

**O'ZBEKISTON RESPUBLIKASI OLIY VA O'RTA MAXSUS TA'LIM
VAZIRLIGI**

**MIRZO ULUG'BEK NOMIDAGI O'ZBEKISTON MILLIY
UNIVERSITETI**

MEXANIKA-MATEMATIKA FAKULTETI

**Matematika-fizika tenglamalari fanidan elektron o'quv
qo'llanma tayyorlash.**

mavzusidagi

BITIRUV MALAKAVIY ISHI

Bajardi: Amaliy matematika va
informatika ta'lim yo'nalishi bitiruvchisi

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MUNDARIJA

I. KIRISH.....	3
II. ASOSIY QISM	
1. Masalaning qo'yilishi.....	7
2. Masalani yechish.....	8
3. Dasturiy ilova.....	64
III. XULOSA.....	84
IV. Foydalanilgan adabiyotlar.....	85

KIRISH

Bugungi kunda kelib davr talabiga ko'ra kompyuter texnologiyasi juda rivojlanib ketdi. Hozirgi kunda kompyuter texnologiyalari hayotimizning barcha jabhalariga kirib bordi desak, mubolag'a bo'lmaydi. Kompyuter texnologiyalari rivojlanib barcha ishlab chiqarish jarayonlari avtomatlashtirilib borilmoqda. Bu esa fan sohasini ham chetlab o'tmadi, hamda ilm fan rivojlanishiga o'z ta'sirini ko'rsatmoqda.

Web –sahifalarni yaratish va undan foydalanish ta'lim tizimida ham muhim ahamiyat kasb etadi. Ta'limda Web-sahifalardan nafaqat tijorat yoki namoyish vositasi sifatida , balki bilim berish maqsadlarida ham foydalanish mumkin. Albatta bunda ta'lim masofadan turib amalga oshiriladi. Bunday ta'lim berish jarayoni o'qituvchi va o'quvchi to'g'ridan to'g'ri muloqot qilmasdan olib boriladi. Buning uchun ta'lim beruvchi (oliy o'quv yurti, maktab va boshqalar) o'qitiladigan predmetga tegishli ma'lumotlarni Web-sahifalarga har xil ko'rinishlarda (matn, rasm, jadval, animatsiya, tovushli ma'lumot va hatto video tasma ko'rinishida) joylashi kerak. O'quvchi esa dunyoning xohlagan joyidan turib Internet orqali bu ma'lumotlardan bilim olishi mumkin. Ta'limning bunday ko'rinishi masofaviy ta'lim deb yuritiladi. Masofaviy ta'lim buguni kunga kelib dunyoning ko'plab rivojlangan davlatlarida qo'llanilib kelinmoqda. Masofaviy ta'limdan foydalanish natijasida vaqt va pulni tejash, ortiqcha ovvoragarchiliklarsiz bilim olish imkoniyatiga ega bo'linadi. Bunday imkoniyatlarni bizga Web-sahifalari yaratib beradi Ma'lum predmetga tegishli ma'lumotlarni (matn, rasm, jadval, animatsiya va boshqalarini) sahifalarga joylab, ularni doimiy ravishda to'ldirib borish, o'quvchilarni bilimlarini baholash uchun nazorat test savollarini kiritish imkoniyatlari mavjud . Buning natijasida o'quvchining olgan bilimini nazorat qilish, baholash imkoniyatlari paydo bo'ladi. Bu esa Web-texnologiyadan ta'limda foydalanishning eng optimal variantlaridan biri hisoblanadi.

Hozirda bizning ta'lim tizimimizda ham multimediali apparatlar yangi kompyuter texnologiyalari vositalari yordamida va masofali o'qitish tizimi ham amalga oshirilgan. Shu sababdan o'qitishning zamonaviy usullariga ya'ni elektron o'quv qo'llanmalariga ehtiyoj ortib bormoqda. Bu o'qitish usuli, tez va sifatli hamda arzon va qulay o'qitishning elektron variantidir. Bundan barcha foydalana olishi, fan yuzasidan bilim va ko'nikmalarga ega bo'lib, o'zlashtirgan bilimlarini sinovdan o'tkazib tahlil qilish imkoniyatiga ega bo'ladilar. Bu web sahifadan barcha foydalana olishi mumkin. Jumladan, imkoniyati cheklanganlar, nogironlar uchun ham, ma'lum bir sabablarga ko'ra yurolmay darsga kelolmaydigan talabalar uchun ham, ayniqsa multimediali, ovozli elektron o'quv qo'llanmalar ko'rish qobiliyati sust yoki ko'rish qobiliyatini yo'qotganlar uchun ham uyda o'tirib bo'lsa-da o'z vaqtida bilimlarni o'zlashtirib olishlariga qulay imkoniyat yaratib beradi.

Shu sababdan aniq fanlardan matematika, fizika fanlaridan va ushbu fanlarni bog'lab turuvchi matematika –fizika tenglamalari fanidan elektron o'quv qo'llanma yaratish zarur deb hisobladik.

Ushbularni hisobga olib bitiruv malakaviy ishimda matematika-fizika tenglamalari fanidan elektron o'quv qo'llanma tayyorladim. Ushbu elektron qo'llanma besh qismdan iborat:

Birinchi, web sahifaning asosiy oynasi (shabloni) bu banner, menyu, ma'lumotlar oynasi, asosiy oyna kabi qismlardan tashkil topgan. Bannerda fanning nomi, menyuda asosiy, ma'ruza, misol, o'qish, testlarga gipermurojaatlar qo'yilgan bo'lib, keraklisini tanlab sichqonchani bosganimizda ushbu qismlarga mos kerakli ma'lumotlarni shablonning asosiy oyna qismida ochib beradi. Ma'lumotlar oynasida esa web sahifa va web sahifaning muallifi haqida ma'lumot keltirilgan. Asosiy oyna qismida O'zbekiston milliy universitetining matematika-fizika kafedrasida fizika-matematika fanlari doktori Qosimov Sh.G' va fizika -matematika fanlari nomzodi Fayziyev Yu.E ustozlarimiz tomonidan

tayyorlangan matematika –fizika tenglamalari fanidan “Xususiy hosilali differensial tenglamalarni kanonik ko’rinishga keltirish va uning umumiy yechimini topishga oid mashqlar” o’quv uslubiy qo’llanmaning ko’rinishi muqovasi ko’rsatilgan.

Asosiy qismini ya’ni elektron o’quv qo’llanmaning ko’rinishini (Shablonini) tayyorlashda Adobe Fotoshop, Macromedia Dreamweaver redaktorining HTML tilidan va buni tayyorlashda qulayroq va osonroq bo’lishi, HTML teglaridan kamroq foydalanishim, redaktorga kiritayotgan ma’lumotlarim tushunarli va ixchamroq, tozaroq ko’rinishga bo’lishi uchun CSS stillar jadvaliga murojaat qilib, bunda foydalanoyotgan teglarning atributlarini kititib qo’ydim. Sarlavha (banner) qismini Adobe Fotoshopda tayyorladim.

Ikkinchisi, Ma’ruza qismi xuddi yuqoridagi kabi faqat bunda ma’lumotlar o’rniga mundarija berilgan har bir mavzuga gipermurojaatlar qo’yilgan ixtiyoriy mavzuni tanlaganimizda shu mavzuga tegishli ma’ruzalar matnini va shu mavzuga oid misollar yechishga doir mashqlarni web sahifaning o’ng tomonida asosiy oynaga ochib beradi.

Uchinchisi, misol qismi ma’ruza qismiga o’xshab bunda mundarijadagi mavzulardan birini tanlaganimizda web sahifaning o’ng tomonidagi asosiy oynaga shu mavzuga tegishli 25 ta yoki 50 ta mustaqil yechish uchun misollar keltiriladi.

To’rtinchisi, O’qish qismi ma’ruza qismidagi kabi bunda mundarijadan kerakli mavzuni tanlaganimizda shu mavzuninig ovoqli video ko’rinishini web sahifaning o’ng tomonidagi asosiy oynaga chiqarib beradi. Ovoqli o’qish qismini tayyorlashda ovozga mos animatsiyalar qo’yish uchun Power pointdan foydalanib videoga yozib oldim. Buni web sahifaga joylashtirish uchun esa Microsoft Office paketiga tegishli MS Front Page redaktoridan obyektarni o’rnatish buyrug’idan foydalandim.

Beshinchisi, test qismi bunda barcha mavzularga doir 100 ta test tuzilgan bo'lib, shu testlardan 10 tadan ixtiyoriy tanlab beriladi. Bu 10 testni ishlab bo'lgandan so'ng oxirida "tekshirish" tugmasi bosilganda nechta to'gri javobligini chiqaradi. Yana shu testni o'zini qaytadan ishlash uchun "tozalash" tugmasi bosilib qaytadan shu test ishlanadi. Boshqa testni ishlamoqchi bo'lsak F5 tugmasi bosiladi.

Test qismini ko'rinishini tayyorlash uchun HTML formalardan , ishlash dasturini tuzish uchun PHP web dasturlash tilidan foydalandim.

ASOSIY QISM

Masalaning qo'yilishi:

Mazkur malakaviy bitiruv ishida “Matematik-fizika tenglamalari” fanidan elektron o'quv qo'llanma tayyorlash masalasi qaraladi.

Mazkur masala HTML tilida va PHP web dasturlash tilida qilingan bo'lib Internetga joylashtirganimizda barcha talabalar uchun qulay uslubiy qo'llanma hisoblanadi.

Mazkur malakaviy bitiruv ishining ya'ni elektron o'quv qo'llanmaning asosiy vazifalari quyidagilardan iborat:

1. Matematik –fizika tenglamalarinining mavzulari haqida to'liq ma'lumot berish;
2. Talabalar o'z bilimlarini yanada mustahkamlashlari uchun mustaqil yechish uchun misollar berish;
3. Mavzular yanada esda qolarli va tushunarli bo'lishi va bundan ko'rish qobiliyatida imkoniyati cheklanganlar ham foydalana olishlari uchun ma'ruzalarni ovozli qilish;
4. Ushbu elektron o'quv qo'llanmadan foydalanuvchilar o'z bilimlarini sinovdan o'tkazish uchun test o'tkazish;

Masalani yechish

Web sahifadan foydalanish uchun komyuterda Internet Explorer, Mozilla Firefox, Opera, Google Chrome yoki boshqa browserlardan biri o'rnatilgan bo'lishi kerak. Agar ushbu elektron qo'llanmani internetga qo'ysak Internetga qo'yilgan URL adresi to'g'ri berilishi kerak. URL adresi quyidagicha beriladi:

Protocol://ServerName:Port Number/FileName

Protocol: bu http protokolidir.

Server Number: masalan: O'zMU.uz

Port Number: 80, agar hech narsa yozilmagan bo'lsa bu avtomatik 80 portdir.

FileName: ko'pincha ko'rsatilmaydi, serverning ishlashiga bog'liqdir

URL adres to'g'ri ko'rsatilgach browserda quyidagi oyna hosil bo'ladi.

Bu elektron o'quv qo'llanmamizning ko'rinishi:

Elektron o'quv qo'llanmamizning asosiy oynasining ko'rinishi

Matematika Fizika Tenglamalar

ASOSIY MA'RUZA MISOL O'QISH TEST

MA'LUMOTLAR

Ushbu web-sahifaning Ma'ruza qismida kitobning ma'ruzalar matni joylashtirilgan. Misol qismida mustaqil yechish uchun har bir mavzudan 25 tadan misol berilgan bo'lib, o'qish qismida ma'ruzalar matnining ovoqli varianti, test qismida esa olgan bilimlaringizni sinab ko'rishingiz uchun Matematik -Fizika tenglamalari fanidan testlar berilgan.

O'zbekiston Milliy Universiteti
Mexanika-Matematika fakulteti
Amaliy matematika va informatika yo'nalishi 4-kurs talabasi
Ne'matova Dilfuzaning ushbu o'quv uslubiy qo'llanma bo'yicha tayyorlagan Malakaviy Bitiruv ishi

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OLIV VA O`RTA MAXSUS TA`LIM VAZIRLIGI

MIRZO ULUG`BEK NOMIDAGI
O`ZBEKISTON MILLIY UNIVERSITETI

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XUSUSIY HOSILALI DIFFERENSIAL TENGLAMALARNI
KANONIK KO`RINISHGA KELTSIRISH VA UNING UMUMIY
YECHIMINI TOPIHGA OID MASHQLAR

USLUBIY QO`LLANMA

TOSHKENT-2011

Toshkent © 2013

Ko'rib turganimizdek asosiy qismda fanning nomi aks etgan sarlavha (banner), ma'ruza, misol, o'qish, test bo'limlaridan tashkil topgan menyu, web sahifaning o'ng tomonida ma'lumotlar oynasi, bu oynada web sahifadan foydalanish va web sahifaning muallifi haqida ma'lumotlar berilgan. Sahifaning o'ng tomonidagi asosiy oynaga O'zbekiston Milliy universitetining matematika-fizika kafedrasini, fizika-matematika fanlari doktori Qosimov Sh.G' va fizika -matematika fanlari nomzodi Fayziyev Yu.E o'qituvchilarimiz tomonidan tayyorlangan matematika –fizika tenglamalari fanidan “Xususiy hosilali differensial tenglamalarni kanonik ko'rinishga keltirish va uning umumiy yechimini topishga oid mashqlar” o'quv uslubiy qo'llanmaning ko'rinishi (muqovasi) ko'rsatilgan.

Ushbu elektron o'quv qo'llanmaning asosiy qismini ya'ni ko'rinishini yaratish uchun Macromedia Dreamweaver redaktorining HTML tilidan, tez, qulayroq va osonroq tayyorlash uchun HTML teglaridan kamroq foydalanish, redaktorga kiritayotgan ma'lumotlar tushunarli, tozaroq ya'ni teglar va teglarning atributlarini kamroq yozish uchun CSS stillar jadvaliga murojaat qilib, bunda foydalanoyotgan teglarning atributlarini kititib qo'yildi. Banner qismi Adobe Fotoshopda tayyorlandi.

Asosan

```
<div>
```

```
</div>
```

blokli elementlaridan, juft teglaridan foydalandim. Stillarini "style.css" degan alohida faylga berib qo'ydim. Stillarni alohida faylga berganimning sababi boshqa bir nechta sahifalarga ham ta'sir qilish uchun. Bu faylni kerakli sahifaga bog'lash uchun esa Macromedia Dreamweaver redaktorida HTML tilidan foydalanish uchun "код" qismini tanlab

```
<head>
```

bo'limida

```
<link href="styles.css" rel="stylesheet" type="text/css" media="screen" />
```

```
</head>
```

deb yozib qo'yiladi

Menyu qismining ma'ruza bo'limi

Elektron o'quv qo'llanmaning menyu qismidan ma'ruza bo'limini tanlaganimizda quyidagi oyna hosil bo'ladi.

The screenshot shows a web interface for 'Matematika Fizika'. At the top, there is a navigation bar with buttons for 'ASOSIY', 'MA'RUZA', 'MISOL', 'O'QISH', and 'TEST'. On the left, a 'MUNDARIJA' (Table of Contents) sidebar lists various topics with blue arrows pointing to the right. The main content area displays the text of a lesson titled '1 - §. XUSUSIY HOSILALI DIFFERENSIAL TENGLAMANING XARAKTERISTIKASI HAQIDA TUSHUNCHA'. The text discusses orthogonal coordinates and partial derivatives, including mathematical formulas for the gradient of a function F with respect to parameters α_j .

Ushbu elektron o'quv qo'llanmaning chap tomonida mundarija berilgan bo'lib har bir mavzuga gipermurojaatlar qo'yilgan bo'lib mundarijadan ixtiyoriy mavzuni tanlasak, elektron o'quv qo'llanmaning o'ng tomonidagi asosiy oynaga shu mavzuga tegishli ma'ruzalar matni va shu mavzudan misollar yechilishiga doir mashqlar beriladi.

Masalan: mundarijadan "Xususiy hosilali differensial tenglamaning xarakteristikasi haqida tushuncha" mavzusi ustiga sichqonchani keltirib bossak web sahifaning o'ng tomonida quyidagi ma'ruzalar matni hosil bo'ladi.

1-& XUSUSIY HOSILALI DIFFERENSIAL TENGLAMANING XARAKTERISTIKASI HAQIDA TUSHUNCHA

Ω -orqali x_1, x_2, \dots, x_n , $n \geq 2$, ortogonal dekart koordinatali x nuqtalarning n -o'lchamli R^n evklid fazosidan olingan sohani belgilaymiz.

