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## differential propositional calculus : appendix 4

Canonical name Differential Propositional Calculus Appendix 4

Date of creation 2013-03-22 18:09:25 Last modified on 2013-03-22 18:09:25 Owner Jon Awbrey (15246) Last modified by Jon Awbrey (15246)

Numerical id 7

Author Jon Awbrey (15246)

Entry type Application
Classification msc 53A40
Classification msc 39A12
Classification msc 34G99
Classification msc 03B44
Classification msc 03B05
Classification msc 03B42

Related topic DifferentialLogic

Related topic MinimalNegationOperator Related topic PropositionalCalculus Related topic ZerothOrderLogic

## Contents

0.1 Detail of Calculation for the Difference Map

## Detail of Calculation for D f = E f + f

	$\mathrm{E} f _{\mathrm{d} x \mathrm{d} y}$	$\mathrm{E} f _{\mathrm{d} x \ (\mathrm{d} y)}$	$\mathrm{E} f _{(\mathrm{d} x) \ \mathrm{d} y}$	$\mathrm{E} f _{(\mathrm{d} x)(\mathrm{d} y)}$
	$+ f _{\mathrm{d}x \ \mathrm{d}y}$	$+ f _{\mathrm{d}x} (\mathrm{d}y)$	$+ f _{(\mathrm{d}x)} \mathrm{d}y$	$+ f _{(\mathrm{d} x)(\mathrm{d} y)}$
	$= Df _{\mathrm{d}x \ \mathrm{d}y}$	$= Df _{\mathrm{d}x} (\mathrm{d}y)$	$= D f _{(\mathrm{d}x)}  \mathrm{d}y$	$= Df _{(\mathrm{d}x)(\mathrm{d}y)}$
<i>c</i>				$-J(\alpha x)(\alpha y)$
$  f_0  $	0 + 0 = 0	0 + 0 = 0	0 + 0 = 0	0 + 0 = 0
	x y dx dy	x (y) dx (dy)	(x) y (dx) dy	$(x)(y) (\operatorname{d} x) (\operatorname{d} y)$
$  f_1  $	+ (x)(y) dx dy	+ (x)(y) dx (dy)	+ (x)(y) (dx) dy	+ (x)(y) (dx) (dy)
	= ((x,y)) dx dy $x (y) dx dy$	$ = (y) \operatorname{d} x (\operatorname{d} y) $ $ x y \operatorname{d} x (\operatorname{d} y) $		$ \begin{array}{c c} = & 0 & (\operatorname{d} x) & (\operatorname{d} y) \\ \hline & (x) & y & (\operatorname{d} x) & (\operatorname{d} y) \end{array} $
$  f_2  $	(x) y dx dy + $(x) y dx dy$	+(x) y dx (dy)	+ (x)(y) (dx) dy	+(x) y (dx) (dy)
	= (x,y) dx dy	= y dx (dy)	= (x) (dx) dy	$= 0 (\operatorname{d} x) (\operatorname{d} y)$
	(x) $y$ $dx$ $dy$	(x)(y) dx (dy)	x y (dx) dy	x (y) (dx) (dy)
$  f_4  $	+ x (y) dx dy	+ x (y) dx (dy)	+ x (y) (dx) dy	+ x (y) (dx) (dy)
	= (x,y) dx dy	$ = \underbrace{(y)  \mathrm{d} x  (\mathrm{d} y)}_{(x)  y  \mathrm{d} x  (\mathrm{d} y)} $	$ = x (\operatorname{d} x) \operatorname{d} y  x (y) (\operatorname{d} x) \operatorname{d} y $	$ = 0  (\operatorname{d} x) \ (\operatorname{d} y) $ $ x \ y \ (\operatorname{d} x) \ (\operatorname{d} y) $
$  f_8  $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{pmatrix} x & y & dx & (dy) \\ + & x & y & dx & (dy) \end{pmatrix}$	$\begin{pmatrix} x & (y) & (\mathrm{d} x) & \mathrm{d} y \\ + & x & y & (\mathrm{d} x) & \mathrm{d} y \end{pmatrix}$	$\begin{array}{c c} x & y & (\operatorname{d} x) & (\operatorname{d} y) \\ + x & y & (\operatorname{d} x) & (\operatorname{d} y) \end{array}$
$\parallel J^8 \parallel$	= ((x,y)) dx dy	= y dx (dy)	= x (dx) dy	= 0 (dx) (dy)
	x dxdy	x dx (dy)	(x) (dx) dy	$(x) (\operatorname{d} x) (\operatorname{d} y)$
$\parallel f_3 \mid$	+ (x) dx dy	+ (x) dx (dy)	+ (x) (dx) dy	+ (x) (dx) (dy)
_	= 1 dx dy	= 1 dx (dy)	$= 0 (\operatorname{d} x) \operatorname{d} y$	$= 0 (\operatorname{d} x) (\operatorname{d} y)$
$  f_{12}  $	(x) dx dy	(x) dx (dy)	x (dx) dy	x (dx) (dy)
$\parallel J_{12} \parallel$	$\begin{array}{ccccc} + & x & d x & d y \\ = & 1 & d x & d y \end{array}$	$\begin{array}{cccc} + & x & \mathrm{d} x & (\mathrm{d} y) \\ & = & 1 & \mathrm{d} x & (\mathrm{d} y) \end{array}$	+ x (dx) dy = 0 (dx) dy	$\begin{array}{cccc} & + x & (\operatorname{d} x) & (\operatorname{d} y) \\ & = 0 & (\operatorname{d} x) & (\operatorname{d} y) \end{array}$
