3. ВЕКТОРЫ И МАТРИЦЫ

Пример. Вычислить значение матричного выражения R. Сохраните промежуточные вычисления. Составите программу для вычисления R, используя язык программирования VBA. Проведите расчёт по программе и сравните результаты. Операция sled([матрица]) – произведение диагональных элементов матрицы.

$$R = \left\| \overline{\overline{A}} \cdot \overline{\overline{B}} \cdot \vec{c} + \overline{\overline{A}} \cdot \vec{d} \right\|$$

$$\overline{\overline{A}} = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \end{bmatrix}; \quad \overline{\overline{B}} = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 4 & 1 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$$

$$\overline{\overline{RM}} = \overline{\overline{A}} \cdot \overline{\overline{B}} = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 4 & 1 \end{bmatrix} = \begin{bmatrix} 9 & 6 \\ 18 & 7 \end{bmatrix}$$

$$\overline{\overline{RV}} = \overline{\overline{RM}} \cdot \vec{c} = \begin{bmatrix} 9 & 6 \\ 18 & 7 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 36 \\ 57 \end{bmatrix} \quad \overline{\overline{RV1}} = \overline{\overline{A}} \cdot \vec{d} = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 9 \\ 10 \end{bmatrix}$$

$$\overline{\overline{RV1}} = \overline{\overline{RV1}} + \overline{\overline{RV}} = \begin{bmatrix} 9 \\ 10 \end{bmatrix} + \begin{bmatrix} 36 \\ 57 \end{bmatrix} = \begin{bmatrix} 45 \\ 67 \end{bmatrix} \quad R = \sqrt{\sum_{i=1}^{2} rv1_i} = \sqrt{45^2 + 67^2} = 80.709$$

Программа вычисления значения матричного выражения

С использованием стандартных (вызываемых) процедур и функций

```
Option Explicit
Option Base 1
Sub main()
Dim A!(2, 3), B!(3, 2), C!(2), D!(3), RM!(2, 2), RV!(2), RV1!(2)
Dim i%, j%, l%, k!, s!, rez!
Call InputMatrix("лист1", 5, 1, 2, 3, A)
Call InputMatrix("лист1", 5, 5, 3, 2, B)
Call InputVector("лист1", 5, 8, 2, C)
Call InputVector("лист1", 5, 10, 3, D)
Call MultMatr(2, 3, 2, A, B, RM)
Call MultMatrVect(2, 2, RM, C, RV)
Call MultMatrVect(2, 3, A, D, RV1)
Call AddVect(2, RV, RV1, RV1)
Cells(2, 5) = NormaVect(2, RV1)
End Sub
'Умножение матриц
```

```
Public Sub MultMatr(LeftRow%,                    Col_Row%, RightCol%, _
            LeftMatr() As Single, RightMatr() As Single, ResMatr() As Singl)
Dim s As Single, i As Integer, j As Integer, l As Integer
For i = 1 To LeftRow Step 1
  For j = 1 To RightCol Step 1
    s = 0
    For l = 1 To Col_Row Step 1
       s = s + LeftMatr(i, l) * RightMatr(l, j)
    Next l
    ResMatr(i, j) = s
  Next j
Next i
End Sub
'Сложение векторов
Public Sub AddVect(Row As Integer, LeftVect() As Single, _
                                   RightVect() As Single, ResVect() As Single)
Dim i As Integer
For i = 1 To Row Step 1
  ResVect(i) = LeftVect(i) + RightVect(i)
Next i
End Sub
'Умножение матрицы на вектор‘
Public Sub MultMatrVect(Row As Integer, ColRow As Integer, _
                          Matr() As Single, Vect() As Single, ResVect() As Single)
Dim i As Integer, j As Integer, s As Single
For i = 1 To Row Step 1
  s = 0
    For j = 1 To ColRow Step 1
      s = s + Matr(i, j) * Vect(j)
    Next j
  ResVect(i) = s
Next i
End Sub
'Норма вектора
Public Function NormaVect(Row As Integer, Vect() As Single) As Single
Dim norma As Single, i As Integer
  norma = 0
  For i = 1 To Row Step 1:    norma = norma + Vect(i) * Vect(i):    Next i
  NormaVect = Sqr(norma)
End Function'
'Ввод матрицы (sh – Лист)
Public Sub InputMatrix(sh As String, UpRow As Integer, _
                                     leftCol As Integer, Row As Integer, _
                                     Col As Integer, Matr() As Single)
  For i = 1 To Row Step 1
    For j = 1 To Col Step 1
      Matr(i, j) = Worksheets(sh).Cells(UpRow - 1 + i, leftCol - 1 + j)
```

```
    Next j
  Next i
End Sub
'Ввод вектора
Public Sub InputVector(sh As String, UpRow As Integer, _
                       leftCol As Integer, Row As Integer, _
                       Vect() As Single)
For i = 1 To Row Step 1
  Vect(i) = Worksheets(sh).Cells(UpRow - 1 + i, leftCol)
Next i
End Sub
```

