Lecture 19 Activity Results for Test Student

Score for this attempt: **1** out of 1
Submitted Mar 12 at 8:27am
This attempt took 1 minute.

Question 1

1 / 1 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Its discriminant is $\delta(x,y) = \left(b(x,y)\right)^2 - a(x,y)c(x,y)$.

Suppose $\delta(x,y) > 0$ at (x, y). Which statement below is true?

Correct!
- (selected) Operator *L* is hyperbolic at (x, y).
- Operator *L* is parabolic at (x, y).
- Operator *L* is elliptic at (x, y).
- There is not enough information to determine the classification of operator *L* at (x, y). The classification is affected by coefficients *d*(x, y) and *e*(x, y).
- Operator *L* is degenerate at (x, y).

Additional Comments:

Question 2

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Its discriminant is $\delta(x,y) = \left(b(x,y)\right)^2 - a(x,y)c(x,y)$.

Suppose $\delta(x,y) = 0$ at (x, y) and *a*(x, y), b(x, y) and c(x, y) are not all zeros. Which statement below is true?

- Operator *L* is hyperbolic at (x, y).

Correct!
- (selected) Operator *L* is parabolic at (x, y).
- Operator *L* is elliptic at (x, y).
- There is not enough information to determine the classification of operator *L* at (x, y). The classification is affected by coefficients *d*(x, y) and *e*(x, y).
- Operator *L* is degenerate at (x, y).

Additional Comments:

Question 3

0 / 0 pts

Which of the following is true? **Select all that apply.**

- $\partial_x\left(a(x,y)\partial_x u\right) = a(x,y)\partial_x^2 u$
- $\partial_x\left(a(x,y)\partial_x u\right) = \partial_x^2\left(a(x,y)u\right)$

Correct!
- (checked) $\partial_x\left(a(x,y)\partial_x u\right)$ and $a(x,y)\partial_x^2 u$ have the same principal part.

Correct!
- (checked) $\partial_x\left(a(x,y)\partial_x u\right)$ and $\partial_x^2\left(a(x,y)u\right)$ have the same principal part.
- $a(x,y)\partial_x^2 u = \partial_x^2\left(a(x,y)u\right)$

Additional Comments:

Question 4

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

The coefficient matrix is $A(x,y) = \begin{pmatrix} a(x,y) & b(x,y) \\ b(x,y) & c(x,y) \end{pmatrix}$.

Which of the following is true? **Select all that apply.**

- The principal part of L(u) is $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} A(x,y) \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$.
- The principal part of L(u) is $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}^T A(x,y) \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$.
- L(u) and $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} A(x,y) \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$ have the same principal part.

Correct!
- (checked) L(u) and $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}^T A(x,y) \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$ have the same principal part.
- L(u) and $A(x,y)\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}^T \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$ have the same principal part.
- L(u) and $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}^T \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}\left(A(x,y)u\right)$ have the same principal part.

Additional Comments:

Question 5

0 / 0 pts

Consider the second order differential operator L(u) with coefficient matrix $A(x,y)$. L(u) and $\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix}^T A(x,y) \begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u$ have the same principal part.

Consider the change of variable $\begin{cases} \xi = \xi(x,y) \\ \eta = \eta(x,y) \end{cases}$. We have

$$\begin{pmatrix} \partial_x \\ \partial_y \end{pmatrix} u = \begin{pmatrix} \xi_x & \eta_x \\ \xi_y & \eta_y \end{pmatrix} \begin{pmatrix} \partial_\xi \\ \partial_\eta \end{pmatrix} u = \left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T \begin{pmatrix} \partial_\xi \\ \partial_\eta \end{pmatrix} u$$

Let $\tilde{L}(u)$ denote operator L(u) in terms of new variables (ξ,η).

What is the coefficient matrix of $\tilde{L}(u)$?

- $\tilde{A}(\xi,\eta) = A(x,y)$
- $\tilde{A}(\xi,\eta) = \left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T A(x,y)\frac{\partial(\xi,\eta)}{\partial(x,y)}$

Correct!
- (selected) $\tilde{A}(\xi,\eta) = \frac{\partial(\xi,\eta)}{\partial(x,y)} A(x,y)\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T$
- $\tilde{A}(\xi,\eta) = A(x,y)\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T$
- $\tilde{A}(\xi,\eta) = \frac{\partial(\xi,\eta)}{\partial(x,y)} A(x,y)$
- $\tilde{A}(\xi,\eta)$ is affected by the first derivative terms in L(u). There is not enough information to determine $\tilde{A}(\xi,\eta)$.

Additional Comments:

Question 6

0 / 0 pts

Consider the second order differential operator L(u) with coefficient matrix $A(x,y)$. Consider the change of variable $\begin{cases} \xi = \xi(x,y) \\ \eta = \eta(x,y) \end{cases}$ with non-singular Jacobian $\frac{\partial(\xi,\eta)}{\partial(x,y)}$. Let $\tilde{L}(u)$ denote operator L(u) in terms of new variables (ξ,η).

Which statement below is true?

- $\tilde{L}(u)$ and $L(u)$ have the same coefficient matrix.

Correct!
- (selected) $\tilde{L}(u)$ and $L(u)$ have the same classification.
- $\tilde{L}(u)$ and $L(u)$ have the same classification only if the non-singular Jacobian $\frac{\partial(\xi,\eta)}{\partial(x,y)}$ is an orthogonal matrix.
- $\tilde{L}(u)$ and $L(u)$ have the same classification only if the non-singular Jacobian $\frac{\partial(\xi,\eta)}{\partial(x,y)}$ is a positive definite matrix.
- $\tilde{L}(u)$ and $L(u)$ have the same classification only if $\det\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right) > 0$.
- $\tilde{L}(u)$ and $L(u)$ have the same classification only if the non-singular Jacobian $\frac{\partial(\xi,\eta)}{\partial(x,y)}$ is a diagonal matrix.

Additional Comments:

Question 7

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Suppose $\delta(x,y) = -\det\begin{pmatrix} a(x,y) & b(x,y) \\ b(x,y) & c(x,y) \end{pmatrix} > 0$ in a region of (x, y).

What is the coefficient matrix of the canonical form?

- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

Correct!
- (selected) $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 0 & \frac{-1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Additional Comments:

Question 8

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Suppose $\delta(x,y) = -\det\begin{pmatrix} a(x,y) & b(x,y) \\ b(x,y) & c(x,y) \end{pmatrix} < 0$ in a region of (x, y).

What is the coefficient matrix of the canonical form?

- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 0 & \frac{-1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$

Correct!
- (selected) $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Additional Comments:

Fudge Points: --

You can manually adjust the score by adding positive or negative points to this box.

Final Score: 1 out of 1

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