

```

> restart;
> phi:=C*(r^2*(alpha-theta)+r^2*sin(theta)*cos(theta)-
r^2*cos(theta)^2*tan(alpha));
      
$$\phi := C (r^2 (\alpha - \theta) + r^2 \sin(\theta) \cos(\theta) - r^2 \cos(\theta)^2 \tan(\alpha))$$

> sr:=simplify(1/r*diff(phi,r)+1/r^2*diff(phi,theta,theta));
      
$$sr := -2 \frac{C (-\cos(\alpha) \alpha + \cos(\alpha) \theta + \sin(\theta) \cos(\theta) \cos(\alpha) + \sin(\alpha) - \cos(\theta)^2 \sin(\alpha))}{\cos(\alpha)}$$

> trt:=simplify(-diff(1/r*diff(phi,theta),r));
      
$$trt := -2 \frac{C (-\cos(\alpha) + \cos(\theta)^2 \cos(\alpha) + \cos(\theta) \sin(\alpha) \sin(\theta))}{\cos(\alpha)}$$

> st:=simplify(diff(phi,r,r));
      
$$st := 2 \frac{C (\cos(\alpha) \alpha - \cos(\alpha) \theta + \sin(\theta) \cos(\theta) \cos(\alpha) - \cos(\theta)^2 \sin(\alpha))}{\cos(\alpha)}$$

> theta:=0;
      
$$\theta := 0$$

> eq1:=st+q/b;
      
$$eq1 := 2 \frac{C (\cos(\alpha) \alpha - \sin(\alpha))}{\cos(\alpha)} + \frac{q}{b}$$

> solnset:=solve({eq1},{C});
      
$$solnset := \left\{ C = -\frac{1}{2} \frac{q \cos(\alpha)}{b (\cos(\alpha) \alpha - \sin(\alpha))} \right\}$$

> assign(solnset);
> C;
      
$$-\frac{1}{2} \frac{q \cos(\alpha)}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> theta:='theta';
      
$$\theta := \theta$$

> sr;
      
$$\frac{q (-\cos(\alpha) \alpha + \cos(\alpha) \theta + \sin(\theta) \cos(\theta) \cos(\alpha) + \sin(\alpha) - \cos(\theta)^2 \sin(\alpha))}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> trt;
      
$$\frac{q (-\cos(\alpha) + \cos(\theta)^2 \cos(\alpha) + \cos(\theta) \sin(\alpha) \sin(\theta))}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> st;
      
$$\frac{q (\cos(\alpha) \alpha - \cos(\alpha) \theta + \sin(\theta) \cos(\theta) \cos(\alpha) - \cos(\theta)^2 \sin(\alpha))}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> theta:=alpha;

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                                 $\theta := \alpha$ 
> simplify(st);
                                0
> simplify(trt);
                                0
> theta:='theta';
                                 $\theta := \theta$ 
>
> st;
                                
$$\frac{q (\cos(\alpha) \alpha - \cos(\alpha) \theta + \sin(\theta) \cos(\theta) \cos(\alpha) - \cos(\theta)^2 \sin(\alpha))}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> trt;
                                
$$\frac{q (-\cos(\alpha) + \cos(\theta)^2 \cos(\alpha) + \cos(\theta) \sin(\alpha) \sin(\theta))}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> theta:=0;
                                 $\theta := 0$ 
> simplify(st);
                                
$$-\frac{q}{b}$$

> simplify(trt);
                                0
> phi:=C*((x^2+y^2)*(alpha-arctan(y/x))+x*y-x^2*tan(alpha));

$$\phi := -\frac{1}{2} \frac{q \cos(\alpha) \left( (x^2 + y^2) \left( \alpha - \arctan\left(\frac{y}{x}\right) \right) + x y - x^2 \tan(\alpha) \right)}{b (\cos(\alpha) \alpha - \sin(\alpha))}$$

> sxelast:=simplify(diff(phi,y,y));

$$sxelast := \frac{q \cos(\alpha) \left( -\alpha x^2 - \alpha y^2 + \arctan\left(\frac{y}{x}\right) x^2 + \arctan\left(\frac{y}{x}\right) y^2 + x y \right)}{b (\cos(\alpha) \alpha - \sin(\alpha)) (x^2 + y^2)}$$

> txyelast:=simplify(-diff(phi,x,y));

$$txyelast := \frac{q \cos(\alpha) y^2}{b (\cos(\alpha) \alpha - \sin(\alpha)) (x^2 + y^2)}$$

Checking Boundary conditions at x=L. You need to simplify them by hand!
> x:=L;
                                 $x := L$ 
> simplify(int(txyelast*b,y=0..L*tan(alpha)),trig);

```

$$-\frac{q L \left(-\sin(\alpha) + \arctan\left(\frac{\sin(\alpha)}{\cos(\alpha)}\right) \cos(\alpha) \right)}{\cos(\alpha) \alpha - \sin(\alpha)}$$

> `simplify(int(sxelast*b,y=0..L*tan(alpha)),trig);`

$$\frac{L \sin(\alpha) \left(-\arctan\left(\frac{\sin(\alpha)}{\cos(\alpha)}\right) + \alpha \right) q}{-\cos(\alpha) \alpha + \sin(\alpha)}$$

> `simplify(int(sxelast*y*b,y=0..L*tan(alpha)),trig);`

$$-\frac{1}{2} \frac{q L^2 \left(\sin(\alpha) \cos(\alpha) + \arctan\left(\frac{\sin(\alpha)}{\cos(\alpha)}\right) - 2 \arctan\left(\frac{\sin(\alpha)}{\cos(\alpha)}\right) \cos(\alpha)^2 - \alpha + \cos(\alpha)^2 \alpha \right)}{\cos(\alpha) (-\cos(\alpha) \alpha + \sin(\alpha))}$$

> `x:='x';`

$$x := x$$

> `I1:=1/12*b*(x*tan(alpha))^3;`

$$I1 := \frac{1}{12} b x^3 \tan(\alpha)^3$$

> `sxelem:=-q*x*x/2*(y-x/2*tan(alpha))/I1;`

$$sxelem := -6 \frac{q \left(y - \frac{1}{2} x \tan(\alpha) \right)}{x b \tan(\alpha)^3}$$

> `txyelem:=q*x/(2*I1)*((y-x/2*tan(alpha))^2-(x/2*tan(alpha))^2);`

$$txyelem := 6 \frac{q \left(\left(y - \frac{1}{2} x \tan(\alpha) \right)^2 - \frac{1}{4} x^2 \tan(\alpha)^2 \right)}{x^2 b \tan(\alpha)^3}$$

> `b:=0.1;`

$$b := .1$$

> `alpha:=20*Pi/180.0;`

$$\alpha := .1111111111 \pi$$

> `L:=10;`

$$L := 10$$

> `q:=1000;`

$$q := 1000$$

> `x:=8;`

$$x := 8$$

> `I1;`

$$4.266666667 \tan(.1111111111 \pi)^3$$

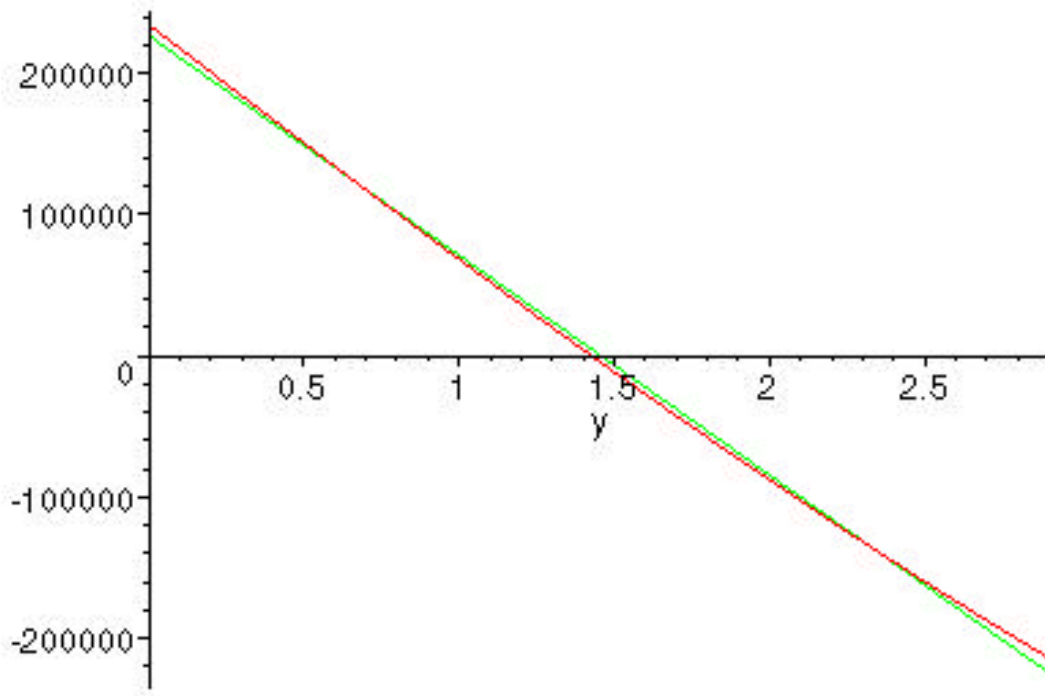
```
> simplify(sxelast);
-0.0005367548295 (-.2792526802 1011 - .436332313 109 y2
+ .8000000000 1011 arctan(.1250000000 y)
+ .1250000000 1010 arctan(.1250000000 y) y2 + .1000000000 1011 y) / (64. + y2)
```

```
> simplify(txyelast);
-670943.5369  $\frac{y^2}{64. + y^2}$ 
```

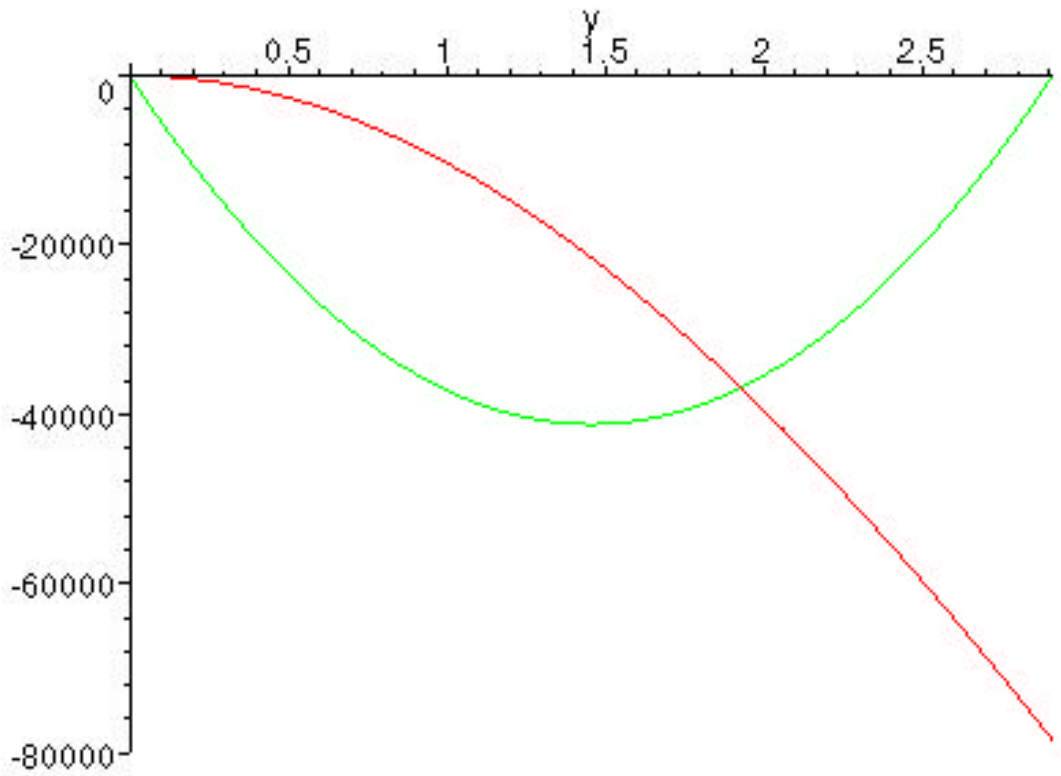
```
> simplify(sxelem);
-155547.7232 y + 226458.9650
```

```
> simplify(txyelem);
19443.46540 y2 - 56614.74125 y - .00002035359360
```

```
> plot([sxelast,sxelem],y=0..x*tan(alpha));
```



```
> plot([txyelast,txyelem],y=0..x*tan(alpha));
```



>