In [8]:
```
#laster inn pakker
import sympy as sp
import sympy.solvers as solve
from sympy.simplify.simplify import nthroot
```

In [11]:
```
#Oppgave 15 1A
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_1 = [
    sp.Eq(2*x+4*y,6),
    sp.Eq(-2*x+y,4)
]

sp.solve(eq_15_1, unknown)
```

Out[11]:
```
{x: -1, y: 2}
```

In [34]:
```
#Oppgave 15 1B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_2 = [
    sp.Eq(2*x+y,-1),
    sp.Eq(x**2+x-y, 1)
]
sp.solve(eq_15_2, unknown)
```

Out[34]:
```
[(-3, 5), (0, -1)]
```

In [37]:
```
#Oppgave 15 2A
x, y = sp.symbols("x y")
unkown = [x, y]
eq_15_3 = [
    sp.Eq(3*x-12,-6*y),
    sp.Eq(4*x-8*y,16)
]
sp.solve(eq_15_3, unknown)
```

Out[37]:
```
{x: 4, y: 0}
```

In [38]:
```
#Oppgave 15 2B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_4 = [
    sp.Eq(x**2+4*x-3, 3*y),
    sp.Eq(2*y, 8-x)
]
sp.solve(eq_15_4, unknown)
```

Out[38]:
```
[(-15/2, 31/4), (2, 3)]
```

In [40]:
```
#Oppgave 16 1A
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_1 = [
    sp.Eq(4*x+2*y, 12),
    sp.Eq(6*x-2*x, 8)
]
sp.solve(eq_15_1, unknown)
```

Out[40]:
```
{x: 2, y: 2}
```

In [41]:
```
#Oppgave 16 1B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_2 = [
    sp.Eq(2*x+y**2, 25),
    sp.Eq(x-2*y, 10)
]
sp.solve(eq_15_2, unknown)
```

Out[41]:
```
[(0, -5), (12, 1)]
```

In [42]:
```
#Oppgave 16 2A
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_3 = [
    sp.Eq(4*x-4*y, 8),
    sp.Eq(9*x-5*y,26)
]
sp.solve(eq_15_3, unknown)
```

Out[42]:
```
{x: 4, y: 2}
```

In [43]:
```
#Oppgave 16 2B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_15_4 = [
    sp.Eq(x+2*y**2,15),
    sp.Eq(x**2-4*y**2,33)
]
sp.solve(eq_15_4, unknown)
```

Out[43]:
```
[(-9, -2*sqrt(3)), (-9, 2*sqrt(3)), (7, -2), (7, 2)]
```

In [44]:
```
#Oppgave 17 1A
x, y = sp.symbols("x y")
unknown = [x, y]
eq_17_1 = [
    sp.Eq(x*y**2-x,0),
    sp.Eq(x+y**2,16)
]
sp.solve(eq_17_1, unknown)
```

Out[44]:
```
[(0, -4), (0, 4), (15, -1), (15, 1)]
```

In [46]:
```
#Oppgave 17 1B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_17_2 = [
    sp.Eq(x**2+y**2,100),
    sp.Eq(x**2*y-36*y,0)
]
sp.solve(eq_17_2, unknown)
```

Out[46]:
```
[(-10, 0), (-6, -8), (-6, 8), (6, -8), (6, 8), (10, 0)]
```

In [47]:
```
#Oppgave 17 2A
x, y = sp.symbols("x y")
unknown = [x, y]
```

```
eq_17_3 = [
    sp.Eq(x*y**2-49*x,0),
    sp.Eq(x**2+y**2,58)
]
sp.solve(eq_17_3, unknown)
```

Out[47]:
```
[(-3, -7), (-3, 7), (0, -sqrt(58)), (0, sqrt(58)), (3, -7), (3, 7)]
```

In [48]:
```
#Oppgave 17 2B
x, y = sp.symbols("x y")
unknown = [x, y]
eq_17_4 = [
    sp.Eq(x**2+y**2,5/4),
    sp.Eq(2*x*y+y,0)
]
sp.solve(eq_17_4, unknown)
```

