**Harold’s Exponential Growth and Decay**

**Cheat Sheet**

16 May 2016

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| **Discrete** | **Continuous** |
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| Simple Interest:A = Amount after time tP = Original amount, such as principlee = The natural number (~2.718)r = Rate of growth/loss, e.g. interest rate (15% = 0.15)t = Elapsed timen = Divides time into periods per time unit | *e* ≈ 2.71828 18284 59045 23536 …  e = =  |
| **Savings Account Example:**P = $100r = 8% = 0.08t = 1 yearn = 4 (quarterly)= $108.24 | **Savings Account Example:** = $108.33If n = 1, A = $108.00 (+0 AnnuallyIf n = 4, A = $108.24 (+24 QuarterlyIf n = 12, A = $108.29 (+5 MonthlyIf n = 365, A = $108.33 (+4 DailyIf n = ∞, A = $108.33 (+0 Continuously |
| Compounded interest after 3 years: = 1.26 *\* P* | (See calculus derivation on page 2) |
| n = ? | n = ∞ |

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| **Calculus Derivation** | **Graphs** |
| Assume the rate of growth or decay is proportional to the amount of substance (P).Separate variables and integrate:Solve for *P(t)*:At t=0 (initial condition):Therefore,or | http://image.tutornext.com/cms/files/u59/Pictures%20for%20tv2_151.gifhttp://img.sparknotes.com/figures/B/b1712db2e6829551c7c529921db9fbfa/figure5-4-1.gif Left: Exponential Growth (k or r positive)Right: Exponential Decay (k or r negative) |
| **Chemistry** | **Half-Life** |
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