

# PDEQ

<p>PDEQ: →PD: bookform to PDE (1s) d→der: d to derivatives</p> <p>Uijkl: generate partial derivatives (0.5s)</p>	<pre> 8: 7: 6: 5: 4: 3: 2: 1:       UXX-UY=SIN(X)       -(d2U(X,Y)-d1d1U(X,Y))=SIN(X)       -[<math>\frac{\partial}{\partial Y}(U(X,Y))-\frac{\partial}{\partial X}(\frac{\partial}{\partial X}(U(X,Y)))]=SIN(X)</math> +Func +PD d+der U:ijk U:lmno HP50       </pre>	<pre> 8: 7: 6: 5: 4: 3: 2: 1:       <math>\frac{\partial}{\partial Z}(\frac{\partial}{\partial Y}(\frac{\partial}{\partial Y}(\frac{\partial}{\partial X}(U))))</math> PD10 PD20 +PD0 U+0E D150 U:ijk       </pre>
<p>PDEQ: U→PD: solution in PDE (1s)</p> <p>Subst, U→PD: substitute special f,g, determine U, check solution</p>	<pre> 8: 7: 6: 5: 4: 3: 2: 1:       Wave: (UTT=a<sup>2</sup>.UXX)       U=f(X+a.T)+g(X-a.T)       0=0 Help U+PD Subst +Func Solve DTAG       </pre>	<pre> 8: 7: 6: 5: 4: 3: 2: 1:       F(X)+UX+g(Y)+UY=0       U=P[RISCH(<math>\frac{1}{F(X)}</math>),X]-RISCH(<math>\frac{1}{g(Y)}</math>),Y       CF(X)=X g(Y)=Y<sup>2</sup>       X*UX+Y*UY=0       U=P(LN(X)-LN(Y))       0=0 Help U+PD Subst +Func Solve DTAG       </pre>
<p>PDSOL: U→PD insert solution</p>	<pre> 40SOL SOLUTIONS OF PD PD'S HAVE MANY SOLUTIONS ONLY SOME OF THEM ARE SHOWN  PD11 LINEAR 1. ORDER PD01 NONLINEAR 1. ORDER PD1H LINEAR HIGHER ORDER PD0H NONLINEAR HIGHER ORDER PDS SYSTEMS PD1list... LIST WITH EXAMPLES PUT ON STACK, DECOMPOSE WITH EVAL EDIT AND +LIST AGAIN +SWIP SWIP+ +DEL DEL+ DEL L INS+       </pre>	<pre> U+PD PD U,U=... + 'A=B' INSERT SOLUTION IN PDE IF U IS LIST WITH SEVERAL SOLUTIONS ONLY THE FIRST IS INSERTED. TO INSERT OTHER SOLUTIONS YOU MUST CHOOSE ONE OF THE LIST Subst PD 'Y=...' 'Y='... + DE' SUBSTITUTE IN DE OR TERM CALLS d+der Solve 'A=B' 'Y,Y(X)' + SOLUTION 4 SOLVE EQ (NONRIGOROUS) +SWIP SWIP+ +DEL DEL+ DEL L INS+       </pre>
<p>PDSOL: help</p>	<pre> Desolve OD 'Y(X)' + OD SOLUTION TriHyp 'A=B' + 'A1=B1' TRIG AND HYPERBOLIC SIMPLIFICATION dEval d1F(X),d2F(X) + derF EVAL DERIVATIVES OF SPECIAL FUNCTIONS d1ACOT(Z) + -1/(1+Z<sup>2</sup>) +Func PD + <math>\frac{1}{2}</math> V(X) ... LIST OF FUNCTIONS FOR Subst +PD UXY + d2d1U(X,Y) d+der 'd2d1U' + 'dY(d2U(X,Y))' works for d1..d3 +SWIP SWIP+ +DEL DEL+ DEL L INS+       </pre>	<pre> works for d1..d3 U:ijk i,j,k l + d1d3,Yd3kZd1U GENERATE PART. DERIVATIVE Dlmo F(X,Y,Z,T) + Flmo CALCULATE PART. DERIVATIVE  RISCH(F(X),X)=F(X) dX P(C)=ARBITRARY FUNCTION  MORE EQUATIONS AND DETAILS SEE: http://eqworld.ipmnet.ru 4 +SWIP SWIP+ +DEL DEL+ DEL L INS+       </pre>
<p>PDSOL: PDL1: choosebox</p> <p>PDN1: choosebox</p>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       LINEAR 1. ORDER PDE       'UX+a(X)*Y+b(X)*UY='       'F(X)*UX+g(Y)*UY=0'='       'UX+f(X*X+b*Y+c)*UY=0'       'UX+f(Y/X)*UY=0'='Y=Y       'X*UX+Y*f(X)*Y*Y)*UY       'UX+a(X)*UY=f(X)*g(Y)'='       'a*UX+b*UY=f(X)'='U=1       'a*UX+b*UY=f(X)+g(Y)'       </pre>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       NONLINEAR 1. ORDER PD       'F1(X)*UX+F2(Y)*UY^2='       'light rays (if a=b):       'UX^2+UY^2=f(X)+g(Y)'       'UX^2+UY^2=f(X)' : <math>\zeta</math>       'F1(X)*UX^2+F2(Y)*UY^2='       'UX+f(Y)*g(X)' : <math>\zeta</math> 'U       'UX-f(X,UY)=0' : <math>\zeta</math> 'UX       'UX+f(X,UY)=g(X)*U'       </pre>