Задания. Вычислите значение матричного выражения R Составите программу, для вычисления R, используя язык программирования VBA.

1) $R = \left\| \overset{=}{A} \cdot \overset{=}{B} \cdot \vec{c} \right\| - \left\| \vec{d} \right\|$

$$\overset{=}{A} = \begin{bmatrix} 1 & 2 & 8 \\ 4 & 2 & 3 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 7 & 1 \\ 4 & 4 \\ 1 & 4 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 5 \\ 9 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 5 \\ 6 \end{bmatrix}$$

2) $R = \left\| \left(\overset{=}{A}^T \cdot \overset{=}{A} - \overset{=}{B} \cdot \overset{=}{B}^T \right) \cdot \vec{d} \right\| - \left\| \vec{c} \right\|$

$$\overset{=}{A} = \begin{bmatrix} 1 & 8 & 5 \\ 6 & 2 & 6 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 5 & 4 \\ 4 & 3 \\ 9 & 3 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 7 \\ 2 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 7 \\ 1 \\ 2 \end{bmatrix}$$

3) $R = \left\| \vec{c}^T \cdot \overset{=}{A} \cdot \overset{=}{A}^T - \vec{d}^T \cdot \overset{=}{B} \right\|$

$$\overset{=}{A} = \begin{bmatrix} 2 & 4 & 3 \\ 8 & 3 & 9 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 3 & 7 \\ 5 & 2 \\ 8 & 3 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 9 \\ 3 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix}$$

4) $$R = \left\| \vec{d}^{\,T} \cdot \overset{=}{B} \cdot \overset{=}{B}^{T} \right\| + \vec{c}^{\,T} \cdot \overset{=}{A} \cdot \vec{d}$$

$$\overset{=}{A} = \begin{bmatrix} 3 & 1 & 9 \\ 1 & 3 & 3 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 1 & 1 \\ 6 & 1 \\ 7 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 7 \\ 9 \\ 4 \end{bmatrix}$$

5) $$R = \vec{c}^{\,T} \cdot \vec{c} - \vec{d}^{\,T} \cdot \overset{=}{A}^{T} \cdot \overset{=}{A} \cdot \vec{d}$$

$$\overset{=}{A} = \begin{bmatrix} 3 & 7 & 6 \\ 3 & 3 & 6 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 8 & 4 \\ 7 & 9 \\ 6 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 5 \\ 6 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 4 \\ 9 \end{bmatrix}$$

6) $$R = \left\| \overset{=}{A} \cdot \overset{=}{B} \cdot \vec{c} \right\| \cdot \left\| \vec{d} \right\| + \left\| \vec{c} \right\|$$

$$\overset{=}{A} = \begin{bmatrix} 4 & 3 & 3 \\ 5 & 4 & 1 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 7 & 7 \\ 8 & 8 \\ 6 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 7 \\ 7 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 9 \\ 5 \end{bmatrix}$$

7) $$R = \left\| \overset{=}{A} \cdot \overset{=}{B} \cdot \vec{c} \right\| - \left\| \overset{=}{B} \cdot \overset{=}{A} \cdot \vec{d} \right\|$$

$$\overset{=}{A} = \begin{bmatrix} 4 & 9 & 1 \\ 7 & 4 & 4 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 5 & 1 \\ 9 & 7 \\ 5 & 1 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 1 \\ 9 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix}$$

