MA 427 Homework 3

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5: Ch 5. #13

a.

```
format short
x = (1782^12 + 1841^12)^(1/12)
```

```
x = 1.9220e+03
```

```
format long
x = (1782^12 + 1841^12)^(1/12)
```

```
x =
     1.921999999955867e+03
```

b.

```
abserror = abs(round(x)-x)
```

```
abserror =
     4.413345777720679e-08
```

```
relerror = abs(round(x)-x)/abs(x)
```

```
relerror =
     2.296225690854328e-11
```

c.

1782 is an even number. Any even number raised to a non-zero integer power will also be even. Therfore 1782^12 is even.

1841 is an odd number. Any odd number raised to a non-zero integer power will also be odd. Therefore 1841^12 is odd.

The sum of any odd and even number is always odd. Therefore 1782^12 + 1841^12 is an odd number. But the equation says:

1782^12 + 1841^12 = 1922^12, which is an even number, and we know this cannot be true.

d.

```
format long
x = (3987^12 + 4365^12)^(1/12)
```

```
x =
     4.472000000007058e+03
```

```
abserror = abs(round(x)-x)
```

```
abserror =
     7.057678885757923e-09
```

```
relerror = abs(round(x)-x)/abs(x)
```

```
relerror =
     1.578192952984522e-12
```

We can see from these MATLAB caluclations that although the error is very small, x is not exactly 4472, which shows that the equation is debunked.

Also, from Fermat's Last Theorem, we know this would be mathematcially impossible since n = 12 >= 3 and the theorem states that there does not exist any natural numbers x, y, and z that satisfy the equation x^n + y^n = z^n for n >= 3.

6: Ch 5. #15

a.

```
binary = '00011001100110011001100';
decimal = 0;
for i = 1:length(binary)
    if binary(i) == '1'
        decimal = decimal + 2^(-i);
    end
end
x = decimal;
sym(x)
```

```
ans =
```

$$\frac{209715}{2097152}$$

b.

```
difference = abs(x-(1/10))
```

```
difference =
     9.536743164617612e-08
```

c.

```
timeerror = abs(360000-3600000*x)
```

```
timeerror =
```

```
    0.343322753906250
```

d.

3750 miles per hour to miles per second:

```
mps = 3750/3600
```

```
mps =
   1.041666666666667
```

Distance (in miles) traveled during time error found in part (c):

```
d = mps*timeerror
```

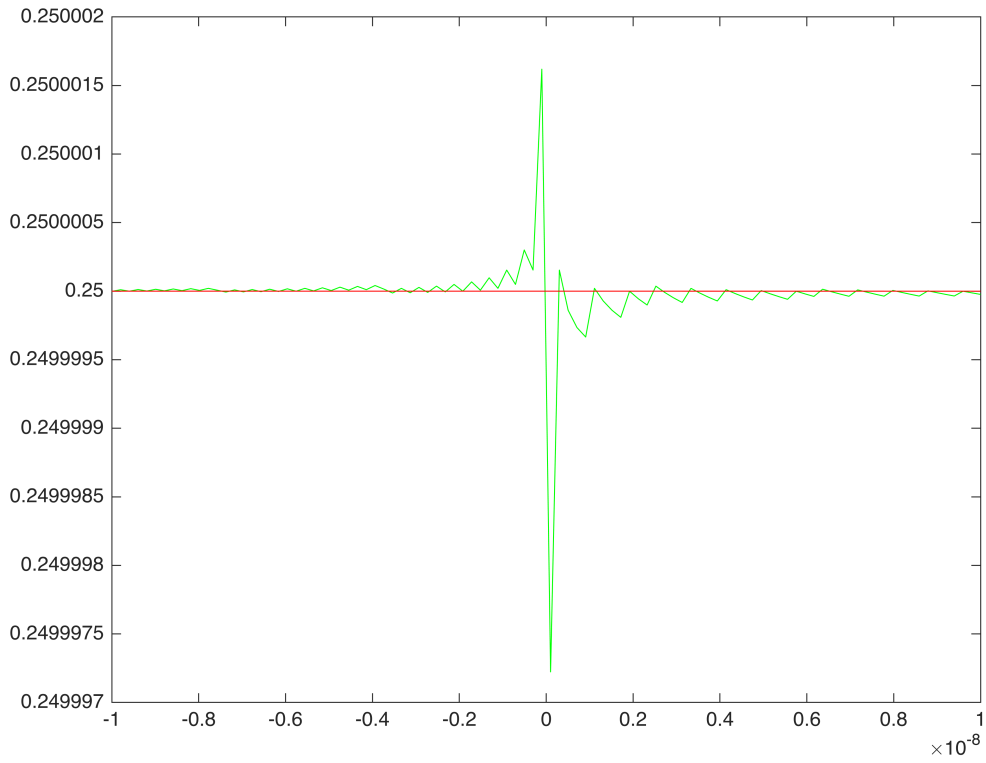
```
d =
   0.357627868652344
```

7.

a.