<p>PDSOL: PDLH: choosebox</p>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       LINEAR HIGHER ORDER PD       1kn. heat: <math>\zeta</math> 'UT=a*UX       axial heat: <math>\zeta</math> 'r=f(X)       Schrodinger: <math>\zeta</math> 'ixhb       Wave: <math>\zeta</math> 'UTT=a^2*UXX       Klein-Gordon: <math>\zeta</math> 'UTT=       3-d Klein-Gordon: <math>\zeta</math>       Telegraph: <math>\zeta</math> 'UTT+k*U       Laplace: <math>\zeta</math> 'UXX+UY=0       </pre>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       LINEAR HIGHER ORDER PD       Laplace: <math>\zeta</math> 'UXX+UY=0       polar Laplace: <math>\zeta</math> '1/r       Poisson: <math>\zeta</math> 'UXX+UY=f       Helmholtz: <math>\zeta</math> 'UXX+UY+       Tricomi: <math>\zeta</math> 'Y*UXX+UY       gen. Tricomi: <math>\zeta</math> 'UXX+       elastic rod: <math>\zeta</math> 'UTT+a       Biharmonic: <math>\zeta</math> 'UXXXX+       </pre>
<p>PDSOL: PDNH: choosebox</p>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       NONLIN. HIGHER ORD. PDE       :Fisher: 'UT=UXX+a*U*(       :Newell-Whitehead: 'UT       :FitzHugh-Nagumo: 'UT       :Nonlin. heat: 'UT=f(U       :Burgers: 'UT=UXX+U*U       :cubic Schrodinger:       :power law Schrodinger       :gen. nonlin. Schrod       </pre>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       NONLIN. HIGHER ORD. PD       nonlin. Klein Gordon:       nonlinear heat: <math>\zeta</math> 'UX       anisotropic heat: <math>\zeta</math>       Monge Ampere: <math>\zeta</math> 'UXY^       Korteweg-de Vries: <math>\zeta</math>       modified Korteweg-de       Boussinesq: <math>\zeta</math> 'UTT+U*       'STCST(U(X,Y,T))=3X(X,Y       </pre>
<p>PDSOL: PDL1: examples</p>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       a*UX+b*UY=f(X)+g(Y)       U=<math>\frac{1}{a}</math>.RISCH(F(X),X)+<math>\frac{1}{b}</math>.RISCH(g(Y),Y)       a*UX+b*UY=f(X)+g(Y)       RISCH(<math>\frac{1}{g(Y)}</math>),Y)=<math>\frac{1}{a}</math>.RISCH(F(X),X)+       </pre>	<pre> 9: 8: 7: 6: 5: 4: 3: 2: 1:       a*UX+b*UY=f(X)+g(Y)       RISCH(<math>\frac{1}{g(Y)}</math>),Y)=<math>\frac{1}{a}</math>.RISCH(F(X),X)+       UX+f(Y)*UY=0       gen. solution: (Y=X*f(Y)+P(Y))       </pre>

<p>PDSOL: PDN1: example U-&gt;PD: insert solution(2s)</p> <p>PDN1: example U-&gt;PD: insert solution(17s)</p>	<pre> RAD XYZ DEC R= 'X' \HOME PDEQ PDSOL3 USR 50: 40: 30: 20: 10: 1: Help U+PD Subst Solue +Func Desol </pre>	<pre> 50: 40: 30: 20: 10: 1: Help U+PD Subst Solue +Func Desol </pre>
<p>PDSOL: PDLH: examples</p> <p>U-&gt;PD: insert solution(7s)</p>	<pre> 7: 6: 5: 4: 3: 2: 1: PDL1 PDN1 PDLH PDNH Help PDL10 </pre>	<pre> 50: 40: 30: 20: 10: 1: Help U+PD Subst Solue +Func Desol </pre>
<p>PDSOL: PDLH: some solutions of the Laplace equation</p> <p>PDNH: some solutions of Burgers PD</p>	<pre> 7: 6: 5: 4: 3: 2: 1: PDL1 PDN1 PDLH PDNH PDS Help </pre>	<pre> 50: 40: 30: 20: 10: 1: PDL1 PDN1 PDLH PDNH PDS Help </pre>
<p>PDSOL: PDNH: examples</p>	<pre> 40: 30: 20: 10: 1: PDL1 PDN1 PDLH PDNH Help PDL10 </pre>	<pre> 40: 30: 20: 10: 1: PDL1 PDN1 PDLH PDNH Help PDL10 </pre>
