Iniciada	quarta, 9 de setembro de 2020 às 09:42
Estado	Terminada
Terminada em	quarta, 9 de setembro de 2020 às 12:03
Tempo gasto	2 horas 20 minutos
Nota	**12,550** num máximo de 20,000 (**63**%)

Informação

Instituto Superior de Engenharia de Coimbra

Licenciaturas em Engenharia Informática

Análise Matemática II

Exame da época especial de setembro

Data: 09/09/2020 **Duração:** 150 minutos

Pergunta 1

Respondida

Sem avaliação

Nome Completo:
Número de aluno:
Curso:

Notas:
i) Caso pretenda desistir deve escrever neste espaço o texto seguinte:
"Declaro que desisto"
Data: Hora:
ii) Se não fizeram nada ou praticamente nada cuja soma das cotações seja muito baixa, o melhor mesmo e aconselhável é desistirem.
iii) Não facilitem, não esgotem totalmente o tempo de prova e não a submetam apenas nos últimos segundos.
iv) No final de concluir a prova deve selecionar o botão "terminar e submeter" existente na última página

Ana Rita Santos Videira

201 501 22 18

Engenharia Informática - Curso Europeu

Pergunta 2

Parcialmente correta

Nota: 0,900 em 3,000

Considere a equação diferencial $(yx^2 - 3y - A(x,y))\mathrm{d}x + \mathrm{d}y = 0$

(a) A Equação diferencial é uma EDO de 1ª ordem.

True

Your last answer was interpreted as follows: $\mathbf{true}$

Correct answer, well done.

(b) Para $A(x,y) = x^2 - 3$:

(i) A equação diferencial não é linear e de 1ª ordem.

False

Your last answer was interpreted as follows: $\mathbf{false}$

Correct answer, well done.

(ii) Determine a solução geral da ED e introduza a constante com %c.

$y = f(x;c) \Leftrightarrow$

(c) Para $A(x,y) = 0$

(i) determine a solução particular da equação diferencial que satisfaz a a condição inicial $y(0) = 5$.

$y = f(x) \Leftrightarrow$ y = e^(x^3 / 3 + 3*x + %c)

Your last answer was interpreted as follows: $y = e^{\frac{x^3}{3}+3\cdot x+\%c}$

The variables found in your answer were: $[\%c, x, y]$

Incorrect answer.

(ii) Sendo a figura 1 o gráfico e campo direcional da ED, qual das figuras 2 ou 3 é o gráfico da sua solução geral?

Figura = 2

Your last answer was interpreted as follows: 2

Correct answer, well done.