Out[48]:
```
[(-1.11803398874989, 0.0),
 (-0.500000000000000, -1.00000000000000),
 (-0.500000000000000, 1.00000000000000),
 (1.11803398874989, 0.0)]
```

In [49]:
```
#Oppgave 19 1A
sp.diff(x**5, x)
```

Out[49]: $\displaystyle 5 x^{4}$

In [50]:
```
#Oppgave 19 1B
sp.diff(x+12, x)
```

Out[50]: $\displaystyle 1$

In [51]:
```
#Oppgave 19 1C
sp.diff(x**3+4*x**2, x)
```

Out[51]: $\displaystyle 3 x^{2} + 8 x$

In [52]:
```
#Oppgave 19 1d
sp.diff(2*x**3+sp.sqrt(36), x)
```

Out[52]: $\displaystyle 6 x^{2}$

In [53]:
```
#Oppgave 19 1e
sp.diff(sp.sqrt(x)+5**2, x)
```

Out[53]: $\displaystyle \frac{1}{2 \sqrt{x}}$

In [54]:
```
#Oppgave 19 1f
sp.diff(x**3+1/x, x)
```

Out[54]: $\displaystyle 3 x^{2} - \frac{1}{x^{2}}$

In [55]:
```
#Oppgave 19 1g
sp.diff(x**3-x**2+1/4*x, x)
```

Out[55]: $\displaystyle 3 x^{2} - 2 x + 0.25$

In [56]:
```
#Oppgave 19 2A
```

```
sp.diff(1/x+6*x**6, x)
```

Out[56]: $\displaystyle 36 x^{5} - \frac{1}{x^{2}}$

In [12]:
```
#Oppgave 19 2B
sp.diff(x+1/2*x**3, x)
```

Out[12]: $\displaystyle 1.5 x^{2} + 1$

In [13]:
```
#Oppgave 19 2C
sp.diff(x*(x**2+2*x-3), x)
```

Out[13]: $\displaystyle x^{2} + x \left(2 x + 2\right) + 2 x - 3$

In [26]:
```
#Oppgave 20 1E
sp.diff(x**4*x**5, x)
```

Out[26]: $\displaystyle 9 x^{8}$

In [15]:
```
#Oppgave 20 1F
sp.diff(x*sp.sqrt(x), x)
```

Out[15]: $\displaystyle \frac{3 \sqrt{x}}{2}$

In [25]:
```
#Oppgave 20 1G
sp.diff(2/(x**3), x)
```

Out[25]: $\displaystyle - \frac{6}{x^{4}}$

In [17]:
```
#Oppgave 20 1H
sp.diff(x**2-2/x**3, x)
```

Out[17]: $\displaystyle 2 x + \frac{6}{x^{4}}$

In [18]:
```
#Oppgave 20 1I
sp.diff(sp.sqrt(x)*x**6, x)
```

Out[18]: $\displaystyle \frac{13 x^{\frac{11}{2}}}{2}$

In [19]:
```
#Oppgave 20 1J
sp.diff(x*(x**2+1), x)
```

Out[19]: $\displaystyle 3 x^{2} + 1$

In [20]:
```
#Oppgave 20 1K
sp.diff(x**2+4/x**3-1, x)
```

Out[20]: $\displaystyle 2 x - \frac{12}{x^{4}}$

In [21]:
```
#Oppgave 20 1L
sp.diff(x**2/x**2+2*x, x)
```

Out[21]: $\displaystyle 2$

In [22]:
```
#Oppgave 20 1M
sp.diff(x**2+4*x+2/x-2, x)
```

Out[22]: $\displaystyle 2 x + 4 - \frac{2}{x^{2}}$

In [27]:
```
#Oppgave 20 2A
sp.diff(x**3-2*x/x**2-1, x)
```

Out[27]: $\displaystyle 3 x^{2} + \frac{2}{x^{2}}$

In [29]:
```
#Oppgave 20 2B
sp.diff((x**2+1)*(x**2-1), x)
```

Out[29]: $\displaystyle 2 x \left(x^{2} - 1\right) + 2 x \left(x^{2} + 1\right)$

