

# Unit 6 - Week 4

## Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Application of Ito's rule on Ito process

Harmonic function and its properties

Maximum principle of harmonic function

Dirichlet Problem and bounded solution

Example of a Dirichlet problem

Regular points at the boundary

Zarembas cone condition for regularity

Quiz : Assignment 4

Probabilistic Methods in PDE: Week 4 Feedback form

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

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## Assignment 4

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

Due on 2020-02-26, 23:59 IST.

1) Assume that  $W^{(1)}$  and  $W^{(2)}$  are independent standard Brownian motions, if  $X_t^{(i)} = \int_0^t u_i(s)dW_s^{(1)} + \int_0^t v_i(s)dW_s^{(2)}$ ,  $i = 1, 2$  then  $\langle X^{(1)}, X^{(2)} \rangle_t$  is equal to

2 points

$\int_0^t (u_1(s)u_2(s) + v_1(s)v_2(s))ds$

$\int_0^t (u_1(s)v_1(s) + u_2(s)v_2(s))ds$

$\int_0^t (u_1(s)v_2(s) + u_2(s)v_1(s))ds$

$\int_0^t (u_1(s)u_2(s) - v_2(s)v_1(s))ds$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$\int_0^t (u_1(s)u_2(s) + v_1(s)v_2(s))ds$

2) Let  $f \in C^2(\mathbb{R}^d)$ . If  $v = I_d$  ( $d$  dimensional identity matrix) then  $\sum_{i,j} (vv^*)_{ij} \frac{\partial^2 f}{\partial x_i \partial x_j}$  is same as

2 points

$\Delta f$

trace of Hessian of  $f$

$\vec{\nabla} \cdot (\nabla f)$

$\sum_{i=1}^d \sum_{j=1}^d \frac{\partial^2 f}{\partial x_i \partial x_j}$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$\Delta f$

trace of Hessian of  $f$

$\vec{\nabla} \cdot (\nabla f)$

3) If  $\tau$  is an unbounded  $\{\mathcal{F}_t\}$ -stopping time with finite expectation, Then  $EW_\tau$  is

2 points

zero

need not be zero but finite

infinite

$E\tau$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

zero

4) Let  $D$  be an open subset of  $\mathbb{R}^d$  and  $\tau_D := \inf\{t \geq 0 | W_t \notin D\}$ . Then for any  $x \notin D$ ,  $\tau_D$

2 points

is equal to zero

need not be zero but finite positive value with probability 1

is such that  $0 < E\tau_D < \infty$

$E\tau_D$  could be infinite

No, the answer is incorrect.  
Score: 0

Accepted Answers:

is equal to zero

5) Let  $B_r$  be the open disc of radius  $r$  around origin in  $\mathbb{R}^2$  and  $\mu_r(A) := P[W_{\tau_{B_r}} \in A | W_0 = 0] \quad \forall A \in \mathcal{B}_{B_r}$ . If  $\theta \in (0, \frac{\pi}{2})$  and  $A_\theta = \{(x, y) \in B_r | 0 < y < r \sin \theta\}$ , then  $\mu_r(A_\theta)$  is equal to,

2 points

$r\theta$

$2r\theta$

$\frac{\theta}{\pi}$

$r \sin \theta$

$2r \sin \theta$

$2\theta$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$\frac{\theta}{\pi}$