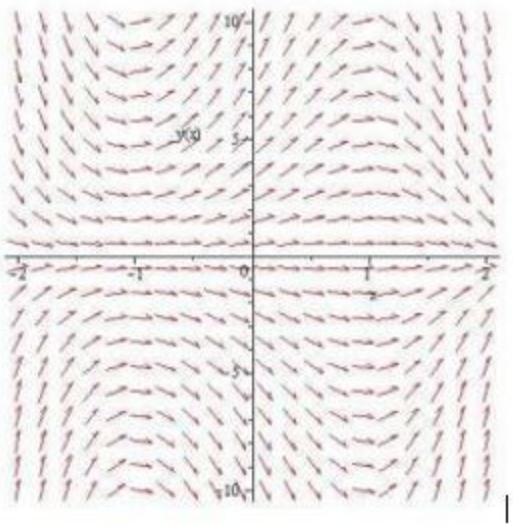


Figura 1

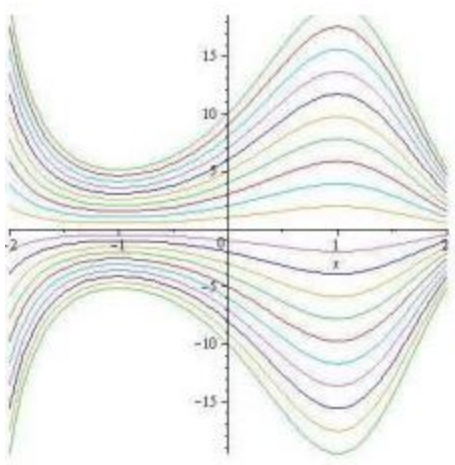


Figura 2

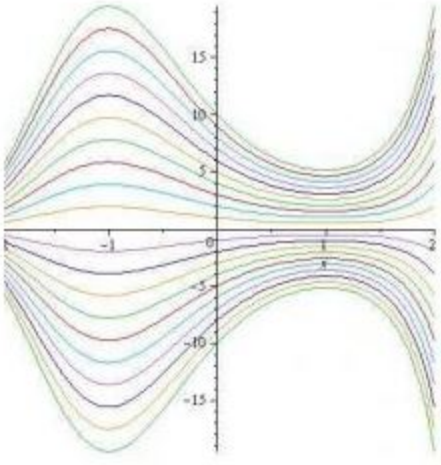


Figura 3

A correct answer is **true**.

A correct answer is **false**.

A correct answer is $y = e^{3 \cdot x - \frac{x^3}{3}} \cdot \left(e^{\frac{x^3}{3} - 3 \cdot x} + \%c \right)$, which can be typed in as follows: `y = %e^(3*x-x^3/3)*(%e^(x^3/3-3*x)+%c)`

A correct answer is $y = 5 \cdot e^{3 \cdot x - \frac{x^3}{3}}$, which can be typed in as follows: `y = 5*%e^(3*x-x^3/3)`

A correct answer is 2, which can be typed in as follows: `2`

Pergunta 3

Parcialmente correta

Nota: 2,700 em 3,000

Considere o sistema de funções $\mathrm{SF} = \{\sin(2 \cdot x), \cos(2 \cdot x)\}$.

a) Calcule o Wronskiano do sistema de funções SF.

$\det(W) =$ -2* (sin(2*x))^2 - 2* (cos(2

Your last answer was interpreted as follows: $-2 \cdot \sin^2(2 \cdot x) - 2 \cdot \cos^2(2 \cdot x)$

The variables found in your answer were: $[x]$

b) SF constitui um Sistema Fundamental de Soluções (SFS) de uma equação diferencial de ordem 2, linear e homogénea?

False

Your last answer was interpreted as follows: $\mathbf{false}$

c) As funções de SF são soluções da equação diferencial $y'' + 2y = 0$.

False

Your last answer was interpreted as follows: $\mathbf{false}$

d) Determine a solução geral da equação diferencial $y'' + 4y = 0$.

$y = c_1 *$ sin(2*x)

Your last answer was interpreted as follows: $\sin(2 \cdot x)$

The variables found in your answer were: $[x]$

$+c_2 *$ cos(2*x)

Your last answer was interpreted as follows: $\cos(2 \cdot x)$

The variables found in your answer were: $[x]$

com $c_1, c_2 \in \mathbb{R}$.

Your answer is partially correct.

Correct answer, well done.

Incorrect answer.

Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

A correct answer is $-2 \cdot \sin^2(2 \cdot x) - 2 \cdot \cos^2(2 \cdot x)$, which can be typed in as follows: `-(2*sin(2*x)^2)-2*cos(2*x)^2`

A correct answer is $\mathbf{true}$.

A correct answer is **false**.

A correct answer is $\sin(2 \cdot x)$, which can be typed in as follows: `sin(2*x)`

A correct answer is $\cos(2 \cdot x)$, which can be typed in as follows: `cos(2*x)`

Pergunta 4

Parcialmente correta

Nota: 2,000 em 4,000

Considere o PVI de ordem 2 definido por:

\(\displaystyle \left (\mathrm{P} \right)\left\{\begin{matrix}
y''-{25}y=0\\
y(0)=1\\
y'(0)=0
\end{matrix}\right. \)

a) Determine a solução particular de P.

\(\displaystyle y=y(t)\Leftrightarrow \) `y = e^(-5*x) * %c1 + e^(5*x)`

Your last answer was interpreted as follows: \(y=e^ {- 5\cdot x }\cdot {\it \%c}_{1}+e^{5\cdot x}\cdot {\it \%c}_{2} \)

The variables found in your answer were: \(\left[{\it \%c}_{1} , {\it \%c}_{2} , x , y \right]\)

b) Transforme o problema diferencial P num PVI de ordem 1, isto é, com um sistema de duas equações diferenciais de ordem 1.

