

```
1: ()
2: Prgm
3: ClrIO
4: ©Program to deal with three vectors in three space
5: Disp "Three vectors in 3-Space"
6: ©Save settings to restore later
7: getMode("Angle")→ma
8: getMode("Display Digits")→mdd
9: getMode("Exact/Approx")→mea
10: © Set the mode values for the program
11: setMode("Display Digits","Fix 4")
12: setMode("Exact/Approx","Approximate")
13: setMode("Angle","RADIAN")
14: © do a little preliminary work to be sure that the vectors are OK
15: {0,0,0}→lz
16: If getType(u)="NONE" Then
17:   lz→u
18: Else
19:   If getType(u)="LIST" Then
20:     If dim(u)=3 Then
21:       Disp "U exists as ",u
22:     Else
23:       Disp "U was ",u," changed to "
24:       lz→u
25:       Disp u
26:     EndIf
27:   Else
28:     Disp "U existed as wrong type"
29:     Disp "Saved as Uold and reset"
30:     u→uold
31:     lz→u
32:     Disp "U now",u
33:   EndIf
34: EndIf
35: If getType(v)="NONE" Then
36:   lz→v
37: Else
38:   If getType(v)="LIST" Then
39:     If dim(v)=3 Then
40:       Disp "V exists as ",v
41:     Else
42:       Disp "V was ",v," changed to "
43:       lz→v
44:       Disp v
45:     EndIf
46:   Else
47:     Disp "V existed as wrong type"
48:     Disp "Saved as Vold and reset"
49:     v→vold
50:     lz→v
51:     Disp "V now",v
52:   EndIf
53: EndIf
```

```
54: If getType(w)="NONE" Then
55:   lz→w
56: Else
57:   If getType(w)="LIST" Then
58:     If dim(w)=3 Then
59:       Disp "W exists as ",w
60:     Else
61:       Disp "W was ",w," changed to "
62:       lz→w
63:       Disp w
64:     EndIf
65:   Else
66:     Disp "W existed as wrong type"
67:     Disp "Saved as Wold and reset"
68:     w→wold
69:     lz→w
70:     Disp "W now",w
71:   EndIf
72: EndIf
73: © Set up menu system
74: Lbl lmain
75: 1→menunum
76: Toolbar
77:   Title "Enter U",lentu
78:   Title "Enter V",lentv
79:   Title "Enter W",lentw
80:   Title "Display",ldisp
81:   Title "Page 2",lmore2
82: EndTBar
83: Lbl lmore2
84: Toolbar
85:   Title "Swap U V",lswapuv
86:   Title "Swap U W",lswapuw
87:   Title "Swap V W",lswapvw
88:   Title "Dot Prod",ldot
89:   Title "Page 3",lmore3
90: EndTBar
91: Lbl lmore3
92: Toolbar
93:   Title "Cross Prod",lcross
94:   Title "Magnitudes",lmgntd
95:   Title "Unit",lunit
96:   Title "Direction",ldrct
97:   Title "Page 4",lmore4
98: EndTBar
99: Lbl lmore4
100: Toolbar
101:   Title "Angles Btwn",langle
102:   Title "Project",lproj
103:   Title "Page 1",lmain
104:   Title "Page 2",lmore2
105:   Title "Quit",lquit
106: EndTBar
```

```
107: Lbl lentu
108: Disp "Enter U as a list {...}"
109: Input "U=",u
110: If dotP(u,u)=0 Then
111:   Disp "Cannot deal with the zero vector."
112:   Goto lentu
113: EndIf
114: Goto lmain
115: Lbl lentv
116: Disp "Enter V as a list {...}"
117: Input "V=",v
118: If dotP(v,v)=0 Then
119:   Disp "Cannot deal with the zero vector."
120:   Goto lentv
121: EndIf
122: Goto lmain
123: Lbl lentw
124: Disp "Enter W as a list {...}"
125: Input "W=",w
126: If dotP(w,w)=0 Then
127:   Disp "Cannot deal with the zero vector."
128:   Goto lentw
129: EndIf
130: Goto lmain
131: Lbl ldisp
132: Disp "U="
133: Pause u
134: Disp "V="
135: Pause v
136: Disp "W="
137: Pause w
138: If menunum=1 Then
139: Goto lmain
140: Else
141: Goto lmore2
142: EndIf
143: Lbl lswapuv
144: u→ls
145: v→u
146: ls→v
147: 2→menunum
148: Disp "Swapped U and V"
149: Goto ldisp
150: Lbl lswapuw
151: u→ls
152: w→u
153: ls→w
154: 2→menunum
155: Disp "Swapped U and W"
156: Goto ldisp
157: Lbl lswapvw
158: v→ls
159: w→v
```

```

160: 1s→w
161: 2→menunum
162: Disp "Swapped V and W"
163: Goto ldisp
164: Lbl ldot
165: Disp "Dot products..."
