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Unit 8 - L^p spaces and completeness

Course outline

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[Sigma algebras, Measures and Integration](#)

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Week 7 Assessment

The due date for submitting this assignment has passed. **Due on 2020-03-18, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Let (X, \mathcal{F}, μ) be a measure space. Then,

1 point

$f, g \in L^1(\mu)$ implies $fg \in L^1(\mu)$

$f, g \in L^2(\mu)$ implies $fg \in L^2(\mu)$

$f, g \in L^2(\mu)$ implies $fg \in L^1(\mu)$

$f \in L^1(\mu)$ and $f \in L^\infty(\mu)$ implies $f \in L^2(\mu)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$f, g \in L^2(\mu)$ implies $fg \in L^1(\mu)$

$f \in L^1(\mu)$ and $f \in L^\infty(\mu)$ implies $f \in L^2(\mu)$

2) Which of the following are true?

1 point

$L^1[0, 1] \subset L^2[0, 1]$

$L^1[0, \infty) \subset L^2[0, \infty)$

$L^2[0, 1] \subset L^1[0, 1]$

L^p spaces and completeness

- Lebesgue set which is not Borel (unit? unit=55&lesson=56)
- L^p spaces (unit? unit=55&lesson=57)
- L^p norm (unit? unit=55&lesson=58)
- Completeness of L^p (unit? unit=55&lesson=59)
- Properties of L^p spaces (unit? unit=55&lesson=60)
- Examples of L^p spaces (unit? unit=55&lesson=61)
- Quiz : Week 7 Assessment (assessment? name=103)**

Product spaces and Fubini's theorem

Applications of Fubini's theorem and complex measures

Complex measures and Radon-Nikodym theorem

Radon-Nikodym theorem and applications

Riesz representation theorem and Lebesgue differentiation theorem

Weekly Feedback forms

$$L^2[0, \infty) \subset L^1[0, \infty)$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$L^2[0, 1] \subset L^1[0, 1]$$

3) Let $f = \chi_{[0, \frac{1}{2}]}$. Then,

f is continuous almost every where with respect to the Lebesgue measure on \mathbb{R}

f can be approximated by continuous functions in the L^∞ norm

There exists a continuous function g such that $f = g$ almost every where

No, the answer is incorrect.

Score: 0

Accepted Answers:

f is continuous almost every where with respect to the Lebesgue measure on \mathbb{R}

4) Which of the following are correct?

$\chi_{|x| \leq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a > -n$

$\chi_{|x| \leq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a < -n$

$\chi_{|x| \geq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a > -n$

$\chi_{|x| \geq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a < -n$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\chi_{|x| \leq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a > -n$

$\chi_{|x| \geq 1}(x) |x|^a \in L^1(\mathbb{R}^n)$ iff $a < -n$

5) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a measurable function. Then,

$f \in L^1(\mathbb{R})$ implies f is bounded

$f \in L^1(\mathbb{R})$ and f is continuous implies f is bounded

$f \in L^1(\mathbb{R})$ and f is continuous implies that $\lim_{|x| \rightarrow \infty} f(x) = 0$

$f \in L^1(\mathbb{R})$ and f is uniformly continuous implies that f is bounded

No, the answer is incorrect.

Score: 0

Accepted Answers:

$f \in L^1(\mathbb{R})$ and f is uniformly continuous implies that f is bounded

6) Let $f_n : [0, 1] \rightarrow \mathbb{R}$ be defined by $f_n(x) = x^n$, $x \in [0, 1]$ for $n = 1, 2, 3, \dots$. Which of the following are correct? **1 point**

1 point

1 point

1 point

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f_n converges to zero uniformly in $[0, 1]$

f_n converges to zero in $L^1[0, 1]$

f_n converges to zero in $L^p[0, 1]$ for all $1 \leq p < \infty$

No, the answer is incorrect.

Score: 0

Accepted Answers:

f_n converges to zero in $L^1[0, 1]$

f_n converges to zero in $L^p[0, 1]$ for all $1 \leq p < \infty$

7) Let $f_n : [1, \infty) \rightarrow \mathbb{R}$ be defined by $f_n(x) = x^{-n}$, $x \in [1, \infty)$ for $n = 1, 2, 3, \dots$. **1 point**
Which of the following are correct?

f_n converges to zero uniformly

f_n converges to zero in $L^1[1, \infty)$

f_n converges to zero in $L^p[1, \infty)$ for all $1 \leq p < \infty$

No, the answer is incorrect.

Score: 0

Accepted Answers:

f_n converges to zero in $L^1[1, \infty)$

f_n converges to zero in $L^p[1, \infty)$ for all $1 \leq p < \infty$

8) Let $f_n : [2, \infty) \rightarrow \mathbb{R}$ be defined by $f_n(x) = x^{-n}$, $x \in [2, \infty)$ for $n = 1, 2, 3, \dots$. **1 point**
Which of the following are correct?

f_n converges to zero uniformly

f_n converges to zero in $L^1[2, \infty)$

f_n converges to zero in $L^p[2, \infty)$ for all $1 \leq p \leq \infty$

No, the answer is incorrect.

Score: 0

Accepted Answers:

f_n converges to zero uniformly

f_n converges to zero in $L^1[2, \infty)$

f_n converges to zero in $L^p[2, \infty)$ for all $1 \leq p \leq \infty$

9) Let (X, \mathcal{F}, μ) be a measure space and $1 \leq p, r, s \leq \infty$. Which of the following are correct? **1 point**

If $p < r < s$, then $L^p \cap L^s(\mu) \subset L^r(\mu)$

If $\mu(X) < \infty$, then $L^p(\mu) \subset L^r(\mu)$ if $r < p$

If $\mu(X) < \infty$ and $f \in L^\infty(\mu)$ then $\|f\|_p \rightarrow \|f\|_\infty$ as $p \rightarrow \infty$

No, the answer is incorrect.

Score: 0

Accepted Answers:

If $p < r < s$, then $L^p \cap L^s(\mu) \subset L^r(\mu)$

If $\mu(X) < \infty$, then $L^p(\mu) \subset L^r(\mu)$ if $r < p$

If $\mu(X) < \infty$ and $f \in L^\infty(\mu)$ then $\|f\|_p \rightarrow \|f\|_\infty$ as $p \rightarrow \infty$

10) Let (X, \mathcal{F}, μ) be a measure space and let f and g be positive measurable functions such that $fg \geq a$ for some $a > 0$. Then, **1 point**

If $\mu(X) = 1$, $(\int_X f d\mu) (\int_X g d\mu) \geq a$

If $\mu(X) < 1$, $(\int_X f d\mu) (\int_X g d\mu) \geq a$

No, the answer is incorrect.

Score: 0

Accepted Answers:

If $\mu(X) = 1$, $(\int_X f d\mu) (\int_X g d\mu) \geq a$