\(\displaystyle \left (\mathrm{Q} \right) \left\{\begin{matrix} \left\{\begin{matrix} u'=f(t,u,v) \\ v'=g(t,u,v) \end{matrix}\right. \\u(0)=1 \\ v(0)=0 \end{matrix}\right. \)

\(\displaystyle f(t,u,v)=\) `v`

Your last answer was interpreted as follows: \(v \)

The variables found in your answer were: \(\left[v \right]\)

\(\displaystyle g(t,u,v)=\) `25*u`

Your last answer was interpreted as follows: \(25\cdot u \)

The variables found in your answer were: \(\left[u \right]\)

Your answer is partially correct.

Incorrect answer.

Correct answer, well done.

Correct answer, well done.

A correct answer is \(y=\frac{e^{5\cdot t}}{2}+\frac{e^ {- 5\cdot t }}{2} \), which can be typed in as follows: `y = %e^(5*t)/2+%e^-(5*t)/2`

A correct answer is \(v \), which can be typed in as follows: `v`

A correct answer is \(25\cdot u \), which can be typed in as follows: `25*u`

Pergunta 5

Parcialmente correta

Nota: 2,500 em 5,000

Considere as funções reais de duas variáveis reais definidas por:

\(\displaystyle f(x,y)={y^2+x^2},\,\,\,\,\,\, g(x,y)=-\frac{1}{4}({y^2+x^2}),\,\,\mathrm{se}\,\,x^2+y^2\le 16,\,\,\,\,\,\,h(x,y)=-2\sqrt{x^2+y^2}+4,\,\,\mathrm{se}\,\,1\le x^2+y^2\le 4\)

a) Determine as derivadas parciais seguintes:

\(\displaystyle \frac{\partial h}{\partial x}\left (x,y \right) =\) - 2*x / sqrt(x^2 +y^2)

Your last answer was interpreted as follows: \(\frac{-2\cdot x}{\sqrt{x^2+y^2}} \)

The variables found in your answer were: \(\left[x , y \right]\)

Correct answer, well done.

\(\displaystyle \frac{\partial g}{\partial y}\left (x,y \right) =\) -2*y

Your last answer was interpreted as follows: \(-2\cdot y \)

The variables found in your answer were: \(\left[y \right]\)

Incorrect answer.

b) Determine a equação da reta tangente à curva \(C\) de interseção da superfície de equação \(\displaystyle z=g(x,y)\) com o plano \(x={1}\) no ponto \(P(x,y)=({1},{2})\).

i) Qual é o declive da reta tangente à curva \(C\) no ponto \(P\)? \(\,\,\, m_t=\) -4

Your last answer was interpreted as follows: \(-4 \)

Incorrect answer.

ii) A equação da reta tangente é dada por: \(\displaystyle x={1}\, \land\, z=\) -4*y -3/4

Your last answer was interpreted as follows: \(-4\cdot y-\frac{3}{4} \)

The variables found in your answer were: \(\left[y \right]\)

Incorrect answer.

c) A temperatura de uma placa de metal aquecida é dada por \(\displaystyle T(x,y) = {y^2+x^2}\).
Determine a taxa de variação de \(T\) em relação à distância no ponto no ponto \(P(x,y)=({1},{2})\) na direção:

i) do eixo dos xx = 2

Your last answer was interpreted as follows: \(2 \)

Correct answer, well done.

ii) do eixo dos yy = 4

Your last answer was interpreted as follows: \(4 \)

Correct answer, well done.

iii) do vetor que faz um ângulo de 30° com a direção positiva do eixo dos xx = sqrt(3) + 2

Your last answer was interpreted as follows: \(\sqrt{3}+2 \)

Correct answer, well done.

d) Se \(\displaystyle z={4-2\cdot \sqrt{y^2+x^2}},\, \, x=\rho\cos(\theta),\,\, y=\rho\sin(\theta) \Rightarrow \frac{\partial^2 z}{\partial \theta^2}+\frac{\partial z}{\partial \rho}=\left (\frac{\partial z}{\partial y} \right)^2+\left (\frac{\partial z}{\partial x} \right)^2\)

True

Your last answer was interpreted as follows: \(\mathbf{true} \)

Incorrect answer.

e) O domínio da função \(h\) é um círculo fechado.