Ω -sohadan olingan x nuqta va

$$\alpha_1, \alpha_2, \dots, \alpha_n, \quad \alpha_j = k, \quad k = 0, \dots, m, \quad m \geq 1, \quad j=1, \dots, n$$

manfiymas butun indeksli $p_{\alpha_1 \alpha_2 \dots \alpha_n}$ haqiqiy o'zgaruvchili

$F(x, \dots, p_{\alpha_1 \alpha_2 \dots \alpha_n})$ - haqiqiy qiymatli funksiya berilgan bo'lib, hech

bo'lmaganda $\frac{\partial F}{\partial p_{\alpha_1 \alpha_2 \dots \alpha_n}}$, bunda

$$\sum_{j=1}^n \alpha_j = m$$

hosilalardan birortasi noldan farqli bo'lsin. Bu yerda

$$p_{\alpha_1 \alpha_2 \dots \alpha_n} = \frac{\partial^m u}{\partial x_1^{\alpha_1} \partial x_2^{\alpha_2} \dots \partial x_n^{\alpha_n}} \quad \text{deb olamiz.}$$

$$F(x, \dots, \frac{\partial^k u}{\partial x_1^{\alpha_1} \dots \partial x_n^{\alpha_n}}, \dots) = 0 \quad (1)$$

shakldagi tenglik $u(x) = u(x_1, x_2, \dots, x_n)$, $x \in \Omega$ noma'lum funksiya nisbatan m -tartibli xususiy hosilali differensial tenglama deyiladi va bu tenglikning chap tomoni esa, m -tartibli xususiy hosilali differensial operator deyiladi.

Ω sohada aniqlangan $u(x)$ haqiqiy qiymatli funksiya va uning (1) tenglamada qatnashgan barcha xususiy hosilalari uzluksiz bo'lib, bu tenglamani ayniyatga aylantirsa, u holda shu funksiya regulyar yechim deyiladi.

Agar F funksiya $p_{\alpha_1 \alpha_2 \dots \alpha_n}$ bunda

$$\alpha = \prod_{j=1}^n \alpha_j = k, \quad k = 0, \dots, m$$

barcha o'zgaruvchilarga nisbatan chiziqli funksiya bo'lsa, u holda (1) tenglamaga chiziqli tenglama deb ataladi. Agar F funksiya $p_{\alpha_1 \alpha_2 \dots \alpha_n}$, bunda

$$\alpha = \prod_{j=1}^n \alpha_j = k, \quad k = 0, \dots, m$$

barcha o'zgaruvchigagina nisbatan chiziqli bo'lsa, u holda (1) tenglamaga kvazichiziqli tenglama deb ataladi.

$Lu = f(x)$ chiziqli tenglama uning o'ng tomonidagi o'ng tomonidagi $f(x)$ funksiyaning barcha $x \in \Omega$ uchun nolga teng yoki aynan noldan farqli bo'lishligiga qarab bir jinsli yoki bir jinsli bo'lmagan tenglama deb ataladi.

Osongina ko'rsatish mumkinki, agar $u(x)$ va $v(x)$ funksiyalar bir jinsli bo'lmagan $Lu = f(x)$ chiziqli tenglamaning yechimlari bo'lsa, u holda ularning ayirmasi $w(x) = u(x) - v(x)$ esa $Lw = 0$ bir jinsli tenglamaning yechimi bo'ladi. Bundan tashqari, agar $u_k(x)$, $k = 1, \dots, l$ funksiyalar bir jinsli tenglamaning yechimlari bo'lsa, u holda

$$u = \sum_{k=1}^l c_k u_k(x),$$

bunda c_k — haqiqiy o'zgarmaslar, ham shu tenglamaning yechimi bo'ladi.

(1) tenglamaning tipi

$$K \xi_1, \dots, \xi_n = \frac{\partial F}{\partial p_{\alpha_1 \alpha_2 \dots \alpha_n}} \xi_1^{\alpha_1} \dots \xi_n^{\alpha_n}$$

xarakteristik forma orqali aniqlanadi.

$$a_\alpha(x) D^\alpha u = f(x) \quad (2)$$

$$\alpha \leq m$$

tenglama m -tartibli xususiy hosilali chiziqli differensial tenglamaning umumiy shakli, bunda $\alpha = \alpha_1, \alpha_2, \dots, \alpha_n$ – multiindeks, $\alpha_j \geq 0, j = 1, n$, bundan tashqari α_j – butun sonlar, $|\alpha| = \alpha_1 + \alpha_2 + \dots + \alpha_n$ multiindeks moduli,

$$D^\alpha u = \frac{\partial^{|\alpha|} u}{\partial x_1^{\alpha_1} \dots \partial x_n^{\alpha_n}}$$

bo'lsin. $D^\alpha \rightarrow \xi^\alpha$ almashtirish orqali (2) tenglamaning

$$a_\alpha(x) \xi^\alpha$$

$$\alpha \leq m$$

simvolini hosil qilamiz, bunda $\xi^\alpha = \xi_1^{\alpha_1} \xi_2^{\alpha_2} \dots \xi_n^{\alpha_n}$.

$$a_\alpha(x) \xi^\alpha$$

$$\alpha = m$$

formaga (2) tenglamaning bosh simvoli yoki xarakteristik ko'phadi deb ataladi. $x \in \Omega$ tayinlangan nuqta bo'lsin. Noldan farqli $\xi = \xi_1, \xi_2, \dots, \xi_n \neq 0$ vektor uchun

$$a_\alpha(x) \xi^\alpha = 0$$

$$\alpha = m$$

bo'lsa, u holda bu vektor xarakteristik yo'nalish deb ataladi.

$F(x_1, x_2, \dots, x_n) = 0$ formula bilan berilgan gipersirt uchun har bir nuqta xarakteristik yo'nalishga ega bo'lsa, ya'ni

$$F(x_1, x_2, \dots, x_n) = 0$$

$$a_{\alpha} x \frac{\partial F}{\partial x_1} \dots \frac{\partial F}{\partial x_n} = 0, \quad \text{grad}F \neq 0 \quad (3)$$

bo'lsa, u holda xarakteristik sirt deb ataladi. Bu xarakteristika tenglamasidir, bunda

$$\text{grad}F = \frac{\partial F}{\partial x_1}, \frac{\partial F}{\partial x_2}, \dots, \frac{\partial F}{\partial x_n}.$$

Ikkinchi tartibli kvazichiziqli (barcha yuqori tartibli hosilalarga nisbatan chiziqli) uzluksiz $a_{ij}(x)$ koeffitsiyentli tenglamani qaraymiz:

$$\sum_{i=1}^n \sum_{j=1}^n a_{ij} x \frac{\partial^2 u}{\partial x_i \partial x_j} + \Phi(x, u, \text{grad} u) = 0. \quad (4)$$

$x = x_1, x_2, \dots, x_n$, $n \geq 2$ o'zgaruvchili $F(x)$ funksiya C^1 sinfdan olingan bo'lib, $F(x) = 0$ sirtida $\text{grad}F(x) \neq 0$ va

$$\sum_{i=1}^n \sum_{j=1}^n a_{ij} x \frac{\partial F}{\partial x_i} \cdot \frac{\partial F}{\partial x_j} = 0 \quad (5)$$

bo'lsin. U holda $F(x) = 0$ esa (4) kvazichiziqli differensial tenglamaning xarakteristik sirti deb, (5) tenglama esa xarakteristik

tenglamasi deb aytiladi. $n = 2$ uchun xarakteristik sirti xarakteristik chiziq deb ataladi.

$$\frac{\partial^2 u}{\partial t^2} = a^2 \Delta u$$

to'liq tarqalish tenglamasi uchun xarakteristik tenglama

$$F = 0$$

da

$$\frac{\partial F}{\partial t} - a^2 \sum_{i=1}^n \frac{\partial F}{\partial x_i} = 0$$

shaklga egadir.

Uchi (x_0, t_0) nuqtada bo'lga xarakteristik konus deb ataluvchi

$$a^2 (t - t_0)^2 - (x - x_0)^2 = 0$$

sirt xarakteristik sirt bo'ladi.

$$\frac{\partial u}{\partial t} = a^2 \Delta u + f$$

Issiqlik o'tkazuvchanlik tenglamasi uchun xarakteristik tenglama

$$F = 0$$

da

$$-a^2 \sum_{i=1}^n \frac{\partial F}{\partial x_i} = 0$$

shaklga egadir. Uning xarakteristiklari osongina ko'rinadiki, $t = C$ tekisliklar oilasidan iborat bo'ladi.

$$\Delta u = f$$

Puasson tenglamasi uchun xarakteristik tenglama

$$F = 0$$

da

$$a^2 \sum_{i=1}^n \frac{\partial F}{\partial x_i} = 0$$

shaklga ega. Bundan $F = 0$ da $grad F = 0$ ekanligi kelib chiqadi, bu esa mumkin emas, ya'ni xarakteristik sirtga ega emas.

Endi xususiy hosilali differensial tenglamaning tartibini va uning chiziqli differensial tenglama ekanligini aniqlashga doir misollar keltiramiz:

1-misol. $\sin u_x - u_y - \sin u_x \cos u_y + \sin u_y \cos u_x = 0$

tenglama xususiy hosilali differensial tenglama bo'ladimi?

Yechish:

$$\begin{aligned} \frac{\partial F}{\partial u_x} &= \frac{\partial \sin u_x - u_y - \sin u_x \cos u_y + \sin u_y \cos u_x}{\partial u_x} = \\ &= \cos u_x - u_y - \cos u_x \cos u_y - \sin u_y \sin u_x = \cos u_x \cos u_y + \\ &\sin u_y \sin u_x - \cos u_x \cos u_y - \sin u_y \sin u_x = 0 \end{aligned}$$

Xuddi

shunday,

$$\frac{\partial F}{\partial u_y} = 0$$

Ekanligini ko'rsatish mumkin. F funksiyadan xususiy hosilalar bo'yicha olingan hosilalar nolga teng ekan. Demak, berilgan tenglama xususiy hosilali differensial tenglama bo'lmas ekan.

2-misol. $u_{xx}^2 + u_{yy}^2 - u_{xx} - u_{yy} = 0$ tenglama xususiy hosilali differensial tenglama bo'ladimi?

Yechish: Avval berilgan tenglamani soddalashtirib olaylik.

$$F = u_{xx}^2 + u_{yy}^2 - u_{xx} - u_{yy} \quad ^2 = u_{xx}^2 - u_{yy}^2 - u_{xx}^2 + 2u_{xx}u_{yy} - u_{yy}^2 = \\ = 2u_{xx}u_{yy}. \text{ Endi esa, xususiy hosilalar bo'yicha hosilalarni hisoblaymiz:}$$

$$\frac{\partial F}{\partial u_{xx}} = 2u_{yy} \neq 0, \quad \frac{\partial F}{\partial u_{yy}} = 2u_{xx} \neq 0.$$

Demak, berilgan tenglama 2-tartibli xususiy hosilali differensial tenglama ekan.

3-misol. $\cos^2 u_{xx} + \sin^2 u_{xx} + 4u_x^3 - 2u_y + u = 0$

tenglamaning tartibini aniqlang.

Yechish:

$$\frac{\partial \cos^2 u_{xx} + \sin^2 u_{xx} + 4u_x^3 - 2u_y + u}{\partial u_{xx}} =$$

$$= -2 \cos u_{xx} \sin u_{xx} + 2 \sin u_{xx} \cos u_{xx} = 0$$

$$\frac{\partial \cos^2 u_{xx} + \sin^2 u_{xx} + 4u_x^3 - 2u_y + u}{\partial u_x} = 12u_x^2 \neq 0$$

Demak, berilgan tenglama 1-tartibli xususiy hosilali differensial tenglama ekan.

4-misol. $x^2 u_{xx} + x u_{xy} + \sin y \cdot u_x - y^2 u = 0$

tenglama xususiy hosilali chiziqli differensial tenglama bo'ladimi?

Yechish:

$$\frac{\partial x^2 u_{xx} + x u_{xy} + \sin y \cdot u_x - y^2 u}{\partial u_{xx}} = x^2 \neq 0$$

bo'lgani uchun berilgan tenglama 2-tartibli. Hamda tenglama $Lu = f$ ko'rinishida bo'lib, bu yerda

$$Lu = x^2 u_{xx} + x u_{xy} + \sin y \cdot u_x - y^2 u$$

operator noma'lum funksiya va uning hosilari u_{xx} , u_{xy} , u_x , u larga nisbatan chiziqlidir, chunki

$$\begin{aligned} L(\alpha u + \beta v) &= x^2 (\alpha u + \beta v)_{xx} + x (\alpha u + \beta v)_{xy} + \sin y \cdot (\alpha u + \beta v)_x - y^2 (\alpha u + \beta v) \\ &= \alpha x^2 u_{xx} + \alpha x u_{xy} + \alpha \sin y \cdot u_x - \alpha y^2 u + \beta x^2 v_{xx} + \beta v_{xy} \\ &\quad + \beta \sin y \cdot v_x - \beta y^2 v = \alpha Lu + \beta Lv \end{aligned}$$

Va tenglamaning o'ng tomoni $f(x) = 0$ dir. Shuning uchun 2-tartibli xususiy hosilali bir jinsli chizikli differensial tenglama bo'ladi.

5-misol. $xu_{xx}^2 + x + y u_{xy} - 5y \cdot u_x - y^2 u + \sin(x + y) = 0$

tenglama xususiy hosilali chizikli differensial tenglama bo'ladimi?

Yechish: Berilgan tenglama chizikli differensial tenglama bo'la olmaydi, chunki

$Lu = xu_{xx}^2 + x + y u_{xy} - 5y \cdot u_x - y^2 u$ operator u_{xx} ga nisbatan birinchi tartibli (chizikli) emas.

6-misol.

$$xu_{xxy} + y^2 u_{yyy} - 5y \cdot u_{xy} - \ln y \cdot u_x - y^2 u + \sin(x + y) + x^2 = 0$$

tenglama xususiy hosilali chizikli differensial tenglama bo'ladimi?

Yechish: Berilgan tenglama bir jinsli bo'lmagan chizikli differensial tenglama bo'ladi, chunki

$$Lu = xu_{xxy} + y^2 u_{yyy} - 5y \cdot u_{xy} - \ln y \cdot u_x - y^2 u$$

Operator $u_{xxy}, u_{yyx}, u_{xy}, u_x, u$ larga nisbatan birinchi darajali differensial ifoda va

$$f(x) = -\sin x + y - x^2 \neq 0.$$

7-misol. $u_{xxy} - tgy \cdot u_{yy} + 7y \cdot u_{xy}u_{yy} - y \cdot u_x - yu + xy = 0$

tenglama xususiy hosilali chiziqli differensial tenglama bo'ladimi?

Yechish: Berilgan tenglama chiziqli differensial tenglama bo'la olmaydi, chunki

$$Lu = u_{xxy} - tgy \cdot u_{yy} + 7y \cdot u_{xy}u_{yy} - y \cdot u_x - yu$$

operator u_{xy}, u_{yy} larga nisbatan birinchi darajali differensial ifoda emas. Ammo ushbu tenglama kvazichiziqli differensial tenglama bo'ladi, chunki

$$Lu = u_{xxy} - tgy \cdot u_{yy} + 7y \cdot u_{xy}u_{yy} - y \cdot u_x - yu$$

operator yuqori tartibli hosila u_{xxy} ga nisbatan birinchi darajali differensial ifoda bo'ladi.

Agar mundarijadan "Xususiy hosilali differensial tanglamalarning klassifikatsiyasi va ularning kanonik shakli" mavzusini tanlasak, sahifaning o'ng tomonida quyidagi ma'ruzalar matni hosil bo'ladi.

2-§. XUSUSIY HOSILALI DIFFERENSIAL TENGLAMALARNING KLASSIFIKATSIYASI VA ULARNING KANONIK SHAKLI

Ta'rif. Agar har qanday $\xi \neq 0$ uchun

$$a_\alpha x^0 \xi^\alpha \neq 0$$

$\alpha = m$

(boshqacha qilib aytganda uning haqiqiy xarakteristikasi yo'q) bo'lsa, u holda

$$a_\alpha x D^\alpha u = f(x)$$

$\alpha \leq m$

chiziqli tenglama x^0 nuqtada elliptik tipdagi tenglama deyiladi.

Ta'rif.

Agar

$$\xi_j^2 \neq 0$$

$j=1$

$n-1$

bo'ladigan har qanday ξ_1, \dots, ξ_{n-1} uchun

$$a_\alpha x^0 \xi_1^{\alpha_1} \dots \xi_n^{\alpha_n} = 0$$

$\alpha = m$

tenglama ξ_n o'zgaruvchiga nisbatan m ta haqiqiy va har xil ildizlarga ega bo'lsa, u holda

$$a_{\alpha} x D^{\alpha} u = f(x)$$

$$\alpha \leq m$$

chiziqli tenglama x^0 nuqtada x_n o'q yo'nalishida giperbolik tipdagi tenglama deyiladi.

Ta'rif. Agar x^0 tayinlangan nuqta uchun shunday bir

$$\xi_i = \xi_i \mu_1, \dots, \mu_n, \quad i = 1, 2, \dots, n,$$

o'zgaruvchilarning affin almashtirishini toppish mumkin bo'lib, natijada,

$$a_{\alpha} x^0 \xi^{\alpha}$$

$$\alpha = m$$

forma μ_i o'zgaruvchilarning faqatgina l -tasinigina, bunda $0 < l < n$, saqlasa, u holda

$$a_{\alpha} x D^{\alpha} u = f(x)$$

$$\alpha \leq m$$

Tenglama x^0 nuqtada parabolik maxsuslikka ega yoki parabolik tipdagi tenglama deyiladi.

