Topic : Newton Raphson Method - Roots of Equations
Simulation : Pitfall - Zero Slope
Language : Mathmatica 4.1
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Abstract : This simulation illustrates a pitfall of zero slope in the Newton-Raphson method of finding roots of f(x)=0.

■ INPUTS: Enter the Following

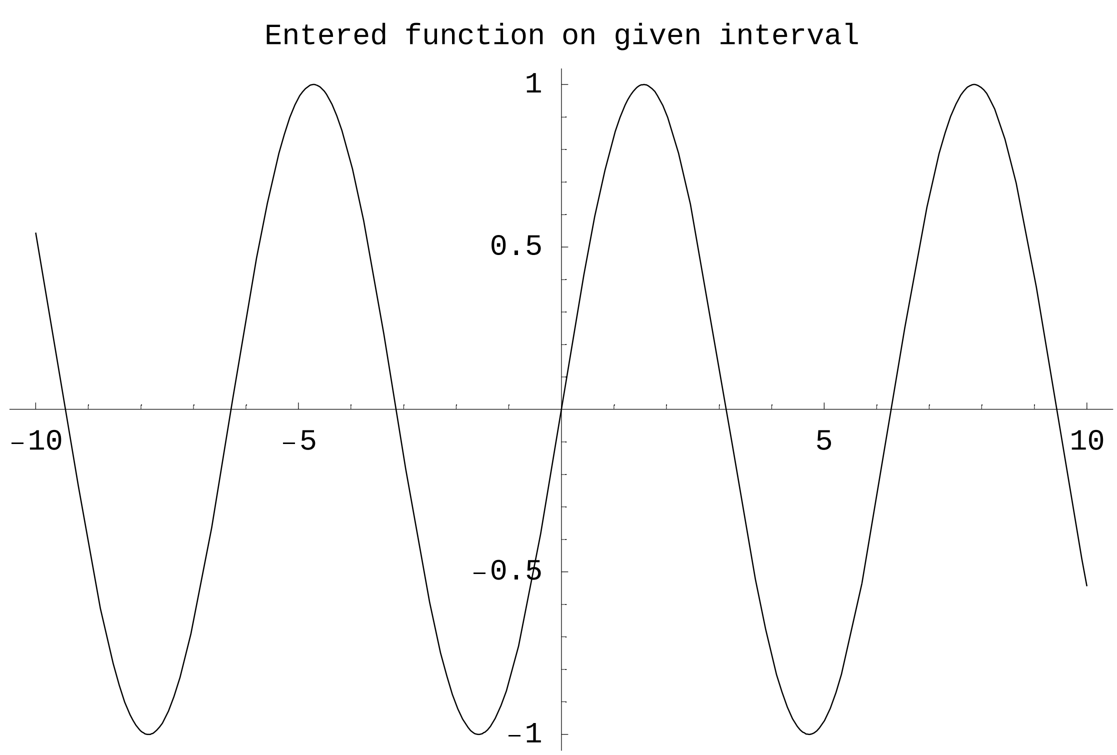
Function in $f[x]$ 0

In[527]:=
```
f[x_] := Sin[x]
```

Range of 'x' you want to see the function

In[528]:=
```
x_begin = -10;
x_end = 10;
```

In[530]:=
```
curve = Plot[f[x], {x, x_begin, x_end}, PlotLabel →
    "Entered function on given interval", TextStyle → {FontSize → 11}];
```



Initial guess

```
In[531]:= x0 = π / 2;
```

Because this method uses a line tangent to the function at the initial guess, we must calculate the derivative of the function to find the slope of the line at this point. Here we will define the derivative of the function $f(x)$ as $g(x)$.

```
In[532]:= g[x_] := f'[x]
```

Iteration 1

```
In[533]:= x1 = x0 - f[x0] / g[x0]
```

Power::infy : Infinite expression $\frac{1}{0}$ encountered.

```
Out[533]= ComplexInfinity
```

In[534]:= ϵ_a = Abs[(x1 - x0) / x1 * 100]

```
∞::indet : Indeterminate expression 0 ComplexInfinity encountered.
Out[534]= Indeterminate
```

```
In[535]:= tanline[x_] := f[x0] + ((0 - f[x0]) / (x1 - x0)) * (x - x0)
```

In[536]:= tline = Plot[tanline[x], {x, x_{begin}, x_{end}}];

```
In[537]:= Show[Graphics[Line[{{x0, 1}, {x0, -1}}]], curve,
            Graphics[Line[{{x1, 1}, {x1, -1}}]], tline, 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.
```