

## International Institute for Technology and Management



Unit 05a : Mathematics 1

Handout #7

### Derivatives

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