Multiple Integration Program
User Manual

What's included in this Zip File:

1) MLTIINT.89p
2) MLTIINT_Manual.pdf

Features:

1) The program can integrate single, double, or even triple integrals!
2) Depending on the type of integration done, you can integrate in rectangular, polar, cylindrical, or even spherical coordinates!
3) Its menu operated, select options through drop-down boxes.
4) Only required input needed is the function your integrating and its upper and lower limits (with respect to particular variable(s))!

Sample Problems

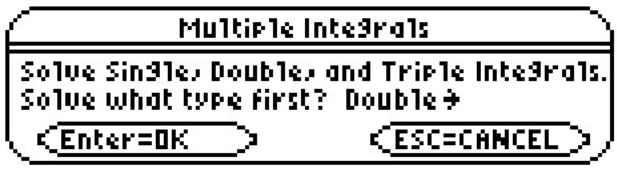
1)

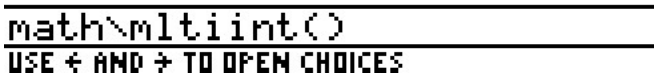
Use a double integral to find the area of the region R enclosed between the parabola $y = \frac{1}{2}x^2$ and the line $y = 2x$.

The integration formula is $\int_0^4 \int_{x^2/2}^{2x} dy\, dx$ (Verify).

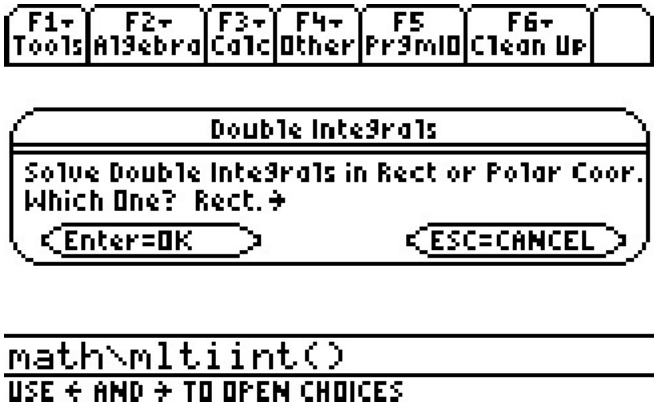
Let's take this step by step:

a) Start the program and drop-down to Double and press Enter.

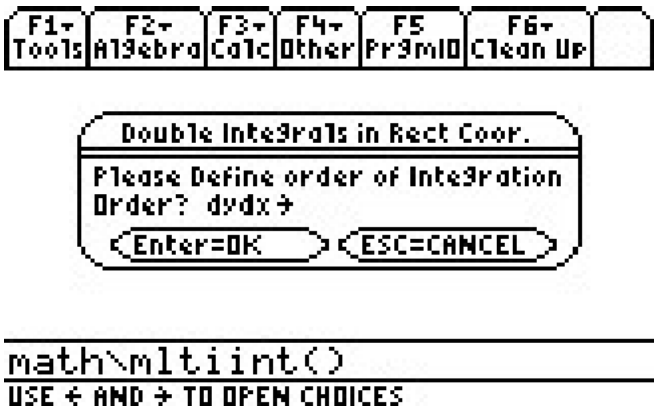




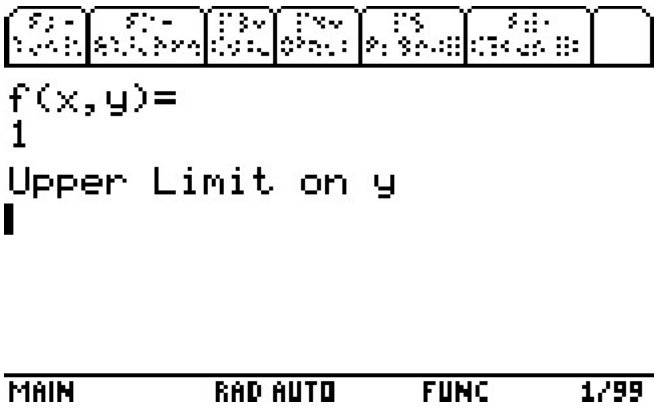
b) At the next menu, the option highlighted is 'Polar'. Use the drop-down box and select Rect. Press Enter.



