Sharjah Institute of Technology

معهد الشارقة للتكنولوجيا
SHARJAH INSTITUTE OF TECHNOLOGY

Differentiation Rules   Handout #13

Derivatives

F(x)	F′(x)
C , C is a Constant	0
Cx , C is a Constant Example: 7x	C 7
x^k Example: $-3x^6$	kx^{k-1} $(-3)(6)x^{6-1} = -18x^5$
U^k , U is a function in x Example: $(x^2-1)^4$	$kU^{k-1} \times U'$ $4(x^2-1)^3 \times (2x) = 8x(x^2-1)^3$
$\sqrt{x}$	$\dfrac{1}{2\sqrt{x}}$
$\sqrt{U}$, U is a function in x Example: $\sqrt{3-2x}$	$\dfrac{U'}{2\sqrt{U}}$ $\dfrac{-2}{2\sqrt{3-2x}} = \dfrac{-1}{\sqrt{3-2x}}$
$u+v$, u and v functions in x Example: $2x+100-3x^2$	$u'+v'$ $2+0-6x = 2-6x$
$u \times v$, u and v functions in x Example: $(-x+7)(3x^2-10)$	$u'v+v'u$ $u = -x+7 \Rightarrow u' = -1$ $v = 3x^2-10 \Rightarrow v' = 6x$ $u'v+v'u =$ $(-1)(3x^2-10)+(6x)(-x+7)$ $-3x^2+10-6x^2+42x = -9x^2+42x+10$

F(x)	F′(x)
$\dfrac{u}{v}$, u and v functions in x Example: $\dfrac{2-3x}{x+1}$	$\dfrac{u'v - v'u}{v^2}$ $u = 2 - 3x \Rightarrow u' = -3$ $v = x + 1 \Rightarrow v' = 1$ $\dfrac{u'v - v'u}{v^2} =$ $\dfrac{(-3)(x+1) - (1)(2-3x)}{(x+1)^2}$ $= \dfrac{-3x - 3 - 2 + 3x}{(x+1)^2} = \dfrac{-5}{(x+1)^2}$
e^x	e^x
e^U , U function in x Example: e^{x^2}	$U'e^U$ $2xe^{x^2}$
lnx	$\dfrac{1}{x}$
lnU , U function in x Example: $\ln(x^2 - 3x + 1)$	$\dfrac{U'}{U}$ $\dfrac{2x - 3}{x^2 - 3x + 1}$
Sin x Sin U , U function in x	Cos x U′ Cos U
Cos x Cos U , U function in x	- Sin x -U′ Sin U