

Numerical Integration Program (SHARP)

This program calculates left- and right-hand Riemann sums, and the trapezoidal, midpoint and Simpson approximations. Since there's not room on the calculator to label each approximation separately, we use a compressed method of displaying the results. For instance, the label "left/right" indicates that the next two numbers are the left- and right-hand Riemann sums, respectively.

To enter the program select NEW in the program menu. Then select REAL in the MODE menu. When prompted for a title, use "integral."

<i>Program</i>	<i>Where the Commands are</i>
Goto start	Goto is in BRANCH menu
Label eqn	Label is in BRANCH menu
$f=...$	replace “...” by the integrand $f(x)$
Return	Return is in BRANCH menu
Label start	
Print “l-limit	Print and “ are in PROG menu
Input a	Input is in PROG menu
Print “u-limit	
Input b	
Print “divns	
Input n	
$x=a$	= is also in INEQ menu
$s=0$	reset memory s to zero
$m=0$	reset memory m to zero
$i=1$	
$h=(b-a)/n$	
Label 1	
Gosub eqn	Gosub is in BRANCH menu
$s=s+f*h$	
$x=x+.5h$	
Gosub eqn	
$m=m+f*h$	
$x=x+.5h$	
$i=i+1$	
If $i \leq n$ Goto 1	If and Goto are in BRANCH menu; \leq is in INEQ menu
Print “left/right	
Print s	
Gosub eqn	
$r=s+f*h$	
$x=a$	
Gosub eqn	
$r=r-f*h$	
Print r	
Wait	Wait is in PROG menu
Print “trap/mid/simp	
$t=.5(s+r)$	
Print t	
Print m	
$s=(2m+t)/3$	
Print s	
End	End is in PROG menu

To run this program:

1. The integrand (the function you want to integrate) $f(x)$ must be entered into where “...” is, with x as the independent variable.
2. Make sure the lower limit of the integral you’re approximating is less than the upper limit.
3. Test on $\int_1^3 x^3 dx = 20$ with 100 subintervals. You should get left- and right-hand sums of 19.7408 and 20.2608, respectively.