In [30]:
```
#Oppgave 20 2C
sp.diff(3*x-4/x**3+7, x)
```

Out[30]: $\displaystyle 3 + \frac{12}{x^{4}}$

In [31]:
```
#Oppgave 21 1A
sp.diff((x**3+6*x)**5, x)
```

Out[31]: $\displaystyle \left(15 x^{2} + 30\right) \left(x^{3} + 6 x\right)^{4}$

In [34]:
```
#Oppgave 21 1B
sp.diff(sp.sqrt(2*x**2+6), x)
```

Out[34]: $\displaystyle \frac{2 x}{\sqrt{2 x^{2} + 6}}$

In [35]:
```
#Oppgave 21 1C
sp.diff((2*x/x**2+3)**4, x)
```

Out[35]: $\displaystyle - \frac{8 \left(3 + \frac{2}{x}\right)^{3}}{x^{2}}$

In [36]:
```
#Oppgave 21 1D
sp.diff((2*x**4+9)**3/2, x)
```

Out[36]: $\displaystyle 12 x^{3} \left(2 x^{4} + 9\right)^{2}$

In [37]:
```
#Oppgave 21 1E
sp.diff(1/sp.sqrt(1+x**2), x)
```

Out[37]: $\displaystyle - \frac{x}{\left(x^{2} + 1\right)^{\frac{3}{2}}}$

In [38]:
```
#Oppgave 21 1F
sp.diff(x**2*(x**2+2*x)**3, x)
```

Out[38]: $\displaystyle x^{2} \cdot \left(6 x + 6\right) \left(x^{2} + 2 x\right)^{2} + 2 x \left(x^{2} + 2 x\right)^{3}$

In [39]:
```
#Oppgave 21 1G
sp.diff(x**2*sp.sqrt(x**2-2*x), x)
```

Out[39]: $\displaystyle \frac{x^{2} \left(x - 1\right)}{\sqrt{x^{2} - 2 x}} + 2 x \sqrt{x^{2} - 2 x}$

In [40]:
```
#Oppgave 21 1H
sp.diff(x**2/(x**2+x)**3, x)
```

Out[40]: $\displaystyle \frac{x^{2} \left(- 6 x - 3\right)}{\left(x^{2} + x\right)^{4}} + \frac{2 x}{\left(x^{2} + x\right)^{3}}$

In [41]:
```
#Oppgave 21 1I
sp.diff((x**2+1)**2*(x**3+1)**3, x)
```

Out[41]: $\displaystyle 9 x^{2} \left(x^{2} + 1\right)^{2} \left(x^{3} + 1\right)^{2} + 4 x \left(x^{2} + 1\right) \left(x^{3} + 1\right)^{3}$

In [42]:
```
#Oppgave 21 2A
sp.diff(sp.sqrt((3*x**2+2*x)**4), x)
```

Out[42]: $\displaystyle \frac{\left(24 x + 8\right) \sqrt{\left(3 x^{2} + 2 x\right)^{4}}}{2 \cdot \left(3 x^{2} + 2 x\right)}$

In [43]:
```
#Oppgave 21 2B
sp.diff((x**3+3)**5*(x**2+3)**4, x)
```

Out[43]: $\displaystyle 15 x^{2} \left(x^{2} + 3\right)^{4} \left(x^{3} + 3\right)^{4} + 8 x \left(x^{2} + 3\right)^{3} \left(x^{3} + 3\right)^{5}$

In [44]:
```
#Oppgave 21 2C
sp.diff(sp.sqrt(x**2+1*x**2), x)
```

Out[44]: $\displaystyle \frac{\sqrt{2} \sqrt{x^{2}}}{x}$

In [45]:
```
#Oppgave 21 2D
sp.diff((2*x+3*x**2)**3/x**2, x)
```

Out[45]: $\displaystyle \frac{\left(18 x + 6\right) \left(3 x^{2} + 2 x\right)^{2}}{x^{2}} - \frac{2 \left(3 x^{2} + 2 x\right)^{3}}{x^{3}}$