8) $$R = \left\| \vec{d}^{\,T} \cdot \overset{=}{B} - \left(\overset{=}{A} \cdot \vec{d} \right)^{T} \right\| - \vec{c}^{\,T} \cdot \vec{c}$$

$$\overset{=}{A} = \begin{bmatrix} 5 & 6 & 7 \\ 9 & 4 & 7 \end{bmatrix}; \quad \overset{=}{B} = \begin{bmatrix} 3 & 3 \\ 1 & 6 \\ 4 & 1 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 8 \\ 6 \end{bmatrix}$$

9) $R = \mathrm{sled}\left(\overline{\overline{A}}^{T} \cdot \overline{\overline{A}}\right) - \left\| \overline{\overline{B}}^{T} \cdot \overline{\overline{B}} \right\|$

$\overline{\overline{A}} = \begin{bmatrix} 6 & 3 & 4 \\ 2 & 5 & 1 \end{bmatrix}$; $\overline{\overline{B}} = \begin{bmatrix} 1 & 6 \\ 2 & 5 \\ 3 & 9 \end{bmatrix}$; $\vec{c} = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$; $\vec{d} = \begin{bmatrix} 3 \\ 4 \\ 2 \end{bmatrix}$

10) $R = \mathrm{sled}\left(\overline{\overline{A}} \cdot \overline{\overline{B}}\right) - \mathrm{sled}\left(\overline{\overline{B}} \cdot \overline{\overline{A}} - \overline{\overline{A}}^{T} \cdot \overline{\overline{A}}\right)$

$\overline{\overline{A}} = \begin{bmatrix} 6 & 8 & 1 \\ 4 & 5 & 4 \end{bmatrix}$; $\overline{\overline{B}} = \begin{bmatrix} 8 & 9 \\ 3 & 4 \\ 3 & 9 \end{bmatrix}$; $\vec{c} = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$; $\vec{d} = \begin{bmatrix} 8 \\ 8 \\ 7 \end{bmatrix}$

11) $R = \left(\overline{\overline{A}} \cdot \vec{d}\right)^{T} \cdot \vec{c} + \left\| \overline{\overline{B}} \right\|$

$\overline{\overline{A}} = \begin{bmatrix} 7 & 5 & 8 \\ 6 & 6 & 7 \end{bmatrix}$; $\overline{\overline{B}} = \begin{bmatrix} 6 & 3 \\ 4 & 3 \\ 2 & 8 \end{bmatrix}$; $\vec{c} = \begin{bmatrix} 1 \\ 6 \end{bmatrix}$; $\vec{d} = \begin{bmatrix} 3 \\ 3 \\ 3 \end{bmatrix}$

12) $R = \left(\overline{\overline{B}} \cdot \vec{c}\right)^{T} \cdot \vec{d} + \left\| \overline{\overline{A}} \right\|$

$\overline{\overline{A}} = \begin{bmatrix} 8 & 2 & 5 \\ 9 & 6 & 2 \end{bmatrix}$; $\overline{\overline{B}} = \begin{bmatrix} 4 & 6 \\ 5 & 2 \\ 1 & 8 \end{bmatrix}$; $\vec{c} = \begin{bmatrix} 3 \\ 7 \end{bmatrix}$; $\vec{d} = \begin{bmatrix} 8 \\ 7 \\ 9 \end{bmatrix}$

13) $R = \left\| \vec{c} \cdot \vec{d}^{T} \right\| + \left\| \vec{d} \cdot \vec{c}^{T} \right\|$

$\overline{\overline{A}} = \begin{bmatrix} 8 & 7 & 2 \\ 2 & 6 & 5 \end{bmatrix}$; $\overline{\overline{B}} = \begin{bmatrix} 2 & 9 \\ 5 & 1 \\ 9 & 7 \end{bmatrix}$; $\vec{c} = \begin{bmatrix} 5 \\ 9 \end{bmatrix}$; $\vec{d} = \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}$

14) $$R = \left\| \left(\vec{c} \cdot \vec{d}^{\,T} \right)^T \cdot \vec{c} \right\| + \left\| \bar{\bar{A}} \cdot \bar{\bar{B}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 9 & 4 & 8 \\ 4 & 7 & 8 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 9 & 3 \\ 6 & 9 \\ 8 & 7 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 8 \\ 1 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 7 \\ 1 \end{bmatrix}$$

