```
Option Base 1

Private Sub ComboBox1_Change()

End Sub

Private Sub UserForm_Initialize()

    With ComboBox1
        .Clear
        .AddItem "qx_base"
        .AddItem "qx_shocked"
    End With

End Sub

Private Sub CommandButton1_Click()

    Dim MortTableName As String

    If ComboBox1.Value = "" Then
        MsgBox "Please select a mortality table", vbExclamation
        Exit Sub
    End If

    MortTableName = ComboBox1.Value

    With Worksheets("Input")
```

```
        ' Formatting
        .Range("B3,B8:B9").NumberFormat = "$#,##0"
        .Range("B4:B5,B12:B14").NumberFormat = "0%"

        ' Write inputs
        .Range("B2").Value = MortTableName
        .Range("B3").Value = CDbl(TextBox1.Value)
        .Range("B4").Value = CDbl(TextBox2.Value) / 100
        .Range("B5").Value = CDbl(TextBox3.Value) / 100

        .Range("B8").Value = CDbl(TextBox5.Value)
        .Range("B9").Value = CDbl(TextBox6.Value)

        .Range("B12").Value = CDbl(TextBox7.Value) / 100
        .Range("B13").Value = CDbl(TextBox8.Value) / 100
        .Range("B14").Value = CDbl(TextBox9.Value) / 100

    End With

    Unload Me

End Sub
Private Sub CommandButton2_Click()
    Unload Me
End Sub
```

```
Sub GPCalc()

    Dim QX(150) As Double, lx(150) As Double, dx(150) As Double
    Dim GP(150, 150) As Double
    Dim sumbenefit(150, 150) As Double
    Dim sumannuity(150, 150) As Double
    Dim sumexpenses(150, 150) As Double
    Dim sumpremiumexpenses(150, 150) As Double

    Dim MortTable As Range, TableSummary As Range
    Dim SelectTable As Integer
    Dim TableName As String

    Dim faceamount As Double, intrate As Double, mortload As Double
    Dim issueExpenses As Double, maintenanceExpenses As Double
    Dim firstyearcomm As Double, renewalyearcomm As Double
    Dim profit As Double

    Dim age As Integer, term As Integer, n As Integer
    Dim STARTQX As Integer, ENDQX As Integer
    Dim v As Double
    Dim commission As Double, policyExp As Double
    Dim rowOut As Integer, colOut As Integer

    ' ======================
    ' Clear output
```

```
' ========================
Worksheets("Gross Premium").Range("B3:D53").ClearContents

' ========================
' Read input
' ========================
With Worksheets("Input")
    TableName = .Range("B2").Value          ' qx_base / qx_shocked
    faceamount = .Range("B3").Value
    intrate = .Range("B4").Value
    mortload = .Range("B5").Value
    issueExpenses = .Range("B8").Value
    maintenanceExpenses = .Range("B9").Value
    firstyearcomm = .Range("B12").Value
    renewalyearcomm = .Range("B13").Value
    profit = .Range("B14").Value
End With

' ========================
' Map table column
' ========================
If TableName = "qx_base" Then
    SelectTable = 1
ElseIf TableName = "qx_shocked" Then
    SelectTable = 2
Else
    MsgBox "Invalid mortality table selected", vbCritical
    Exit Sub
```

```
End If

' ========================
' Discount factor
' ========================
v = 1 / (1 + intrate)

' ========================
' Set ranges
' ========================
Set MortTable = Worksheets("Mortality Table").Range("A1:E52")

' ?? PENTING: header qx_base / qx_shocked ADA DI ROW 2
Set TableSummary = Worksheets("Mortality Table").Range("H2:I4")

' ========================
' Get start & end age (INI FIX UTAMA)
' ========================
STARTQX = Application.HLookup(TableName, TableSummary, 2, False)
ENDQX = Application.HLookup(TableName, TableSummary, 3, False)

If STARTQX = 0 Or ENDQX = 0 Then
    MsgBox "STARTQX / ENDQX not found", vbCritical
    Exit Sub
End If

' ========================
' Load qx
```

```
' ========================
For age = STARTQX To ENDQX
    QX(age) = Application.VLookup(age, MortTable, SelectTable + 1, False) * mortload
Next age

' ========================
' Life table
' ========================
lx(STARTQX) = 10000

For age = STARTQX To ENDQX
    lx(age + 1) = lx(age) * (1 - QX(age))
    dx(age) = lx(age) - lx(age + 1)
Next age

' ========================
' Gross Premium calculation
' ========================
For age = 20 To 70
    For term = 10 To 30 Step 10

        sumbenefit(age, term) = 0
        sumannuity(age, term) = 0
        sumexpenses(age, term) = 0
        sumpremiumexpenses(age, term) = 0

        For n = 0 To term - 1
```

```
    If n = 0 Then
        commission = firstyearcomm
        policyExp = issueExpenses
    Else
        commission = renewalyearcomm
        policyExp = maintenanceExpenses
    End If

    sumbenefit(age, term) = sumbenefit(age, term) _
        + v ^ (n + 1) * dx(age + n) / lx(age)

    sumannuity(age, term) = sumannuity(age, term) _
        + v ^ n * lx(age + n) / lx(age)

    sumexpenses(age, term) = sumexpenses(age, term) _
        + policyExp * v ^ n * lx(age + n) / lx(age)

    sumpremiumexpenses(age, term) = sumpremiumexpenses(age, term) _
        + v ^ n * lx(age + n) / lx(age) * (commission + profit)

Next n

GP(age, term) = _
    (sumbenefit(age, term) * faceamount + sumexpenses(age, term)) _
    / (sumannuity(age, term) - sumpremiumexpenses(age, term))

rowOut = 3 + (age - 20)
colOut = 1 + term / 10
```

```
            Worksheets("Gross Premium").Cells(rowOut, colOut).Value = GP(age, term)

        Next term
    Next age

    MsgBox "Gross Premium calculation completed", vbInformation

End Sub
```