Ikkinchi tartibli xususiy hosilali chiziqli tenglamani quyidagi shaklda yozish mumkin:

$$\sum_{j=1}^n a_{ij} x_j \cdot u_{x_i x_j} + \sum_{i=1}^n b_i x_i \cdot u_{x_i} + c x u + f x = 0$$

($a_{ij} = a_{ji}$), bunda a, b, c, f funksiyalar $x = x_1, x_2, \dots, x_n$ o'zgaruvchiga bog'liqdir. Yangi ξ_k erkli o'zgaruvchilarni $\xi_k = \xi_k x_1, x_2, \dots, x_n, k = 1, n$ shaklda kiritamiz. U holda

$$u_{x_i} = \sum_{k=1}^n u_{\xi_k} \cdot \alpha_{ik},$$

$$u_{x_i x_j} = \sum_{k=1}^n \sum_{l=1}^n u_{\xi_k \xi_l} \cdot \alpha_{ik} \alpha_{jl} + \sum_{k=1}^n u_{\xi_k} \cdot \xi_k x_i x_j,$$

bunda $\alpha_{ik} = \frac{\partial \xi_k}{\partial x_i}$. Hosila uchun olingan ifodalarni berilgan tenglamaga qo'ysak, quyidagini hosil qilamiz:

$$\sum_{k=1}^n \sum_{l=1}^n a_{kl} \cdot u_{\xi_k \xi_l} + \sum_{k=1}^n b_k \cdot u_{\xi_k} + cu + f = 0,$$

bunda

$$a_{kl} = \sum_{i=1}^n \sum_{j=1}^n a_{ij} \alpha_{ik} \alpha_{jl},$$

$$b_k = \sum_{i=1}^n b_i \cdot \alpha_{ik} + \sum_{i=1}^n \sum_{j=1}^n a_{ij} \cdot \xi_k x_i x_j$$

Endi

$$\sum_{i=1}^n \sum_{j=1}^n a_{ij} x^0 y_i y_j$$

Kvadratik formani qaraymiz. y o'zgaruvchi ustida

$$y_i = \sum_{k=1}^n \alpha_{ik} \eta_k$$

chiziqli almashtirish bajarib,

$$\sum_{k=1}^n \sum_{l=1}^n a_{kl} x^0 \eta_k \eta_l$$

kvadratik formaga ega bo'lamiz, bunda

$$a_{kl} x^0 = \sum_{i=1}^n \sum_{j=1}^n a_{ij} x^0 \alpha_{ik} \alpha_{jl}$$

bo'ladi.

Ma'lumki, chiziqli almashtirishni mos tanlash yo'li bilan kvadratik formaning

$a_{ij} x^0$ matritsasini diagonal shaklga, ya'ni

$$\sum_{i=1}^n \alpha_i \cdot \eta_i^2$$

kanonik shaklga keltirish mumkin bo'lib, bunda $\alpha_i, i = 1, n$ koeffitsiyentlar 1, -1, 0 qiymatlarni qabul qiladi, bundan tashqari inertsia qonuniga ko'ra, musbat, manfiy va nolga teng koeffitsiyentlar soni kvadratik formani kanonik shaklgakeltirishdagi chiziqli almashtirishga invariantdir.

Agar barcha n ta α_i koeffitsiyentlar bir xil ishorali bo'lsa, u holda tenglama x^0 nuqtada elliptik tipdagi tenglama deb, agar $n - 1$ ta α_i koeffitsiyentlar bir xil ishorali va bitta koeffitsiyent unga qarama-qarshi ishorali bo'lsa, u holda tenglama x^0 nuqtada giperbolik tipdagi (yoki normal giperbolik tipdagi) tenglama deb, agar α_i koeffitsiyentlarning m tasi bir xil ishorali va $n - m$ tasi unga qarama-qarshi ishorali $m > 1, n - m > 1$ bo'lsa, u holda tenglama x^0 nuqtada ultragiperbolik tipdagi tenglama deb, agar α_i koeffitsiyentlarning hech bo'lmaganda bittasi nolga teng bo'lsa, u holda tenglama x^0 nuqtada parabolik tipdagi tenglama deb ataladi.

Kanonik formalar:

$$\Delta u + \Phi = 0 \quad \text{elliptik tip ,}$$

$$u_{x_1 x_1} = \sum_{i=2}^n u_{x_i x_i} + \Phi \quad \text{giperbolik tip}$$

$$u_{x_i x_i} = \sum_{i=m+1}^n u_{x_i x_i} + \Phi \quad m > 1, n - m > 1$$

(ultragiperbolik tip)

$$\sum_{i=1}^{n-m} \pm u_{x_i x_i} + \Phi = 0 \quad (m > 0) \quad \text{parabolik tip}$$

O'zgaras koeffitsiyentli bo'lgan holda

$$\sum_{i=1}^n \sum_{j=1}^n a_{ij} u_{x_i x_j} + \sum_{i=1}^n b_i u_{x_i} + cu + f = 0$$

Tenglama uning aniqlanish sohasining barcha nuqtalari uchun bir vaqtda o'zgaruvchilarni chiziqli almashtirish yordamida kanonik shaklga keltiriladi. u funksiya o'rniga $u = v \cdot e^{\lambda_1 x_1 + \lambda_2 x_2 + \dots + \lambda_n x_n}$ tenglik yordamida v yangi funksiyani kiritib va λ_1 o'zgaraslarini tegishli tanlash yordamida biz tenglamani yanada sodda shakldagi kanonik formaga keltirishimiz mumkin bo'ladi.

$n = 2$ uchun

$$v_{\xi\xi} + v_{\eta\eta} + cv + f_1 = 0 \quad \text{elliptik tip ,}$$

$$v_{\xi\eta} + cv + f_1 = 0$$

yoki

$$v_{\xi\xi} - v_{\eta\eta} + cv + f_1 = 0$$

giperbolik tip ,

$$v_{\xi\xi} + b_2 v_{\eta} + f_1 = 0$$

parabolik tip .

Menyu qismining MISOL bo'limi

Menyu qismidan misol bo'limini tanlaganimizda quyidagi oyna hosil bo'ladi.

MUNDARIJA

- [Xususiy hosilali differensial tenglamaning xarakteristikasi haqida tushuncha](#)
- [Xususiy hosilali differensial tenglamalarning klassifikatsiyasi va ularning kanonik shakli](#)
- [Chiziqli bo'lmagan xususiy hosilali differensial tenglamani uning berilgan yechimi bo'ylab sinflarga ajratish](#)
- [Xususiy hosilali differensial tenglamalar sistemasining tipini aniqlash](#)
- [Ikki o'zgaruvchili ikkinchi tartibli xususiy hosilali differensial tenglamalarning umumiy yechimini topishga doir misollar](#)
- [Laplasning Kaskad usuli](#)
- [Foydalanilgan adabiyotlar ro'yxati](#)

Mustaqil yechish misollar

Quyida berilgan tenglamalarning tartibini aniqlang:

1. $\cos^2 u_{xy} + \sin^2 u_{yy} + 4u_x^3 - 2u_y + u = 0.$
2. $\cos^2 u_{yy} + \sin^2 u_{yy} + 4u_x^3 - 2u_y + u = 0.$
3. $\sin(u_{xy} - u_y) - \sin u_{xy} \cos u_y + \sin u_y \cos u_{xy} = 0.$
4. $\cos(u_{xy} - u_y) + \cos u_{xy} \cos u_y + \sin u_y \cos u_x = 0.$
5. $(u_{xx} - u_{yy})^2 - u_{xx}^2 - u_{yy}^2 = 0$
6. $(u_{xx} + u_{yy})^2 - 2u_{xx}u_{yy} = 0$
7. $(u_{xx} + u_y)^2 - u_{xx}^2 - 2u_{xx}u_y + 2u_x^2 + u = 0$
8. $(u_{xx} + u_{yy})^3 - u_{xx}^3 - 3u_{xx}^2u_{yy} - 3u_{xx}u_{yy}^2 - u_{yy}^3 + u_x^3 + u = 0$
9. $(u_{xx} + u_{yy})^3 - u_{xx}^3 - u_{yy}^3 + u_y^2 + 5u = 0$
10. $(u_{xx} - u_{yy})^3 - u_{xx}^3 - 3u_{xx}^2u_{yy} - 3u_{xx}u_{yy}^2 - u_{yy}^3 + u_y^3 + u_x = 0$
11. $\cos^2(u_{xy} + u_{yy}) + \sin^2(u_{xy} + u_{yy}) + u_{yy} - (u_y + 4)^2 + 8u_y + u = 0$
12. $\lg|u_{xx}u_{yy}| - \lg|u_{xx}| - \lg|u_{yy}| + 6u_y^3 + u_x = 0$
13. $(u_{xx} - u_{yy})(u_{xx} + u_{yy}) - \frac{\partial}{\partial x}(u_x - u_y) - \frac{\partial}{\partial y}(u_x - u_y) + 6u_x = 0$
14. $(u_x - u_y)(u_x + u_y) - \frac{\partial}{\partial x}(u_x - u_y) - \frac{\partial}{\partial y}(u_x - u_y) + 6u_x = 0$
15. $2(u_x - 2u)u_{xy} - \frac{\partial}{\partial y}(u_x - 2u)^2 - xy = 0$
16. $\frac{\partial}{\partial x}(u_{yy}^2 - u_y) - 2u_{yy} \frac{\partial}{\partial y}(u_{xx} - u_x) - 2u_x + 2 = 0$
17. $2u_{xx}u_{xxy} - \frac{\partial}{\partial y}(u_{xx} - u_y)^2 - 2u_yu_{xxy} + u_x = 0$
18. $u_{xxy} - \frac{\partial}{\partial y}(u_{xx} - u_y) - 2u_yu_{xx} + u_x = 0$

Menyuning misol bo'limiga murojaat qilganimizda bunda ham ma'ruza bo'limidagi kabi mundarija va asosiy oyna bo'ladi. Faqat mundarijadagi mavzular ro'yxatidan ixtiyoriysini tanlaganimizda shu mavzuga oid mustaqil yechish uchun 25 ta yoki 50 ta misol beriladi.

Masalan: "Xususiy hosilali differensial tenglamaning xarakteristikasi haqida tushuncha" mavzusi tanlanganda web sahifaning o'ng tomonidagi asosiy oynaga quyidagicha mustaqil yechish uchun misollar paydo bo'ladi.

Mustaqil yechish uchun misollar

Quyida berilgan tenglamalarning tartibini aniqlang:

$$1.1 \quad \cos^2 u_{xy} + \sin^2 u_{yy} + 4u_x^3 - 2u_y + u = 0.$$

$$1.2 \quad \cos^2 u_{yy} + \sin^2 u_{yy} + 4u_x^3 - 2u_y + u = 0.$$

$$1.3 \quad \sin u_{xy} - u_y - \sin u_{xy} \cos u_y + \sin u_y \cos u_{xy} = 0.$$

$$1.4 \quad \cos u_{xy} - u_y + \cos u_{xy} \cos u_y + \sin u_y \cos u_x = 0.$$

$$1.5 \quad u_{xx} - u_{yy}^2 - u_{xx}^2 - u_{yy}^2 = 0$$

$$1.6 \quad u_{xx} + u_{yy}^2 - 2u_{xx}u_{yy} = 0$$

$$1.7 \quad u_{xx} + u_y^2 - u_{xx}^2 - 2u_{xx}u_y + 2u_x^2 + u = 0$$

$$1.8 \quad u_{xx} + u_{yy}^3 - u_{xx}^3 - 3u_{xx}^2u_{yy} - 3u_{xx}u_{yy}^2 - u_{yy}^3 + u_x^3 + u = 0$$

$$1.9 \quad u_{xx} + u_{yy}^3 - u_{xx}^3 - u_{yy}^3 + u_y^2 + 5u = 0$$

$$1.10 \quad u_{xx} - u_{yy}^3 - u_{xx}^3 - 3u_{xx}^2u_{yy} - 3u_{xx}u_{yy}^2 - u_{yy}^3 + u_y^3 + u_x = 0$$

$$1.11 \quad \cos^2 u_{xy} + u_{yy} + \sin^2 u_{xy} + u_{yy} + u_{yy} - u_y + 4^2 + 8u_y + u = 0$$

$$1.12 \quad \lg u_{xx}u_{yy} - \lg u_{xx} - \lg u_{yy} + 6u_y^3 + u_x = 0$$

$$1.13 \quad u_{xx} - u_{yy} \quad u_{xx} + u_{yy} - \frac{\partial}{\partial x} u_x - u_y - \frac{\partial}{\partial y} u_x - u_y + 6u_x = 0$$

$$1.14 \quad u_x - u_y \quad u_x + u_y - \frac{\partial}{\partial x} u_x - u_y - \frac{\partial}{\partial y} u_x - u_y + 6u_x = 0$$

$$1.15 \quad 2 u_x - 2u u_{xy} - \frac{\partial}{\partial y} u_x - 2u^2 - xy = 0$$

$$1.16 \quad \frac{\partial}{\partial x} u_{yy}^2 - u_y - 2u_{yy} \frac{\partial}{\partial y} u_{xx} - u_x - 2u_x + 2 = 0$$

$$1.17 \quad 2u_{xx}u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y^2 - 2u_yu_{xxy} + u_x = 0$$

- 1.18 $u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y - 2u_y u_{xx} + u_x = 0$
- 1.19 $\frac{\partial}{\partial x} u_{yy}^2 - u_y - 2u_{yy} \frac{\partial}{\partial x} u_{yy} - u_x - 5u_x = 0$
- 1.20 $tgu_{xx} + ctgu_{xx}^2 - tg^2u_{xx} - ctg^2u_{xx} + 6u_x = 0$
- 1.21 $\cos 2u_{xx} - \cos^2 u_{xx} + \sin^2 u_{xx} - \sin u_{xx} + 8u_x + u = 0$
- 1.22 $\frac{\partial}{\partial y} \cos u_{xx} + \cos^2 u_{xx} + \sin^2 u_{xx} + u_{xxy} \sin u_{xx} + 8u_y + 5u = 0$
- 1.23 $2u_{xy} - 6\frac{\partial}{\partial x} u^2 - xy + u_{yy} = 0$
- 1.24 $tgu_{xx} + ctgu_{yy}^2 - tg^2u_{xx} - ctg^2u_{yy} + 6u_x = 0$
- 1.25 $\frac{\partial}{\partial y} yu_y + u_x^2 - 2u_x u_{xy} + u_x - 6u = 0$

Quyida berilgan xususiy hosilali tenglamalarning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

