Topic : Secant Method - Roots of Equations
Simulation : Graphical Simulation of the Method
Language : Mathmatica 4.1
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Date : 2 July 2002
Abstract : This simulation shows how the secant method for finding roots of an equation $f[x]$ 0 works.

■ INPUTS: Enter the Following

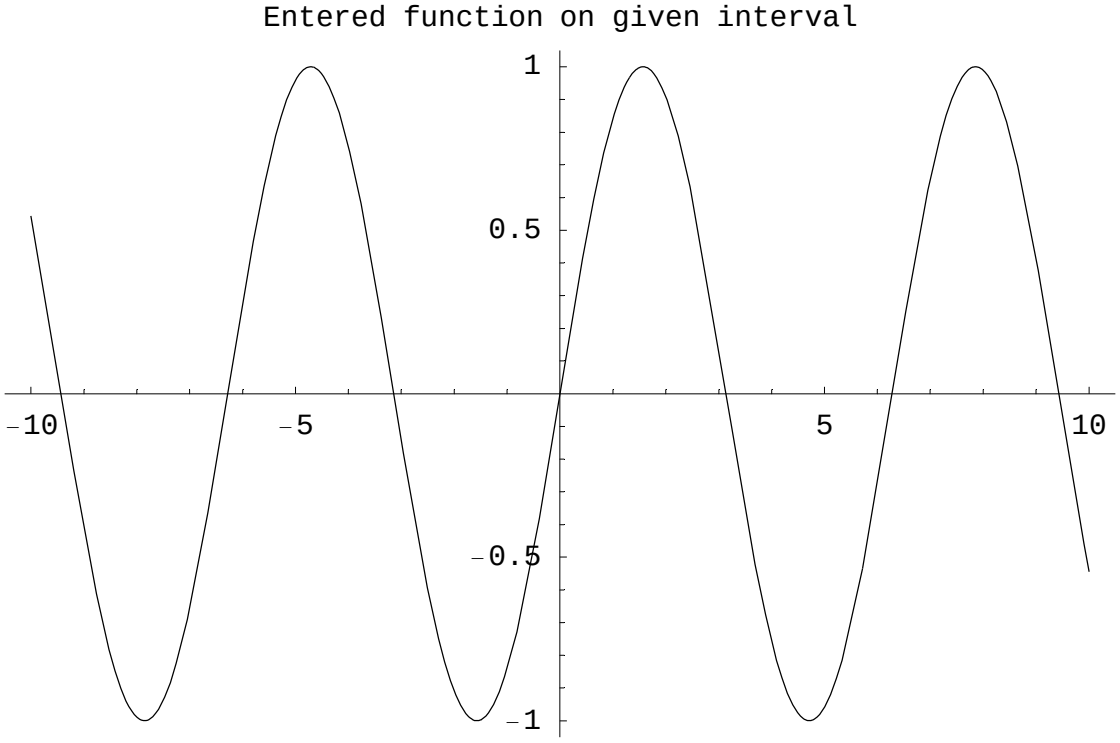
Function in $f[x]$ 0

In[538]:=
```
f[x_] := Sin[x]
```

Range of 'x' you want to see the function

In[539]:=
```
xb = -10;
xe = 10;
```

In[541]:=
```
curve = Plot[f[x], {x, xb, xe}, PlotLabel →
    "Entered function on given interval", TextStyle → {FontSize → 11}];
```



