class1

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1 algebra and symbolic math with sympy

1.0.1 defining symbols using sympy

[ ]:
```
from sympy import Symbol , symbols

x = Symbol("x")
y = Symbol("y")

x , y = symbols("x,y")

s = x*y + y*x

s
```

[ ]: $2xy$

[ ]:
```
p = x*(x+x)
p
```

[ ]: $2x^2$

1.0.2 Factorisation

[ ]:
```
from sympy import factor

exp = x**2 - y**2

factor(exp)
```

[ ]: $(x - y)(x + y)$

[ ]:
```
exp1 = x**2 + y**2 + y*2*x

factor(exp1)
```

[ ]: $(x + y)^2$

[ ]:
```
exp2 = x**2 + y**2 - y*2*x

factor(exp2)
```

[ ]: $(x - y)^2$

[ ]:
```
exp3 = x*(x+x)

factor(exp3)
```

[ ]: $2x^2$

1.0.3 Expanding

[ ]:
```
from sympy import expand

expand((x - y)**2)
```

[ ]: $x^2 - 2xy + y^2$

[ ]:
```
expand((x + y)**2)
```

[ ]: $x^2 + 2xy + y^2$

1.0.4 pprint

[ ]:
```
from  sympy import pprint
pprint(x**2 + 2*x*y + y**2)
```

```
 2           2
x  + 2 x y + y
```

[ ]:
```
from sympy import init_printing

init_printing(order = "rev-lex")

pprint(exp2)
```

```
 2           2
y  - 2 x y + x
```

1.0.5 fact_list

[ ]:
```
from sympy import *

x , y, z = symbols("x,y,z")

factor_list(x**2 - y**2)
```

[ ]: $(1,\ [(-y + x,\ 1),\ (y + x,\ 1)])$

1.0.6 collect

[ ]:
```
exp = x*y + (x-3) + 2*x**2 - z*x**2 + x**3

c = collect(exp,x)

c
```

[ ]: $-3 + x\,(1 + y) + x^2 \cdot (2 - z) + x^3$

1.0.7 coeff

[ ]:
```
c.coeff(x,2)
```

[ ]: $2 - z$

1.0.8 cancel

[ ]:
```
cancel((2*x**2 - 2)/(x**2 - 2*x + 1))
```

[ ]: $\dfrac{2 + 2x}{-1 + x}$

[ ]:
```
cancel((x**2 + 2*x + 1)/(x**2 + x))
```

[ ]: $\dfrac{1 + x}{x}$

excercise

- Factorize
  - x^3 - y^3
  - 2x^2 + 5x = 12
  - x^2 - 3x - 10 = 0
- Expand obtained above
- Simplify
  - x^3 + 3x^2 + 3x + 1 / x^2 - x - 2
  - x^2 - 9 / x^2 + 5x + 6
  - x^2 + 3x / x^2 + 5x

factorize

[ ]:
```
factor(x**3 - y**3)
```

[ ]: $(-y + x)\,(y^2 + xy + x^2)$

[ ]:
```
factor(2*x**2 + 5*x)
```

[ ]: $x\left(5+2x\right)$

[ ]:
```
factor(x**2 - 3*x - 10)
```

[ ]: $\left(-5+x\right)\left(2+x\right)$

expand

[ ]:
```
expand((- y +x)*(y**2+x*y+x**2))
```

[ ]: $-y^3+x^3$

[ ]:
```
expand(x*(5 + 2*x))
```

[ ]: $5x+2x^2$

[ ]:
```
expand((-5 + x)*(2 + x))
```

[ ]: $-10-3x+x^2$

simplify

[ ]:
```
cancel(x**3 + 3*x**2 + 3*x + 1 / x**2 - x - 2)
```

[ ]: $\frac{1-2x^2+2x^3+3x^4+x^5}{x^2}$

[ ]:
```
cancel(x**2 - 9 / x**2 + 5*x + 6)
```

[ ]: $\frac{-9+6x^2+5x^3+x^4}{x^2}$

[ ]:
```
cancel(x**2 + 3*x / x**2 + 5*x)
```

[ ]: $\frac{3+5x^2+x^3}{x}$