- 2.1 $2u_{xy} - 6\frac{\partial}{\partial x} u^2 - xy + u_{yy} = 0$
- 2.2 $u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y - 2u_y u_{xx} + u_x + x - 3y = 0$
- 2.3 $u_y u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y - 2u_y u_{xx} + u_x + 4y^2 = 0$
- 2.4 $y \frac{\partial}{\partial y} yu_y + u_x^2 - 2yu_x u_{xy} + u_x - 6u + xe^y = 0$
- 2.5 $2u_{xx} u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y^2 - 2u_y u_{xxy} + u_x = 0$
- 2.6 $\frac{\partial}{\partial x} u_{yy}^2 - u_y - 2u_{yy} \frac{\partial}{\partial y} u_{xx} - u_x - 2u_x + 2 = 0$
- 2.7 $2xu_{xy} - 8\frac{\partial}{\partial x} u^2 - xy - 2u_{yy} = 0$

$$2.8 \quad \frac{\partial}{\partial y} yu_y + u_x^2 - 2u_x u_{xy} + u_{yy} - 6u_x + u + xe^y = 0$$

$$2.9 \quad yu_{xy} + u_{yy} - 6u_x + u^2 + 4xy = 0$$

$$2.10 \quad yu_{xy} + u_{yy} - yu_x + x^2u - 8xy = 0$$

$$2.11 \quad yu_{xyy} + u_{yy} - yu_{xy} + x^2u = 0$$

$$2.12 \quad 2xu_{xy} - 2\frac{\partial}{\partial y} y^2 - xyu - 2u_{yy} + 4y = 0$$

$$2.13 \quad u_{xyy} + xu_{yy} - \cos y \cdot u_{xy} + \sin x^2 u = 0$$

$$2.14 \quad a_{x,y} u_{xx} + 2b_{x,y} u_{xy} + c_{x,y} u_{yy} + d_{x,y} u_x + e_{x,y} u_y + h_{x,y} = 0$$

$$2.15 \quad 3x + 4y u_{xx} + 4x - y u_{xy} + 4x - 3y u_{yy} + x + y u_x + yu_y + 2x + 5y = 0$$

$$2.16 \quad \cos y \cdot u_{xyy} + u_{xxyy} - yu_{xy} + x^2 u^3 + yu = 0$$

$$2.17 \quad tgu_{xx} + ctgu_{xx}^2 - tg^2u_{xx} - ctg^2u_{xx} + 4u_{xx} + u_{xy} - 3u = 0$$

$$2.18 \quad xu_{xxy} - \frac{\partial}{\partial y} xu_{xx} - 3xy - 2u_{xx} + u_x + 3x = 0$$

$$2.19 \quad x^2 yu_{xyy} + 2e^x y^2 u_{yy} - x^2 + y^2 u_{xy} + x^2 u = 0$$

$$2.20 \quad 2u_x u_{xy} - \frac{\partial}{\partial y} yu_y + u_x^2 + yu_{yy} - 6u_x + u + ye^{x+y} = 0$$

$$2.21 \quad u_x - u_y \quad u_x + u_y - \frac{\partial}{\partial x} u_x - u_y - \frac{\partial}{\partial y} u_x - u_y + 6u_x = 0$$

$$2.22 \quad \frac{\partial}{\partial x} u_x - u_y + \frac{\partial}{\partial y} u_x - u_y + x + y u_x + xe^y = 0$$

$$2.23 \quad u_x u_{xyy} + 8e^{x+y} u_{yy} - 9u_{xy} + f_{x,y} u = 0$$

$$2.24 \quad u_{xyy} + xye^{xy} u_{xy} - 9xu_{yy} + 7u_{yzz} + f_{x,y,z} u = 0$$

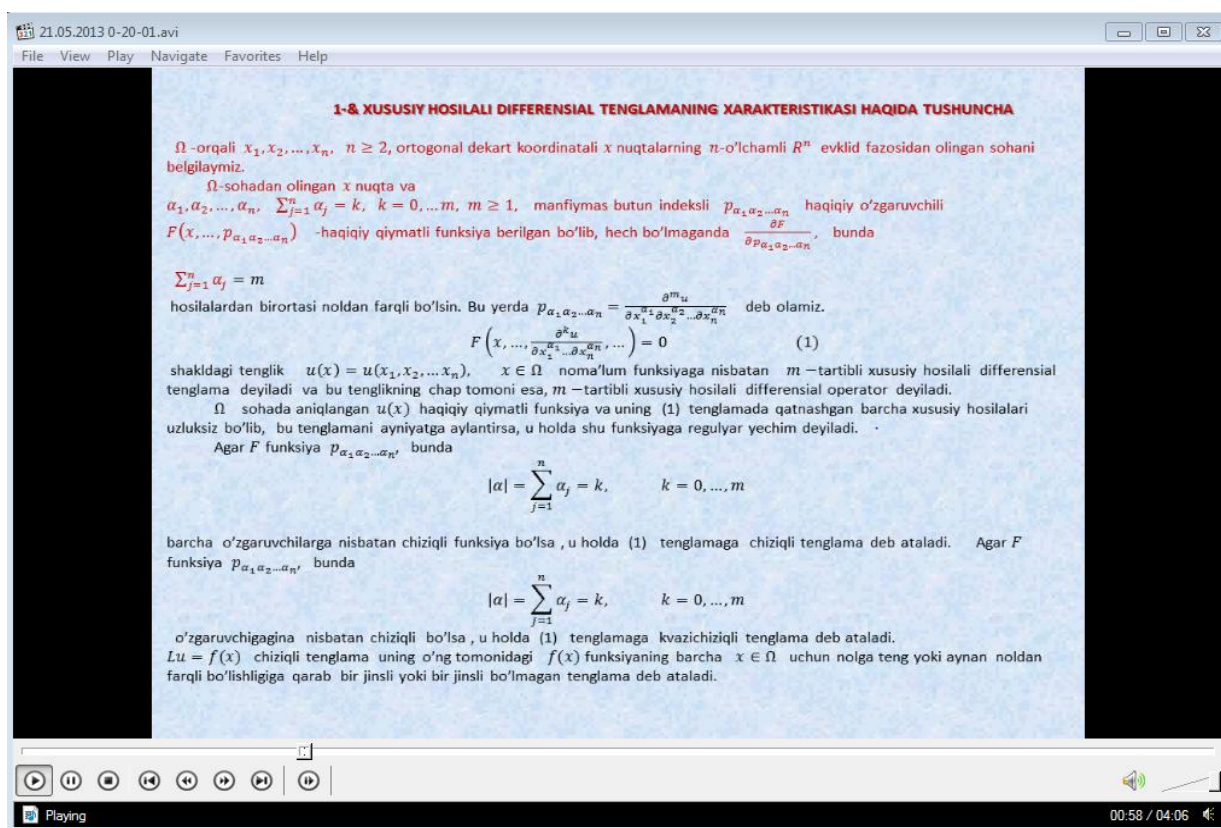
$$2.25 \quad u_t - 6uu_x + u_{xxx} = 0.$$

Mundarijadagi qolgan mavzularga ham xuddi shunday gipermurojaatlar qo'yilgan bo'lib, shu mavzular ichidan ixtiyoriy mavzuni tanlaganimizda yuqoridagi kabi mustaqil yechish uchun misollarni elektron o'quv qo'llanmaning o'ng tomonidagi asosiy oynaga chiqarib beradi.

Misollarni formulalarni HTML tilida teglar yordamida kiritish birmuncha qiyinchiliklar tug'dirishi sababli formulalarni rasm ko'rinishida kiritamiz. Buning uchun HTML tilining `` toq tegidan foydalanamiz.

Menyu qismining O'qish bo'limi

Menyudan o'qish bo'limini tanlaganimizda bunda ham ma'ruza va misol bo'limlaridagi kabi bo'ladi. Bunda ham mundarijadan ixtiyoriy mavzuni tanlaganimizda shu mavzuga mos ma'ruzalar matnining ovozli varianti hosil bo'ladi ya'ni quyidagicha video ko'rinishida bo'ladi.



Bunda o'qib borilayotgan joyi qizil rangda o'zgarib boradi.

Ushbu videoni animatsiyasiz ya'ni o'qilayotgan joyini boshqa rangda o'zgarib borishini Power pointda hosil qilamiz va buni windows media video qilib saqlaymiz yoki ekranni o'zini videoga olamiz. Ushbu videoni web sahifaga joylashtirish uchun MS Front Page redaktorining obyektlar bilan ishlash funksiyasidan ya'ni redaktor oynasining pastki qismidagi instrumentlar qatoridan yoki Вставка → Рисунок → { из файла... видеозапись } tanlanadi.

Menyu qismining Test bo'limi

Menyudan test bo'limini tanlasak quyidagi oyna hosil bo'ladi.

1	Tenglamani tipini aniqlang $4u_{xx} + 2u_{yy} - 6u_{xz} + 6u_{xy} + 10u_{yz} + 4u_{yz} + 2u = 0$
<input type="radio"/> A)	Parabolik
<input type="radio"/> B)	Elliptik
<input type="radio"/> C)	Giperbolik
2	Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring: $3u_{yy} - 2u_{xy} - 2u_{yz} + 4u = 0$
<input type="radio"/> A)	$v_{\xi\xi} - v_{\eta\eta} + 4v = 0, \quad \xi = y + z, \quad \eta = -y - 2z, \quad \zeta = x - z$
<input type="radio"/> B)	$v_{\xi\xi} - v_{\zeta\zeta} + 4v = 0, \quad \xi = x + y + z, \quad \eta = -y - z, \quad \zeta = x + y - z$
<input type="radio"/> C)	$v_{\eta\eta} + v_{\zeta\zeta} - 4v = 0, \quad \xi = x + y + z, \quad \eta = x - y - 2z, \quad \zeta = x - z$
3	Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring: $u_{xx} + 2u_{xy} + 2u_{yy} + 4u_{yz} + 5u_{zz} = 0$
<input type="radio"/> A)	$v_{\xi\xi} - v_{\eta\eta} - v_{\zeta\zeta} = 0, \quad \xi = -x, \quad \eta = -x + y, \quad \zeta = 2x + 2y + z$
<input type="radio"/> B)	$v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} = 0, \quad \xi = x, \quad \eta = -x + y, \quad \zeta = 2x - 2y + z$
<input type="radio"/> C)	$v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} = 0, \quad \xi = x, \quad \eta = -x + y, \quad \zeta = 2x - 2y + z$
4	Quyida berilgan tenglamalar sistemasining tipini aniqlang: $\begin{cases} 15u_x + 9v_x + 12u_y + 17v_y - 3x \cdot \cos y = 0 \\ 3u_x + 2v_x + u_y - 6u = 0. \end{cases}$
<input type="radio"/> A)	Giperbolik
<input type="radio"/> B)	Elliptik
<input type="radio"/> C)	Parabolik
5	Quyida berilgan xususiy hosilali differensial tenglamani tipini saqlanadigan sohalarida kanonik shaklga keltiring: $u_{xx} + 4u_{xy} + 10u_{yy} - 24u_x + 42u_y + 2(x + y) = 0$
<input type="radio"/> A)	$v_{\xi\eta} + v_{\eta\eta} + 15v_{\xi} - 4\sqrt{6}v_{\eta} + \frac{1}{3}\xi = 0, \quad \xi = y - 2x, \quad \eta = \sqrt{6}x.$
<input type="radio"/> B)	$v_{\xi\xi} + v_{\eta\eta} + 15v_{\xi} + 4\sqrt{6}v_{\eta} - \frac{1}{6}\xi + \frac{1}{\sqrt{6}}\eta = 0, \quad \xi = y + 2x, \quad \eta = \sqrt{6}x.$
<input type="radio"/> C)	$v_{\xi\xi} + v_{\eta\eta} + 15v_{\xi} - 4\sqrt{6}v_{\eta} + \frac{1}{3}\xi + \frac{1}{\sqrt{6}}\eta = 0, \quad \xi = y - 2x, \quad \eta = \sqrt{6}x.$

Bunda barcha mavzular bo'yicha quyidagicha 100 ta test tuzilgan.

TEST

1. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$\cos u_x + u_y - \cos u_x \cdot \cos u_y + \sin u_x \cdot \sin u_y = 0$$

A) Yo'q; B) Ha; C) To'g'ri javob yo'q;

2. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$u_{xx}^2 + u_{yy}^2 - u_{xx} - u_{yy}^2 = 0$$

A) Ha; B) Yo'q; C) To'g'ri javob yo'q;

3. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$\sin^2 u_{xx} + u_{xy} + \cos^2 u_{xx} + u_{xy} - u = 1$$

A) Yo'q; B) Ha; C) To'g'ri javob yo'q;

4. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$\sin u_{xy} + u_x - \sin u_{xy} \cos u_x - \cos u_{xy} \sin u_x + 2u = 0$$

A) Yo'q; B) Ha; C) To'g'ri javob yo'q;

5. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$\frac{\partial}{\partial x} tgu - u_x \sec^2 u - 3u + 2 = 0$$

A) Yo'q; B) Ha; C) To'g'ri javob yo'q;

6. Quyida berilgan tenglama xususiy hosilali differensial tenglama bo'ladimi?

$$\log u_x u_y - \log u_x - \log u_y + 5u - 6 = 0$$

A) Yo'q; B) Ha; C) To'g'ri javob yo'q;

7. Tenglama nechanchi tartibligini aniqlang?

$$\log u_{xx}u_{yy} - \log u_{xx} - \log u_{yy} + u_x + u_y = 0$$

A) Birinchi; B) Ikkinchi; C) Nolinchi;

8. Tenglama nechanchi tartibliligini aniqlang?

$$u_x u_{xy}^2 + u_{xx}^2 - 2u_{xy}^2 + u_y^2 - 2xy = 0$$

A) Ikkinchi; B) Birinchi; C) Uchinchi;

9. Tenglama nechanchi tartibliligini aniqlang?

$$\cos^2 u_{xy} + \sin^2 u_{xy} - 2u_x^2 - 3u_y + u = 0$$

A) Birinchi; B) Ikkinchi; C) Nolinchi;

10. Tenglama nechanchi tartibliligini aniqlang?

$$2u_x - 2u u_{xy} - \frac{\partial}{\partial y} u_x - 2u^2 - xy = 0$$

A) Birinchi; B) Ikkinchi; C) Nolinchi;

11. Tenglama nechanchi tartibliligini aniqlang?

$$\frac{\partial}{\partial x} u_{yy}^2 - u_y - 2u_{yy} \frac{\partial}{\partial y} u_{xy} - u_x - 2u_x + 2 = 0$$

A) Ikkinchi; B) Birinchi; C) Uchinchi;

12. Tenglama nechanchi tartibliligini aniqlang?

$$2u_{xx}u_{xxy} - \frac{\partial}{\partial y} u_{xx} - u_y^2 - 2u_y u_{xxy} + u_x = 0$$

A) Ikkinchi; B) Birinchi; C) Uchinchi;

13. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$u_x u_{xy}^2 + 2xuu_{yy} - 3xyu_y - u = 0$$

A) Chiziqli emas; B) Chiziqli; C) Kvazichiziqli.

14. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$u_y u_{xx} - 3x^2 u u_{xy} + 2u_x - f(x, y) u = 0$$

A) Kvazichiziqli. B) Chiziqsiz, bir jinsli emas; C) Chiziqli;

15. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$2 \sin x + y \cdot u_{xx} - x \cdot \cos y \cdot u_{xy} + xy u_x - 3u + 1 = 0$$

A) Chiziqli, bir jinsli emas; B) Kvazichiziqli, bir jinsli; C) Chiziqsiz, bir jinsli emas.

16. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$x^2 y u_{xxy} + 2e^x y^2 u_{xy} - x^2 y^2 + 1 u_{xx} - 2u = 0$$

A) Chiziqli, bir jinsli; B) Kvazichiziqli, bir jinsli emas; C) Chiziqsiz, bir jinsli emas.

17. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$3u_{xy} - 6u_{xx} + 7u_y - u_x + 8x = 0$$

A) Chiziqli, bir jinsli emas; B) Kvazichiziqli, bir jinsli; C) Chiziqsiz, bir jinsli emas.

18. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$u_{xy} u_{xx} - 3u_{yy} - 6xu_y + xyu = 0$$

A) Chiziqsiz, bir jinsli; B) Kvazichiziqli, bir jinsli; C) Chiziqli, bir jinsli emas.

19. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$a(x, y) u_{xx} + b(x, y) u_{xy} + c(x, y) u_{yy} + d(x, y) u_x + e(x, y) u_y + h(x, y) = 0$$

A) Chiziqli, bir jinsli emas agar $h(x, y) \neq 0$ bo'lsa;

B) Kvazichiziqli, bir jinsli agar $h(x, y) \neq 0$ bo'lsa;

C) Chiziqsiz, bir jinsli emas agar $h(x, y) = 0$ bo'lsa.

20. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$a x, y, u_x, u_{xy} u_{xyy} + b x, y, u_{yy} u_{yyy} + 2uu_x^2 - f x, y = 0$$

A) Kvazichiziqli, bir jinsli agar $f x, y = 0$ bo'lsa;

B) Chiziqli, bir jinsli agar $f x, y \neq 0$ bo'lsa;

C) Chiziqsiz, bir jinsli emas agar $f x, y = 0$ bo'lsa.

21. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$u_{xy} + u_y + u^2 - xy = 0$$

A) Kvazichiziqli, bir jinsli emas; B) Chiziqli, bir jinsli emas

C) Chiziqsiz, bir jinsli;

22. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$u_{xy} + 2 \frac{\partial}{\partial x} u_x^2 + u - 6x \cdot \sin y = 0$$

A) Kvazichiziqli; B) Chiziqli; C) Chiziqsiz;

23. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$2u_{xy} - 6 \frac{\partial}{\partial x} u^2 - xy + u_{yy} = 0$$

A) Kvazichiziqli, bir jinsli emas; B) Chiziqli, bir jinsli emas

C) Chiziqsiz, bir jinsli;

24. Quyida berilgan xususiy hosilali differensial tenglamaning chiziqli, kvazichiziqli, bir jinsli yoki bir jinsli emasligini aniqlang:

$$\frac{\partial}{\partial y} yu_y + u_x^2 - 2u_x u_{xy} + u_x - 6u = 0$$

A) Chiziqli, bir jinsli; B) Kvazichiziqli, bir jinsli emas;

C) Chiziqsiz, bir jinsli emas;

25. Tenglamaning tipini aniqlang:

$$u_{xx} + 4u_{xy} + u_{yy} + u_x + u_y + 2u - x^2 y = 0$$

A) Giperbolik; B) Parabolik; C)Elliptik.

26. Tenglamaning tipini aniqlang:

$$2u_{xx} + 2u_{xy} + u_{yy} + 2u_x + 2u_y - u = 0$$

A) Elliptik; B) Parabolik; C)Giperbolik.

27. Tenglamaning tipini aniqlang:

$$u_{xx} + 2u_{xy} + u_{yy} + u_x + u_y + 3u - xy^2 = 0$$

A) Parabolik; B) Giperbolik; C)Elliptik.