15) $$R = \left\| \left(\vec{d} \cdot \vec{c}^{\,T} \right)^T \cdot \vec{d} \right\| + \left\| \bar{\bar{A}} \cdot \bar{\bar{B}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 1 & 1 & 6 \\ 6 & 7 & 2 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 7 & 6 \\ 7 & 8 \\ 8 & 6 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 2 \\ 6 \end{bmatrix}$$

16) $$R = \left(\left(\bar{\bar{A}} + \bar{\bar{B}}^T \right) \cdot \vec{d} \right)^T \cdot \vec{c} + \left\| \bar{\bar{A}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 1 & 6 & 3 \\ 8 & 7 & 5 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 6 & 8 \\ 8 & 7 \\ 7 & 6 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 7 \\ 2 \end{bmatrix}$$

17) $$R = \left(\left(\bar{\bar{A}} - \bar{\bar{B}}^T \right) \cdot \vec{d} \right)^T \cdot \vec{c} + \left\| \bar{\bar{A}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 2 & 3 & 9 \\ 1 & 8 & 8 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 4 & 2 \\ 9 & 6 \\ 6 & 5 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 6 \\ 6 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 2 \\ 7 \end{bmatrix}$$

18) $$R = \left(\left(\bar{\bar{B}} + \bar{\bar{A}}^T \right) \cdot \vec{c} \right)^T \cdot \vec{d} + \left\| \bar{\bar{B}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 2 & 9 & 6 \\ 3 & 8 & 3 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 2 & 5 \\ 1 & 5 \\ 5 & 5 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 8 \\ 7 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 6 \\ 3 \end{bmatrix}$$

19) $$R = \left(\left(\overline{\overline{B}} - \overline{\overline{A}}^{T} \right) \cdot \vec{c} \right)^{T} \cdot \vec{d} + \left\| \overline{\overline{B}} \right\|$$

$$\overline{\overline{A}} = \begin{bmatrix} 3 & 5 & 4 \\ 5 & 8 & 6 \end{bmatrix}; \quad \overline{\overline{B}} = \begin{bmatrix} 9 & 8 \\ 2 & 3 \\ 5 & 4 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 1 \\ 9 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 1 \\ 9 \end{bmatrix}$$

20) $$R = \left\| \overline{\overline{A}}^{T} \cdot \vec{c} + \overline{\overline{B}} \cdot \left(\overline{\overline{A}} \cdot \vec{d} \right) \right\|$$

$$\overline{\overline{A}} = \begin{bmatrix} 4 & 2 & 1 \\ 7 & 9 & 9 \end{bmatrix}; \quad \overline{\overline{B}} = \begin{bmatrix} 7 & 2 \\ 3 & 2 \\ 4 & 4 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 9 \\ 6 \\ 5 \end{bmatrix}$$

21) $$R = \left\| \overline{\overline{A}} \cdot \vec{d} + \overline{\overline{B}}^{T} \cdot \left(\overline{\overline{A}}^{T} \cdot \vec{c} \right) \right\|$$

$$\overline{\overline{A}} = \begin{bmatrix} 4 & 8 & 7 \\ 9 & 9 & 3 \end{bmatrix}; \quad \overline{\overline{B}} = \begin{bmatrix} 5 & 5 \\ 4 & 1 \\ 3 & 3 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 6 \\ 3 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 1 \\ 1 \end{bmatrix}$$

22) $$R = \left\| \overline{\overline{B}}^{T} \cdot \vec{d} + \overline{\overline{A}} \cdot \left(\overline{\overline{B}} \cdot \vec{c} \right) \right\|$$

$$\overline{\overline{A}} = \begin{bmatrix} 5 & 5 & 4 \\ 2 & 9 & 6 \end{bmatrix}; \quad \overline{\overline{B}} = \begin{bmatrix} 3 & 8 \\ 5 & 9 \\ 2 & 3 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 8 \\ 4 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 9 \\ 5 \\ 6 \end{bmatrix}$$

23) $$R = \left\| \bar{\bar{B}} \cdot \vec{c} + \bar{\bar{A}}^{T} \cdot \left(\bar{\bar{B}}^{T} \cdot \vec{d} \right) \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 6 & 1 & 2 \\ 4 & 1 & 9 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 1 & 2 \\ 6 & 8 \\ 1 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix}$$

