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# METHODS OF TEACHING THE PRACTICAL APPLICATION OF TOPICS RELATED TO DIFFERENTIAL EQUATIONS

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## ABSTRACT

It is known that various processes occurring in nature have their own laws of physical, chemical, biological, economic and other issues.Differential equations help us in solving these laws. In solving problems representing natural processes, we often turn to differential equations. Solving problems using differential equations leads to a relatively clear answer. The topic we are going to reveal is scientifically and practically relevant. In teaching "Ordinary differential equations" or "Partial differential equations" it is useful to pay special attention to the practical application of these disciplines, as well as to increase the interest in the study of these complex disciplines. In this article, we will analyze some of the problems that can be solved using the concepts of "Ordinary differential equations" or "Partial differential equations".

**Keywords:** Ordinary differential equations, partial differential equations, natural processes, teaching methods.

## INTRODUCTION

Different processes that occur in nature have their own laws of motion. Some processes can follow the same law, which makes it easier to study them. However, it is not always possible to find the laws that describe the process directly. It is naturally easy to find the relationship between characteristic quantities and their derivatives or differentials.

**Definition 1.** Let $f(x)$ define a function of $x$ on an in interval $I: a < x < b$. By an ordinary differential equation we mean an equation involving $x$, the function $f(x)$ and one or more of its derivatives.

**Definition 2.** The order of a differential equation is the order of the highest derivative involved in the equation.

This creates a relationship in which an unknown function or vector-function is involved under the product or differential sign. Including the following equation

$$\frac{dy}{dx} = f(x, y)$$

is called the first ordinary differential equation.

$$F\left(x, y, y', y'', \dots y^{(n)}\right) = 0 \text{ -}$$

is called the ordinary differential equation of order *n*.

$$F(x, y, y') = 0$$

It is an ordinary differential equation that has not been solved for a derivative of order one.

$$y^{(n)} = f\left(x, y, y', \dots y^{(n-1)}\right)$$

is called an ordinary differential equation solved with respect to an *n*-order high-order derivative. If $f\left(x, y.. y^{(n-1)}\right)$or $F\left(x, y, y' \dots y^{(n)}\right)$s $y, y' \dots y^{(n-1)}$and $y^{(n)}$are linear functions with respect to the arguments, the corresponding differential equation is called linear.In the above differential equations, the unknown function is considered to have one argument. In fact, it is often the case that an unknown function has many arguments. In this case, the differential

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equation is called a partial differential equation. This equation $F\left(u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y}\right)=0$is derived from the first order partial differential equations,

$$\Phi\left(u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},\frac{\partial u}{\partial x^2},\frac{\partial u}{\partial x\partial y},\frac{\partial u}{\partial y^2}\right)=0$$

and the equations are partial differential equations of the second order.
The following

$\frac{\partial^2 u}{\partial t^2}=a^2\frac{\partial^2 u}{\partial x^2}$ (narrow vibration equation);

$\frac{\partial u}{\partial t}=a^2\frac{\partial^2 u}{\partial x^2}$ (heat transfer equation);

$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ (The Laplace equation);

$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=f(x,y)$ (Poisson's equation);

equations are important special cases of partial differential equations of the second order, in which the unknown function has two arguments.

## STATEMENT OF THE PROBLEM

Now let's stop solving some issues.

**№1.** ([2]) There is air in a 20 *l* container.The air contains 80% nitrogen and 20% oxygen.0.1 *l* of nitrogen per second enters the vessel and is continuously added to the available air and the same amount of mixture flows out.How long does it take for the container to contain 99% nitrogen?

**Solution:** Q(t)-we consider the amount of nitrogen in the vessel at time t.Each time the amount of nitrogen flows$\frac{0{,}1Q(t)}{20}$an amount equal to$Q'(t)=0{,}1-\frac{0{,}1Q(t)}{20}$.

So the process represented by the law $\frac{dQ(t)}{dt}=0{,}1\left(1-\frac{Q(t)}{20}\right)$.

Now we solve the given equation:

$$\frac{dQ(t)}{dt}=\frac{0{,}1}{20}(20-Q(t))$$

$\frac{dQ(t)}{20-Q(t)}=\frac{1}{200}dt;$

integrate$\int\frac{dQ(t)}{20-Q(t)}=\int\frac{1}{200}dt$ ,

$$ln\,(20-Q(t))=-\frac{1}{200}t+ln\,C$$

$20-Q(t)=Ce^{-\frac{t}{200}}$;

$$Q(t)=20-e^{-\frac{t}{200}}c$$

At$t$ = 0, 80% oftheairinthecontainerisnitrogen.

Using this condition of the matter,16=20-C $e^{0/200}$ $=>16=20-C=>C=4$, henceforth, it turns out that$Q(t)=20-4e^{-\frac{t}{200}}$.

