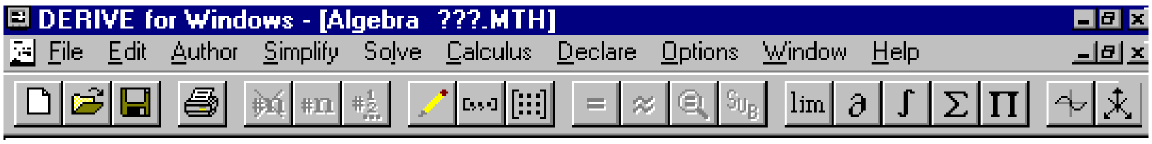
DERIVE LABORATORY EXERCISE - Prof. Richard B. Goldstein

BOOT-UP PROCEDURE

Press the **Start** button ( lower left) and open the folders  **Programs ▸** and **Derive for Windows** to find the **DERIVE** package.

OPENING SCREEN



Icons: (as shown in groups from left to right)

New | Open | Save
Print
Remove | Unremove | Renumber
Author expression | Author vector | Author matrix
Simplify | Approximate | Solve | Substitute for variables
Calculate limit | Calculate derivative | Calculate integral | Calculate sum | Calculate product
2D - plot window [Ctrl + 2] | 3D - plot window [Ctrl + 3]

Alternatively, one can use the **pull-down menu**.

File

New... (Ctrl+N)
Open... (Ctrl+O)
Close
Load
Save (Ctrl+S)
Save As...
Write To
Change Directory...
Print... (Ctrl+P)
Print Preview
Page Setup...
Exit

Edit

Expression...
Annotation...
Go to Expression...
Remove... (Ctrl+R)
Unremove... (Ctrl+U)
Move (Ctrl+M)
Renumber
Copy Expressions (Ctrl+C)
Mark and Copy... (Ctrl+Shift+M)

Author

Expression... (Ctrl +A)
Vector...
Matrix...

Simplify

Basic... (Ctrl+B)
Expand... (Ctrl+E)
Factor... (Ctrl+F)
Approximate... (Ctrl+G)
Substitute for

Solve

Algebraically... (Ctrl+Shift+A)
Numerically... (Ctrl+Shift+N)
System... (Ctrl+shift+S)

Calculus

Limit...
Differentiate...
Taylor Series...
Integrate...
Sum...
Product...
Vector...

Declare	**Options**	**Window**	**Help**
Variable Value...	Color	New Algebra View	Content
Variable Domain...	Printing	New 2D-plot Window	Index
Function Definition...	Tile Entry Dialogs	New 3D-plot Window	Using Help
Algebra State...		Cascade	About DERIVE
		Tile Horizontally	
		Tile Vertically	
		Arrange Icons	
		Toolbar	
		Status Bar	
		1 Algebra ???.MTH	

ENTERING EXPRESSIONS

Choose **Author | Expression** or **Ctrl + E**

Algebraic Expression	DERIVE form
$x^3 - 6x^2 + 9$	X^3-6X^2+9
$\frac{e^{x^2}}{\sqrt{2x+1}}$	#e^(x^2)/sqrt(2x+1)
$\frac{d^2}{dx^2}\int_0^x t^3 e^{-t} dt$	dif(int(t^3#e^(-t),t,0,x),x,2)

Note: for text such as your name simply enter the text within quotes for example: “James Smith”

REMOVING EXPRESSIONS

One can highlight the expressions to erase and press the **Delete** key or the **Remove icon**.

PRINTING

From any Window - Algebraic, 2D-plot, or 3D-Plot type **Ctrl + P** or use the **print icon** or the pull-down menu **File | Print**.

SAVE

You can save your work by **Ctrl + S** or use the **save icon** or by the pull-down menu **File | Save**. Also there is a **Save As** option in the pull-down menu.

OPEN

This allows the user to open previously saved files.

LOAD

This option allows the user to load **Math, Data, Demo**, or **Utility** files. There are many useful utility files to load as **Dif_apps.mth, Int_apps.mth, Ode1.mth, Orth_pol.mth, and Plotpara.mth**. Once loaded there are additional built-in calculations that these provide.

2D PLOT SCREEN

Either highlight an algebraic expression that has already been entered or enter an expression by Ctrl + A. Press the 2D - plot window icon or type Ctrl + 2. Once in the 2D - plot Window press the **plot icon** or use the pull-down menu **Plot!** You can change colors, size, view, add additional graphs, recenter, rescale, etc.

3D PLOT SCREEN

Similar to 2D except this only plots on two variable function at a time. For example, you might try **x^2+y^2**.

EXIT

To exit use the pull-down menu **File | Exit**

SAMPLE ACTIVITIES:

CALCULUS

Let f(x) = $\dfrac{2x^2 - 5x + 2}{x^2 - 6x + 8}$

Calculate: $\lim\limits_{x \to 2} f(x),\ \lim\limits_{x \to \infty} f(x),\ f'(x),\ \int f(x)\,dx,\ \int_5^t f(x)\,dx$

- Enter the expression as: (2x^2-5x+2)/(x^2-6x+8)
- Press the **[lim]** button (limit icon), let the variable be x, the limit point be **2**, from both sides and select **Simplify**. The answer is **1/4**
- Highlight the expression again, press the **[lim]** button, and use for the second limit point enter either: **inf** or the ∞ as chosen from the character set in the dialog box. After **Simplify** the answer is shown as **2**.
- The expression is highlighted again and the **[ ]** button (derivative icon) is chosen. The order is **1.** **Simplify.**

- After the expression is highlighted press the **[ ]** button (integral icon). This is an indefinite integral. **Simplify.**
- Finally, highlight the expression one more time and press the **[ ]** button. This time we have a definite integral with lower limit of 5 and upper limit to t. After we choose **Simplify** all of the calculations have been made.
- You may wish to graph one or more of these answers along with the original expression.

LINEAR ALGEBRA

Let **a** = [2, -1, 6] and **b** = [4, 2, 2] Find **a b** and **a × b**

- There are choices here again. Either enter the expressions using Ctrl + A and type **a:=[2,-1,6]** and then repeat with **b:=[4,2,2]** or use the **Author vector icon** shown as **[ ]**. Here the expression will be simply known as #1 and #2 for example.
- To get the dot (inner) product, author the expression **a.b** or **#1.#2** After using **Simplify** or after the expression is entered type **Ctrl + B** The result is **18**.
- To get the cross product, author the expression **cross(a,b)** or **cross(#1,#2)**. The result this time is the vector: **[15, -10, -8]**.

DIFFERENTIAL EQUATIONS

(1) Solve: $y' + 3x^2y = 6x^2,\ y(0) = 5$

This is a linear ordinary differential equation of form: $y' + p(x)y = q(x),\ y(x_0) = y_0$
The utility expression in DERIVE is linear1(p, q, x, y, x_0, y_0)

- Load the file Ode1.mth by **File | Load | Utility**
- Enter the expression: linear1(3x^2,6x^2,x,y,0,5)
- The result is $3e^{-x^3} + 2$

(2) Find the Taylor Series solution of $y' = x^2y,\ y(0)=2$

This is an equation of the form: $y' = r(x,y),\ y(x_0) = y_0$
The utility expression is TAYLOR_ODE1(r, x, y, x_0, y_0, n)

- Load the file Ode_appr.mth
- Enter the expression: taylor_ode1(x^2y,x,y,0,2,6)
- The result is $\frac{x^2}{9} + \frac{2x^3}{3} + 2$