False

Your last answer was interpreted as follows: \(\mathbf{false} \)

Correct answer, well done.

(f) Das figuras seguintes qual delas é o gráfico da função:

i) \(\displaystyle z=g(x,y)\rightarrow \) Figura = 2

Your last answer was interpreted as follows: \(2 \)

Incorrect answer.

ii) \(\displaystyle z=h(x,y)\rightarrow \) Figura = 3

Your last answer was interpreted as follows: \(3 \)

Incorrect answer.

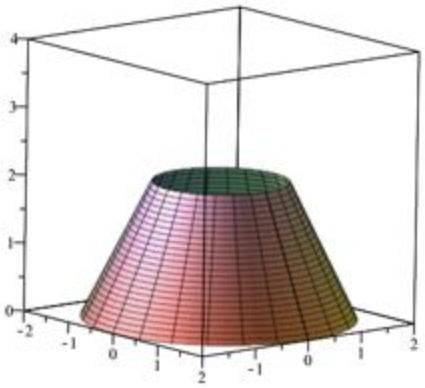


Figura 1

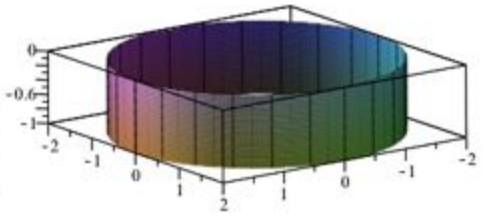


Figura 2

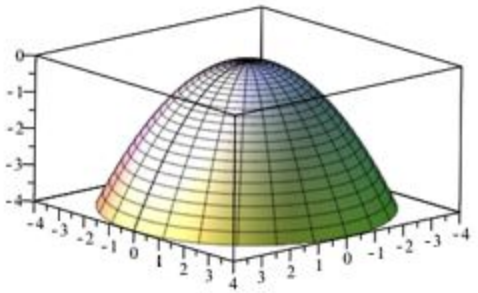


Figura 3

A correct answer is \(-\frac{2\cdot x}{\sqrt{y^2+x^2}} \), which can be typed in as follows: `-((2*x)/sqrt(y^2+x^2))`

A correct answer is \(-\frac{y}{2} \), which can be typed in as follows: `-(y/2)`

A correct answer is \(-1 \), which can be typed in as follows: `-1`

A correct answer is \(\frac{3}{4}-y \), which can be typed in as follows: `3/4-y`

A correct answer is \(2 \), which can be typed in as follows: `2`

A correct answer is \(4 \), which can be typed in as follows: `4`

A correct answer is \(\sqrt{3}+2 \), which can be typed in as follows: `sqrt(3)+2`

A correct answer is \(\mathbf{false} \).

A correct answer is \(\mathbf{false} \).