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```
Sub GPCalc_10Year_Term()

    ' ========================
    ' Declaration
    ' ========================
    Dim QX(150) As Double, lx(150) As Double, dx(150) As Double
    Dim GP(150) As Double

    Dim MortTable As Range, TableSummary As Range
    Dim SelectTable As Integer
    Dim TableName As String

    Dim faceamount As Double, intrate As Double, mortload As Double
    Dim issueExpenses As Double, maintenanceExpenses As Double
    Dim firstyearcomm As Double, renewalyearcomm As Double
    Dim profit As Double
```

```
Dim age As Integer, n As Integer
Dim STARTQX As Integer, ENDQX As Integer
Dim v As Double
Dim commission As Double, policyExp As Double

Dim sumbenefit As Double
Dim sumannuity As Double
Dim sumexpenses As Double
Dim sumpremiumexpenses As Double

Dim rowOut As Integer
Dim term As Integer

term = 10   ' FIXED: 10-YEAR TERM ONLY

' ========================
' Clear output
' ========================
Worksheets("Gross Premium").Range("B3:B53").ClearContents

' ========================
' Read input
' ========================
With Worksheets("Input")
    TableName = .Range("B2").Value          ' qx_base / qx_shocked
    faceamount = .Range("B3").Value
    intrate = .Range("B4").Value
    mortload = .Range("B5").Value
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    issueExpenses = .Range("B8").Value
    maintenanceExpenses = .Range("B9").Value
    firstyearcomm = .Range("B12").Value
    renewalyearcomm = .Range("B13").Value
    profit = .Range("B14").Value
End With

' ========================
' Map mortality table
' ========================
If TableName = "qx_base" Then
    SelectTable = 1
ElseIf TableName = "qx_shocked" Then
    SelectTable = 2
Else
    MsgBox "Invalid mortality table selected", vbCritical
    Exit Sub
End If

' ========================
' Discount factor
' ========================
v = 1 / (1 + intrate)

' ========================
' Set ranges
' ========================
Set MortTable = Worksheets("Mortality Table").Range("A1:E52")
```

```
Set TableSummary = Worksheets("Mortality Table").Range("H2:I4")

' ========================
' Get start & end age
' ========================
STARTQX = Application.HLookup(TableName, TableSummary, 2, False)
ENDQX = Application.HLookup(TableName, TableSummary, 3, False)

If STARTQX = 0 Or ENDQX = 0 Then
    MsgBox "STARTQX / ENDQX not found", vbCritical
    Exit Sub
End If

' ========================
' Load qx
' ========================
For age = STARTQX To ENDQX
    QX(age) = Application.VLookup(age, MortTable, SelectTable + 1, False) * mortload
Next age

' ========================
' Life table
' ========================
lx(STARTQX) = 10000

For age = STARTQX To ENDQX
    lx(age + 1) = lx(age) * (1 - QX(age))
    dx(age) = lx(age) - lx(age + 1)
```

```
Next age

' ========================
' Gross Premium Calculation
' ========================
For age = STARTQX To ENDQX - term

   sumbenefit = 0
   sumannuity = 0
   sumexpenses = 0
   sumpremiumexpenses = 0

   For n = 0 To term - 1

      If n = 0 Then
         commission = firstyearcomm
         policyExp = issueExpenses
      Else
         commission = renewalyearcomm
         policyExp = maintenanceExpenses
      End If

      ' EPV of death benefit
      sumbenefit = sumbenefit _
         + v ^ (n + 1) * dx(age + n) / lx(age)

      ' EPV of premium annuity
      sumannuity = sumannuity _
```

```
            + v ^ n * lx(age + n) / lx(age)

        ' EPV of expenses
        sumexpenses = sumexpenses _
            + policyExp * v ^ n * lx(age + n) / lx(age)

        ' EPV of commission & profit (as % premium)
        sumpremiumexpenses = sumpremiumexpenses _
            + v ^ n * lx(age + n) / lx(age) * (commission + profit)

    Next n

    GP(age) = _
        (sumbenefit * faceamount + sumexpenses) _
        / (sumannuity - sumpremiumexpenses)

    rowOut = 3 + (age - STARTQX)
    Worksheets("Gross Premium").Cells(rowOut, 2).Value = GP(age)

Next age

MsgBox "10-Year Term Assurance Gross Premium completed", vbInformation

End Sub
```