Fall 09, Precalculus (Honors) Quiz 3 Howard University Mathematics
Math 007-9 Sitaraman 9/18/09

SOLUTIONS

1. Solve the following exponential equation: $e^{2x} - 3e^x = -2$.

Soln: This is a quadratic equation:$(e^x)^2 - 3e^x + 2 = 0$. Letting $e^x = u$, we get $u^2 - 3u + 2 = 0$. Solving, we get $u = 2$ or $u = 1$. This gives two exponential equations: $e^x = 2$ and $e^x = 1$. The first one has the solution $x = ln2$ and the second gives $x = 0$.

2.Find the amount after 3 years if \$200 is invested in a fund that gives an annual return of 5 percent.

Soln: $P = 200$, $t = 3, n = 1$, $r = 0.05$. We get $A(3) = 200(1 + 0.05)^3 = 200(1.05)^3 = 231.53$ dollars.

3. Find the amount that should be invested now in a savings account paying 4 percent annual interest if you want to retire with \$500,000 in 20 years.

Soln: P is unknown, $A(20) = 500,000$, $n = 1$, $r = 0.04$, $t = 20$. We have $500,000 = P(1.04)^{20}$. Solving for P, we get $P = 500,000/(1.04^{20}) = 228,193$ dollars.

4.Find how long it would take for \$1000 to grow to \$2000 when interest is compounded twice a year at 8 percent annual rate.

Soln:$A(t) = 2000$, $P = 1000$, $r = 0.08$, $n = 2$, $t = ?$. We have $2000 = 1000(1 + (r/2))^{2t} = 1000(1.04)^{2t}$. Cancelling 1000 on both sides, we get $2 = 1.04^{2t}$ which means $ln2 = (2t)ln(1.04)$ taking logarithms of both sides. Solving, we get $t = ln2/(2ln(1.04)) = 8.83649$ or about 8 years and 10 months.

5. Find the time required for population at a town growing exponentially, uninhibited at a rate of 3 percent to double.

Soln: The equation we are looking at is $P(t) = Pe^{0.03t}$. Notice that **we don't need to know the current population** because, as we saw in previous problem, the initial population P will cancel out leaving $2 = e^{0.03t}$ which upon solving for t gives $t = ln2/(0.03) = 23.1049$ or 23 years, 1 month and about 8 days.

6. Find the half-life of iodine 131 if it decays at the rate of 0.087 (8.7 percent).

Soln: The equation of decay is $A(t) = A_0 e^{-0.087t}$. Half-life is given by letting $A(t) = A_0/2$ and solving for t. You get $0.5 = e^{-0.087t}$ and solving, we get $t = ln 0.5/(-0.087) = 7.96721$ or 7 years, 11 months and 19 days.