A correct answer is \(3 \), which can be typed in as follows: `3`

A correct answer is \(1 \), which can be typed in as follows: `1`

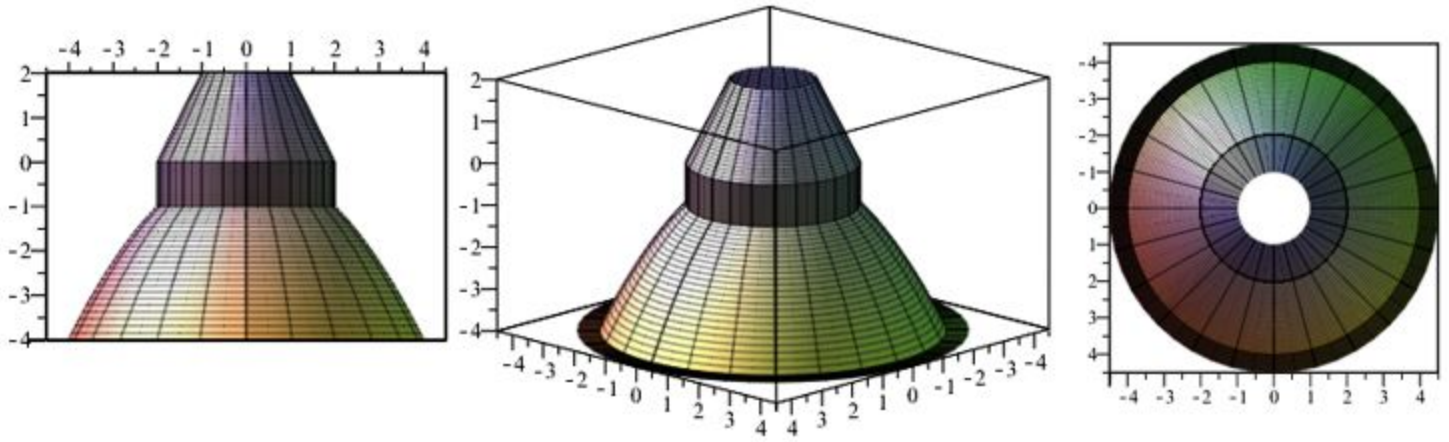
Pergunta 6

Parcialmente correta

Nota: 4,450 em 5,000

A figura seguinte representa um prototipo de um **candeeiro de teto** existente em laboratórios do ISEC.
O sólido é composto por 4 partes/superfícies, a saber:

- Tronco de um cone de altura \(h=4\) e raio \(r=2\);
- Cilindro de raio \(r=2\) e altura \(h=1\);
- Segmento de um paraboloide de altura \(h=4\) e largura máxima de raio \(r=4\);
- Anel circular de largura \(l=\frac{1}{2}\).



(a) Associando os conjuntos seguintes a sistemas de coordenadas 3D, complete-os de forma a definir corretamente o sólido \(\displaystyle S=S_1\cup S_2 \cup S_3\cup S_4 \):

\(\displaystyle S_1=\left \{ (\rho,\theta,z):r_1\leq \rho \le 2\,\wedge 0\leq \theta\leq \theta_2 \, \wedge \, z=z(\rho,\theta) \right \}\)

\(\displaystyle r_1 =\) 1

Your last answer was interpreted as follows: \(1 \)

Correct answer, well done.

\(\displaystyle \theta_2 =\) 2* pi

Your last answer was interpreted as follows: \(2\cdot \pi \)

Correct answer, well done.

\(\displaystyle z(\rho,\theta) =\) -2*rho-4

Your last answer was interpreted as follows: \(-2\cdot \rho-4 \)

The variables found in your answer were: \(\left[\rho \right]\)

Incorrect answer.

$\displaystyle S_2=\left \{ (x,y,z)\in\mathbb{R}^3:x^2+y^2\leq 4\,\wedge z_1\leq z\leq 0\right \}$

$\displaystyle z_1 =$ -1

Your last answer was interpreted as follows: -1

Correct answer, well done.

$\displaystyle S_3=\left \{ (\rho,\theta,z): r_1\leq \rho\le r_2\,\wedge 0\leq \theta\leq 2\pi \, \wedge \, z=z(\rho,\theta) \right \}$

$\displaystyle r_1 =$ 2

Your last answer was interpreted as follows: 2

Correct answer, well done.

$\displaystyle r_2 =$ 4

Your last answer was interpreted as follows: 4

Correct answer, well done.

$\displaystyle z(\rho,\theta) =$ rho^2 / 4

Your last answer was interpreted as follows: $\frac{\rho^2}{4}$

The variables found in your answer were: $\left[\rho \right]$

Incorrect answer.

$\displaystyle S_4=\left \{ (x,y,z): r_1\leq x^2+y^2\le r_2\, \wedge z=z(x,y) \right \}$

$\displaystyle r_1=$ 4

Your last answer was interpreted as follows: 4

Correct answer, well done.

$\displaystyle r_2 =$ 9/2

Your last answer was interpreted as follows: $\frac{9}{2}$

Correct answer, well done.

\(\displaystyle z(x,y) =\) -4

Your last answer was interpreted as follows: \(-4 \)

Correct answer, well done.

(b) Atendendo à forma do candeeiro em funil, determine o volume de vinho de Pinhel (Cidade do vinho 2020-21) do funil cheio (capacidade do funil) e a massa do anel inferior sabendo que a sua densidade é \(\displaystyle \rho(x,y)={8}\)

Nota: por uma questão de simplificação dos cálculos para o cálculo do volume de vinho, considere que a espessura do funil é desprezável.

(i) \(\displaystyle V(S)=V(S_1)+V(S_2)+V(S_3)\)

\(\displaystyle V(S_1) =\) (14* pi) /3

Your last answer was interpreted as follows: \(\frac{14\cdot \pi}{3} \)

Correct answer, well done.

\(\displaystyle V(S_2) =\) 4*pi

Your last answer was interpreted as follows: \(4\cdot \pi \)

Correct answer, well done.

\(\displaystyle V(S_3) =\) 30* pi

Your last answer was interpreted as follows: \(30\cdot \pi \)

Correct answer, well done.

(ii) \(\displaystyle M(S_4) = \) 30 * pi / 4

Your last answer was interpreted as follows: \(\frac{30\cdot \pi}{4} \)

Incorrect answer.

(c) Defina \(S_4\) em coordenadas cilíndricas completando o conjunto seguinte:

\(\displaystyle S_4=\left \{ (\rho,\theta,z): \rho_1\leq \rho\le \rho_2\,\wedge \theta_1\leq \theta\leq \theta_2 \, \wedge \, z =z(\rho,\theta) \right \}\)

\(\displaystyle \rho_1 =\) 4

Your last answer was interpreted as follows: \(4 \)

Correct answer, well done.

\(\displaystyle \rho_2 =\) 9/2

Your last answer was interpreted as follows: \(\frac{9}{2} \)

Correct answer, well done.

\(\displaystyle \theta_1 =\) 0

Your last answer was interpreted as follows: \(0 \)

Correct answer, well done.

\(\displaystyle \theta_2 =\) 2*pi

Your last answer was interpreted as follows: \(2\cdot \pi \)

Correct answer, well done.

\(\displaystyle z(\rho,\theta) =\) -4

Your last answer was interpreted as follows: \(-4 \)

Correct answer, well done.

(d) A expressão seguinte permite determinar o volume do tronco de cone \(S_1\).

\(\displaystyle I=\int_{0}^{2}\int_{0}^{2\pi}\int_{0}^{-2\rho+4}r\,\mathrm{d}z\mathrm{d}\theta\mathrm{d}\rho\,-\,\int_{0}^{1}\int_{0}^{2\pi}\int_{2}^{-2\rho+4}r\,\mathrm{d}z\mathrm{d}\theta\mathrm{d}\rho\)

True

Your last answer was interpreted as follows: \(\mathbf{true} \)

Correct answer, well done.

A correct answer is \(1 \), which can be typed in as follows: `1`

A correct answer is \(2\cdot \pi \), which can be typed in as follows: `2*%pi`

A correct answer is \(4-2\cdot \rho \), which can be typed in as follows: `4-2*rho`

A correct answer is \(-1 \), which can be typed in as follows: `-1`

A correct answer is \(2 \), which can be typed in as follows: `2`

A correct answer is \(4 \), which can be typed in as follows: `4`

A correct answer is \(-\frac{\rho^2}{4} \), which can be typed in as follows: `-(rho^2/4)`

A correct answer is \(4 \), which can be typed in as follows: `4`

A correct answer is \(\frac{9}{2} \), which can be typed in as follows: `9/2`

A correct answer is \(-4 \), which can be typed in as follows: `-4`

A correct answer is \(\frac{14\cdot \pi}{3} \), which can be typed in as follows: `(14*%pi)/3`

A correct answer is \(4\cdot \pi \), which can be typed in as follows: `4*%pi`

A correct answer is \(30\cdot \pi \), which can be typed in as follows: `30*%pi`

A correct answer is \(34\cdot \pi \), which can be typed in as follows: `34*%pi`

A correct answer is \(4 \), which can be typed in as follows: `4`

A correct answer is \(\frac{9}{2} \), which can be typed in as follows: `9/2`

A correct answer is \(0 \), which can be typed in as follows: `0`

A correct answer is \(2\cdot \pi \), which can be typed in as follows: `2*%pi`

A correct answer is \(-4 \), which can be typed in as follows: `-4`

A correct answer is \(\mathbf{true} \).

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NEXT ACTIVITY
Submissão de rascunhos e página de consulta permitida no exame da época especial »