28. Tenglamaning tipini aniqlang:

$$4u_{xx} + 2u_{yy} - 6u_{zz} + 6u_{xy} + 10u_{xz} + 4u_{yz} + 2u = 0$$

A) Parabolik; B) Giperbolik; C)Elliptik.

29. Tenglamaning tipini aniqlang:

$$2u_{xy} - 2u_{xz} + 2u_{yz} + 3u_x - u = 0$$

A) Giperbolik; B) Parabolik; C)Elliptik.

30. Tenglamaning tipini aniqlang:

$$u_{xx} + 2u_{xy} + 2u_{yy} + 4u_{yz} + 5u_{zz} - xu_x + yu_z = 0$$

A) Elliptik; B) Giperbolik; C)Parabolik.

31. Tenglamaning tipini aniqlang:

$$u_{xx} - 4u_{xy} + 2u_{xz} + 4u_{yy} + u_{zz} - 2xyu_x + 3xu = 0$$

A) Giperbolik; B) Elliptik; C)Parabolik.

32. Tenglamaning tipini aniqlang:

$$u_{xy} + u_{yz} + u_{xz} - 3x^2u_y + y \cdot \sin xu + xe^{-y} = 0$$

A) Giperbolik; B) Elliptik; C)Parabolik.

33. Tenglamaning tipini aniqlang:

$$5u_{xx} + u_{yy} + 5u_{zz} + 4u_{xy} - 8u_{xz} - 4u_{yz} - u + yz^2 \cdot \sin x = 0$$

A) Elliptik; B) Giperbolik; C)Parabolik.

34. Tenglamani tipini aniqlang:

$$u_{xx} + 2u_{xy} + 2u_{yy} - 2u_{yz} + 3u_z - u = 0$$

A) Giperbolik; B) Parabolik; C)Elliptik.

35. Tenglamani tipini aniqlang:

$$3u_{xx} + 4u_{yy} + 5u_{zz} + 4u_{xy} - 4u_{yz} + 2u_x - u_y + xye^z = 0$$

A) Elliptik; B) Giperbolik; C)Parabolik.

36. Quyidagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$u_{xx}^2 + u_{xx} - 2u_{xy} - u_{yy}^2 = 0, \quad u = x^2 + y^2$$

A) Giperbolik; B) Parabolik; C)Elliptik.

37. Quyidagi tenglamani berilgan $u(x,y)$ yechimlar bo'ylab tipini aniqlang:

$$u_{xy}^2 + u_{xx}u_{yy} + u_{yy}^2 = 8, \quad 1) u = x^2 + y^2, \quad 2) u = 2\sqrt{2}xy.$$

A) 1) Elliptik, 2)Giperbolik; B)1) Giperbolik 2)Parabolik;
C) 1)Parabolik 2) Elliptik.

38. Quyidagi tenglamani berilgan $u(x,y)$ yechimlar bo'ylab tipini aniqlang:

$$u_{xx}^2 - 4u_{xy} + u_{yy}^2 = 0, \quad 1) u = x + y^2, \quad 2) u = x,$$

A) 1) Elliptik, 2)Giperbolik; B)1) Giperbolik 2)Parabolik;
C) 1)Parabolik 2) Elliptik.

39. Quyidagi tenglamani berilgan $u(x,y)$ yechimlar bo'ylab tipini aniqlang:

$$u_{xx} + u_{xy}u_{yy} + u_{yy}^2 - 4u_{yy} = 0, \quad 1) u = 2y^2, \quad 2) u = 5xy, \\ 3) u = x.$$

- A) 1)Parabolik, 2)Elliptik, 3)Giperbolik ;
 B) 1)Giperbolik, 2)Elliptik, 3)Parabolik ;
 C) 1)Elliptik, 2)Giperbolik, 3)Parabolik;

40. Quydagi tenglamani berilgan $u(x,y)$ yechimlar bo'ylab tipini aniqlang:

$$3u_{xx}^2 - 6u_{xy} + u_{yy} - 4 = 0, \quad u = \frac{1}{2}x^2 + y^2, \quad u = 2y^2$$

- A) 1) Parabolik, 2)Giperbolik; B)1) Giperbolik 2)Parabolik;
 C)1)Parabolik 2) Elliptik.

41. Quydagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$u_{xx}^2 u_{xy} - 5u_{yy} + u_x - 2x + y - 8 = 0, \quad u = x^2 + 2xy$$

- A)Giperbolik; B) Parabolik; C) Elliptik.

42. Quydagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$u_{xx}^4 + 2u_{xy}^2 - 3u_{yy} + u_y - 2x = 0, \quad u = 2xy - 8y.$$

- A)Giperbolik; B) Parabolik; C) Elliptik.

43. Quydagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$2u_{xx}^3 + 2u_{xy}^5 + 3u_{yy} - 2u_y + 2x = 0, \quad u = xy - \frac{1}{2}x^2$$

- A)Giperbolik; B) Parabolik; C) Elliptik.

44. Quydagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$5u_{xx}^5 - 7u_{xy} + 25u_{yy} - 150y = 0, \quad u = \frac{x^2}{2} + y^3 + \frac{5}{7}xy$$

- A) Elliptik; B) Giperbolik; C) Parabolik.

45. Quydagi tenglamani berilgan $u(x,y)$ yechimlar bo'ylab tipini aniqlang:

$$u_{xx}^2 + 5u_{xy}^2 + 6u_{yy}^2 = 12, \quad 1) u = \frac{1}{2} x + y^2, \quad 2) u = \sqrt{3}x^2.$$

- A) 1) Giperbolik 2) Parabolik; B) 1) Parabolik, 2) Giperbolik;
C) 1) Parabolik 2) Elliptik.

46. Quyidagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$u_{xx}^3 - 4u_{xy}^2 + 7u_{yy} - 4u_x + u_y + 3x + 4y + 3 = 0, \quad u = \frac{1}{2}x^2 + xy.$$

- A) Elliptik; B) Giperbolik; C) Parabolik.

47. Quyidagi tenglamani berilgan $u(x,y)$ yechim bo'ylab tipini aniqlang:

$$u_{xx}^2 - 2u_{xy}^2 + u_{yy}^2 + 2u_x - 2x + y = 0, \quad 1) u = \frac{1}{2} x + y^2.$$

- A) Parabolik; B) Giperbolik; C) Elliptik.

48. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned} 2u_x + 3u_y - 3v_y + u &= 0 \\ -u_x + u_y + v_x + xy &= 0. \end{aligned}$$

- A) Elliptik; B) Giperbolik; C) Parabolik.

49. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned} 2u_x + 3v_y + 3u_y - 6u &= 0 \\ u_x + u_y + v_x + x^2u &= 0. \end{aligned}$$

- A) Giperbolik; B) Parabolik; C) Elliptik.

50. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned} 2u_x + 3v_y + 3u_y - 2u &= 0 \\ u_x + v_x - u + xy^2 &= 0. \end{aligned}$$

- A) Parabolik; B) Giperbolik; C) Elliptik.

51. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned} 2u_x - 4v_x + 3u_y + 8v_y - u &= 0 \\ 3u_x - 2v_x + 6u_y + 3v_y + 2u &= 0. \end{aligned}$$

- A) Giperbolik; B) Parabolik; C) Elliptik.

52. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$2u_x + v_x + 12u_y - 2u = 0$$

$$v_x + 4u_y + v_y + xy = 0.$$

A) Giperbolik; B) Parabolik; C) Elliptik.

53. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$2u_x + v_x + 7u_y - 2u = 0$$

$$3u_x + 3v_x + 31u_y + v_y - e^y \cdot \sin x = 0.$$

A) Elliptik ; B) Giperbolik; C) Parabolik;

54. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$5u_x + 22.5v_x + 2u_y + v_y - 6u = 0$$

$$5v_x + 2u_y + 3v_y - 2xu = 0.$$

A) Parabolik; B) Giperbolik; C) Elliptik.

55. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$v_x + 12u_y + v_y + 3u - 32xe^y = 0$$

$$-5u_x + \frac{5}{6}v_x + u_y + v_y - e^x u = 0.$$

A) Elliptik; B) Giperbolik; C) Parabolik.

56. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$15u_x + 9v_x + 12u_y + 17v_y - 3x \cdot \cos y = 0$$

$$3u_x + 2v_x + v_y - 6u = 0.$$

A) Parabolik; B) Giperbolik; C) Elliptik.

57. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$3u_x + 3v_x + 3u_y + 4v_y = 0$$

$$2u_x + 3v_x - v_y - 3u = 0.$$

A) Giperbolik; B) Parabolik; C) Elliptik.

58. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$u_x - v_y + 2u_z - 3v_z - u = 0$$

$$u_y + 2v_x - 2u_z + v_y + 2u = 0.$$

A) Giperbolik; B) Parabolik; C) Elliptik.

59. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned}u_x - u_y + 2v_y - 3v_z + 2u &= 0 \\u_x + 2u_z - v_x + v_z - u &= 0.\end{aligned}$$

A) Giperbolik; B) Parabolik; C) Elliptik.

60. Quyida berilgan tenglamalar sistemasining tipini aniqlang:

$$\begin{aligned}u_x + u_y + v_y + v_z - xyu &= 0 \\v_x - u_y - v_y + u_z + 2u &= 0.\end{aligned}$$

A) Parabolik; B) Giperbolik; C) Elliptik.

61. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} + 2u_{xy} + 5u_{yy} - 32u = 0$$

A) $v_{\xi\xi} + v_{\eta\eta} - 8v = 0, \quad \xi = y - x, \quad \eta = 2x$

B) $v_{\xi\eta} + v_{\eta\eta} - v = 0, \quad \xi = y + x, \quad \eta = 2x - y$

C) $v_{\xi\xi} - v_{\eta} - 8v = 0, \quad \xi = y + x, \quad \eta = x - y$

62. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} - 2u_{xy} + u_{yy} + 9u_x + 9u_y - 9u = 0$$

A) $v_{\eta\eta} + 18v_{\xi} + 9v_{\eta} - 9v = 0, \quad \xi = x + y, \quad \eta = x$

B) $v_{\xi\xi} + 18v_{\xi} + 9v_{\eta} - v = 0, \quad \xi = x + y, \quad \eta = x$

C) $v_{\xi\eta} + 18v_{\xi} + v_{\eta} - 9v = 0, \quad \xi = x + y, \quad \eta = x$

63. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$2u_{xx} + 3u_{xy} + u_{yy} + 7u_x + 4u_y - 2u = 0$$

A) $v_{\xi\eta} + 3v_{\xi} - v_{\eta} + 2v = 0, \quad \xi = y - x, \quad \eta = 2y - x.$

B) $v_{\xi\eta} + 3v_{\xi} - v = 0, \quad \xi = y - x, \quad \eta = 2y + x.$

C) $v_{\xi\eta} - v_{\eta} + 2v = 0, \quad \xi = y + x, \quad \eta = 2y - x.$

64. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} + u_{xy} - 2u_{yy} - 3u_x - 15u_y + 27x = 0$$

A) $v_{\xi\eta} + v_{\xi} - 2v_{\eta} + \xi + \eta = 0, \quad \xi = 2x - y, \quad \eta = x + y.$

B) $v_{\xi\eta} - 2v_\eta + \xi + \eta = 0, \quad \xi = 2x + y, \quad \eta = x + y$

C) $v_{\xi\eta} + v_\xi + \xi = 0, \quad \xi = x - y, \quad \eta = 2x + y$

65. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$9u_{xx} - 6u_{xy} + u_{yy} + 10u_x - 15u_y - 50u + x - 2y = 0$$

A)

$$27v_{\eta\eta} - 105v_\xi + 30v_\eta - 150v - 2\xi + 5\eta = 0, \quad \xi = x + 3y, \quad \eta = x.$$

B)

$$27v_{\xi\xi} - 105v_\xi + 30v_\eta - 150v - \xi + 5\eta = 0, \quad \xi = x + 3y, \quad \eta = x.$$

C)

$$27v_{\xi\eta} - 105v_\xi + 30v_\eta - 150v - 2\xi + \eta = 0, \quad \xi = x + 3y, \quad \eta = x.$$

66. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} + 4u_{xy} + 10u_{yy} - 24u_x + 42u_y + 2(x + y) = 0$$

A)

$$v_{\xi\xi} + v_{\eta\eta} + 15v_\xi - 4\bar{6}v_\eta + \frac{1}{3}\xi + \frac{1}{\bar{6}}\eta = 0, \quad \xi = y - 2x, \quad \eta = \bar{6}x.$$

B) $v_{\xi\eta} + v_{\eta\eta} + 15v_\xi - 4\bar{6}v_\eta + \frac{1}{3}\xi = 0, \quad \xi = y - 2x, \quad \eta = \bar{6}x.$

C)

$$v_{\xi\xi} + v_{\eta\eta} + 15v_\xi + 4\bar{6}v_\eta - \frac{1}{6}\xi + \frac{1}{\bar{6}}\eta = 0, \quad \xi = y + 2x, \quad \eta = \bar{6}x.$$

67. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} + 4u_{xy} + 13u_{yy} + 3u_x + 24u_y - 9u + 9(x + y) = 0$$

A) $v_{\xi\xi} + v_{\eta\eta} - 2v_\xi + v_\eta - v + \eta - \xi = 0, \quad \xi = 2x - y, \quad \eta = 3x.$

B) $v_{\xi\xi} - v_{\eta\eta} + 4v_\xi - v + \eta - \xi = 0, \quad \xi = 2x - y, \quad \eta = x.$

C) $v_{\xi\eta} + v_{\eta\eta} - 2v_\xi + v_\eta - v + \eta - \xi = 0, \quad \xi = 2x - y, \quad \eta = x.$

68. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$1 + x^2 u_{xx} + u_{yy} + 2x(1 + x^2) u_x = 0$$

A) $v_{\xi\xi} + v_{\eta\eta} = 0, \quad \xi = y, \quad \eta = \arctg x.$

B) $v_{\xi\eta} + v_{\eta\eta} = 0, \quad \xi = x, \quad \eta = \arctg y.$

A) $v_{\xi\xi} - v_{\eta\eta} + 2v_\xi = 0, \quad \xi = y, \quad \eta = \arctg x.$

69. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$y^2 u_{xx} + 2xy u_{xy} + x^2 u_{yy} = 0$$

A) $v_{\eta\eta} - \frac{\xi}{2\eta} v_\xi + \frac{1}{2\eta} v_\eta = 0, \quad \xi = y^2 - x^2, \quad \eta = x^2.$

B) $v_{\eta\eta} + v_{\xi\xi} - \frac{\xi}{2\eta} v_\xi + \frac{1}{2\eta} v_\eta = 0, \quad \xi = y^2 + x^2, \quad \eta = x^2.$

C) $v_{\xi\eta} - \frac{\xi}{2\eta} v_\xi + \frac{1}{2\eta} v_\eta = 0, \quad \xi = y^2 - x^2, \quad \eta = x^2.$

70. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} - (1 + y^2) u_{yy} - 2y(1 + y^2) u_y = 0$$

A) $v_{\xi\eta} = 0, \quad \xi = x + \arctg y, \quad \eta = x - \arctg y.$

B) $v_{\xi\xi} - v_{\eta\eta} = 0, \quad \xi = x + \arctg y, \quad \eta = x - \arctg y$

C) $v_{\xi\xi} = 0, \quad \xi = x - \arctg y, \quad \eta = x.$

71. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$1 + x^2 u_{xx} + (1 + y^2) u_{yy} + xu_x + yu_y - 2u = 0$$

A)

$$v_{\xi\xi} + v_{\eta\eta} - 2v = 0, \quad \xi = \ln x + \sqrt{1 + x^2},$$

$$\eta = \ln y + \sqrt{1 + y^2}$$

B)

$$v_{\xi\xi} - v_{\xi\eta} - 2v = 0, \quad \xi = \ln x + \sqrt{1 + x^2},$$

$$\eta = \ln y + \sqrt{1 + y^2}$$

C) $v_{\xi\xi} + v_{\eta\eta} + v_\eta = 0, \quad \xi = \ln x - \sqrt{1 + x^2},$

$$\eta = \ln y - \sqrt{1 + y^2}$$

72. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring

$$x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} - 2yu_x + ye^{y/x} = 0$$

A) $v_{\eta\eta} + 2\frac{\xi^2}{\eta^2} v_\xi + \frac{1}{\eta} e^\xi = 0 \quad \xi = \frac{y}{x}, \quad \eta = y.$

B) $v_{\xi\eta} + 2\frac{\xi^2}{\eta^2} v_\eta + \frac{1}{\eta} e^\xi = 0 \quad \xi = \frac{y}{x}, \quad \eta = y$

C) $v_{\xi\xi} + 2\frac{\xi^2}{\eta^2} v_\xi + \frac{1}{\eta} e^\xi = 0 \quad \xi = \frac{y}{x}, \quad \eta = xy$

73. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring

$$xy^2 u_{xx} - 2x^2 y u_{xy} + x^3 u_{yy} - y^2 u_x = 0$$

A) $v_{\eta\eta} + \frac{2\eta^2}{\xi - \eta^2} v_\xi - \frac{1}{\eta} v_\eta = 0, \quad \xi = x^2 + y^2, \quad \eta = x$

