Exercise: Math mode

1) Inline math

Inline formula: $y = mx + c$. Another one: $5^2 = 3^2 + 4^2$. Superscripts and subscripts: a^b and a_b, and also x_n^2.

Note: in math mode spaces are ignored, so $a\ \ b$ and ab are very similar, and for manual spacing there are commands such as $a\,b$, $a\;b$, $a\quad b$.

2) Display math

The same formula, but on its own line:

$$y = mx + c$$

The text continues after the display formula as a normal paragraph.

3) Greek letters (lower/upper case)

For example: $\alpha, \beta, \gamma, \theta, \lambda, \pi, \omega$ and $\Gamma, \Delta, \Theta, \Lambda, \Pi, \Omega$.

4) Integral + neatly typeset `dx`

$$\int_{-\infty}^{+\infty} e^{-x^2}\,\mathrm{d}x$$

5) Numbered equation

$$(x + y)(x - y) = x^2 - y^2 \tag{1}$$

6) amsmath: alignment (align) and text inside math

$$Q_{n,0} = 1, \quad Q_{0,k} = [k = 0]; \tag{2}$$

$$Q_{n,k} = Q_{n-1,k} + Q_{n-1,k-1} + \binom{n}{k}, \quad \text{for } n, k > 0. \tag{3}$$

7) Matrices

$$\begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix} \quad \begin{bmatrix} 1 & 2 \\ -5 & -6 \end{bmatrix}$$

8) Fonts in math mode + nesting

Compare:

$$\text{“size”} \neq \mathit{size} \neq \text{size} \neq \mathbf{size}$$

Individual styles:

$$\mathrm{ABC} \quad \mathit{ABC} \quad \mathbf{ABC} \quad \mathsf{ABC} \quad \mathtt{ABC} \quad \mathbb{R}\,\mathbb{N}\,\mathbb{Z}$$

Now nesting (compile and see what actually changes):

$$\mathsf{A} \quad \mathbf{A} \quad \boldsymbol{\alpha} \quad \alpha$$

Hint: α typically does not bold Greek letters, while $\boldsymbol{\alpha}$ does.

9) Two more environments: gather and multline

$$P(x) = ax^5 + bx^4 + cx^3 + dx^2 + ex + f \tag{4}$$

$$x^2 + x = 10 \tag{5}$$

$$\begin{aligned}(a+b+c+d)x^5 + (b+c+d+e)x^4 \\ + (c+d+e+f)x^3 + (d+e+f+a)x^2 + (e+f+a+b)x \\ + (f+a+b+c)\end{aligned}$$