Multiply by conjugate to rewrite:

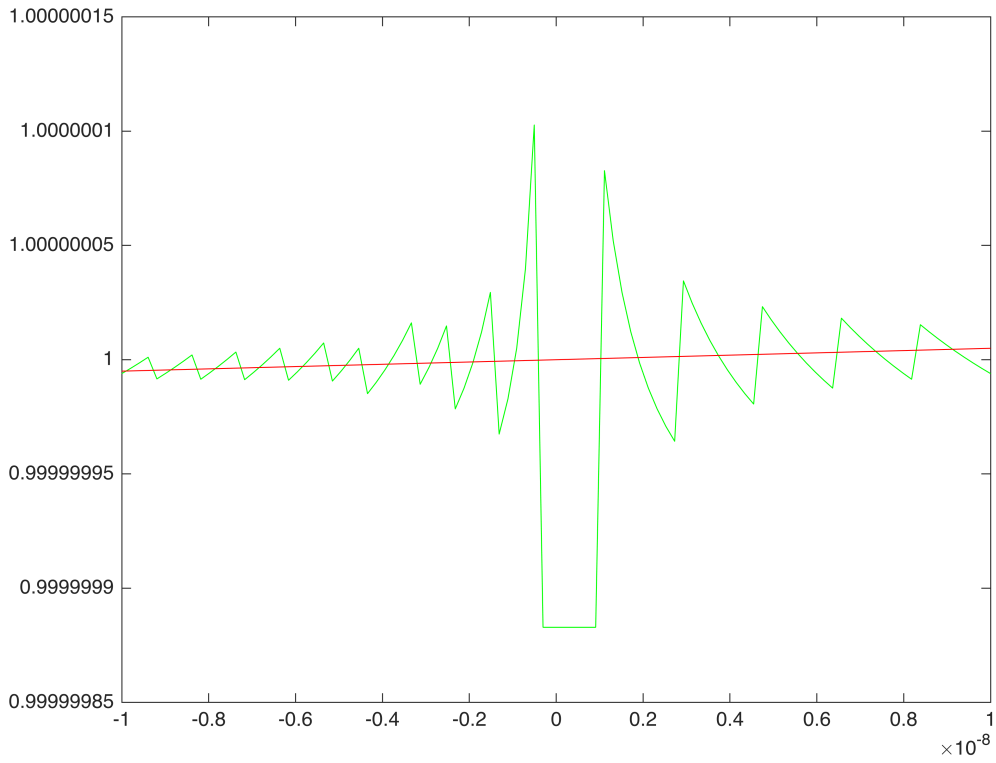
```
x = linspace(-1e-8,1e-8,100);
y1 = (sqrt(4+x)-2)./x;
plot(x,y1,'g')
hold on
y2 = 1./(sqrt(4+x)+2);
plot(x,y2,'r')
hold off
```



b.

Use Taylor expansion of e^x around x = 0 and substitute the expansion back into f(x) to simplify and rewrite:

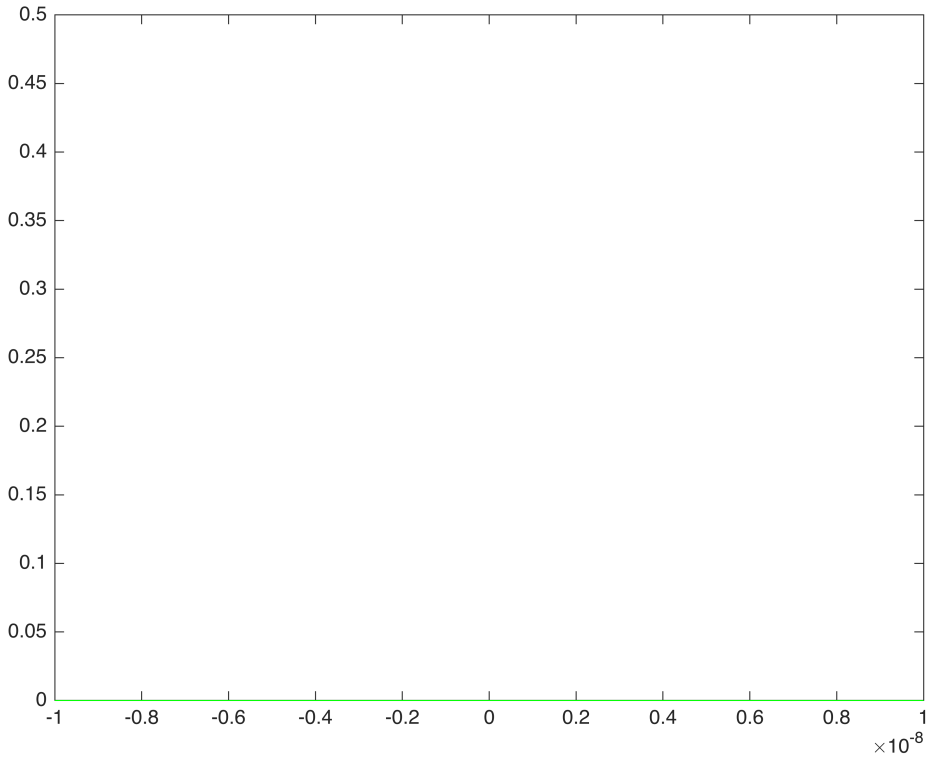
```
x = linspace(-1e-8,1e-8,100);
y1 = (exp(x)-1)./x;
plot(x,y1,'g')
hold on
y2 = (x+2)./2;
plot(x,y2,'r')
hold off
```



c.

Use Taylor expansion of cos(x) around x = 0, subtituting x^15 into the expansion and then the expansion back into f(x) to simplify and rewrite:

```
x = linspace(-1e-8,1e-8,100);
y1 = (1-cos(x.^15))./(x.^30);
plot(x,y1,'g')
hold on
y2 = 1/2;
plot(x,y2,'r')
hold off
```



Not sure why my second plot of (x,y2) is not showing up.