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math.csi.cuny.edu/webwork2/Math229_36386_Maher_F20/08-newton/3/

(c) The function value at the approximate zero is

- (•) within `1e-15` of 0
- ( ) more than `1e-15` away from 0

(d) Use Newton's method to find an intersection point of $f(x) = e^{-x^2}$ and $g(x) = 4x$.

(Look at $h(x) = f(x) - g(x) = 0$.)

Start with an initial guess of 0.

The approximate x value of the point of intersection is:

0.2364107748525736

(e) Use Newton's method to find *both* positive intersection points (the x values) of $f(x) = e^x$ and $g(x) = 2x^2$. Make a graph to identify good initial guesses. (You need to use Newton's method twice, each with different initial guesses.)

The smallest *positive* interesection point is:

1.4879620654981773

(f) The largest *positive* intersection point is:

2.6178666130668127

(g) The function `f(x) = exp(x) / (1 + 2exp(x))` has an inflection point near -0.5. Use Newton's method to find it.

The inflection point occurs at?

-0.6931471805599454

Note: *You can earn partial credit on this problem.*

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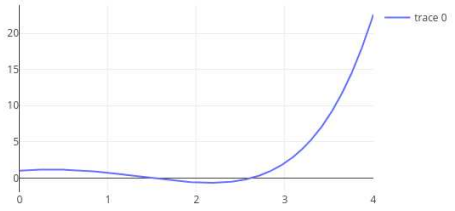
```
Out[119]: 0.2364107748525736

In [120]: # (e)
          f(x) = exp(x)
          g(x) = 2x^2
          h(x) = f(x) - g(x)
Out[120]: h (generic function with 1 method)

In [121]: plot(h, 0, 4)
```




```
Out[121]:

In [108]: newton(h, 1.5)
Out[108]: 1.4879620654981773

In [109]: newton(h, 2.5)
Out[109]: 2.6178666130668127

In [110]: # (f)
          f(x) = exp(x) / (1 + 2exp(x))
Out[110]: f (generic function with 1 method)

In [113]: plot(f'', -10, 10)
```

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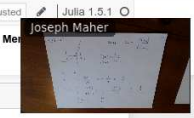


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Out[109]: 2.6178666130668127

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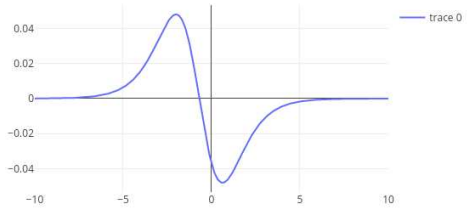
          f(x) = exp(x) / (1 + 2exp(x))
Out[110]: f (generic function with 1 method)

In [113]: plot(f'', -10, 10)
```




```
Out[113]:

In [114]: newton(f'', -0.5)
Out[114]: -0.6931471805599454

In [ ]:
```

1 2 [3] 4 5 6 7 8 9 10 11 12 13 14 15 16 : Tall : 00-blank-notebook - Jupyter Notebook - Chromium

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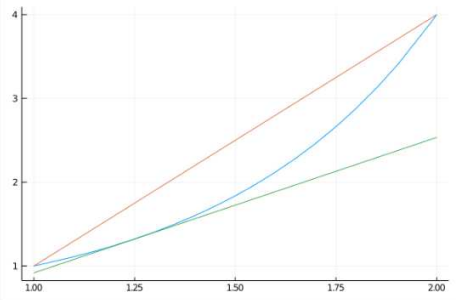
The mean value theorem

The mean value theorem states that for a function *continuous* on $[a, b]$ and *differentiable* on (a, b) that there exists c, with $a < c < b$, such that the derivative at c is equal to the slope of the secant line between a and b.

That is there is a tangent line parallel to the secant line. (Perhaps more than one, but at least one.)

Where is c? That needs to be found. The value solves $f'(c) = (f(b) - f(a))/(b - a)$. From the graph below of $f(x) = x^x$ over $[1, 2]$, estimate a possible value for c, then use `fzero` to find a numeric answer. (The tangent line at $x = 1.25$ is seen to be not steep enough.)



Graph of $f(x) = x^x$

(e) From the graph, identify a better estimate for c than 1.25? (We will use this as a starting point.)

1.5

(f) Using `fzero`, what is the more precise numeric value for c? (Use your last guess as the starting point.)

1.579582352985165

Note: *You can earn partial credit on this problem.*

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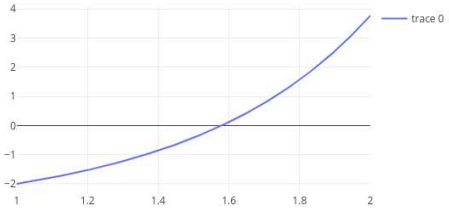
Out[140]:

In [146]:
```
# (f)
f(x) = x^x
g(x) = f'(x) - 3
```

Out[146]: g (generic function with 1 method)

In [147]:
```
plot(g, 1, 2)
```



Out[147]:

In [148]:
```
fzero(g, 1, 2)
```

Out[148]: 1.579582352985165

In [151]:
```
(f(2) - f(1) ) / (2 - 1)
```

Out[151]: 3.0

In [150]:
```
f'(1.579582352985165)
```

Out[150]: 3.0000000000000004

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