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Courses » Integral Equations,calculus of variations and its applications

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Unit 11 - Week 10

Course outline

Assignment 10

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

Due on 2018-10-10, 23:59 IST.

1) $The\ extremal\ of\ the\ functional\ \int_0^1 (y'^2 + y''^2)dx\ subject\ to$ $the\ boundary\ conditions\ y(0)=0,\ y(1)=\sinh 1,\ y'(0)=1\ and\ y'(1)=\cosh 1,\ is$ *1 point*

- $y = \sinh x(1 - \cos\frac{\pi x}{2})$
- $y = 1 - \cosh x$
- $y = \sinh x$
- $does\ not\ exist$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$y = \sinh x$

2) $The\ extremal\ of\ the\ functional\ \int_0^1 \frac{y''^2}{2}\, dx\ satisfying\ the\ boundary\ conditions$ $y(0)=0,\ y(1)=\frac{1}{2},\ y'(0)=0\ and\ y'(1)=1\ is$ *1 point*

- $y = \frac{x+\sin(x^2-x)}{2}$
- $y = \frac{1-\cos(x^2-x)}{2}$
- $y = \frac{x^2}{2}$
- $does\ not\ exist$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$y = \frac{x^2}{2}$

3) $The\ extremal\ of\ the\ functional\ \int_0^{\frac{\pi}{2}} (2xy - 2x^2 + \dot{x}^2 - \dot{y}^2)dt\ subject\ to\ the\ boundary\ conditions$ $x(0)=1,\ y(0)=0,\ x(\frac{\pi}{2})=\frac{\pi}{4},\ y(\frac{\pi}{2})=\frac{\pi}{2},\ is\ given\ by$ *1 point*

- $x = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t$
  $y = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t + \frac{\pi}{4}\sin t - \cos t$
- $x = \left(1 - \frac{\pi}{4}t\right)\cos t + \left(\frac{\pi}{2} - t\right)\sin t,$
  $y = \left(1 - \frac{\pi}{4}t\right)\cos t + \left(\frac{\pi}{2} - t\right)\sin t + \frac{\pi}{4}\sin t - \cos t$

$x = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t,$

$y = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t + \frac{\pi}{2}\sin t - \frac{\pi}{4}\cos t$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t$
$y = \left(1 - \frac{\pi}{8}t\right)\cos t + \left(\frac{\pi}{2} - \frac{t}{2}\right)\sin t + \frac{\pi}{4}\sin t - \cos t$

4) $The\ extremal\ of\ the\ functional\ \int_0^1 \{2x + \left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2\}dt$ **1 point**

$satisfying\ the\ boundary\ conditions\ x(0) = 0,\ y(0) = 1,\ x(1) = 1,\ y(1) = -1\ is$

$x = t,\ y = -2t + 1$

$x = \frac{t(t+1)}{2},\ y = -t$

$x = t,\ y = -t$

$x = \frac{t(t+1)}{2},\ y = -2t + 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = \frac{t(t+1)}{2},\ y = -2t + 1$

5) $The\ equation\ y'' = f(x, y, y')\ is\ a\ Euler\ equation\ for\ some\ functional\ I[y(x)] = \int_a^b F(x, y, y')dx$ **1 point**
$where\ F(x, y, y')\ is\ the\ solution\ of\ the\ partial\ differential\ equation$

$F_{y'y'x} + y'F_{y'y'y} + fF_{y'y'y'} + f_{y'}F_{y'y'} = 0$

$F_{y'y'x} + y'F_{y'y'y} + fF_{y'y'y'} + F_{y'y'} = 0$

$F_{y'y'x} + F_{y'y'y} + fF_{y'y'y'} + f_{y'}F_{y'y'} = 0$

$F_{y'y'x} + y'F_{y'y'y} + F_{y'y'y'} + f_{y'}F_{y'y'} = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$F_{y'y'x} + y'F_{y'y'y} + fF_{y'y'y'} + f_{y'}F_{y'y'} = 0$

6) $Consider\ the\ functional$ **1 point**

$I[\phi] = \int_{-\infty}^{\infty} [p(x)(\phi'(x))^2 + 2\phi(x+1)\phi(x-1) - \phi^2(x) - 2\phi(x)f(x)]dx$

$then\ the\ differential\ difference\ equation\ for\ the\ argument\ function\ \phi(x)\ is$

$(p\phi') - \phi(x+2) - \phi(x-2) + \phi(x) + f(x) = 0$

$(p\phi')' - \phi(x+2) - \phi(x-2) + \phi(x) + f(x) = 0$

$(p\phi')' - \phi(x+2) - \phi(x-2) + f(x) = 0$

$(p\phi') + \phi(x+2) + \phi(x-2) - \phi(x) + f(x) = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(p\phi')' - \phi(x+2) - \phi(x-2) + \phi(x) + f(x) = 0$

7) $The\ extremal\ of\ the\ functional$ **1 point**

$I[z(x, y)] = \int\int_D [z_y^2\left(\frac{xy}{2}\right) - z_x\left(\frac{x^2y^2}{2}\right)]dxdy$

is

$z = \frac{y^3}{3} + c_1(y)\ln y + c_2(x)$

$z = \frac{y^3}{9} + c_1(x)\ln x + c_2(x)$

$z = \frac{y^3}{9} + c_1(y)\ln x + c_2(y)$

$z = \frac{y^3}{9} + c_1(x)\ln y + c_2(x)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$z = \frac{y^3}{9} + c_1(x)\ln y + c_2(x)$

8) *The extremal of the functional* $I[z(x,y)] = \int\int_D (xyz + xp^2)dxdy$ *is* **1 point**

$z(x,y) = x^2y + c_1(y)\ln x + c_2(x)$

$z(x,y) = x^2y + c_1(x)\ln y + c_2(y)$

$z(x,y) = \frac{x^2y}{8} + c_1(y)\ln x + c_2(y)$

none of these.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$z(x,y) = \frac{x^2y}{8} + c_1(y)\ln x + c_2(y)$

9) **1 point**
Assuming the second ordere partial derivatives of $z(x,y)$ *continuous, the Euler – Ostrogradski equation for the* .
$I[z(x,y)] = \int\int_D \sqrt{1 + z_x^2 + z_y^2}\,dxdy$
is

$z_{xx}(1 + z_y^2) + 2z_x z_y z_{xy} - z_{yy}(1 + z_x^2) = 0$

$z_{xx}(1 + z_y^2) - 2z_x z_y z_{xy} + z_{yy}(1 + z_x^2) = 0$

$z_{xx}(1 + z_x^2) - 2z_x z_y z_{xy} - z_{yy}(1 + z_y^2) = 0$

none of these.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$z_{xx}(1 + z_y^2) - 2z_x z_y z_{xy} + z_{yy}(1 + z_x^2) = 0$

10) *The variational derivative* $\frac{\delta J}{\delta y}$ *of the functional* $J[y(x)] = y(1)$, *defined on* $C'[0,1]$, *is given by* **1 point**

$\delta(x-1)$

$\delta(x+1)$

$\delta(x)$

can not be defined.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\delta(x-1)$

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