In [47]:
```
#Oppgave 21 2E
sp.diff(nthroot(x**4-5, 3), x)
```

Out[47]: $\displaystyle \frac{4 x^{3}}{3 \left(x^{4} - 5\right)^{\frac{2}{3}}}$

In [48]:
```
#Oppgave 21 2F
sp.diff(x**3/sp.sqrt(x**4-1), x)
```

Out[48]: $\displaystyle - \frac{2 x^{6}}{\left(x^{4} - 1\right)^{\frac{3}{2}}} + \frac{3 x^{2}}{\sqrt{x^{4} - 1}}$

In [54]:
```
#Oppgave 22 1A
sp.diff(sp.log(5*x), x)
```

Out[54]: $\displaystyle \frac{1}{x}$

In [57]:
```
#Oppgave 22 1B
sp.diff(sp.exp(-2*x), x)
```

Out[57]: $\displaystyle - 2 e^{- 2 x}$

In [58]:
```
#Oppgave 22 1C
sp.diff(sp.log(12*x)-3, x)
```

Out[58]: $\displaystyle \frac{1}{x}$

In [60]:
```
#Oppgave 22 1D
sp.diff(2**x, x)
```

Out[60]: $\displaystyle 2^{x} \log{\left(2 \right)}$

In [61]:
```
#Oppgave 22 1E
sp.diff(sp.exp(3*x+5), x)
```

Out[61]: $\displaystyle 3 e^{3 x + 5}$

In [62]:
```
#Oppgave 22 1F
sp.diff(sp.log(x**5+1), x)
```

Out[62]: $\displaystyle \frac{5 x^{4}}{x^{5} + 1}$

In [63]:
```
#Oppgave 22 1G
sp.diff(sp.exp(4*x**2+8*x), x)
```

Out[63]: $\displaystyle \left(8 x + 8\right) e^{4 x^{2} + 8 x}$

In [64]:
```
#Oppgave 22 1H
sp.diff(sp.log(1/x), x)
```

Out[64]: $\displaystyle - \frac{1}{x}$

In [66]:
```
#Oppgave 22 1I
sp.diff(6*sp.log(x+3*sp.exp(4*x)), x)
```

Out[66]: $\displaystyle \frac{6 \cdot \left(12 e^{4 x} + 1\right)}{x + 3 e^{4 x}}$

In [67]:
```
#Oppgave 22 1J
sp.diff(x*sp.exp(-x), x)
```

Out[67]: $\displaystyle - x e^{- x} + e^{- x}$

In [68]:
```
#Oppgave 22 1K
sp.diff(x**2*sp.log(x**2+2), x)
```

Out[68]: $\displaystyle \frac{2 x^{3}}{x^{2} + 2} + 2 x \log{\left(x^{2} + 2 \right)}$

In [69]:
```
#Oppgave 22 2A
sp.diff(x**3*sp.exp(2*x), x)
```

Out[69]: $\displaystyle 2 x^{3} e^{2 x} + 3 x^{2} e^{2 x}$

In [71]:
```
#Oppgave 22 2B
sp.diff(sp.log(x**2-1/x**2+1), x)
```

Out[71]: $\displaystyle \frac{2 x + \frac{2}{x^{3}}}{x^{2} + 1 - \frac{1}{x^{2}}}$

In [72]:
```
#Oppgave 22 2C
sp.diff(x**2*sp.log(x**2+2), x)
```

Out[72]: $\displaystyle \frac{2 x^{3}}{x^{2} + 2} + 2 x \log{\left(x^{2} + 2 \right)}$

In [74]:
```
#Oppgave 22 2D
sp.diff(sp.exp(-x)/x**2+1, x)
```

Out[74]: $\displaystyle - \frac{e^{- x}}{x^{2}} - \frac{2 e^{- x}}{x^{3}}$

In [ ]: