

Program Description I

Program Title

Multipel integrals

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Program Description, Equations, Variables

The program computes the integral of functions of 1, 2, or 3 variables over a finite interval a rectangular region in the plane or a parallelepiped in 3-space by means of the rectangle rule. When pressing C, D or E again the number of intervals is doubled, of ~~subrectangles~~ subparallelepipeds increases by a factor of 4, of subparallelepipeds increases by a factor of 8. Then Richardson-extrapolation is performed by using the formulas:

$$F_2(2) = F_2(2) + \frac{F_1(2) - F_1(2r)}{r^2 - 1} \quad \text{where } r=2 \text{ in case}$$

of $\int$; $r=4$ for $\iint$ and $r=8$ for $\iiint$

$F_1(2)$ is the computed integral for 2($\int$) 4($\iint$) or 8($\iiint$) subinterval

Operating Limits and Warnings

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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50495 Program Description II

Sketch(es)

Sample Problem(s) ①

$$\text{solve } \int_0^1 \int_0^1 \int_0^1 (x e^{-\sin xy}) dx dy dz$$

$$\text{solve } \textcircled{2} \int_0^1 \int_0^1 xy dx dy$$

Solution(s)

① 1 [H] 0 [ENT] 1 [B] 0 [ENT] 1 [B]

0 [ENT] 1 [B] [DSP] [9]

→ 1.00

[E]

→ 0.398249140

[E]

→ 0.400413339

② 1 [H] 0 [ENT] 1 [B] 0 [ENT] 1 [B]

[D]

→ 1.00

→ 0.25

(Exact value is 0.25)

Reference(s)

"Numerical methods" Björk - Dahlqvist
Prentice - Hall

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA		Start		RCLO		
	CLRES				PSS		
	RAD				RCLO		
	STOO				÷		
	1			060	STO7		
	9				RCLF		
	STI				RCL7		
	RTN				2		
	*LBLB				÷		
010	X=Y				+		
	ISZ		Input		STO3		
	STOI				1		
	-				STO4		
	ISZ			070	GSB2		
	STOI				*LBL9		
	RTN				1		
	*LBLC				STO+4		
	SFO				RCL7		
	CFI				STO+3		
020	GTOD				GSB2		
	*LBLD		Compute		RCLO		
	SFI				RCL4		
	CEO				X=Y		
	GTOD			080	GTOS		
	*LBLE				GT09		
	CEO				*LBL2		
	CFI				RCLC		
	RCL8				RCL6		
	X≠0				2		
030	GTOD				÷		
	RCL				+		
	PSS				STO2		
	STOO				PSS		
	PSS			090	1		
*LBLO					STO8		
2					PSS		
STOXO					GSB1		
RCL8					*LBL8		
X≠0					RCL6		
040	SF2				STO+2		
STO9					GSB1		
0					PSS		
STO8					1		
RCL8				100	STO+8		
RCLO					RCL8		
÷					PSS		
STO5					RCLO		
F20					X≠Y		
GT01					GT08		
050	RCLD				F21		
RCLO					GT05		
÷					RTN		
STO6					*LBL1		
F21				110	RCLH		
GT02					RCL5		
PSS					2		

REGISTERS									
h	1 x ₂	2 Y	3 Z	4 LOOP	5 used	6 used	7 used	8 integral	9 integral
S _{F-e}	S1	S2	S3	S4	S5	S6	S7	S8	S9
A a	B b-a	C c	D d-c	E e	I used				

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
	÷				STO×8		Richardson
	+			170	RCL8		
	STO1				RCL9		
	GSB9				-		
	STO+8				RTN		
	1				* LBL9		
120	STJ				RTN		
	* LBL7						
	ISZ						
	RCL5			180			
	STO+1						
	GSB9						
	STO+8						
	RCL						
	RCL0						
	X≠Y						
130	GT07						
	F?0						
	GT05						
	RTN						
	* LBL5		Output				
	RCL5		SSS	190			
	F?0						
	GT04						
	RCL6						
	X						
140	F?1						
	GT06						
	RCL7						
	X						
	GSB3			200			
	6						
	3						
	÷						
	RCL8						
	F?2						
	+						
150	RTN						
	* LBL6		SS				
	GSB3						
	1			210			
	5						
	÷						
	RCL8						
	F?2						
	+						
	RTN						
160	* LBL4		S				
	GSB3						
	3						
	÷						
	RCL8			220			
	F?2						
	+						
	RTN						
	* LBL3						

LABELS					FLAGS	SET STATUS		
n→	B Input	C S	D SS	E SSS	0 used	FLAGS	TRIG	DISP
a function	b	c	d	e	1 used	ON OFF		
0 Loop	inner loop	inner loop	extrapol	output	2 used	0 ☐ ☒	DEG ☐	FIX ☒
5 output	output	loop	loop	loop	3	1 ☐ ☒	GRAD ☐	SCI ☐
						2 ☐ ☒	RAD ☒	ENG ☐
						3 ☐ ☐		n 2