## In Class work sheet: Math 1526

### Work sheet #5

Total income from a continuous income stream for the rate of flow function \( f(x) \)

\[
TI = \int_{0}^{A} f(x) \, dx
\]

Present Value for a continuous income stream (or annuity) from \( t = 0 \) to \( t = A \)

\[
PV = \int_{0}^{A} R(t) e^{-rt} \, dt
\]

Future Value for a continuous income stream (or annuity) from \( t = 0 \) to \( t = A \)

\[
FV = e^{rA} \int_{0}^{A} R(t) e^{-rt} \, dt = \int_{0}^{A} [R(t) e^{r(A-t)}] \, dt
\]

### Problems:

1) a) Find the present value of a continuous annuity over 12 years if \( r = .06 \) and \( f(t) = 5000 \). b) Find the future value as well.

2) A student in this class (who will remain anonymous) is planning to establish a scholarship fund after graduation. The scholarship fund will need to produce $8000 per year indefinitely. Determine the capital value needed to be invested at 7% interest compounded continuously in order to fund this scholarship.

3) A donor wishes to provide a cash gift to a hospital that will generate a continuous income stream with an annual rate of flow at time \( t \) given by \( f(t) = $20000 \). If the annual interest rate is 12% compounded continuously, find the capital value of this perpetuity.

4) A small oil company considers the continuous pumping of oil from a well as a continuous income stream with its annual rate of flow at time \( t \) given by \( f(t) = 600e^{-0.2t} \) in thousands of dollars. Find an estimate of the total income from this well over the next 10 years.

5) The oil company in 4) is planning to sell the well because of its remote location. They need to use the present value of the well over the next 10 years to help establish a selling price. The company determines that the annual rate of flow is given by \( f(t) = 600e^{-0.2t} \) in thousands of dollars. The money is worth 10% compounded continuously, find the present value.

6) Using the oil company's information from above find the future value of the oil well 10 years from now.

7) If the rate of flow of income from a vending machine is $1000 a month and if the income is invested at 6% compounded continuously:
   a) find the total income over a year.
   b) find the present value for the next 6 years.
   c) find the future value 6 years from now.