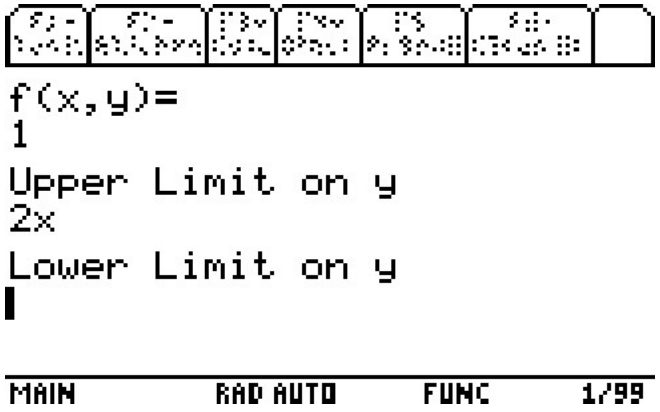
c) At the next menu, select the order of integration dydx and then press Enter.



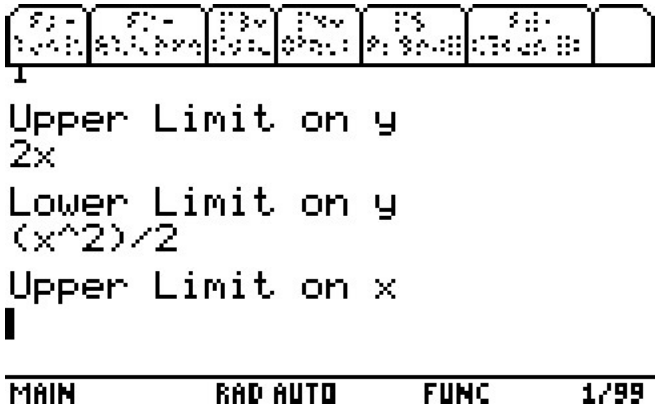
d) You are prompted to put in f(x,y). In this case, f(x,y) is equal to 1. So type in 1 and then press Enter.



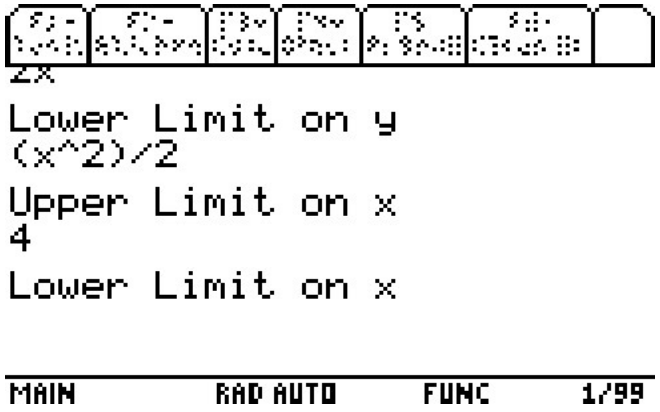
e) You are then prompted to put in the upper limit of y. Type 2x and then press Enter.



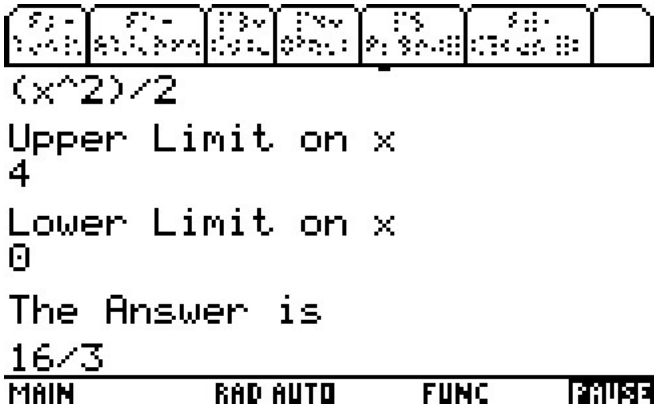
f) You are then prompted to put in the lower limit of y. Type (x^2)/2 and then press Enter.



g) You are then prompted to put in the upper limit of x. Type 4 and then press Enter.



h) You are then prompted to put in the lower limit of x. Type 0 and then press Enter. The answer is outputted.



Let's verify the answer analytically.

$$\int_0^4 \int_{\frac{x^2}{2}}^{2x} dy dx = \int_0^4 \left[y \right]_{y=\frac{x^2}{2}}^{2x} dx = \int_0^4 \left(2x - \frac{1}{2}x^2 \right) dx = \left[x^2 - \frac{1}{6}x^3 \right]_0^4 = \frac{96-64}{6} = \frac{32}{6} = \frac{16}{3}.$$

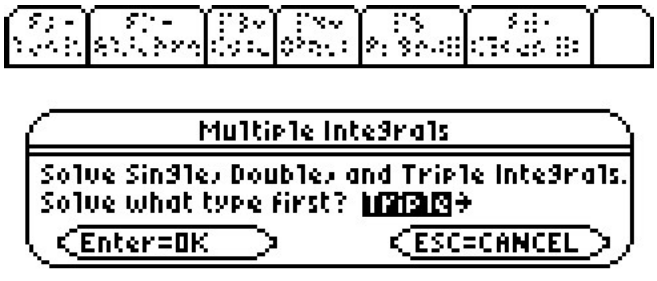
This is the typical way you would solve a double integral. Now lets try a triple integral problem.

