

## 5i Z'XYb 'Gdi fYb 'XYf '9f]bbYfi b[Yb. 'A Ul < c ZZa Ubbg': f]YX\c ZghUl ]']b '? UggY`

A UI '<cZZa Ubb'ghYi Yfh'XUg'\_cghYb`cgY': f]YX\cZghUI ]']b ?UggY`i bX'V]YhYh'Y]bY'VYgcbXYfY'JYfV]bXi b['ZØf HfUi Yf[ ÀghYi bX'6Ygi WXYf"

A UI '< c ZZa Ubbž'Y]b'' %! 'À\f][ Yf': f]YX\c ZgZU\fYf'Ui g'? UggY`ž'\Uh Y]bY'[ Ubn'VYgcbXYfY'5i Z[ UVY'Ui Z'XYa '? UggY`Yf' < Ui dhZf]YX\c Z 9f'ghYi Yfh'XUg': f]YX\c ZghUl ]ž'Y]b'\_cghYb`cgYg'5b[ YVch'ZØf A YbgWXYbž'X]Y'GW\k ]Yf][ \_Y]hYb'VY]a '@Ui ZYb'\UVYb''' < c ZZa Ubbž XYf'gY]h'&\$%) ']a '8 ]Ybgh']ghž'VY[ `Y]hYh'gY]bY': U\f[ ÀghY'b]W\h'bi f Ubg'N]Y`ž'gcbXYfb'gW\UZZh'Ui W\h]YZ[ Y\YbXY'JYfV]bXi b[ Yb''' \=\W\ \_YbbY''YXYb'6Ui a 'VY]a 'B Ua Yb ž'gU[ h'Yf'gW\a i bnY`bX'i bX VYhcbhž'k]Y'gY\f'a ]h'XYa 'C fh'j YfVi bXYb']gh''

## 8 Ug 5 b [ Y V c h X Y g : f]Y X \ c ZghUl ]g

A UI '<cZZa Ubbg'5fVY]h']gh'j cf'U``Ya 'ZØf'A YbgWXYb'j cb 6YXYi hi b[ž'X]Y'a cV]`]hÀhgY]b[YgWXfÀb\_h'g]bX'cXYf'XYbYb'Y]b GdUn]Yf[Ub['ØVYf'XYb': f]YX\cZ'gWXk YfZÀ``h"'8 Ug': f]YX\cZghUI] \_Ubb'\_cghYb`cg']b'5bgdfi WX'[Ybca a Yb'k YfXYbž']bXYa 'X]Y ?i bXYb'Y]bZUWX'Ubfi ZYb'i bX'<cZZa Ubb'ni ']\fYa 'GhUbXcfh'fi ZYb"  $CZh'g]bX'X]YgY': U\fhYb'a ]h'Y]bYa 'VYgcbXYfYb'Ya ch]cbU`Yb ; Yk ]Wkh'j YfVi bXYb''' < cZZa Ubb'YfnÀ\`h' 9]bY': fUi 'Vf]b[ h'a ]f ]a a Yf'Y]bYb'7\f]ghghc``Yb'ni 'K Y]\bUWkhYbž'k Ybb'X]Y'GU]gcb YbXYh'''8 Ug'nY][ hž'XUgg']Wk'Y]bYb'V`Y]VYbXYb'9]bXfi W_\]bhYf`UggY''$ 

 $\label{eq:GY_b_HU_VY_b_hamile} GY_b^HU[~VY[~]bbh^a~]h^Y]bYf^Fi~bXZU\fh^ØVYf^XYb^:~f]YX\cZ^*i~a~bUWX^I~bfY[~Y^a~A^*][~_Y]hYb^*ni~gWX~Ui~Yb^*i~bX^*U^*Yg^*]b^*C~fXbi~b[~ni~U^hYb^*K~Ybb^*XUg^*HY^*YZcb^*_^]b[~Y^hz^*]gh^Yg^*cZh^ZØf^Y]bYb^*HfUi~YfZU^*z^*i~bX^*<cZZa~Ubb^*VYfY]hYh^*g]WX^*XUfUi~Z^*j~cfz^*X]Y^*;~AghY^ni~]\fYa~YhnhYb^*C~fh^ni~VY[~Y]hYb^*$ 

6YgcbXYfg'VYfØ\fh']\b'XYf'?cbhU\_h'ni 'À`hYfYb'6Ygi W\Yfbž'X]Y k À\fYbX'XYf': U\fhYb'; YgW\]W\hYb'Ui g']\fYf'J Yf[ Ub[ Yb\Y]h YfnÀ\`Yb"'8UVY]'a i gg'<cZZa Ubb'cZh'Ub'VYfØ\a hY DYfgÒb`]W\\_Y]hYb'XYb\_Ybž'X]Y'Ui Z'XYa ': f]YX\cZ'fi \Ybž'XUfi bhYf @i Xk ][ '9a ]`'; f]a a 'i bX'5fbc`X'6cXY"'8]YgY'[ YgW\]W\h`]W\Yb JYfV]bXi b[ Yb'g]bX'ZØf']\b'j cb'[ fc»Yf'6YXYi hi b[ 'i bX'[ YVYb gY]bYb': U\fhYb'Y]bY'ni gÀhn`]W\Y'H]YZY"

