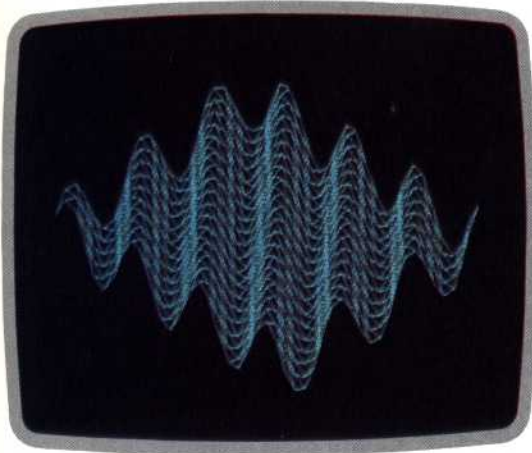




results are held in an array and take time to work out. The calculations depend on the function chosen and may take several minutes; during this



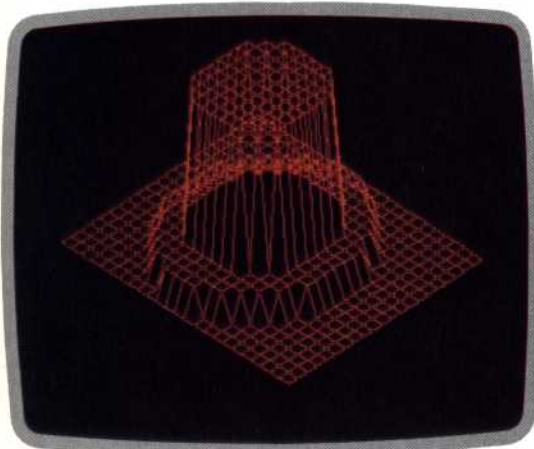
```
170 Y=SIN(X+Z)/12
```

period the computer appears to be doing nothing. Calculating the function first saves time in the long run. If calculations were made while the lines were being plotted, the program would take almost twice as long to plot the graph.

We have listed several different functions for you to experiment with. The illustrations show the results you can expect. You should also try to develop your own graphs by entering different functions into the program. Take care when doing this; you must make sure that the graph will fit on the screen, and that no illegal mathematical operations are attempted. The two most common errors are trying to divide by zero (which gives infinity) and attempting to find the square root of a negative number (there is no such thing).

To avoid division by zero, add a very small constant (say 0.00001) to any variable that might become zero. The only way to protect against square roots of negative numbers is to use the ABS function to make all the numbers positive before finding the square root.

Some interesting displays may be produced by common mathematical functions such as SIN, COS, LOG, etc. Others may be achieved by using



```
165 C=X*X+Z*Z+0.00001
170 Y=SGN(INT(23/C))/3+SGN(INT(55/C))/15
```

functions that are found only on computers — try INT, SGN and ABS.

This program may be improved in a number of ways. You could try adapting it so that any function is automatically scaled to fit within the screen boundaries, or you could try plotting points in a third direction, giving curves for X and Z while Y is kept as a constant (this is relatively complicated). But even if you simply use the program as it is written here, you should find that it is amusing to try out the silliest equations you can think of. The results may surprise you.

This program is written in BBC BASIC.

```
10 REM * GRAPH PLOTTING
20:
30 REM * SET UP SCREEN
40 ACROSS=1280:TALL=1024:UP=-1
50 XGAP=25:ZGAP=15
60 WIDE=INT(ACROSS/XGAP/2)
70 DEPTH=INT(TALL/ZGAP/3)
80 MODE4:CLS:PRINTTAB(12)"CALCULATING"
90:
100 REM * CALCULATE GRAPH
110 START=20
120 DIM G(WIDE,DEPTH)
130 FOR A=-DEPTH/2 TO DEPTH/2
140 FOR B=-WIDE/2 TO WIDE/2
150 X=A*20/WIDE:Z=B*20/DEPTH
160 REM * INSERT FUNCTION BELOW HERE
170 Y=(SIN(X)+COS(Z))/60
180 G(B+WIDE/2,A+DEPTH/2)=Y*UP*TALL
190 NEXT B:NEXT A:CLS
200:
210 REM * DRAW GRAPH ; X-Y PLANE
220 FOR Z=1 TO DEPTH
230 XBASE=XGAP*Z
240 ZBASE=TALL/2+Z*ZGAP+START*UP
250 XOLD=XBASE+XGAP
260 ZOLD=ZBASE-ZGAP-G(1,Z)
270 FOR X=1 TO WIDE
280 XNEW=XBASE+X*XGAP
290 ZNEW=ZBASE-X*ZGAP-G(X,Z)
300 PLOT 4,XOLD,ZOLD:PLOT 5,XNEW,ZNEW
310 XOLD=XNEW:ZOLD=ZNEW
320 NEXT X:NEXT Z
330:
340 REM * DRAW GRAPH ; Z-Y PLANE
350 FOR X=1 TO WIDE
360 XBASE=XGAP*X+DEPTH*XGAP
370 ZBASE=TALL/2-X*ZGAP+DEPTH*ZGAP+START*UP
380 ZOLD=ZBASE-ZGAP-G(X,DEPTH-1)
390 XOLD=XBASE-XGAP
400 FOR Z=0 TO DEPTH-1
410 XNEW=XBASE-Z*XGAP
420 ZNEW=ZBASE-Z*ZGAP-G(X,DEPTH-Z)
430 PLOT 4,XOLD,ZOLD:PLOT 5,XNEW,ZNEW
440 XOLD=XNEW:ZOLD=ZNEW
450 NEXT Z:NEXT X
460:
470 REM * HOLD DISPLAY
480 GOTO 470
```

Basic Flavours

Spectrum

Insert LET in all assignment statements. Insert the following lines:

```
40 LET ACROSS=256:LET TALL=176:LET UP=1
50 LET XGAP=5:LET ZGAP=3
80 CLS
290 PLOT XOLD,ZOLD:DRAW XNEW-XOLD,ZNEW-ZOLD
410 PLOT XOLD,ZOLD:DRAW XNEW-XOLD,ZNEW-ZOLD
```

Oric-1/Atmos

Insert the following lines:

```
40 ACROSS=239:TALL=199:UP=1
50 XGAP=5:ZGAP=3
80 HIRIS
300 CURSET XOLD,ZOLD,1:DRAW XNEW-XOLD,ZNEW-ZOLD,1
430 CURSET XOLD,ZOLD,1:DRAW XNEW-XOLD,ZNEW-ZOLD,1
```