B) $v_{\xi\xi} + \frac{2\eta^2}{\xi - \eta^2} v_\xi - \frac{1}{\xi} v_\eta = 0, \quad \xi = x^2 + y^2, \quad \eta = x$

C) $v_{\eta\eta} + \frac{2\eta^2}{\xi - \eta^2} v_\eta - \frac{1}{\eta} v_\xi = 0, \quad \xi = x^2 - y^2, \quad \eta = x$

74. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$u_{xx} - 2 \sin x u_{xy} - \cos^2 x u_{yy} - \cos x u_y = 0$$

A) $v_{\xi\eta} = 0, \quad \xi = x + y - \cos x, \quad \eta = -x + y - \cos x$

B) $v_{\xi\eta} + v_\xi = 0, \quad \xi = x - y - \cos x, \quad \eta = x + y - \cos x$

C) $v_{\xi\eta} - v_\eta = 0, \quad \xi = -x + y - \cos x, \quad \eta = x + y - \cos x$

75. Quyida berilgan xususiy hosilali differensial tenglamani tipi saqlanadigan sohalarda kanonik shaklga keltiring :

$$e^{2x} u_{xx} + 2e^{x+y} u_{xy} + e^{2y} u_{yy} - xu = 0$$

A) $v_{\eta\eta} - \frac{\xi}{1 + \xi e^\eta} v_\xi - \eta e^{-2\eta} v = 0, \quad \xi = e^{-y} - e^{-x}, \quad \eta = x$

$$B) v_{\eta\eta} + \frac{\xi}{1+\xi e^\eta} v_\xi + \eta e^{-2\eta} = 0, \quad \xi = e^{-y} - e^{-x}, \quad \eta = x$$

$$C) v_{\xi\eta} - \frac{\xi}{1+\xi e^\eta} v_\xi - \eta e^{-2\eta} v = 0, \quad \xi = e^{-y} + e^{-x}, \quad \eta = -x$$

76. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring :

$$u_{xx} - 4u_{xy} + 5u_{yy} - 3u_x + u_y + u = 0.$$

A)

$$w_{\xi\xi} + w_{\eta\eta} - \frac{15}{2}w = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\frac{5\xi+3\eta}{2}} w(\xi,\eta)$$

$$B) w_{\xi\eta} - w_{\eta\eta} + \frac{15}{2}w = 0, \quad \xi = 2x + y, \quad \eta = x,$$

$$v_{\xi,\eta} = e^{\frac{5\xi+3\eta}{2}} w(\xi,\eta)$$

$$C) w_{\xi\xi} - w_{\eta\eta} = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\frac{5\xi+3\eta}{2}} w(\xi,\eta)$$

77. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring :

$$u_{xx} - 6u_{xy} + 9u_{yy} - u_x + 2u_y = 0.$$

$$A) w_{\eta\eta} - w_\xi = 0, \quad \xi = 3x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\frac{-\xi+2\eta}{4}} w(\xi,\eta)$$

$$B) w_{\eta\eta} + w_{\xi\eta} = 0, \quad \xi = 3x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\frac{-\xi+2\eta}{4}} w(\xi,\eta)$$

$$C) w_{\eta\eta} - w_{\xi\xi} = 0, \quad \xi = 3x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\frac{-\xi+2\eta}{4}} w(\xi,\eta)$$

78. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$2u_{xy} - 4u_{yy} + u_x - 2u_y + u + x = 0$$

$$A) w_{\xi\eta} + \frac{1}{2}w + \frac{\eta}{2}e^{\frac{\xi}{2}} = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\frac{\xi}{2}} w(\xi,\eta)$$

$$B) w_{\xi\eta} - \frac{1}{2}w = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\frac{\xi}{2}} w(\xi,\eta)$$

$$C) w_{\xi\eta} + \frac{\eta}{2}e^{\frac{\xi}{2}} = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\frac{\xi}{2}} w(\xi,\eta)$$

79. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xy} + 2u_{yy} - u_x + 4u_y + u = 0$$

A) $w_{\xi\eta} - 7w = 0, \quad \xi = 2x - y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-6\eta}w(\xi,\eta)$

B) $w_{\xi\eta} - 7w_{\xi\xi} = 0, \quad \xi = 2x - y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-6\eta}w(\xi,\eta)$

C) $w_{\xi\eta} + 7w_{\eta\eta} = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-6\eta}w(\xi,\eta)$

80. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$2u_{xx} + 2u_{xy} + u_{yy} + 4u_x + 4u_y + u = 0$$

A)

$$w_{\xi\xi} + w_{\eta\eta} - \frac{3}{2}w = 0, \quad \xi = 2y - x, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-\eta}w(\xi,\eta)$$

B)

$$w_{\xi\xi} - w_{\eta\eta} + \frac{3}{2}w = 0, \quad \xi = 2y - x, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-\eta}w(\xi,\eta)$$

A) $w_{\xi\eta} + w_{\eta\eta} = 0, \quad \xi = 2y - x, \quad \eta = x, \quad v_{\xi,\eta} = e^{-\xi-\eta}w(\xi,\eta)$

81. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xx} + 2u_{xy} + u_{yy} + 3u_x - 5u_y + 4u = 0$$

A) $w_{\eta\eta} - 2w_{\xi} = 0 \quad \xi = y - x, \quad \eta = y + x, \quad v_{\xi,\eta} = e^{\frac{15\xi+8\eta}{22}}w(\xi,\eta)$

B) $w_{\eta\eta} + 2w_{\xi\xi} = 0 \quad \xi = y - x, \quad \eta = y + x, \quad v_{\xi,\eta} = e^{\frac{15\xi+8\eta}{22}}w(\xi,\eta)$

C) $w_{\eta\eta} - 2w_{\xi\eta} = 0 \quad \xi = y - x, \quad \eta = y + x, \quad v_{\xi,\eta} = e^{\frac{15\xi-8\eta}{22}}w(\xi,\eta)$

82. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xx} - u_{yy} + u_x + u_y - 4u = 0$$

A) $w_{\xi\eta} - w = 0, \quad \xi = x - y, \quad \eta = x + y, \quad v_{\xi,\eta} = e^{-\frac{1}{2}\xi}w(\xi,\eta)$

B) $w_{\xi\eta} - w_{\xi\xi} = 0, \quad \xi = x + y, \quad \eta = x - y, \quad v_{\xi,\eta} = e^{-\frac{1}{2}\xi}w(\xi,\eta)$

C) $w_{\xi\eta} + w_{\eta} = 0, \quad \xi = x - y, \quad \eta = x + y, \quad v_{\xi,\eta} = e^{-\frac{1}{2}\eta}w(\xi,\eta)$

83. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xy} + u_{xx} - u_y - 10u + 4x = 0$$

A) $w_{\xi\eta} + 9w + 4\xi - \eta e^{\xi+\eta} = 0, \quad \xi = y - x, \quad \eta = y,$

$v_{\xi,\eta} = e^{-\xi-\eta}w(\xi,\eta);$

B) $w_{\xi\eta} - 9w_{\xi\xi} + 4\xi - \eta e^{\xi+\eta} = 0, \quad \xi = y - x, \quad \eta = y,$

$v_{\xi,\eta} = e^{-\xi-\eta}w(\xi,\eta);$

C) $w_{\eta\eta} + 9w + 4\xi - \eta e^{\xi+\eta} = 0, \quad \xi = y - x, \quad \eta = y,$

$v_{\xi,\eta} = e^{\xi-\eta}w(\xi,\eta)$

84. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$3u_{xx} + u_{xy} + 3u_x + u_y - u + y = 0$$

A) $w_{\xi\eta} - w + \xi e^\eta = 0 \quad \xi = y, \quad \eta = x - 3y, \quad v_{\xi,\eta} = e^{-\eta}w_{\xi,\eta};$

B) $w_{\xi\eta} - \xi e^\eta = 0 \quad \xi = y, \quad \eta = x - 3y, \quad v_{\xi,\eta} = e^{-\eta}w_{\xi,\eta};$

C) $w_{\xi\eta} + w_{\xi\xi} = 0 \quad \xi = y + x, \quad \eta = x - 3y, \quad v_{\xi,\eta} = e^{\xi-\eta}w_{\xi,\eta}.$

85. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xx} + 4u_{xy} + 5u_{yy} - 2u_x - 2u_y + u = 0$$

A) $w_{\xi\xi} + w_{\eta\eta} - w = 0, \quad \xi = 2x - y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\xi+\eta}w_{\xi,\eta};$

B) $w_{\xi\xi} - w_{\eta\eta} = 0, \quad \xi = 2x - y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\xi+\eta}w_{\xi,\eta};$

C) $w_{\xi\eta} + w_{\eta\eta} + w = 0, \quad \xi = 2x + y, \quad \eta = x, \quad v_{\xi,\eta} = e^{\xi-\eta}w_{\xi,\eta}.$

86. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$5u_{xx} + 16u_{xy} + 16u_{yy} + 24u_x + 32u_y + 64u = 0$$

A)

$w_{\xi\xi} + w_{\eta\eta} + 2w = 0, \quad \xi = y, \quad \eta = 4x - 2y, \quad v_{\xi,\eta} = e^{-\xi-\eta}w_{\xi,\eta};$

B) $w_{\xi\xi} + 2w = 0, \quad \xi = y, \quad \eta = 4x - 2y, \quad v_{\xi,\eta} = e^{-\xi-\eta}w_{\xi,\eta};$

C)

$$w_{\xi\xi} + w_{\xi\eta} + 2w = 0, \quad \xi = y, \quad \eta = 4x + 2y, \quad v_{\xi,\eta} = e^{-\xi+\eta} w_{\xi,\eta};$$

87. Quyida berilgan xususiy hosilali differensial tenglamani sodda kanonik shaklga keltiring:

$$u_{xx} - 2u_{xy} + u_{yy} - 3u_x + 12u_y + 27u = 0$$

A) $w_{\xi\xi} + w_{\eta} = 0, \quad \xi = 2x - y, \quad \eta = x + y, \quad v_{\xi,\eta} = e^{\xi-2\eta} w_{\xi,\eta};$

B) $w_{\xi\xi} + 2w = 0, \quad \xi = y, \quad \eta = 4x - 2y, \quad v_{\xi,\eta} = e^{-\xi-\eta} w_{\xi,\eta};$

C) $w_{\xi\xi} + w_{\eta\eta} = 0, \quad \xi = 2x - y, \quad \eta = x + y, \quad v_{\xi,\eta} = e^{\xi-2\eta} w_{\xi,\eta};$

88. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + 2u_{xy} + 2u_{yy} + 4u_{yz} + 5u_{zz} = 0$$

A) $v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} = 0 \quad \xi = x, \quad \eta = -x + y, \quad \zeta = 2x - 2y + z$

B) $v_{\xi\xi} - v_{\eta\eta} - v_{\eta\zeta} = 0 \quad \xi = -x, \quad \eta = -x + y, \quad \zeta = 2x + 2y + z$

C) $v_{\xi\xi} + v_{\eta} + v_{\zeta} = 0 \quad \xi = x, \quad \eta = -x + y, \quad \zeta = 2x - 2y + z$

89. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} - 4u_{xy} + 2u_{xz} + 4u_{yy} + u_{zz} + 3u_x = 0.$$

A)

$$v_{\xi\xi} + v_{\eta\eta} - v_{\zeta\zeta} + 3v_{\xi} + \frac{3}{2}v_{\eta} - \frac{9}{2}v_{\zeta} = 0; \quad \xi = x,$$

$$\eta = \frac{1}{2}x + y + z, \quad \zeta = 2x - 2y + z;$$

B)

$$v_{\xi\xi} + v_{\eta\eta} - v_{\zeta\zeta} + 3v_{\xi} + \frac{3}{2} = 0; \quad \xi = z,$$

$$\eta = \frac{1}{2}x + y + z, \quad \zeta = 2x - 2y + z;$$

C)

$$v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} + \frac{3}{2}v_{\eta} - \frac{9}{2}v_{\zeta} = 0; \quad \xi = x,$$

$$\eta = \frac{1}{2}x - y + z, \quad \zeta = 2x - 2y - z.$$

90. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xy} + u_{xz} + u_{yz} - u_x + u_y = 0.$$

A)

$$v_{\xi\xi} - v_{\eta\eta} - v_{\zeta\zeta} + 2v_{\eta} = 0 \quad \xi = x + y, \quad \eta = -x + y, \quad \zeta = -x - y + z$$

B) $v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} = 0 \quad \xi = x, \quad \eta = -x + y, \quad \zeta = -2x - y + z$

C)

$$v_{\xi\xi} - v_{\eta\eta} - 2v_{\zeta} + 2v_{\eta} = 0 \quad \xi = 2x + y, \quad \eta = x - y, \quad \zeta = -x + y + z$$

91. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$3u_{xy} - 2u_{xz} - u_{yz} - u = 0.$$

A) $v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} + v = 0; \quad \xi = y + z, \quad \eta = -y + z,$

$$\zeta = \frac{1}{6}x - \frac{2}{6}y + \frac{\bar{6}}{2}z$$

B) $v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} = 0; \quad \xi = y + z, \quad \eta = -y + z, \quad \zeta = x - y + z$

C) $v_{\xi\xi} + v_{\eta\eta} - v_{\zeta\zeta} + v_{\xi} = 0; \quad \xi = y + z, \quad \eta = -y + z,$

$$\zeta = \frac{1}{6}x - \frac{2}{6}y + \frac{\bar{6}}{2}z.$$

92. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + 3u_{yy} + 3u_{zz} - 2u_{xy} - 2u_{xz} - 2u_{yz} - 8u = 0$$

A) $v_{\eta\eta} + v_{\zeta\zeta} - 8v = 0, \quad \xi = x + \frac{1}{2}y + \frac{1}{2}z, \quad \eta = -\frac{1}{2}y + z,$

$$\zeta = -\frac{1}{2}y - z;$$

B) $v_{\eta\eta} + v_{\zeta\zeta} = 0, \quad \xi = x + \frac{1}{2}y + \frac{1}{2}z, \quad \eta = y + z, \quad \zeta = y - z$

$$\text{C) } v_{\eta\eta} + v_{\zeta\zeta} - 8v_{\zeta} = 0, \quad \xi = x + y + z, \quad \eta = -\frac{1}{2}y + z,$$

$$\zeta = -\frac{1}{2}y - z;$$

93. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + u_{yy} + u_{zz} + 6u_{xy} + 2u_{xz} + 2u_{yz} + 2u_x + 2u_y + 2u_z + 4u = 0$$

$$\text{A) } v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} + 2v_{\xi} - \sqrt{2}v_{\eta} + \sqrt{2}v_{\zeta} + 4v = 0, \quad \xi = x,$$

$$\eta = -\frac{1}{\sqrt{2}}(3x - y), \quad \zeta = -\frac{1}{\sqrt{2}}(x + y - 4z);$$

$$\text{B) } v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} + 2v_{\xi} - 4v = 0, \quad \xi = x, \quad \eta = -3x - y,$$

$$\zeta = -x + y - 4z;$$

$$\text{C) } v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} - \sqrt{2}v_{\eta} + \sqrt{2}v_{\zeta} = 0, \quad \xi = x,$$

$$\eta = -2\sqrt{2}(3x - y), \quad \zeta = -\frac{1}{\sqrt{2}}(x + y - 4z);$$

94. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$2u_{xx} + 5u_{yy} + 2u_{zz} - 6u_{xy} - 4u_{xz} + 6u_{yz} - 3u + y - 2z = 0$$

$$\text{A) } v_{\xi\xi} + v_{\eta\eta} - 3v + \frac{1}{2}\xi + \eta - 2\zeta = 0, \quad \xi = \frac{1}{2}x,$$

$$\eta = \frac{3}{2}x + \sqrt{2}y, \quad \zeta = x + z;$$

$$\text{B) } v_{\xi\xi} + v_{\eta\eta} - 3v - 2\zeta = 0, \quad \xi = x, \quad \eta = x + y, \quad \zeta = x + z;$$

$$\text{C) } v_{\xi\xi} + v_{\zeta\zeta} - 3v + \frac{1}{2}\xi + \eta - 2\zeta = 0, \quad \xi = \frac{1}{2}x + y,$$

$$\eta = \frac{3}{2}x + \sqrt{2}y, \quad \zeta = x + y + z;$$

95. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$3u_{yy} - 2u_{xy} - 2u_{yz} + 4u = 0$$

$$\text{A) } v_{\xi\xi} - v_{\eta\eta} + 4v = 0, \quad \xi = y + z, \quad \eta = -y - 2z, \quad \zeta = x - z;$$

B)

$$v_{\xi\xi} - v_{\zeta\zeta} + 4v_{\eta} = 0, \quad \xi = x + y + z, \quad \eta = -y - z, \quad \zeta = x + y - z$$

C) $v_{\eta\eta} + v_{\xi\xi} - 4v_{\xi} = 0, \quad \xi = x + y + z, \quad \eta = x - y - 2z, \quad \zeta = x - z.$

96. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + 4u_{yy} + u_{zz} + 4u_{xy} + 2u_{xz} + 4u_{yz} + 2u = 0$$

A) $v_{\xi\xi} + 2v = 0, \quad \xi = x, \quad \eta = -2x + y, \quad \zeta = -x + z;$

B) $v_{\eta\eta} + 2v = 0, \quad \xi = x + y, \quad \eta = -x + y, \quad \zeta = -x + z;$

C) $v_{\xi\xi} + 2v_{\zeta} = 0, \quad \xi = x - z, \quad \eta = -2x + y, \quad \zeta = -x + z.$

97. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + 4u_{yy} + 9u_{zz} + 4u_{xy} + 6u_{xz} + 12u_{yz} - 2u_x - 4u_y - 6u_z = 0$$

A) $v_{\xi\xi} - 2v_{\xi} = 0, \quad \xi = x, \quad \eta = -2x + y, \quad \zeta = -3x + z;$

B) $v_{\eta\eta} - 2v_{\xi} = 0, \quad \xi = x + y, \quad \eta = -2x + y, \quad \zeta = -x + z;$

C) $v_{\xi\xi} - 2v_{\eta} = 0, \quad \xi = x, \quad \eta = x + y, \quad \zeta = -3x + y + z.$

98. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$u_{xx} + 2u_{xy} - 2u_{xz} + 2u_{yy} - 2u_x + 6u_{zz} = 0$$

A) $v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} = 0, \quad \xi = x, \quad \eta = y - x, \quad \zeta = x - \frac{1}{2}y + \frac{1}{2}z;$

B) $v_{\xi\xi} + v_{\zeta\zeta} = 0, \quad \xi = x, \quad \eta = y - x, \quad \zeta = x + \frac{1}{2}z;$

C) $v_{\xi\xi} + v_{\eta\eta} + v_{\zeta\zeta} + v_{\xi} = 0, \quad \xi = x, \quad \eta = y + x, \quad \zeta = x - \frac{1}{2}y + \frac{1}{2}z.$

99. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

$$4u_{xx} - 4u_{xy} - 2u_{yz} + u_y + u_z = 0$$

A)

$$v_{\xi\xi} - v_{\eta\eta} + v_{\zeta\zeta} + v_{\eta} = 0, \quad \xi = \frac{1}{2}x, \quad \eta = \frac{1}{2}x + y, \quad \zeta = -\frac{1}{2}x - y + z$$

B) $v_{\xi\xi} - v_{\eta\eta} + v_{\eta} = 0, \quad \xi = \frac{1}{2}x, \quad \eta = \frac{1}{2}x + y, \quad \zeta = -\frac{1}{2}x - y;$

A) $v_{\xi\xi} + v_{\zeta} + v_{\eta} = 0, \quad \xi = x, \quad \eta = \frac{1}{2}x + y, \quad \zeta = -x - y + z.$

100. Quyida berilgan xususiy hosilali differensial tenglamani kanonik shaklga keltiring:

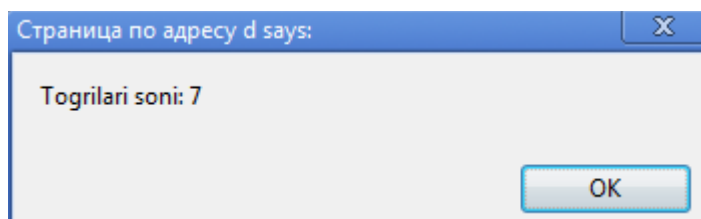
$$u_{xy} - u_{xz} + u_x + u_y - u_z = 0$$

A) $v_{\xi\xi} - v_{\eta\eta} + 2v_{\xi} = 0, \quad \xi = x + y, \quad \eta = y - x, \quad \zeta = y + z;$

B) $v_{\xi\xi} - v_{\eta\eta} + 2v_{\zeta\zeta} = 0, \quad \xi = x + y + z, \quad \eta = y - x, \quad \zeta = y + z;$

C) $v_{\xi\xi} - v_{\xi} + v_{\zeta} = 0, \quad \xi = x + y, \quad \eta = y - x + z, \quad \zeta = y + z.$

Web sahifada shu 100 ta testdan ixtiyoriy 10 tasi beriladi har bir testga 3 tadan variant berilgan bo'lib shu variantlardan biri tanlanadi. Test ishlab bo'lingach testning oxiridagi **tekshirish** tugmasi bosilsa, nechta to'gri javobligini chiqarib beruvchi



hosil bo'ladi.

Agar shu testni o'zini yana qayta ishlamoqchi bo'lsak, **tozalash** tugmasi bosiladi. Yangi boshqa testni ishlamoqchi bo'lsak klaviaturadan F5 tugmasi bosiladi

10	Tenglamani tipini aniqlang $u_{xy} + u_{yx} + u_{xx} - 3x^2 u_y + y \cdot \sin xu + xe^{-y} = 0$
<input type="radio"/> A)	Parabolik
<input type="radio"/> B)	Giperbolik
<input type="radio"/> C)	Elliptik
<input type="button" value="Tekshirish"/> <input type="button" value="Tozalash"/>	

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Test qismining ko'rinishi HTML tilida `<table></table>` juft tegidan variantlarni va tugamalarni qo'yishda HTML forma elementlaridan ya'ni `<form></form>` tegini ichida variantlarni berish uchun `<input type="radio" name="rad" value="a">` tegidan Tekshirish tugmasini qo'yish uchun `<input type="submit" name="nomi" value="Tekshirish">` Tozalash tugmasini qo'yish uchun `<input type="reset" name="nomi" value="Tozalash">` Teglaridan foydalanamiz.

Testni o'zini dasturini tuzish uchun PHP web dasturlash tilidan va Java Scriptdan foydalanamiz. Testni ishlash dasturini tuzish uchun avval testni o'zini tuzib bitta faylga yozib chiqamiz. So'ng PHP web dasturlash tilidagi mantiqiy, tanlash, takrorlash, o'tish kabi operatorlaridan, PHP da massivlar, satrlar va fayllar bilan ishlash funksiyalaridan foydalanib test programmasini HTML tili bilan bog'lagan holda tuzamiz. Buning uchun test dasturini tuzishda foydalanilgan HTML formalardan va yuqorida aytib o'tilgan PHP web dasturlash tilidagi ayrim funksiyalar haqida qisqacha ma'lumot keltirib o'tamiz.

Elektron o'quv qo'llanmaning dasturiy ta'minoti

HTML formalar

HTML formalar, foydalanuvchilar tomonidan, ma'lumotlarni kiritish va kiritilgan ma'lumotlardan keyinchalik foydalanish maqsadida tashkil qilingan. Formalar – matnli oynalar, tugmalar, bayroqchalar, ulagich (pereklyuchatel)lar va menyular kabi boshqariladigan elementlardan tashkil topishi mumkin. Formalar **<form>** va **</form>** teglari orasida joylashadi.

Ba'zi xollarda foydalanuvchi bilan brauzer o'rtasida aktiv muloqat qilishga to'g'ri keladi, ya'ni ma'lumotlarni kiritishga va tahrir qilishga to'g'ri keladi. Bunday hollarda biz yuqorida aytganimizdek HTML hujjatning formalar deb ataluvchi bo'limidan foydalanamiz. Foydalanuvchi yuqorida ko'rsatilgan formalarni ma'lumotlar bilan to'ldiradi va uni qayta ishlash uchun serverga jo'natadi. Server bu odatda Web-server yoki elektron pochta serveri bo'lishi mumkin.

Shunday qilib har qanday formaning asosiy qismi bo'lib uning boshqariladigan elementlari hisoblanadi. Bu elementlarning har biri o'z nomiga ega va bundan tashqari bu elementlar o'zining boshlang'ich qiymatiga hamda joriy qiymatiga ega.

Elementning boshlang'ich qiymati uning birinchi hosil qilinishida yoki uning qaytadan o'rnatilishida (initsializatsiya) ekranda tasvirlanadi. Keyinchalik foydalanuvchi bu qiymatlarni o'zgartirishi mumkin. Foydalanuvchi tomonidan to'ldirilgan formaning qiymatlari «nom=qiymat» juftlik ko'rinishida qayta ishlash uchun jo'natiladi.

HTML formalar quyidagi boshqariladigan elementlardan foydalanadi:

<form> **</form>** teglari

Formalar tashkil qilish **form** elementi yordamida amalga oshiriladi va biz uning umumiy ko'rinishi bilan tanishib chiqamiz.

Umumiy ko'rinishi:

Sintaksis : <FORM>...</FORM> (Blokli element)

Atributlar: id, class, style, title, lang, dir, xodisa

action = URL (formalarni qayta ishlash uchun ko'rsatilgan URL manzil)

method = GET | POST (formalardagi ma'lumotlarni jo'natish uchun HTTP metodi)

enctype = fayl tipi (formaga murojat qilish uchun)

accept = fayllar tiplari (bo'lishi mumkin bo'lgan fayllar tiplari)

accept-charset = kodlashtirishlar (bo'lishi mumkin bo'lgan simvollarni kodlash usullari)

name = CDATA (stsenariya uchun forma nomi)

target = freym (natijalarni hosil qilish uchun freym)

onsubmit = stsenariya (formani jo'natish)

onreset = stsenariya (formani qaytadan o'rnatish)

Ma'lumotlarni kiritish INPUT elementi

Umumiy ko'rinishi:

Sintaksis: <INPUT> (Yopiluvchi tegi yo'q)

Atributlar: id, class, style, title, lang, dir, hodisa

type = TEXT | PASSWORD | CHECKBOX | RADIO | SUBMIT | RESET | FILE | HIDDEN | IMAGE | BUTTON (Kiritish turi)

name = CDATA (Element nomi)

value = CDATA (Elementning boshlang'ich qiymati)

checked = CHECKED (Bayroqchalar va ulagichlarning tanlanganlik holati)

readonly = READONLY (Matn va parol uchun faqat o'qish uchun)

disabled = DISABLED (Element taqiqlangan)

size = CDATA (Elementning boshlang'ich kengligi)

maxlength = son (Matndagi maksimal simvollar soni)

src = URI (URI (Universal Resource Identifier) Tugmaning grafik shakli)

alt = tekst (Tugma uchun alternativ matn)

usemap = URI (URI murojaatlarning mijoz kartasi)

ismap = ISMAP (murojaatlarning server kartasi)

accesskey= simvol (Tez murojaat uchun tugma nomi)

tabindex = son (Tab tugmasi bilan borish uchun tartib raqami)

accept = fayllar tiplari (Mumkin bo'lgan fayllar tiplari)

onfocus = stsenariya (Element fokuslanganda yuz beradi)

onblur = stsenariya (Element fokusi yo'qolganda sodir bo'ladi)

onselect = stsenariya (Element matni tanlanganda)

onchange = stsenariy (Element qiymati o'zgarganda)

text – bir qatorli kiritish maydoni.

value – bu parametrga maydoning boshlang'ich qiymati beriladi.

size – maydoning o'lchami.

maxlength – bir maydondagi mumkin bo'lgan simvollar soni.

readonly – matnni o'zgartirishni taqiqlaydi.

password – parolni kiritish maydoni, bu maydoning matnni kiritish maydonidan farqi shundaki bu erda kiritilayotgan simvollar * bilan almashtiriladi va qaysi belgilar kiritilayotganligi ekranda ko'rinmaydi. Ammo kiritilgan matn serverga hech qanday kodlanmasdan oddiy matn ko'rinishida yuboriladi, shuning uchun bu element yordamida mahfiy ma'lumotlarni (kredit kartochka nomerlari) yuborish tavsiya qilinmaydi.

radio – ulagich. Value ning qiymati tanlangan element qiymatiga teng bo'ladi.

reset – formaning bekor tugmasi. Bu tugma bosilsa formadagi hamma qiymatlar boshlang'ich qiymatga qaytariladi.

submit – formaning jo'natish tugmasi. Bu tugma bosilsa formadagi qiymatlar serverga “value=qiymat” ko'rinishida jo'natiladi. Agarda bitta formada bar nechta shunday (submit) tugma bo'lsa unda ularga name atributi yordamida nom berish kerak. Chunki jo'natilgan ma'lumotlarni qayta ishlovchi dastur qaysi tugma bosilganini aniqlab olishi lozim.

image – formani jo'natishning grafik tugmasi. Bu erda src atributi yordamida grafik tasvirning manzili beriladi, alt yordamida esa tugmaning alternativ matni o'rnatiladi. Grafik tugmaning sichqoncha bosilgan joyining koordinatalari serverga name.x va name.y o'zgaruvchilar yordamida jo'natiladi, bu erda name tugma nomi.

button – umumiy turdagi tugma. value atributiga tugma matni beriladi. onclick atributiga tugma bosilganda ishlashi kerak bo'lgan stsenariy beriladi.

PHP web dasturlash tilida fayllar bilan ishlash

Fayllarni ochish

Fayl biror ma'lumot saqlash fizik qurilmasidagi baytlar ketma ketligidir. Har bir fayl joylashuvini ko'rsatuvchi absolyut yo'lga ega. Yo'l ajratuvchisi sifatida Windows da to'g'ri slesh (/) yoki teskari slesh (\) ishlatilishi mumkin. Boshqa operatsion tizimlarda faqat to'g'ri slesh ishlatiladi.

Fayllarni server fayl tizimida ochish **fopen** funktsiyasi yordamida amalga oshiriladi:

int fopen(string filename, string mode [, int use_include_path])

Birinci argument **filename** – fayl nomi yoki unga olib boruvchi absolyut yo'l. Agar absolyut yo'l ko'rsatilmasa, fayl kattalogda joylashgan bo'lishi kerak.

Ikkinchi argument **mode** fayl qaysi amallar uchun ochilganligini ko'rsatadi va quyidagi qiymatlarga ega bo'lishi mumkin:

- **r** (faylni faqat o'qish uchun ochish; ochilgandan so'ng fayl ko'rsatkichi fayl boshiga o'rnatiladi);
- **r+** (faylni o'qish va yozish uchun ochish; ochilgandan so'ng fayl ko'rsatkichi fayl boshiga o'rnatiladi);
- **w** (Yozish uchun yangi bo'sh fayl yaratish; agar shu nomli fayl mavjud bo'lsa, undagi hamma ma'lumot o'chiriladi);
- **w+** (Yozuvlarni o'qish uchun yangi bo'sh fayl yaratish; agar shu nomli fayl mavjud bo'lsa, undagi hamma ma'lumot o'chiriladi);
- **a** (Yozuv qo'shish uchun faylni ochish, ma'lumotlar fayl oxiriga yoziladi);
- **a+** (Yozuv qo'shish va o'qish uchun faylni ochish, ma'lumotlar fayl oxiriga yoziladi);
- **b** (Ikkilik fayl bilan ishlash usulini(o'qish va yozish) ko'rsatuvchi bayroq; faqat Windows da ko'rsatiladi).

Uchinchi shart bo'lmagan argument **use_include_path** fayllar **include_path** kattalogida izlash kerakligini belgilaydi. (**include_path** parametr `php.ini` faylda o'rnatiladi).

Fayl muvaffaqiyatli ochilganda, **fopen** funksiyasi fayl descriptorini qaytaradi, aks holda – **false** qaytaradi. **Fayl Descriptori** ochilgan faylga ko'rsatkich bo'lib, operatsion tizim tomonidan shu fayl bilan amallarni qo'llash uchun ishlatiladi. Funktsiya tomonidan qaytarilgan fayl descriptorini keyinchalik shu fayl bilan ishlaydigan hamma funksiyalarda ko'rsatish lozim.

Ikkilik fayl, masalan rasmni ochish shu tariqa **fb** bayrog'i binoan bajariladi:

Fayllarni akslantirish

Ochilgan fayldagi ma'lumotlarni browserda **fpass thru** funksiyasi yordamida akslantirish mumkin:

Matnli fayllarni akslantirish uchun yana bir **readfile** akslantirish funksiyasi mavjuddir:

readfile (string filename)

Shuni ta'kidlash lozimki argument sifatida bu funktsiya fayl nomini emas, uning descriptorini qabul qiladi:

Fayllarni berkitish

Fayl bilan ishni tugallagandan so'ng uni yopish kerak, Fayllarni yopish **fclose** funksiyasi yordamida amalga oshiriladi:

int fclose (int file)

Argument **file** yopish kerak bo'lgan fayl descriptori.

Fayllardan o'qish

Ochiq fayldan qatorni **fread** funksiyasi yordamida o'qish mumkin:

string fread (int file, int length)

Bu funktsiya fayl simvollaridan iborat **length** uzunlikdagi **file** descriptorli qatorni qaytaradi.

Fayldan o'qish uchun **fgets** funksiyasidan foydalanish ham mumkin:

string fgets (int file, int length)

Bu funksiya **length - 1** bayt uzunlikdagi satrni o'qiydi va qaytaradi. Yangi satr yoki fayl oxiriga etilganda o'qish to'xtatiladi. Fayl oxiriga etilganda funksiya bo'sh satr qaytaradi.