<p>PDSOL: PDNH: insert solution</p> <p>PDN1: insert solution (4s)</p>	<pre> 7: 6: 5: 4: 3: 2: 1: Help U+PD Subst +Func Solue DTAG </pre>	<pre> 50: 40: 30: 20: 10: 1: Help U+PD Subst +Func Solue DTAG </pre>
<p>PD10: LP1XY: linear partial diff.eq. of 1. order, char. eq. (6s)</p> <p>U-&gt;DE: insert solution (4s)</p>	<pre> 50: 40: 30: 20: 10: 1: Examp PDE LP1XY Qlcs Nlcs Help </pre>	<pre> 50: 40: 30: 20: 10: 1: Help +PDE U+DE Disol U1,kl U1lmo </pre>
<p>PD10: Qlcs: (quasi-) linear system to char. system (1.6s)</p> <p>Qlcs: second example (2s)</p>	<pre> 40: 30: 20: 10: 1: Examp PDE LP1XY Qlcs Nlcs Help </pre>	<pre> 60: 50: 40: 30: 20: 10: 1: Examp PDE LP1XY Qlcs Nlcs Help </pre>
<p>PD10: Nlcs: char. system of nonlinear PDEQ (4s)</p> <p>PD20: LPC2XY: solve linear PDEQ of 2. order (4s)</p>	<pre> 50: 40: 30: 20: 10: 1: Examp PDE LP1XY Qlcs Nlcs Help </pre>	<pre> 60: 50: 40: 30: 20: 10: 1: Examp PDE LP2XY Qlcs Nlcs Help </pre>

<p>PD2O: LPC2XY: solve linear partial differential eq. of 2. order (4s), U→DE (8s)</p> <p>U→DE: insert solution (40s)</p>	<pre> 8: 7: 6: 5: 4: 3: 2: 1: </pre> $2 \cdot U_{XX} + 2 \cdot U_{XY} + U_{YY} = 0$ $g\left(-\frac{(1-i) \cdot X - 2 \cdot Y}{2}\right) + h\left(-\frac{(1+i) \cdot X - 2 \cdot Y}{2}\right)$ <p>0=0</p> <p>Help +PDE U→DE Disol UI,jkl Dlnno</p>	<pre> 8: 7: 6: 5: 4: 3: 2: 1: </pre> $U_{XX} + 4 \cdot U_{XY} + 4 \cdot U_{YY} + U_X + 2 \cdot U_Y = 0$ $\frac{g(-(2 \cdot X - Y))}{2} + h(-(2 \cdot X - Y))$ <p>0=0</p> <p>Help +PDE U→DE Disol UI,jkl Dlnno</p>
<p>PD2O: V→CH: linear PDEQ to char. system (11s) C→NF: PDEQ with constant coeff. to transformations and normal form (4s)</p>	<pre> 4: 3: 2: 1: </pre> $X \cdot U_{XX} + U_{YY} + \frac{1}{2} \cdot U_X = 0$ $\begin{cases} \frac{\partial}{\partial X}(Y(X)) = -\frac{\sqrt{-X} \cdot  X }{X^2} \\ \frac{\partial}{\partial X}(Y(X)) = -\frac{\sqrt{-X} \cdot  X }{X^2} \end{cases}$ <p>Examp PDE C→NF LPC2X TLIST V→CH</p>	<pre> 8: 7: 6: 5: 4: 3: 2: 1: </pre> $U_{XX} - (4 \cdot U_{XY} - 3 \cdot U_{YY}) = 0$ $\begin{cases} x = 3 \cdot X + Y \\ y = X + Y \end{cases}$ $-(4 \cdot V_{xy}) = 0$ <p>Examp PDE C→NF LPC2X TLIST V→CH</p>
<p>PD2O: Pdsep: separable PDEQ (5s) D1solve: solve x component (6s)</p>	<pre> 2: 1: </pre> $U_{XX} + U_{YY} = \frac{1}{a^2} \cdot U_{TT}$ $\begin{cases} \frac{\partial}{\partial X}\left(\frac{\partial}{\partial X}(F(X))\right) = \lambda \cdot F(X) \\ \frac{\partial}{\partial Y}\left(\frac{\partial}{\partial Y}(F(Y))\right) = \lambda \cdot F(Y) \\ \frac{-1}{a^2} \cdot \frac{\partial}{\partial T}\left(\frac{\partial}{\partial T}(F(T))\right) = \lambda \cdot F(T) \end{cases}$ <p>Examp PDE C→NF LPC2X V→CH Pdsep</p>	<pre> 6: 5: 4: 3: 2: 1: </pre> $\frac{\partial}{\partial X}\left(\frac{\partial}{\partial X}(F(X))\right) = \lambda \cdot F(X)$ $\frac{\partial}{\partial Y}\left(\frac{\partial}{\partial Y}(F(Y))\right) = \lambda \cdot F(Y)$ $\frac{-1}{a^2} \cdot \frac{\partial}{\partial T}\left(\frac{\partial}{\partial T}(F(T))\right) = \lambda \cdot F(T)$ $\frac{\lambda \cdot cC0 - \sqrt{\lambda} \cdot cC1}{2 \cdot \lambda} \cdot (-\sqrt{\lambda} \cdot X) + \frac{\lambda \cdot cC0 + \sqrt{\lambda}}{2 \cdot \lambda}$ <p>Help +PDE U→DE Disol UI,jkl Dlnno</p>