

# Introduction to L<sup>A</sup>T<sub>E</sub>X

## EXERCISE 2

Try to do the following with L<sup>A</sup>T<sub>E</sub>X. Their hardness increases, but not monotonically. Consult the on-line L<sup>A</sup>T<sub>E</sub>X cheatsheets to identify the appropriate commands.

1. Typeset:

$$x_1, x_2 = \frac{-\beta \pm \sqrt{\alpha^2 - 4 \cdot \alpha \omega \cdot \gamma}}{2\alpha\omega}, \quad (\alpha^2 - 4\alpha\omega\gamma) > 0.$$

*Hint:* remember `\,`, and `\qquad`. `\cdot` makes a centred dot ( $\cdot$ ).

2. Typeset this using `align`:

$$x^2 + 2x - 15 = 0, \tag{1}$$

$$\Rightarrow (x + 5)(x - 3) = 0, \\ \Rightarrow x = -5, 3. \tag{2}$$

*Hint:* `\Rightarrow` makes  $\Rightarrow$ .

3. Typeset:

$$\sin 30^\circ = \frac{1}{2} = \frac{1}{\sqrt{3}} \sin 60^\circ = \cos(\pi/3).$$

*Hint:* You can make the degree symbol  $^\circ$  with `\circ`.

4. Typeset:

$$\arccos x = \int_x^1 \frac{du}{\sqrt{1-u^2}}.$$

*Hint:* `\int` is  $\int$ . Put the limits on it using sub- and super-scripts. Try to get the roman d in  $du$ !

5. Use the math superscript operator  $\textsuperscript{\sim}$  to create things like:

$$n^{\text{th}}, \quad 1^{\text{st}}, \quad 2^{\text{nd}}.$$

*Hint:* the “th”, “st” and “nd” must be in ROMAN font!

6. Use `\newcommand` to define a command `\fork` so that `\fork(f)` outputs “Fork( $f$ )”.

7. Use the `array` environment to create this matrix:

$$\begin{pmatrix} F[1,1] & \cdots & F[1,m] \\ \vdots & \ddots & \vdots \\ F[n,1] & \cdots & F[n,m] \end{pmatrix}$$

*Hint:* The following kinds of dots are available in math mode.

`\cdots` Horizontal (centred) ...  
`\ldots` Horizontal (bottom) ...  
`\vdots` Vertical  $\vdots$   
`\ddots` Diagonal  $\ddots$ .

8. Typeset:

$$\alpha = \frac{e^2}{2h\epsilon_0 c} \approx \frac{1}{137}, \quad k = 1.38 \times 10^{-23} \text{ J K}^{-1}.$$

9. Typeset with `align*`:

$$\begin{aligned} f(x) &= \frac{a_0}{2} + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx), \\ a_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \cos nx \, dx, \quad n = 1, 2, \dots, \\ b_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \sin nx \, dx, \quad n = 1, 2, \dots \end{aligned}$$

10. Define (and test) a `proof` environment which has text printed in *slanted* face and that terminates with the final “Q.E.D.” in roman font. Example:

PROOF. *Since the Grolfuss norm of  $f$  is upwardly-mobile, Fork ( $f$ ) is necessarily Axiom-A.* Q.E.D.

11. Use `\newcommand` to define a command `\defint` with 1 *argument* so that typing:

`\defint{ \frac{\sin\theta+\cos\theta}{\Theta} }`

outputs

$$\left[ \frac{\sin \theta + \cos \theta}{\Theta} \right]_0^{\frac{\pi}{2}}.$$

*Hint:* the sizing of the square brackets should be automatic.

12. In the previous question, change `\defint` so that the limits on the right bracket are also input as arguments.