Objectives

Program Purpose

- Display each of the number series below:
  1. Numbers 1 - 10 and 10 - 1
  2. Even numbers
  3. Multiples of 3
  4. Odd numbers between 99 and 33
  5. Square numbers
- Clear the display

Learning Goals

- To demonstrate further the use of FOR-NEXT loops
- To use a picture box as a way of displaying a list
- To use a STEP value in a FOR-NEXT loop
- To consolidate ideas developed in the last project

Design Notes

When creating the command buttons and other controls, set the font and formatting for the first one, then copy and paste the object to create the other controls. When copying and pasting, the application will ask the question "Do you want to create a control array?" It is very important to answer 'No'.

The 'For..Next' loop is very flexible. The step value can be an integer or decimal, positive or negative. It can also be a variable.

Interface

Create the interface as shown below.
Use 8 command buttons and 1 picture box.
### Names of Objects

<table>
<thead>
<tr>
<th>Type of Object</th>
<th>Number</th>
<th>Names of Objects</th>
<th>Simple Initial Properties of Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>1</td>
<td>Form1</td>
<td>Caption – &quot;Simple Loops 2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Startup Position - 2 – Center Screen</td>
</tr>
<tr>
<td>Picture Box</td>
<td>1</td>
<td>picDisplay</td>
<td>Font – Bold, 12</td>
</tr>
<tr>
<td>Command Buttons</td>
<td>8</td>
<td>cmdDisplay1To10</td>
<td>Font – Bold, 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cmdDisplay10To10</td>
<td>Captions – As Shown on interface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cmdDisplay</td>
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<td>cmdDisplay</td>
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</tr>
</tbody>
</table>

### Further Initial Properties of Objects

None required.

### Events – Code

```vbnet
Private Sub cmdClear_Click()
    picDisplay.Cls
End Sub

Private Sub cmdDisplay1To10_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 10 To 1 Step -1
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdDisplay1to10_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 1 To 10
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdDisplay1to10_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 1 To 10
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdEvens_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 2 To 20 Step 2
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdExit_Click()
    End
End Sub

Private Sub cmdMultiples3_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 3 To 33 Step 3
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdMultiples3_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 3 To 33 Step 3
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdOdds99to33_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 99 To 33 Step -2
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdOdds99to33_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 99 To 33 Step -2
        picDisplay.Print i
    Next i
End Sub

Private Sub cmdSquares_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 1 To 10
        picDisplay.Print i ^ 2
    Next i
End Sub

Private Sub cmdSquares_Click()
    Dim i As Integer
    picDisplay.Cls
    For i = 1 To 10
        picDisplay.Print i ^ 2
    Next i
End Sub
```
Suggestions for Consolidation and Extension

1. Modify the captions of the command buttons so they don’t have the same ‘Quick Key’ (or keyboard shortcut) of ‘D’.

2. Add a command button and code to display cubic numbers.

3. Add a command button and code to display triangle numbers:
   
   *Hint: the algorithm for triangle numbers is:* \( \text{Triangle Number} (n) = n \times (n+1) / 2 \)

4. Experiment with series of other multiples.

5. Try displaying multiple items in a single row:
   
e.g. Times tables

\[
\begin{align*}
1 \times 2 &= 2 \\
2 \times 2 &= 4 \\
\text{etc.}
\end{align*}
\]

Questions

1. Write code to display the multiples of 4 from 24 to 100.

2. Write code to display the ‘7 Times Tables’.

3. How could we display even numbers without using the ‘STEP’ function?

4. The statement ‘Dim i as Integer’ appears many times in the code. How could we reduce the number of times we use that statement without affecting the running of the program?

5. How could we display square numbers without using the \(^\) symbol?