2)

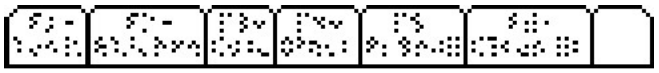
Using spherical coordinates, find the volume of the solid that is bounded above by the sphere $\rho = 4$ and the cone $\phi = \frac{\pi}{3}$.

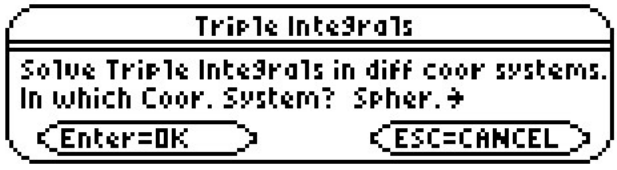
The integration formula is $\int_0^{2\pi} \int_0^{\frac{\pi}{3}} \int_0^4 \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ (Verify).

a) Go back to the home screen by selecting Go Back from the dropdown menu. Select Triple and then press Enter.



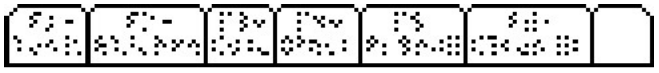
b) At the next menu, you are asked to select the coordinate system you want to integrate in. Select Spher. and then press Enter.

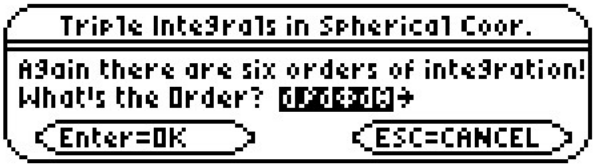




USE ← AND → TO OPEN CHOICES

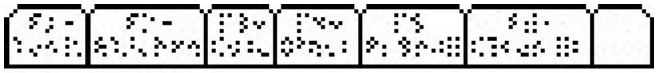
c) At the next menu, you are asked what order of integration should be used. Select dρdϕdθ and then press Enter.





USE ← AND → TO OPEN CHOICES

d) You are then asked to input f(ρ,ϕ,θ). Type 1 and then press Enter.



f(ρ,ϕ,θ)=
1
Upper Limit on ρ

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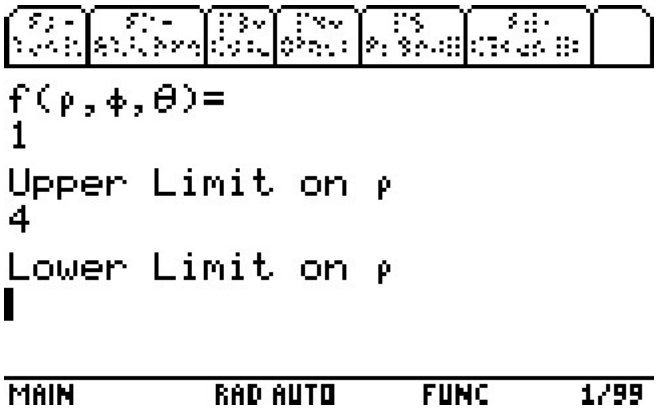
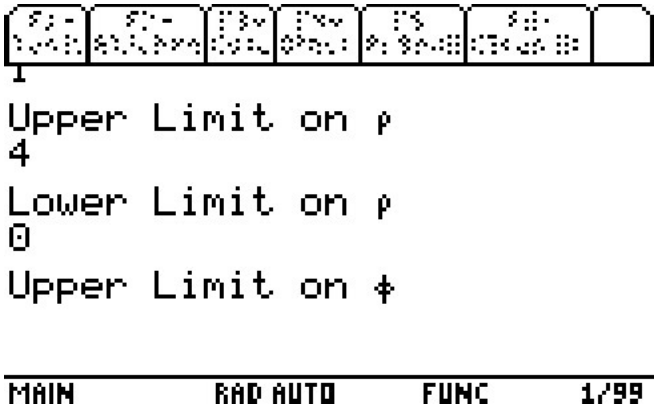
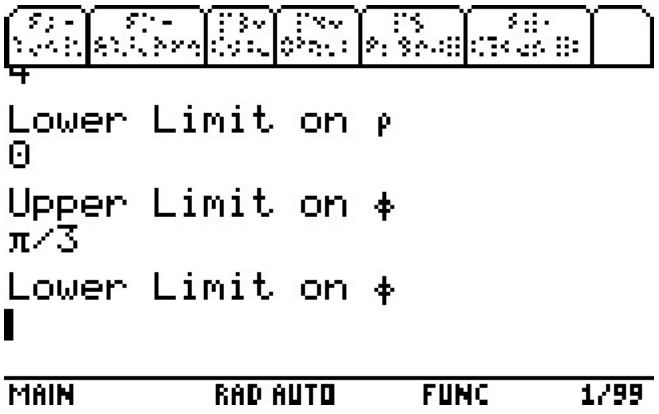
e) You are then asked for the upper limit of ρ. Type 4 and then press Enter.



