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```
clear all;
format long;
```

1.

Use a computer algebra system to compute the arclength of f(x) = e^x^2 from 0 to 1 with 16 digits of accuracy

using Mathematica to perform the integraiton. I am using the arc length formula: a = int(a,b) sqrt(1-f'(x)^2) dx

```
TrueVal = 2.127616414686636;
```

2.

See arclength.m for my function defintion.

```
r = arclength(0,1,2^10)
Error = TrueVal-r
relE = abs(Error)/TrueVal
```

```
r =

   2.127617691971491


Error =

    -1.277284855216720e-06


relE =

     6.003360598272336e-07
```

3.

See arclength1.m for my function definition

```
r1 = arclength2(0, 1, 2^10)
Error1 = TrueVal-r1
relE1 = abs(Error1)/TrueVal
```

```
r1 =

   2.129096187874880


Error1 =

  -0.001479773188244


relE1 =

     6.955075069120623e-04
```

4.

```
        use newton's method with aprime and arclength to find when the arclength
        is equal to pi.
```

```
clear all ;
xold = 1 ;
n = 2^8 ;
tol = 1e-8;
maxiter = 50;
for i = 1:maxiter
    % must subtract pi from arclength as newton's methods wants to
 find zeros so we must shift entire function to make pi a zero
    x = xold - (arclength(0,xold,n)-pi)/aprime(xold);
    if abs(x-xold)<tol
       i
       break
    end
    xold = x;
end
```

```
i =

     5
```

Thus we can see that it took 9 iterations to find the x value to a tolerance of 1e-8. Now I will verify that the function does truly evaluate to pi

```
arc_pi = arclength(0, xold,n)
diff = abs(arc_pi - pi)
```

```
arc_pi =

   3.141592652571839


diff =

     1.017953721316189e-09
```

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