Lab 3

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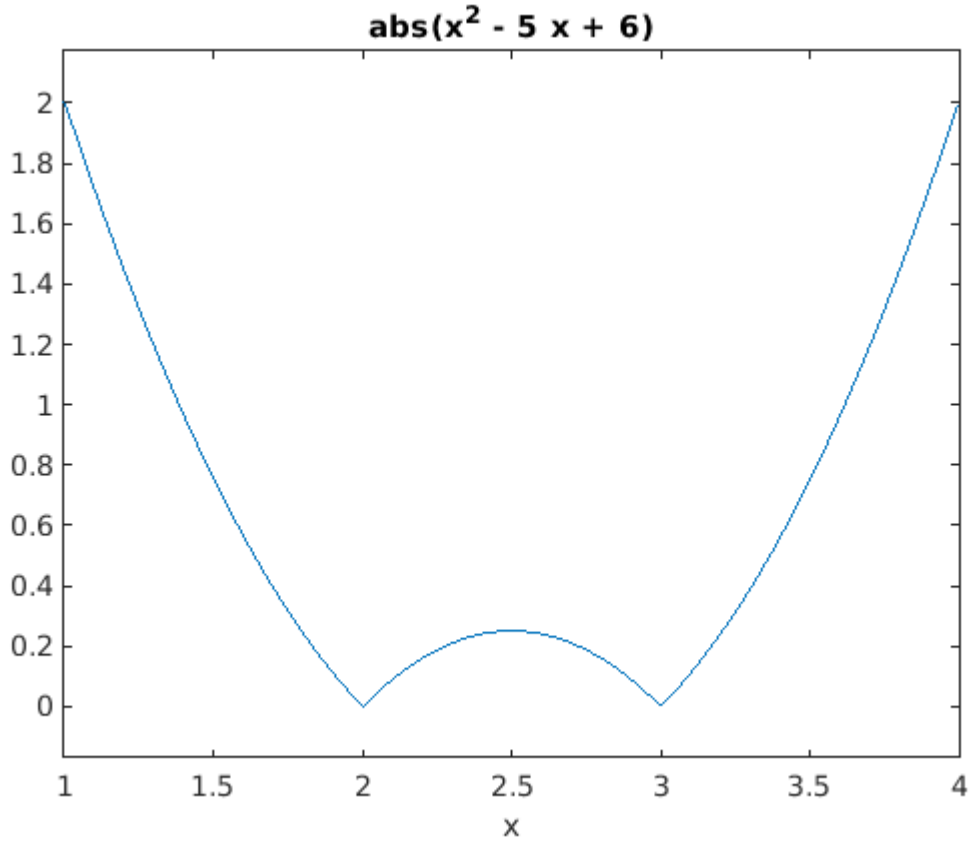
1. Find the slopes of the tangent lines for the graph at x = 1.5, 2.5 and 3.5. Explain what you find. Be sure you are using limits in the dq function as h goes to 0. Why are the slopes positive, negative or zero?

```
syms x h c
p(x) = abs(x^2 - 5*x + 6)
```

p(x) = $|x^2 - 5\,x + 6|$

```
ezplot(p(x), [1, 4])
```




```
dq(c,h)=(p(c + h) - p(c))/h
```

dq(c, h) =

$$\frac{|5\,c + 5\,h - (c + h)^2 - 6| - |c^2 - 5\,c + 6|}{h}$$

```
vpa(limit(dq(1.5,h),h,0),4)
```

ans = -2.0

p(x) at 1.5 is trending down, so it will be negitive.

```
vpa(limit(dq(2.5,h),h,0),4)
```

```
ans = 0.0
```

p(x) at 2.5 is not trending up or down and is flat.

```
vpa(limit(dq(3.5,h),h,0),4)
```

```
ans = 2.0
```

p(x) at 3.5 is trending up so it will be positive.