Now we find the time when the nitrogen content of the container is 99%, ie Q (t) = 19.8 *l*:

It turns out that

$$19{,}8=20-4e^{-\frac{t}{200}},$$

$$4e^{-\frac{t}{200}}=0{,}2,$$

$$e^{\frac{t}{200}}=20,$$

$$\frac{t}{200}=ln20,$$

$$t = 200ln20.$$

At $t = 200ln20$s, 99% of the air in the vessel is nitrogen.

**№2.** ([2]) The tank contains 100 liters of liquid containing 10 kg of salt.The tank is constantly poured water (5 liters per minute) mixed with liquid.The mixture flows at this speed.How much salt is left in the tank after one hour?

**Solution:** *Q(t)* is the amount of salt in the tank at time *t*.If the liquid concentration is $\frac{Q(t)}{100}$, the amount of salt per minute is $\frac{Q(t)}{100} \cdot 5$.. $Q'^{(t)} = -\frac{Q(t)}{100} \cdot 5$henceforth

$$\frac{dQ(t)}{dt} = -\frac{Q(t)}{100} \cdot 5 \quad =>$$

$$\frac{dQ(t)}{Q(t)} = -\frac{5}{100} dt$$

Integrate$\int \frac{dQ(t)}{Q(t)} = -\frac{5}{100} \int dt \quad =>$

$$lnQ(t) = -\frac{5}{100} t + lnC$$

we find the solution of the equation $Q(t) = Ce^{-\frac{5}{100}t}$. At *t* = 0, the amount of salt is 10 kg, that is, using the initial condition $Q(0) = 10$and the general solution,

$$10 = Ce^{-\frac{5}{100} \cdot 0},$$

$$C = 10.$$

From this,$Q(t) = 10 \cdot e^{-\frac{5}{100}t}$.

Now we determine the amount of salt after t = 60:

$Q(t) = 10 \cdot e^{-\frac{5}{100} \cdot 60} = 10 \cdot e^{-3} \approx 0,5$ kg.

## METHODOLOGY

From these issues, it is clear that the student must have a thorough analysis of the process in solving the problems and a good understanding of interdisciplinary integration. As a result of solving more similar problems in process analysis, the learner develops skills and competencies.

There are many interactive ways to solve such problems that can make the learning process more interesting.For example, I know, I want to know, I learned technology

I know / I want to know / I learned

| № | Subject Questions | I know (Q) | I want to know (?) | I learned |
|---|---|---|---|---|
| 1 | What are the issues that represent natural processes? | | | |
| 2 | What equations are called equations involving differentials? | | | |
| 3 | What natural processes can be used to construct differential equations? | | | |
| 4 | Construct a differential equation for a problem representing a natural process? | | | |

### The rule of working in small groups

1. Students have the knowledge and skills needed to do the job;
2. Give specific assignments to groups;
3. Allocate enough time for the small group to complete the task;

4. Warning that opinions in groups are not restricted or pressured;

5. Know exactly how the group will present the results of the work, the teacher will instruct them;

6. Let them communicate and express themselves freely

Working according to the plan will enliven the course of the lesson.

## RESULTS

There has always been a strong emphasis on the practical application of mathematics. In teaching science, its practical application, teaching skills and modern special technologies help to improve the quality of education.

## REFERENCES

1. Салохиддинов М.С., Насритдинов Г.Н. Оддий дифференциал тенгламалар. Тошкент, “Ўзбекистон”, 1994.
2.Филиппов А.Ф. Сборник задач по дифференциальным уравнениям. М. наука, 1979 (5 – е издание).
3. Morris Tenebout, Harry Pollard. Ordinary Differential Equations. Birkhhauzer. Germany, 2010.-819 p.
4.Эльсгольц Л.Е. Дифференциальные уравнения вариационное исчиление. М. Ком Книга / URSS 2006.-312 с.
5. Салохиддинов М.С. Математик физика тенгламалари. Тошкент. «Ўзбекистон», 2002.
6. Бицадзе А.В., Калиниченко Д.Ф. Сборник задач по уравнениям математической физики. М. 1977.
7. Ишмуҳамедов Р., Абдуқодиров А., Пардаев А. Таълимда инновацион технологиялар /Амалий тавсиялар. – Т.:“Истеъдод” жамғармаси, 2008.–180 б.
8. Ш.Б. Меражова, Ф.Я. Марданова “Хусусий ҳосилали дифференциал тенгламалар” фанини интерфаол усуллардан фойдаланиб ўқитиш самараси ҳақида. Pedagogik mahorat. Ilmiy-nazariy va metodik jurnal, 2019 y, №5, 131-133 б.
9. Меражова Ш.Б., Нуриддинов Ж.З., Меражов Н.И., Хидиров У.Б. Методы решений задачи коши для уравнения волны в случае n = 2 и n = 3. Academy. Научно-методический журнал. 2020, № 4 (55), стр. 21-25.
10. Merajova Sh. Matematik fizika tenglamalari fanidan mashqlar to`plami. Buxoro, Ziyo-Rizograf, 2007, 56b.