1. For a 20 year term insurance policy sold to (65), you are given:
   a. The death benefit of 50,000 is payable at the end of the year of death.
   b. Annual premiums are payable for 20 years during the life of the insured.
   c. Mortality follows the Illustrative Life Table.
   d. $i = 8\%$ $\iff$ Note that $i \neq 6\%$.
   e. Commissions are 80% of premiums in the first year and 10% of premiums thereafter.
   f. Per policy expenses at the beginning of the year are 100 in the first year and 32 in subsequent years.
   g. The gross premium reserve at the end of the 19th year is 3184.93.

Calculate the annual gross premium.

You cannot use the values in the ILT except for $\delta x$ since they are calculated at 6% and this is at 8%. Therefore, you must use a
recursive formula.

\[
20V = 0
\]
\[19V = 3184.93\]
\[
20V = \frac{(19V + P - 0.1P - 32)(1.08) - (50000)(0.11369)}{1 - 0.11369}
\]
\[
0 = (3152.93 + 0.9P)(1.08) - 5684.5
\]
\[
P = \frac{5684.5 - 3405.1644}{0.9(1.08)} = 2345.00\]
2. A whole life policy to (x) has a death benefit of 1000 payable at the end of the year of death and annual premiums payable for as long as (x) lives.

You are given:

a. \( v = 0.90 \)

b. \( 1000A_x = 500 \)

c. \( q_x = 0.04 \)

\[ \ddot{\text{d}} = 1 - v = 0.1 \]

Calculate the first year premium \((P_{\text{FPT}})\) under Full Preliminary Term and the renewal premium \((P_{x+1})\) for years 2 and later under Full Preliminary Term.

\[
P_{\text{FPT}} = 500 \times 0.9 \times (1 - 0.04) = 36
\]

**First Way**

\[
P_{\text{FPT}} = P_{\text{VB}} + P_{x+1}^{\text{FPT}} A_x = 500
\]

\[
A_x = 0.9 - 1 = \frac{1 - A_x}{d} = \frac{1 - 0.5}{1 - 0.9} = 4
\]

\[
36 + 4P_{x+1}^{\text{FPT}} = 500
\]

\[
P_{x+1}^{\text{FPT}} = \frac{500 - 36}{4} = 116
\]

**Second Way**

\[
P_{x+1}^{\text{FPT}} \times 0.9 + A_{x+1} = 1000 A_{x+1}
\]

\[
A_x = v_q_x + v_p_x A_{x+1} \Rightarrow 0.5 = (0.9)(0.04) + (0.9)(0.96) A_{x+1}
\]

\[
A_{x+1} = \frac{0.537037}{0.9} = 5.937037
\]

\[
\ddot{\text{d}}_{x+1} = \frac{1 - A_{x+1}}{d} = \frac{1 - 5.37037}{1 - 0.9} = 4,162962963
\]

\[
P_{x+1}^{\text{FPT}} = \frac{(1000)(0.537037)}{4,162962963} = 116
\]