Example 1

Initially there are 600g of a radioactive substance. It continuously decays at a rate of 5% per hour, how many hours will it take this substance to reach 200g.

$a = 600$
$r = -.05$
$f(x) = 200$

$$200 = 600e^{(-.05 \cdot t)}$$

$$.333 = e^{(-.05 \cdot t)}$$

$$\ln(.333) \cancel{\ln} e^{(-.05 \cdot t)}$$

$$\frac{\ln(.333)}{-.05} = \frac{-.05t}{-.05}$$

$$t \approx 22 \text{ hours}$$

* use ln when using continuous growth

ln(e) ← cancel each other out.

Example 2

If a loan is taken out at 6% for an amount of 250,000 and the interest is compounded continuously, with zero payments when will the loan grow to $300,000?

$$f(t) = ae^{rt}$$

$a = 250,000$
$r = .06$
$f(t) = 300000$

$$300,000 = 250000e^{(.06 \cdot t)}$$

$$1.2 = e^{(.06 \cdot t)}$$

$$\ln 1.2 = \cancel{\ln}(e^{(.06 \cdot t)})$$

$$\frac{\ln 1.2}{.06} = \frac{.06t}{.06}$$

3.04

Example 3

If there are 20 polar bears are roaming around, no one is hunting them so their population is increasing by 15% each year, how many years will it take for the population to reach 50 bears?

$a = 20$
$r = .15$
$f(t) = 50$

$$50 = 20(1.15)^t$$

$$2.5 = (1.15)^t \nearrow \log_{1.15} 2.5 = t$$

$$\frac{\log 2.5}{\log 1.15} = t$$

6.56 ~~21.85~~ yrs.