166: Disp "U dot V =",dotP(u,v)
167: Disp "U dot W =",dotP(u,w)
168: Disp "V dot W =",dotP(v,w)
169: Goto lmore2
170: Lbl lcross
171: Disp "Cross products..."
172: Disp "U x V ="
173: Pause crossP(u,v)
174: Disp "U x W ="
175: Pause crossP(u,w)
176: Disp "V x W ="
177: Pause crossP(v,w)
178: Goto lmore3
179: Lbl lmgntd
180: √(dotP(u,u))→mu
181: √(dotP(v,v))→mv
182: √(dotP(w,w))→mw
183: Disp "Magnitude U=",mu
184: Disp "Magnitude V=",mv
185: Disp "Magnitude W=",mw
186: Goto lmore3
187: Lbl lunit
188: √(dotP(u,u))→mu
189: √(dotP(v,v))→mv
190: √(dotP(w,w))→mw
191: Disp "Unit Vector in ","U direction is",1/mu*u
192: Disp "Unit Vector in ","V direction is",1/mv*v
193: Pause "Paused..."
194: Disp "Unit Vector in ","W direction is",1/mw*w
195: Goto lmore3
196: Lbl ldrct
197: √(dotP(u,u))→mu
198: √(dotP(v,v))→mv
199: √(dotP(w,w))→mw
200: Disp "Direction Angles for U=",,"in radians..."
201: Pause cos-1(u/mu)
202: Disp "Direction Angles for U=",,"in degrees..."
203: Pause 180/π*cos-1(u/mu)
204: Pause "Paused..."
205: Disp "Direction Angles for V=",,"in radians..."
206: Pause cos-1(v/mv)
207: Disp "Direction Angles for V=",,"in degrees..."
208: Pause 180/π*cos-1(v/mv)
209: Pause "Paused..."
210: Disp "Direction Angles for W=",,"in radians..."
211: Pause cos-1(w/mw)
212: Disp "Direction Angles for W=",,"in degrees..."

```

```
213: Pause  $180/\pi*\cos^{-1}(w/mw)$ 
214: Goto lmore3
215: Lbl langle
216:  $\sqrt{\text{dotP}(u,u)}\rightarrow\mu$ 
217:  $\sqrt{\text{dotP}(v,v)}\rightarrow m$ 
218:  $\sqrt{\text{dotP}(w,w)}\rightarrow mw$ 
219:  $\cos^{-1}(\text{dotP}(u,v)/(\mu*m))\rightarrow auv$ 
220:  $\cos^{-1}(\text{dotP}(u,w)/(\mu*mw))\rightarrow auw$ 
221:  $\cos^{-1}(\text{dotP}(v,w)/(m*mw))\rightarrow avw$ 
222: Disp "Angle between U and V is",auv,"radians, or"
223: Disp  $180/\pi*auv$ ,"degrees"
224: Pause "Paused..."
225: Disp "Angle between U and W is",auw,"radians, or"
226: Disp  $180/\pi*auw$ ,"degrees"
227: Pause "Paused..."
228: Disp "Angle between V and W is",avw,"radians, or"
229: Disp  $180/\pi*avw$ ,"degrees"
230: Goto lmore4
231: Lbl lproj
232:  $\text{dotP}(u,v)/\text{dotP}(v,v)*v\rightarrow puv$ 
233:  $\text{dotP}(u,w)/\text{dotP}(w,w)*w\rightarrow puw$ 
234:  $\text{dotP}(v,w)/\text{dotP}(w,w)*w\rightarrow pvw$ 
235:  $\text{dotP}(u,v)/\text{dotP}(u,u)*u\rightarrow pvu$ 
236:  $\text{dotP}(u,w)/\text{dotP}(u,u)*u\rightarrow pwu$ 
237:  $\text{dotP}(v,w)/\text{dotP}(v,v)*v\rightarrow pvw$ 
238: Disp "Project U onto V gives"
239: Pause puv
240: Disp "Project U onto W gives"
241: Pause puw
242: Disp "Project V onto W gives"
243: Pause pvw
244: Disp "Project V onto U gives"
245: Pause pvu
246: Disp "Project W onto U gives"
247: Pause pwu
248: Disp "Project W onto V gives"
249: Pause pwv
250: Goto lmore4
251: Lbl lquit
252: setMode("Angle",ma)
253: setMode("Display Digits",mdd)
254: setMode("Exact/Approx",mea)
255: Stop
256: EndPrgm
```