24) $$R = \left(\vec{c}^{\,T} \cdot \bar{\bar{A}} + \vec{d}^{\,T} \right) \cdot \bar{\bar{B}} \cdot \vec{c}$$

$$\bar{\bar{A}} = \begin{bmatrix} 6 & 7 & 8 \\ 6 & 1 & 4 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 8 & 5 \\ 7 & 7 \\ 1 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 4 \\ 7 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$$

25) $$R = \mathrm{sled}\left(\left(\vec{c} \cdot \vec{d}^{\,T} + \bar{\bar{A}} \right) \cdot \bar{\bar{B}} \right) + \left\| \bar{\bar{B}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 7 & 4 & 5 \\ 8 & 1 & 7 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 6 & 7 \\ 7 & 6 \\ 9 & 1 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 6 \\ 9 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 4 \\ 9 \\ 3 \end{bmatrix}$$

26) $$R = \mathrm{sled}\left(\left(\vec{d} \cdot \vec{c}^{\,T} + \bar{\bar{B}} \right) \cdot \bar{\bar{A}} \right) + \left\| \bar{\bar{A}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 7 & 9 & 2 \\ 1 & 2 & 1 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 5 & 1 \\ 8 & 5 \\ 8 & 1 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 9 \\ 1 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 9 \\ 4 \\ 8 \end{bmatrix}$$

27) $$R = \left\| \left(\vec{c} \cdot \vec{d}^{\,T} + \bar{\bar{A}} \right)^T + \bar{\bar{B}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 8 & 6 & 9 \\ 3 & 2 & 4 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 3 & 4 \\ 9 & 4 \\ 7 & 9 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 5 \\ 9 \\ 5 \end{bmatrix}$$

28) $$R = \left\| \left(\vec{d} \cdot \vec{c}^{\,T} + \bar{\bar{B}} \right)^T + \bar{\bar{A}} \right\|$$

$$\bar{\bar{A}} = \begin{bmatrix} 1 & 8 & 2 \\ 1 & 1 & 8 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 2 & 9 \\ 8 & 1 \\ 3 & 7 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 1 \\ 5 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 3 \\ 3 \end{bmatrix}$$

29) $$R = \vec{d}^{\,T} \cdot \left(\vec{c} \cdot \vec{d}^{\,T} + \bar{\bar{A}} \right)^T \cdot \vec{c}$$

$$\bar{\bar{A}} = \begin{bmatrix} 1 & 1 & 9 \\ 2 & 1 & 9 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 1 & 6 \\ 9 & 9 \\ 7 & 3 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 7 \\ 2 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 1 \\ 5 \\ 5 \end{bmatrix}$$

30) $$R = \vec{c}^{\,T} \cdot \left(\vec{c} \cdot \vec{d}^{\,T} + \bar{\bar{A}} \right) \cdot \vec{d}$$

$$\bar{\bar{A}} = \begin{bmatrix} 2 & 4 & 8 \\ 3 & 2 & 2 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 9 & 3 \\ 9 & 9 \\ 2 & 7 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 3 \\ 7 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 3 \\ 7 \\ 8 \end{bmatrix}$$

31) $$R = \vec{c}^{\,T} \cdot \left(\vec{d} \cdot \vec{c}^{\,T} + \bar{\bar{B}} \right)^{T} \cdot \vec{d}$$

$$\bar{\bar{A}} = \begin{bmatrix} 2 & 7 & 6 \\ 4 & 2 & 3 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 8 & 9 \\ 1 & 8 \\ 6 & 2 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 9 \\ 3 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 6 \\ 9 \\ 2 \end{bmatrix}$$

32) $$R = \vec{d}^{\,T} \cdot \left(\vec{d} \cdot \vec{c}^{\,T} + \bar{\bar{B}} \right) \cdot \vec{c}$$

$$\bar{\bar{A}} = \begin{bmatrix} 2 & 1 & 5 \\ 5 & 2 & 5 \end{bmatrix}; \quad \bar{\bar{B}} = \begin{bmatrix} 7 & 6 \\ 1 & 8 \\ 1 & 7 \end{bmatrix}; \quad \vec{c} = \begin{bmatrix} 6 \\ 8 \end{bmatrix}; \quad \vec{d} = \begin{bmatrix} 8 \\ 2 \\ 4 \end{bmatrix}$$