```
In [86]: import numpy as np
         from matplotlib import pyplot as plt
         import sympy as sp
```

```
In [ ]: a)
```

```
In [87]: x, N, K , w , r = sp.symbols('x, N K w r ', positive=True, real=True)

         def produkt(N,K):
             produktfunksjon= N**(0.5)*K**(0.5)
             return produktfunksjon

         produkt(N,K)
```

Out[87]: $\displaystyle K^{0.5} N^{0.5}$

```
In [88]: def kostnad(N,K,w,r):
             kostnadsfunksjon= N*w + K*r + 10000
             return kostnadsfunksjon

         kostnad(N,K,w,r)
```

Out[88]: $\displaystyle K r + N w + 10000$

```
In [89]: L = sp.solve(produkt(N,K)- x, N)[0]
         L
```

Out[89]: $\displaystyle \frac{x^{2}}{K}$

```
In [90]: kostnad(L,K,350,500)
```

Out[90]: $\displaystyle 500 K + 10000 + \frac{350 x^{2}}{K}$

```
In [91]: def Z(K,x):
             return 500*K+10000+(350*x**2)/K

         Z(K,x)
```

Out[91]: $\displaystyle 500 K + 10000 + \frac{350 x^{2}}{K}$
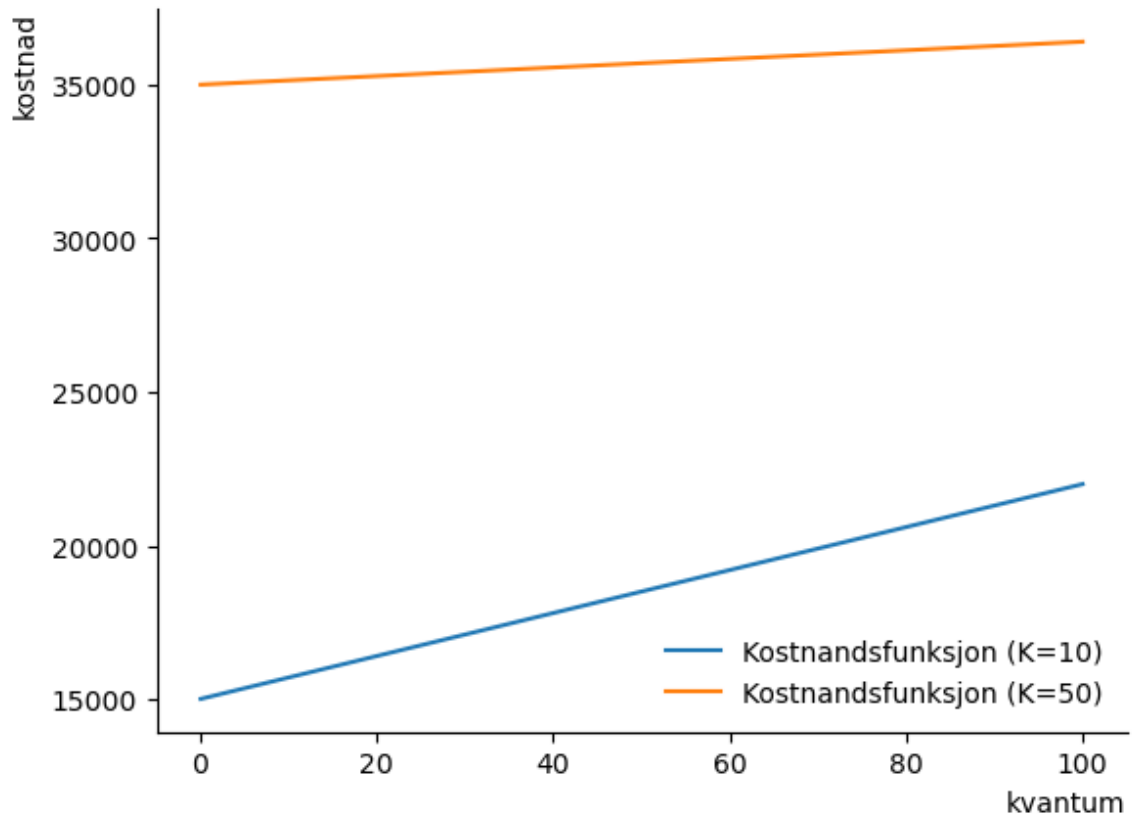
```
In [92]: x_num = np.linspace(0.1,100,100)

         fig1, ax = plt.subplots()
         ax.spines['top'].set_color('none')
         ax.spines['right'].set_color('none')
         ax.set_xlabel('kvantum', loc = 'right')
         ax.set_ylabel('kostnad', loc = 'top')

         ax.plot(x_num, fn(10,x_num), label = 'Kostnandsfunksjon (K=10)')
         ax.plot(x_num, fn(50,x_num), label = "Kostnandsfunksjon (K=50)")

         ax.legend(loc = 'best', frameon = False);
```

In [ ]:
```
b)
```

In [93]:
```python
def i_kostnad(x, K):
    return L(x,K)/x


def u_kostnad(x, K):
    return (L(x, K)-10000)/x
```

