PROGRAM : BISECT

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PURPOSE : To compute the value of a zero (root) of a function *f*(*x*) on an interval (*a*,*b*).

PLATFORM: Texas Instruments TI 82/83/84 (plus) graphing calculators

DEFINITION: *x* = *r* is a *root* or *zero* of a function *f*(*x*) means that *f*(*r*) = 0
The program utilizes the method of successive interval halving or *bisection*
which is applicable to any continuous function with a zero in the interval [*a*, *b*].

Input : The function *f*(*x*) is stored in $\mathbf{y}_1$ prior to running the program.
Interval endpoints *a* and *b* are prompted for in the program.

Output: the approximate value of the root, stored in *c*

Note: For the program to successfully determine the value of the root in the interval [*a*, *b*], make sure the interval contains a single root, e.g. by graphing *f*(*x*).

PROGRAM BISECT

```
:Prompt A,B
:If y1(A)y1(B)≥0
:Then
:Disp("CHANGE INTERVAL")
:Stop
:Else
:While Abs(B-A)>1E-8
:(A+B)/2→C
:Disp C
:If y1(A)y1(C)>0
:Then
:C→A
:Else
:C→B
:End
:End
:Stop
:End
```

Command Locations

```
Prompt: prgm I/O
If: Prgm Ctl
Then: Prgm Ctl
Disp: Prgm I/O
Else: Prgm Ctl
While: Prgm Ctl  -: (-) not - !
→: Sto
y1: vars y-vars functions 1
End: Prgm Ctl
Stop: Prgm Ctl
```

EXAMPLE: To solve the equation $3^x = 2$ for *x*, we need to determine the root of the function $f(x) = 3^x - 2$ on the interval [0,2]. (Ans: 0.6309298)

EXAMPLE: To solve the equation $x^4 - 2x^2 - x - 2 = 5$ for $x>0$, we need to determine the root of the function $f(x) = x^4 - 2x^2 - x - 7$, on the interval [0,5] (check this graphically). (Ans: 2.04178286)

EXAMPLE: To determine the point of intersection of the graphs of $g(x) = \log_2 x$ and $h(x) = 5 - x$,
We need to solve the equation $g(x) = h(x) \Rightarrow \log_2 x = 5 - x \Rightarrow \log_2 x - 5 + x = 0$
on the interval [1,5] . Use the change of base: $\log_2 x = \ln(x)/\ln(2)$
(Ans: 3.28437926)