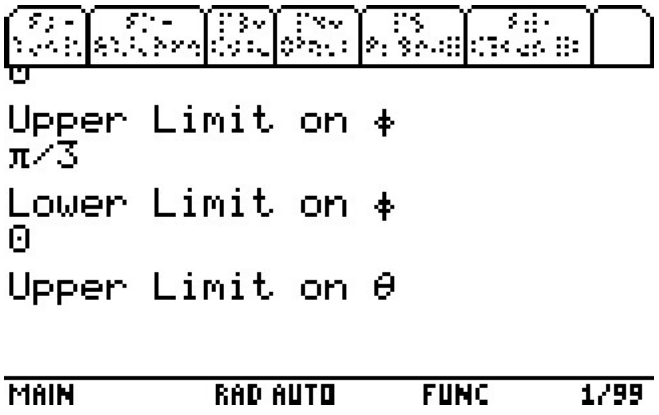
f) You are then asked for the lower limit of ρ. Type Ø and then press Enter.



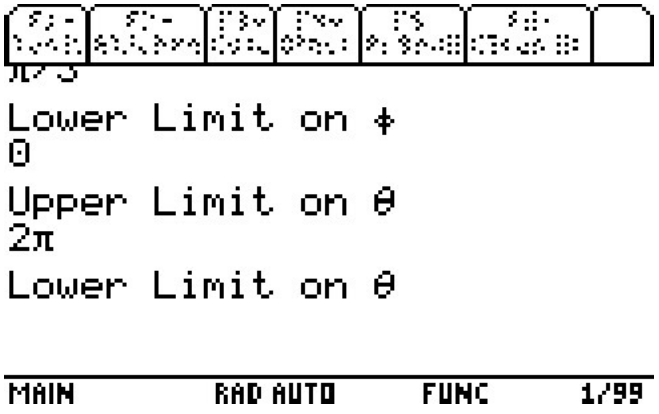
g) You are then asked for the upper limit of ϕ. Type π/3 and then press Enter.



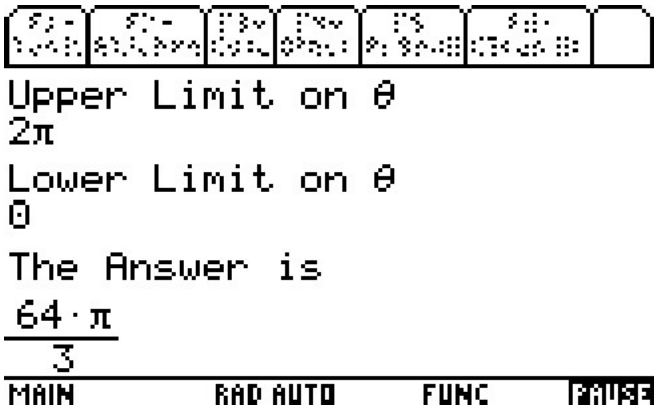
h) You are then asked for the lower limit of ϕ. Type Ø and then press Enter.



i) You are then asked for the upper limit of θ. Type 2π and then press Enter.



j) You are then asked for the lower limit of θ. Type Ø and then press Enter. The answer is outputted.



Let's verify this analytically as well.

$$\int_0^{2\pi}\int_0^{\frac{\pi}{3}}\int_0^{4}\rho^2\sin\phi\,d\rho\,d\phi\,d\theta=\int_0^{2\pi}\int_0^{\frac{\pi}{3}}\left[\frac{\rho^3}{3}\sin\phi\right]_{\rho=0}^{4}d\phi\,d\theta=\frac{64}{3}\int_0^{2\pi}\int_0^{\frac{\pi}{3}}\sin\phi\,d\phi\,d\theta=$$

$$-\frac{64}{3}\int_0^{2\pi}\left[\cos\phi\right]_{\phi=0}^{\frac{\pi}{3}}=-\frac{64}{3}\int_0^{2\pi}\left(\frac{1}{2}-1\right)d\theta=\frac{32}{3}\int_0^{2\pi}d\theta=\frac{64}{3}\pi$$

Questions? Comments? Suggestions?

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