In [95]:
```python
d_kostnad = sp.diff(L(x,K),x)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[95], line 1
----> 1 d_kostnad = sp.diff(L(x,K),x)

TypeError: 'Mul' object is not callable
```

In [96]:
```python
m_kost = sp.lambdify((x,K),d_kost)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[96], line 1
----> 1 m_kost = sp.lambdify((x,K),d_kost)

NameError: name 'd_kost' is not defined
```

In [97]:
```python
fig, ax = plt.subplots()
ax.spines['top'].set_color('none')
ax.spines['right'].set_color('none')
ax.set(ylim = (0, 10000))
ax.set_title('Produksjonskostnader på kort sikt')
ax.set_ylabel('Kostnad (kr)', loc='top')
ax.set_xlabel('Kvantum', loc='right')
```

```
ax.plot(g_kost(x_num, 10), label = 'Grensekostnad')
ax.plot(v_kost(x_num, 10), label = 'Variabel gjennomsnitt')
ax.plot(t_kost(x_num, 10), label = 'Total gjennomsnitt')

ax.legend(loc = 'best', frameon = False);
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[97], line 9
      6 ax.set_ylabel('Kostnad (kr)', loc='top')
      7 ax.set_xlabel('Kvantum', loc='right')
----> 9 ax.plot(g_kost(x_num, 10), label = 'Grensekostnad')
     10 ax.plot(v_kost(x_num, 10), label = 'Variabel gjennomsnitt')
     11 ax.plot(t_kost(x_num, 10), label = 'Total gjennomsnitt')

NameError: name 'g_kost' is not defined
```
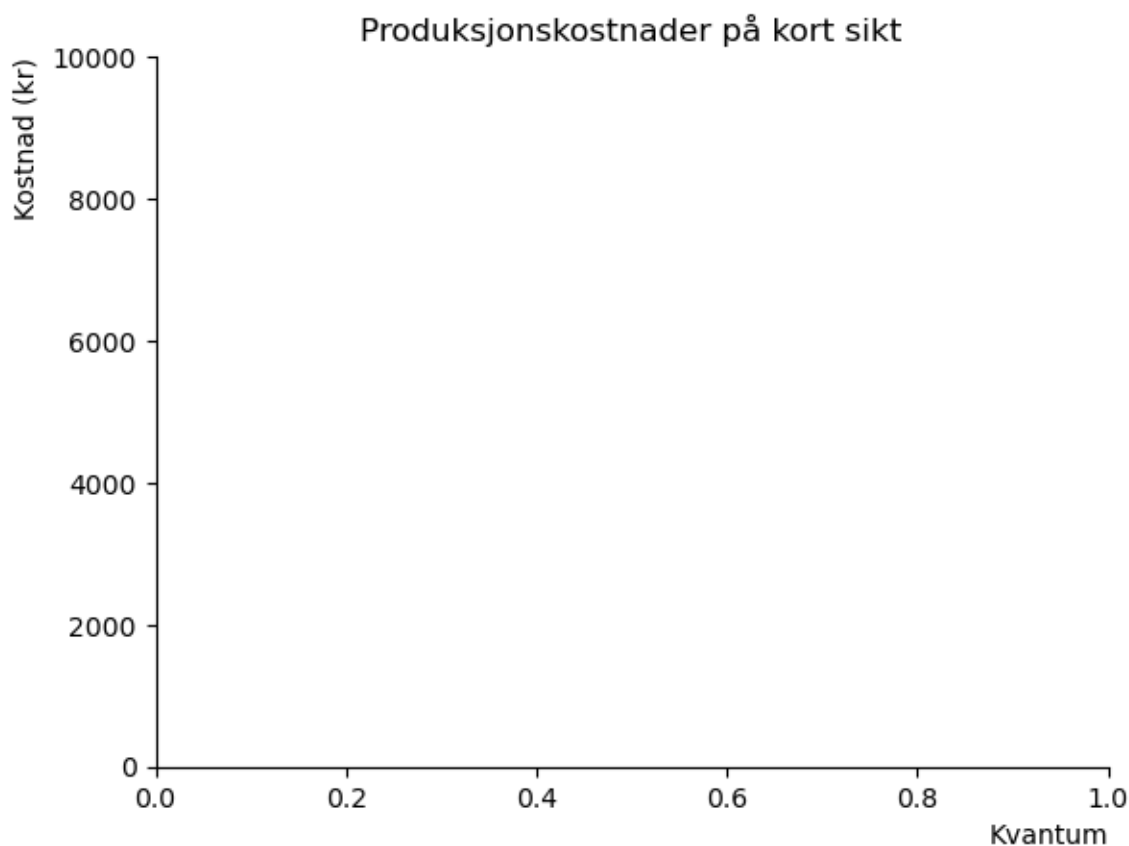

In [34]:
```
f(N, K) = N**a*K**b

mtsb = sp.diff(,N)/sp.diff(,K) -> w/r
```

```
  Cell In[34], line 1
    f(N, K) = N**a*K**b
    ^
SyntaxError: cannot assign to function call
```