2. Plot p(x) and secline(2,h,x) together over the interval [1,4] for small values of h, namely h 0.001 and h = -0.001.

```
ezplot(p(x), [1 4])
hold on
secline(c,h,x) = p(c)+dq(c,h)*(x-c)
```

```
secline(c, h, x) =
```

$$|c^2 - 5\,c + 6| - \frac{(|5\,c + 5\,h - (c+h)^2 - 6| - |c^2 - 5\,c + 6|)\ (c - x)}{h}$$

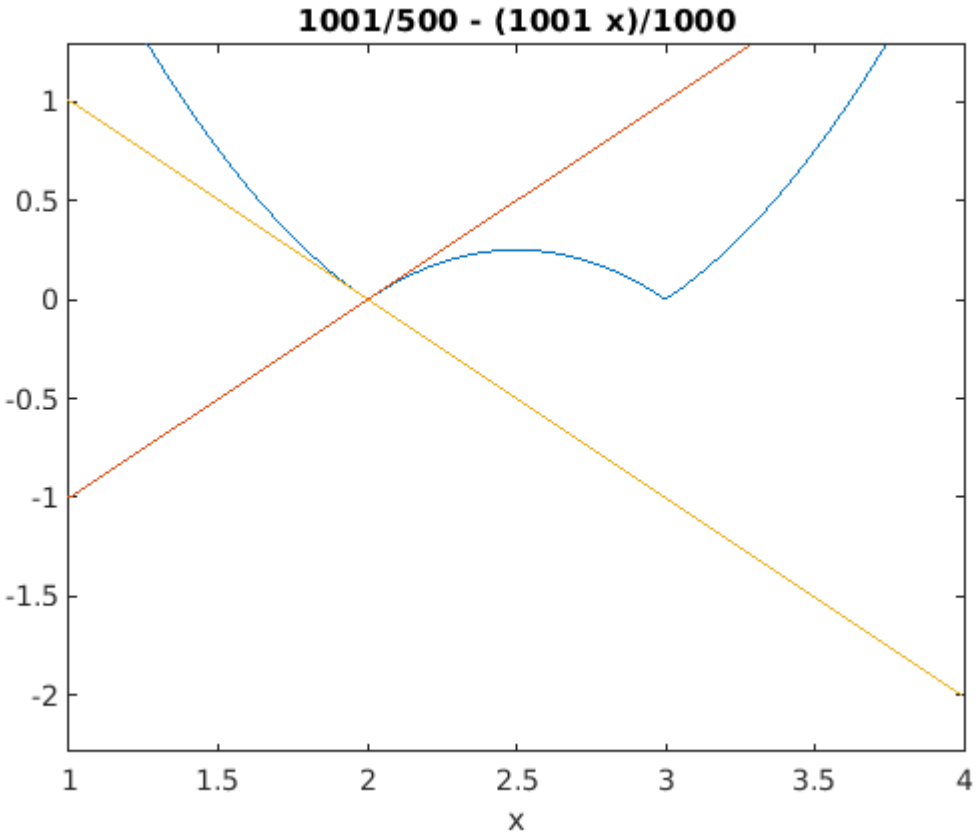
```
h_placeholder= 0.001
```

```
h_placeholder = 1.0000e-03
```

```
ezplot(secline(2,h_placeholder,x),[1 4])
h_placeholder= -0.001
```

```
h_placeholder = -1.0000e-03
```

```
ezplot(secline(2,h_placeholder,x),[1 4])
```



Explain why the plots are so different depending on whether h is positive or negative

The plots very when 0.001 and -0.001 because they are a negitive of the same value so they will cross over thhe same point as there slopes appose eachother, or are opposites.

Find the limit of dq(2,h) as h approaches 0

```
limit(dq(2,h),h,0)
```

```
ans = NaN
```

Would you expect to get a numerical answer if you found the left- and right-hand limits? Why?

For the right hand limmit i would guess 3 and for the left i would guess negitive infinity.