	(x,y) dx dy	$\frac{-1 \operatorname{d} x \operatorname{d} y}{((x,y)) \operatorname{d} x \operatorname{d} y}$	$\frac{- \circ (\operatorname{d} x) \operatorname{d} y}{((x,y)) (\operatorname{d} x) \operatorname{d} y}$	(x,y) (dx) (dy)
$\parallel f_6 \mid$	+ (x,y) dx dy	+ (x,y) dx (dy)	+ (x,y) (dx) dy	+ (x,y) (dx) (dy)
	= 0 dx dy	= 1 $dx (dy)$	$=$ 1 $(\operatorname{d} x) \operatorname{d} y$	$= 0 (\operatorname{d} x) (\operatorname{d} y)$
· ·	((x,y)) dx dy	(x,y) dx (dy)	(x,y) $(dx)$ $dy$	$((x,y)) (\operatorname{d} x) (\operatorname{d} y)$
$  f_9  $	+ ((x,y)) dx dy	+ ((x,y)) dx (dy)	+ ((x,y)) (dx) dy	+ ((x,y)) (dx) (dy)
$  f_5  $	y d x d y + (y) d x d y	(y) dx (dy) + (y) dx (dy)	$\begin{pmatrix} y & (\mathrm{d}x) & \mathrm{d}y \\ + & (y) & (\mathrm{d}x) & \mathrm{d}y \end{pmatrix}$	$\begin{pmatrix} y & (\operatorname{d} x) & (\operatorname{d} y) \\ + & (y) & (\operatorname{d} x) & (\operatorname{d} y) \end{pmatrix}$
$\parallel J_{5} \parallel$	$= \begin{array}{cccccccccccccccccccccccccccccccccccc$	= 0 dx (dy)	= 1 (dx) dy	= 0 (dx) (dy)
	(y) dx dy	y dx (dy)	$(y) (\operatorname{d} x) \operatorname{d} y$	$y (\operatorname{d} x) (\operatorname{d} y)$
$\mid f_{10} \mid$	+ y dx dy	+ y dx (dy)	+ y (dx) dy	$+ y (\operatorname{d} x) (\operatorname{d} y)$
	= 1 dx dy	= 0 dx (dy)	$= 1 (\operatorname{d} x) \operatorname{d} y$	= 0 (dx) (dy)
f	((x)(y)) dx dy	((x) y) dx (dy)	(x (y)) (dx) dy	$(x \ y) \ (d \ x) \ (d \ y)$
$  f_7  $	$ \begin{vmatrix} + & (x \ y) & d \ x \ d \ y \\ = & ((x,y)) & d \ x \ d \ y \end{vmatrix} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{vmatrix} + & (x \ y) & (d \ x) \ d \ y \\ = & x & (d \ x) \ d \ y \end{vmatrix} $	$\begin{vmatrix} + (x \ y) & (d \ x) & (d \ y) \\ = 0 & (d \ x) & (d \ y) \end{vmatrix}$
	$ \begin{array}{c c} - (x,y) & dx & dy \\ \hline ((x) & y) & dx & dy \end{array} $	$\frac{-g \operatorname{d} x \operatorname{d} y}{((x)(y)) \operatorname{d} x \operatorname{d} y}$	$\begin{array}{c c} - x & (dx) dy \\ \hline (x y) & (dx) dy \end{array}$	$\frac{-\operatorname{d}(\operatorname{d}x)\operatorname{d}y)}{(x\ (y))\ (\operatorname{d}x)\ (\operatorname{d}y)}$
$\parallel f_{11} \parallel$	+(x(y)) dx dy	+ (x(y)) dx (dy)	+ (x (y)) (dx) dy	+ (x (y)) (dx) (dy)
, I	= (x,y) dx dy	= $(y)$ $dx (dy)$	= x (dx) dy	$= 0  (\operatorname{d} x) (\operatorname{d} y)$
	(x(y)) dx dy	$(x \ y) \ dx \ (dy)$	((x)(y)) (dx) dy	((x) y) (dx) (dy)
$  f_{13}  $	$ \begin{vmatrix} + ((x) \ y) \ dx \ dy \\ = (x,y) \ dx \ dy \end{vmatrix} $	$\begin{array}{cccc} & + & ((x) & y) & d & x & (d & y) \\ & = & y & d & x & (d & y) \end{array}$	$ \begin{vmatrix} + & ((x) & y) & (d & x) & d & y \\ = & (x) & (d & x) & d & y \end{vmatrix} $	$\begin{vmatrix} +((x) y) (dx) (dy) \\ = 0 (dx) (dy) \end{vmatrix}$
1	(x y) dx dy	$\begin{array}{c c} - & g & dx & (dy) \\ \hline & (x & (y)) & dx & (dy) \end{array}$	$ \begin{array}{c c} - & (x) & (dx) & dy \\ \hline & ((x) & y) & (dx) & dy \end{array} $	$\begin{array}{c c} - & (\operatorname{d} x) (\operatorname{d} y) \\ \hline & ((x)(y)) (\operatorname{d} x) (\operatorname{d} y) \end{array}$
$  f_{14}  $	+ ((x)(y)) dx dy	+ ((x)(y)) dx (dy)	$+((x)(y))(\mathrm{d} x)\mathrm{d} y$	$+((x)(y))(\operatorname{d} x)(\operatorname{d} y)$
	= ((x,y)) dx dy	= (y)  dx (dy)	= (x) (dx) dy	$= 0 \qquad (\operatorname{d} x) \ (\operatorname{d} y)$
$f_{15}$	1 + 1 = 0	1 + 1 = 0	1 + 1 = 0	1 + 1 = 0
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