**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 t  P = Original amount, such as principle  e = The natural number (~2.718)  r = Rate of growth/loss, e.g. interest rate (15% = 0.15)  t = Elapsed time  n = Divides time into periods per time unit | *e* ≈ 2.71828 18284 59045 23536 …      e = = |
| **Savings Account Example:**  P = $100  r = 8% = 0.08  t = 1 year  n = 4 (quarterly)  = $108.24 | **Savings Account Example:**  = $108.33  If n = 1, A = $108.00 (+0 Annually  If n = 4, A = $108.24 (+24 Quarterly  If n = 12, A = $108.29 (+5 Monthly  If n = 365, A = $108.33 (+4 Daily  If 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.gif  http://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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