Then compute the left- and right-hand limits for dq(2,h) as h approaches 0.

```
limit(dq(2,h),h,0, 'right')
```

```
ans = 1
```

```
limit(dq(2,h),h,0, 'left')
```

```
ans = -1
```

What does the two values for the Left- and Right- limits for the slopes of p(x) at x = 2 tell you?

That the function approches 1 and -1

3.There is another point on the graph where the limit of the dq function does not exist. Where is it? Analyze the graph in the same way (geometrically and with limits)

```
ezplot(p(x), [1 4])
hold on
secline(c,h,x) = p(c)+dq(c,h)*(x-c)
```

```
secline(c, h, x) =
```

$$|c^2 - 5\,c + 6| - \frac{(|5\,c + 5\,h - (c+h)^2 - 6| - |c^2 - 5\,c + 6|)\;(c - x)}{h}$$

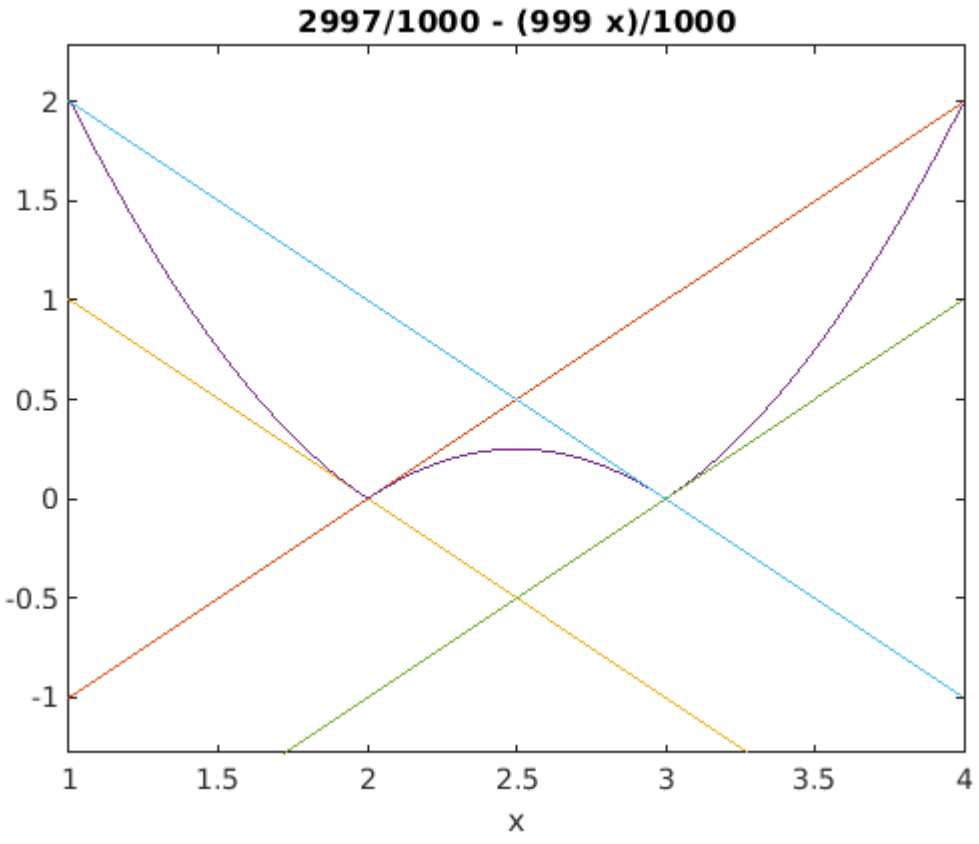
```
h_placeholder= 0.001
```

```
h_placeholder = 1.0000e-03
```

```
ezplot(secline(3,h_placeholder,x),[1 4])
h_placeholder= -0.001
```

```
h_placeholder = -1.0000e-03
```

```
ezplot(secline(3,h_placeholder,x),[1 4])
```



```
limit(dq(3,h),h,0)
```

ans = NaN

```
limit(dq(3,h),h,0, 'right')
```

ans = 1

```
limit(dq(3,h),h,0, 'left')
```

ans = −1