HTML teglarini tashlab yuborgan xolda faylni o'qish uchun **fgetss** funksiyasi qo'llanadi:

string fgetss (int file, int length [, string allowable_tags])

Shart bo'lmagan uchinchi parametr **allowable_tags** tashlab yuborilmasligi kerak bo'lgan teglar ro'yxatidan iborat satrni o'z ichiga oladi. Bu satrda teglar vergul bilan ajratiladi.

Agar fayldagi bor ma'lumotlarni massivga yozish kerak bo'lsa, **file** funksiya si qo'llanadi:

array file (string filename [, int use_include_path])

Funksiya **filename** nomli faylni o'qiydi va har bir elementi o'qilgan fayldagi satrga mos keluvchi massiv qaytaradi.

Shuni e'tiborga olish kerakki **file** funksiyasini faqat kichkina fayllarni o'qish uchun qo'llash kerak.

Kengaytmasi ***.csv** bo'lgan fayllarni o'qish uchun **fgetcsv** funksiyasi qo'llanadi:

Web sahifaning dasturiy ilovasi

HTML va PHP tilidagi kodlari

1.Stillar jadvali

```
{margin: 0px;
padding: 0px;}
a:link {color: #107280;}
a:hover {text-decoration: none;
color: #FF0000;}
a:visited {color: #107280;}
body {background: #FFD723 url(images/back_all.gif);
font: 13px Tahoma, Verdana, Arial, Helvetica, sans-serif;
color: #666666}
#content{margin: 0 auto;
background: #ffffff;
width: 762px;
text-align: left;
padding-left: 10px;
padding-right: 10px;}
#back {background: #CEF9FF;
width: 762px;}
#header {height: 200px;
text-align: left;
padding-top: 10px;}
#menu{width: 613px;
height: 69px;
margin: 10px;
padding-left: 130px;
background: url(images/menu.gif) repeat-x;
}
```

```
#menu ul {list-style: none;}
#menu li {display: inline; }
#menu a {float: left;
width: 79px;
height: 32px;
display: block;
text-align: center;
text-decoration: none;
color: #000000;
font-weight: bold;
font-size: 12px;
text-transform: uppercase;
padding-top: 15px;
padding-left:12px;
padding-right:12px;}
#menu a:hover {width: 79px;
height: 32px;
color: #ffffff;
text-decoration: underline;
background: {url(images/menu_r.gif) repeat-x;}
#logo {background: url(images/banner.gif) no-repeat;
width: 728px;
height: 109px;
text-align: right;
padding-top: 5px;
padding-right: 30px;
margin-left: 15px;}
```

```

#left
{width: 223px;
margin-left: 10px;}

#left H3
{width: 208px;
height: 37px;
font-size: 14px;
font-weight: bold;
padding-left: 15px;
padding-top: 15px;
text-transform: uppercase;
color: #ffffff;
background: url(images/title.gif) no-repeat;}

#left ul {
    list-style: none;
    border-bottom: 1px solid #0C728C;
    border-left: 1px solid #0C728C;
    border-right: 1px solid #0C728C;}

#left li ul {border: 0px;
    margin-left: 20px;
    margin-bottom: 10px;}

#left li li {padding: 4px 20px;
    background:url(images/BD21300_.gif) no-repeat left;}

#left a {color: #107280;}

#left a:visited {color: #107280;}

#left p
{padding: 10px;
border-bottom: 1px solid #107280;
border-left: 1px solid #107280;

```

```
border-right: 1px solid #107280;}
```

```
#right
```

```
{float: right;  
width: 500px;  
border:1px #000099;  
height:800px;  
padding-right: 10px;  
background:#FFFFFF;  
overflow:scroll;  
}
```

```
#rightl
```

```
{float: right;  
width: 500px;  
border:1px #000099;  
padding-right: 10px;  
}
```

```
#right H4
```

```
{ margin: 0;  
padding: 0px;  
font-size: 12px;  
color: #107280;}
```

```
#right a
```

```
{color: #107280;  
text-decoration: none;}
```

```
#right p {margin: 0;
```

```
padding: 0;  
margin-left:10px;  
text-indent:20px;  
padding-bottom: 10px;  
}
```

```
#right h2 {margin: 0;
padding: 0;
padding-top: 10px;
color: #107280;}

#right ul, #right ol
{margin-left: 30px;}

#footer {height: 37px;
clear: both;
padding-top: 10px;
background: url(images/menu.gif) repeat-x;
margin-left: 10px;
margin-right: 10px;
width: 743px;}

#footer p {margin: 0;
font-size: 10px;
text-align: center;
color: #ffffff;}

#footer a {
color: #ffffff;}
```

MA'RUZA QISMINING HTML KODI

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<html xmlns="http://www.w3.org/1999/xhtml">

<head>

<meta http-equiv="content-type" content="text/html; charset=windows-
1251" />

<title>Название сайта</title>

<link href="styles.css" rel="stylesheet" type="text/css" media="screen" />

</head>

<body>

<div class="width=100% height=100% align-left"></div><div
class="width=100% height=100% align-left"></div><div class="align-
left"></div>

<div class="padding valign-image-left"></div><div class="padding valign-
image-right"></div><div class="padding valign-image-center"></div>

<div id="content">

<div id="back">

<!-- header begins -->

<div id="header">
```

```
<div id="logo">
```

```
</div>
```

```
<div id="menu">
```

```
<ul>
```

```
<li><a href="INDEX.html" title="">ASOSIY</a></li>
```

```
<li><a href="Ma'ruza.html" title="">MA'RUZA</a></li>
```

```
<li><a href="Misollar.html" title="">MISOL</a></li>
```

```
<li><a href="O'qish.html" title="">O'QISH</a></li>
```

```
<li><a href="Testlar.php" title="">TEST</a></li>
```

```
</ul> </div>
```

```
</div>
```

```
<div id="main">
```

```
<div id="right2">
```

```
<a name="kirish"><h2 align="center">KIRISH</h2></a>
```

<p>Ma`lumki, tabiiy fanlarning har xil sohalarida uchraydigan ko`pgina jarayonlarni o`rganishda xususiy hosilali differensial tenglama yoki xususiy hosilali differensial tenglamalar sistemasini oldindan berilgan boshlang`ich va chegaraviy shartlarda yechish masalalarini o`rganishga duch kelinadi. Bunday jarayonni ifodalavchi matematik masalalar ko`pgina umumiylikka ega bo`lib, matematik fizika tenglamalarining predmetini tashkil etadi. Matematik fizika tenglamalari matematikaning asosiy fundamental va tadbqiqiy bo`limlaridan bo`lib, u bakalavryatning matematika, mexanika, amaliy matematika va informatika kabi yo`nalishlari o`quv rejasidagi umumkasbiy fanlardan biri

hisoblanadi. Xususiyl hosilali differensial tenglama yoki xususiyl hosilali differensial tenglamalar sistemasini o`rganish uchun ularni sinflarga ajratish maqsadga muvofiqdir.

Uslubiy qo`llanmada xususiyl hosilali differensial tenglamalarning va differensial tenglamalar sistemasining klassifikatsiyasi masalasi, hamda ikkinchi tartibli xususiyl hosilali differensial tenglamalarning umumiy yechimini topish usullari bayon etilgan.

Ushbu uslubiy qo`llanma universitetlarning "Amaliyl matematika va informatika" yo`nalishlari bo`yicha bakalavrlar tayyorlaydigan fakultet talabalari uchun mo`ljallangan bo`lib, shu yo`nalishning namunaviyl dasturida kiritilgan "Matematik fizika tenglamalari" fani rejasiga asosan yozilgan

[!\[\]\(d13256b26863c183fc53da1e88a7a3c0_img.jpg\)](#)



















</div>

<div id="left">

<h3>Mundarija</h3>

Kirish

Xususiy hosilali differensial tenglamaning xarakteristikasi haqida tushuncha

Xususiy hosilali differensial tenglamalarning klassifikatsiyasi va ularning kanonik shakli

Ikkinchi tartibli ikki o'zgaruvchili xususiy hosilali chiziqli differensial tenglamalarni kanonik shaklga keltirish

 O'zgarvas koefitsiyentli ikki o'zgaruvchili ikkinchi tartibli xususiy hosilali chiziqli differensial tenglamalarni kanonik shaklga keltirishga doir misollar

O'zgaruvchi koefitsiyentli ikki o'zgaruvchili ikkinchi tartibli xususiy hosilali chiziqli differensial tenglamalarni kanonik shaklga keltirishga doir misollar

[Chiziqli bo'lmagan xususiy hosilali differensial tenglamani uning berilgan yechimi bo'ylab sinflarga ajratish](#3)

[Xususiy hosilali differensial tenglamalar sistemasining tipini aniqlash](#4)

[Ikki o'zgaruvchili ikkinchi tartibli xususiy hosilali differensial tenglamalarning umumiy yechimini topishga doir misollar](#5)

[Laplasning Kaskad usuli](#6)

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TEST BO'LIMINING HTML VA PHP TILIDAGI KODI;

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="content-type" content="text/html; charset=windows-
1251" />
<title>Название сайта</title>

<link href="styles.css" rel="stylesheet" type="text/css" media="screen" />
</head>
<body>
<div class="width=100% height=100% align-left"></div><div
class="width=100% height=100% align-left"></div><div class="align-
left"></div>
<div class="padding valign-image-left"></div><div class="padding
valign-image-right"></div><div class="padding valign-image-
center"></div>
<div id="content">
<div id="back">
<!-- header begins -->
<div id="header">
    <div id="logo">
    </div>
    <div id="menu">
        <ul>
            <li><a href="INDEX.html" title="">ASOSIY</a></li>
```

```
                <li><a href="Ma'ruza.html"
title="">MA'RUZA</a></li>
                <li><a href="Misollar.html" title="">MISOL</a></li>
                <li><a href="O'qish.html" title="">O'QISH</a></li>
                <li><a href="Testlar.php" title="">TEST</a></li>
            </ul>
```

```
        </div>
```

```
</div>
```

```
<div id="main">
```

```
<?php
```

```
$file_name = "test/word.txt";
$f = fopen($file_name,"rt");
$k=0;
while($s = fgets($f,4096))
{
    $m = explode('*', $s);
    $k++;
    for($j = 0; $j < count($m); $j++)
    {
        $question[$k][$j] = $m[$j];
    }
}
for($i = 1; $i <= $k; $i++)
{
    $q = rand(1,$k);

    if($question[$q][0] != "0")
    {
        for($j = 0; $j < count($m); $j++)
            $question1[$i][$j] = $question[$q][$j];
```

```

$question[$q][0] = "0";
}
else
{
    while($question[$q][0] == "0")
    {
        if($q == $k)
            $q = 0;
        $q++;
    }
    for($j = 0; $j < count($m);$j++)
        $question1[$i][$j] = $question[$q][$j];
    $question[$q][0] = "0";
}
}

```

```

for($i = 1; $i <= $k; $i++)
{
    $r = 0;
    for($j = 1; $j < count($m);$j++)
    {
        $w = rand(1,count($m)-1);
        if($question1[$i][$w] != "0")
        {
            $question2[$i][0] = $question1[$i][0];
            $question2[$i][$j] = $question1[$i][$w];
            $question1[$i][$w] = "0";
            if($w == 1)
                $javob[$i] = $j;
        }
    }
}

```

```

else
{
    while($question1[$i][$w] == "0")
    {
        if($w == count($m)-1)
        $w = 0;
        $w++;
    }
    $question2[$i][0] = $question1[$i][0];
    $question2[$i][$j] = $question1[$i][$w];
    $question1[$i][$w] = "0";
    if($w == 1)
    $javob[$i] = $j;
}
}
}
echo "<html><head><title>Test</title>
<script type='text/javascript'>
<!--
function get_radio_value()
{
var rad_val;
var t=0;
var                                     javob=new
Array($javob[1],$javob[2],$javob[3],$javob[4],$javob[5],$javob[6],$javo
b[7],$javob[8],$javob[9],$javob[10]);
for (var j=0; j < javob.length; j++)
for (var i=0; i < document.orderform.test1.length; i++)
{
    switch(j)

```

```

    {
        case 0:    if    (document.orderform.test1[i].checked    &&
document.orderform.test1[i].value===javob[j])t+=1;break;
        case 1:    if    (document.orderform.test2[i].checked    &&
document.orderform.test2[i].value===javob[j])t+=1;break;
        case 2:    if    (document.orderform.test3[i].checked    &&
document.orderform.test3[i].value===javob[j])t+=1;break;
        case 3:    if    (document.orderform.test4[i].checked    &&
document.orderform.test4[i].value===javob[j])t+=1;break;

        case 4:    if    (document.orderform.test5[i].checked    &&
document.orderform.test5[i].value===javob[j])t+=1;break;
        case 5:    if    (document.orderform.test6[i].checked    &&
document.orderform.test6[i].value===javob[j])t+=1;break;
        case 6:    if    (document.orderform.test7[i].checked    &&
document.orderform.test7[i].value===javob[j])t+=1;break;
        case 7:    if    (document.orderform.test8[i].checked    &&
document.orderform.test8[i].value===javob[j])t+=1;break;

        case 8:    if    (document.orderform.test9[i].checked    &&
document.orderform.test9[i].value===javob[j])t+=1;break;
        case 9:    if    (document.orderform.test10[i].checked    &&
document.orderform.test10[i].value===javob[j])t+=1;break;
    }
}

    alert('Togrilari soni: ' + t);

}

//-->

```

```

</script>

</head>

<body>
<table border='1' cellpadding='0' cellspacing='0'><form
name='orderform'>;
$k=10;
for($i = 1; $i <= $k; $i++)
{
    $i1 ="test".$i;
    //echo "<br>".$javob[$i]." ";
    for($j = 0; $j < count($m);$j++)
    {
        if($j == 0)
            echo "                "<tr
bgcolor='#00FFFF'><td>$i</td><td>{ $question2[$i][$j]}</td></tr>";
        if($j == 1)
            echo " <tr><td><input type='radio' name='$i1' value='1' />
A)</td><td>{ $question2[$i][$j]}</td></tr>";
        if($j == 2)
            echo " <tr><td><input type='radio' name='$i1' value='2'
/>B)</td><td>{ $question2[$i][$j]}</td></tr>";
        if($j == 3)
            echo " <tr><td><input type='radio' name='$i1' value='3'
/>C)</td><td>{ $question2[$i][$j]}</td></tr>";
        if($j == 4)
            echo " <tr><td><input type='radio' name='$i1' value='4'
/>D)</td><td>{ $question2[$i][$j]}</td></tr>";
    }
    echo " <tr bgcolor='FFFFFF'><td colspan='2'>.</td></tr>";
}

```

```
}  
echo "<tr><td><input type='button' name='check' value='Tekshirish'  
onClick='return get_radio_value()'/></td><td><input type='reset'  
name='reset' value='Tozalash' /></td></tr>";  
echo "</form></table></body></html>";
```

```
echo "  
</div>  
</div>  
</body>  
</html>  
";  
?>  
<div id="footer">
```

```
<p>Toshkent &copy; 2013  
</p>  
</div>  
</div></div></body></html>
```

Xulosa

Ushbu malakaviy bitiruv ishida “Matematika-fizika tenglamalari” fanidan elektron o’quv qo’llanma yaratish masalasi qaralgan. Ushbu malakaviy bitiruv ishi Macromedia Dreamweaver, MS Front Page redaktorlarida HTML tilida va PHP web dasturlash tilida qilingan. Malakaviy bitiruv ishida ma’ruzalar matni va har bir ma’ruzada misollar yechishidan mashqlar, mustaqil yechish uchun misollar va talaba o’zining olgan bilimlarini mustahkamlash uchun test topshiriqlari berilgan. Malakaviy bitiruv ishida ko’rish qobiliyati sust yoki ko’rish qobiliyatini yo’qotgan kishilar uchun qulaylik yaratish maqsadida ma’ruzalar matnining ovozli varianti mavjud bo’lib, u ko’rish qobiliyatida imkoniyati cheklangan kishilar eshitish orqali ham matematika-fizika tenglamalari haqida ma’lumotlarga ega bo’lishi mumkin. Umumiy holda elektron o’quv qo’llanma HTML tili va PHP web dasturlash tili yordamida qilingan. Sahifalarning fon qismini va sarlavha (banner) qismini yaratishda Adobe Photoshop dasturidan foydalanilgan. O’qish qismining o’qib borilayotgan joyini ajratib ko’rsatish ya’ni animatsiya qismi Power pointda yordamida qilingan.

Ushbu malakaviy bitiruv ishidan davlatimizdagi barcha oliy o’quv yurtlarining mexanika, matematika, amaliy matematika va informatika yunalishlarida “Matematika –fizika tenglamalari” fanini o’qitishda foydalanish mumkin.

Ushbu malakaviy bitiruv ishini O’zbekiston Milliy universitetining internetdagi saytlariga joylashtirish imkoniyati mavjud.

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