)}{50}=\frac{27(-1+6)}{50}=\frac{27}{10}$.

This is equally strong as (7), so the problem is proved. Δ

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