**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 \( y_1 \) 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**

```plaintext
:Prompt A,B
:If \( y_1(A)y_1(B) < 0 \)
:Then
:Disp ("CHANGE INTERVAL")
:Stop
:Else
:While Abs(B-A)>1E-8
:(A+B)/2 \( \rightarrow \) C
:Disp C
:If \( y_1(A)y_1(C)>0 \)
:Then
:C \( \rightarrow \) A
:Else
:C \( \rightarrow \) 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
→: StO
\( y_1: \) vars y-vars functions

**Examples**

1. 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)

2. 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)

3. 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)