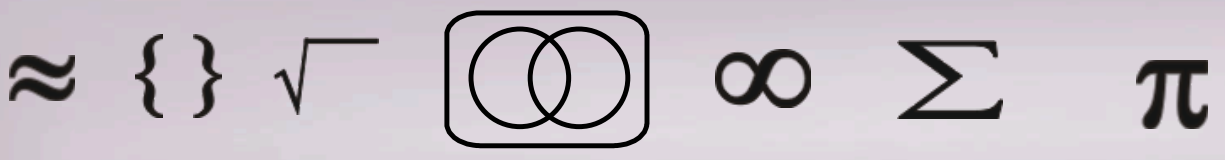

Math 1030 #16c

Exponential Modeling

inflation

radiometric dating

Applications

EX 1: Radioactive Carbon-14 has a half-life of about 5700 years.

When a living organism dies, Carbon-14 growth discontinues and it only decays from that point forward. If a mammal has been dead for 900 years, what fraction of the carbon-14 still exists in the bone that is found?

$T_{half} = 5700$ yrs

eqn (2b) $Q = Q_0 \left(\frac{1}{2}\right)^{\frac{t}{5700}}$

if $t = 900$ yrs,

$Q = Q_0 \left(\frac{1}{2}\right)^{\frac{900}{5700}} \simeq Q_0 (0.896)$

$\Rightarrow$ 89.6% of original amt of carbon-14 is still in the bone

EX 2: Suppose that the number of alien encounters doubles every 32 years, and there were 45 alien encounters in the year 2012.

$Q_0 = 45$ $T_d = 32$ yrs, $t = 0$ in yr 2012

a) How many alien encounters can you expect in 2068?

use eqn (2a) $Q = Q_0(2)^{t/T_d}$

$Q = 45\left(2^{\frac{t}{32}}\right)$

$Q = ?$ when $t = 2068 - 2012 = 56$ yrs

$Q = 45\left(2^{\frac{56}{32}}\right) \approx 151$ alien encounters

b) When will the number of alien encounters reach 360?

$t = ?$ when $Q = 360$ alien encounters

in 32 yrs, $Q = 45(2) = 90$

in 64 yrs, $Q = 90(2) = 180$

in 96 yrs, $Q = 180(2) = 360$ alien encounters

$\Rightarrow$ so there are 360 alien encounters after 96 yrs $\Rightarrow$ in year $2012 + 96 = 2108$

EX 3: The inflation rate in mid 2014 was 2.1%. If this rate continues for five years, estimate the cost of a $10,000 year of college in 2019.

use eqn ① $Q = Q_0(1+r)^t$

$r = 0.021$, $Q_0 = \$10{,}000$, $t = 0$ in yr 2014

$\Rightarrow Q = 10000(1.021)^t$

$Q = ?$ when $t = 2019 - 2014 = 5$ yrs

$Q = 10000(1.021)^5 \approx \$11{,}095$