## 8]Y 9a ch]cbU`]hÀh XYg 5fVY]hgd`UhnYg

A UI '< c ZZa Ubb']gh'c Zh'a ]h'H\Ya Yb'k ]Y'Hc X'i b X'HfUi Yf \_cb Zfcbh]Yfh"'9f'[Y\h'XUa ]h'Ui Z'gY]bY'Y][YbY'5fh'i a 'i b X'Yf\_Ybbh X]Y'< YfUi gZcfXYfi b[Ybž'X]Y'X]YgY'H\Ya Yb'a ]h'g]W\'Vf]b[Yb"' 9g hf]ZZh'a ]W\'VYgcbXYfgž'k Ybb'9`hYfb']\fY'?]bXYf'VYYfX][Yb ž fYZ'Y\_h]Yfh'Yf'X]Y'gW\k]Yf][Yb'A ca YbhY'gY]bYf'5fVY]h"'9f']gh'g]W\\VYk i gghž'k ]Y'k Yfhj c``X]Y'; Ygi bX\Y]h']gh'i bX'k ]Y'gW\bY``g]Y'g]W\ j YfÀbXYfb'\_Ubb"

Hfchn'XYf'gWk YfYb'A ca YbhY'\Uh'<cZZa Ubb'Y]bY'\_`UfY'A ]gg]cb.
9f'a ÒWkhY'XYb'A YbgWkYb'\Y`ZYbž'XYb'5i ZYbh\U`h'Ui Z'XYa
: f]YX\cZ'gc'Ub[YbY\a'k]Y'a Ò[`]Wk'ni '[YghU`hYb"'8i fWk'gY]bY
ZfYi bX`]WkY'5fh'i bX'gY]b'9b[U[Ya Ybh'\]`Zh'Yfž'XYb'5b[Y\Òf][Yb
Hfcgh'ni 'gdYbXYb'i bX'X]Y'HfUi Yf']b'Y]bYa 'fYgdY\_hj c``Yb'FU\a Yb
ni 'VY[`Y]hYb"

 $< c Z\!\!/ a \;\; Ubb \;\; gY \;\; Vgh \;\; V \;\; ]W\_h \;\; a \;\; ]h \;\; Ghc \;\; n \;\; Ui \;\; Z \;\; gY \;]bY \;\; 5 \;\; fVY \;]h \;\; ni \;\; f @W\_" \;\; 9 \;\; f \;\; V \;\; Uh \;\; ]b$ 

 $\label{eq:continuous_problem} j \ YfgWX \ ]YXYbYb '6YfY \ ]WXYb 'XYf'? \ UggY `Yf'K \ Yf_ghÀhhYb' [ \ YUfVY]hYhž \ UVYf'_Y]b 'UbXYfYf' <math>\approx$  V '\ Uh']\ b'gc 'YfZØ``h'k ]Y'X]Y'HÀh][ \_Y]h'Ui Z'XYa : f]YX\cZ'' \ 9g' ]gh'b]WX h'Y]bZUWX ž'a ]h'Y]bYf'6Y\]bXYfi b[ 'ni '`YVYbž i bX'Ui WX'k Ybb'a Ub'Yg'a ]f'b]WX h'Ubg]Y\hž'V]b']WX 'ghYhg'XUfUi Z \ VYXUWX hž'XUgg'k ]f'U``Y' [ `Y]WX'VY\UbXY`h'k YfXYb ž'Yfk À\bh'Yf'i bX Yf\_`Àfh'gY]bY'G]WX hk Y]gY'ni '\#b\_`i g]cb''

: Øf' < c ZZa Ubb']gh'Yg'k ]Wkh][ ž'XUgg'A YbgWkYb'a ]h'6Y\]bXYfi b[ Yb
X]YgY`VY'K YfhgWkÀhni b[ 'YfZU\fYb'k ]Y'U``Y'UbXYfYb'Ui Wk"' Bi f'gc
\_Ubb'=b\_`i g]cb'Zi b\_h]cb]YfYb ž'g]bX'g]Wk' < c ZZa Ubb'i bX'gY]bY
?c``Y[ Yb'Y]b][ ž'U`g'g]Y'Ua ' < Ui dhY]b[ Ub[ 'XYg': f]YX\cZg
Ub\_ca a Ybž'k c'VYfY]hg'X]Y'bÀWkghY'HfUi Yf[ Ya Y]bXY'k UfhYh"</pre>

Gc 'V`Y]Vh'A UI '<cZZa Ubb 'b]W\h'bi f': U\fYfž'gcbXYfb 'Ui W\'Y]b Y]bZØ\`gUa Yf'6Y[`Y]hYf'Ui Z'Y]bYf``YhnhYb'FY]gY"'9f'j Yfk UbXY`h'XUg : f]YX\cZghUI ]']b'a Y\f'U`g'bi f'Y]b'HfUbgdcfha ]hhY`/'Yg'k ]fX'ni Y]bYa 'Gma Vc``ZØf'JYfVi bXYb\Y]hž'JYfhfUi Yb'i bX'A ]h[YZØ\``]b Y]bYa '6YfY]W\ž'XYf'cZh'j cb'HfUi Yf'i bX'9]bgUa \_Y]h'[YdfÀ[h']gh"

8 Y hU1`a

6 Y gi W Y b 'G ] Y 'i b g 'U i Z 'b ! U [ "X Y