Lower initial guess

In[542]:=
```
xguess1 = 3 * Pi / 4;
```

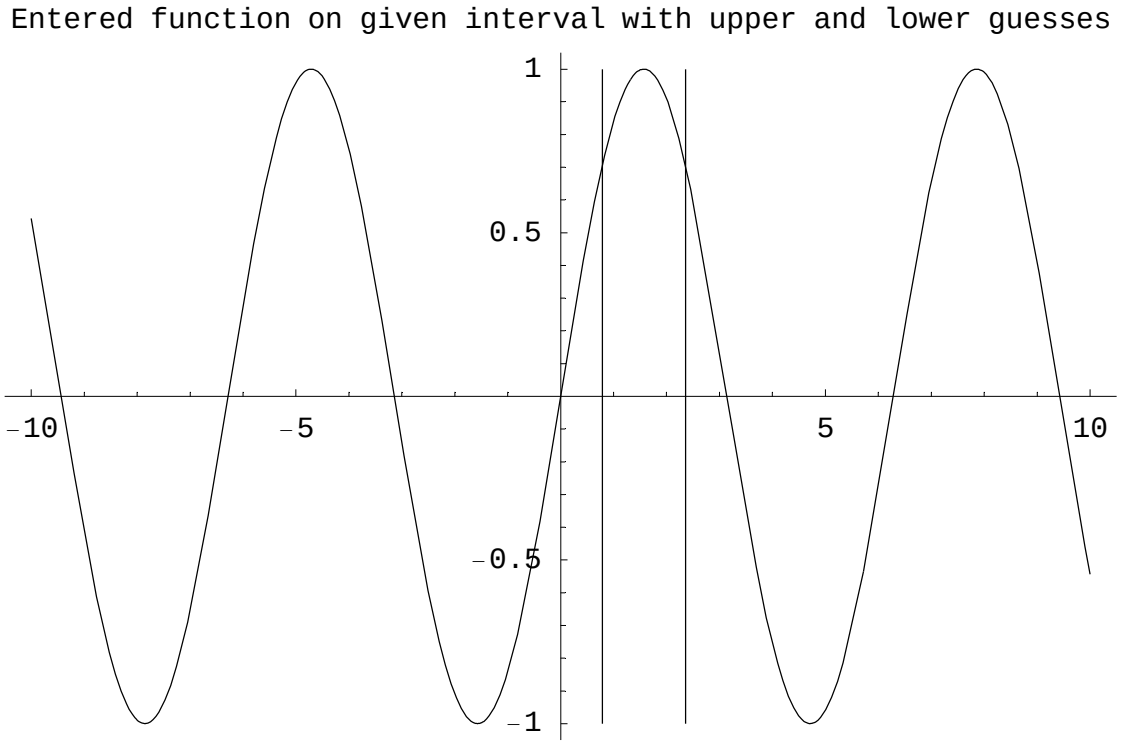
Upper initial guess

In[543]:=
```
xguess2 = Pi / 4;
```

■ SOLUTION

Check first if the lower and upper guesses bracket the root of the equation

In[544]:=
```
Show[Graphics[Line[{{xguess2, 1}, {xguess2, -1}}]], curve,
  Graphics[Line[{{xguess1, 1}, {xguess1, -1}}]], Axes → True, PlotLabel →
   "Entered function on given interval with upper and lower guesses",
  TextStyle → {FontSize → 11}];
```



Iteration 1

Choose two initial guesses of root.

In[545]:=
```
x1' = xguess1;
x0 = xguess2;
```

Estimate of root

In[547]:=
```
x1 = x0 - (f[x0] * (x1' - x0)) / (f[x1'] - f[x0])
```

```
Power::infy : Infinite expression 1/0 encountered.
```

Out[547]=
```
ComplexInfinity
```

Absolute relative approximate error

In[548]:=
```
ϵa = Abs[(x1 - x0) / x1 * 100]
```

```
∞::indet : Indeterminate expression 0 ComplexInfinity encountered.
```

Out[548]=
```
Indeterminate
```

In[549]:=
```
m = (f[x0] - f[x1']) / (x0 - x1');
secantline[x_] = m * x + f[x0] - m * x0;
```

In[551]:=
```
sline = Plot[secantline[x], {x, xb, xe}];
```

In[552]:=
```
Show[Graphics[Line[{{x0, 1}, {x0, -1}}]], Graphics[Line[{{x1, 1}, {x1, -1}}]],
  curve, Graphics[Line[{{x1', 1}, {x1', -1}}]], sline, Axes → True,
  PlotLabel → "Entered function on given interval with upper and
     lower guesses and estimated root", TextStyle → {FontSize → 11}];
```

```
Graphics::gptn : Coordinate ComplexInfinity
   in {ComplexInfinity, 1} is not a floating-point number.

Graphics::gptn : Coordinate ComplexInfinity
   in {ComplexInfinity, -1} is not a floating-point number.
```

d function on given interval with upper and lower guesses and estimated