Introduction to LaTeX

EXERCISE 2

Try to do the following with LaTeX. Their hardness increases, but not monotonically. Consult the on-line LaTeXguides (listed in Appendix A) to identify the appropriate commands.
Note that, to use the align environment, you will have to include:
`\usepackage{amsmath}`
in the preamble.

1. Typeset:

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

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

2. Typeset:

$$\begin{aligned} x^2 + 2x - 15 &= 0, && (1)\\ \Rightarrow (x+5)(x-3) &= 0, \\ \Rightarrow x &= -5,\, 3. && (2) \end{aligned}$$

   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:

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

   Hint: `\int` is $\int$, put the limits on it using sub- and super-scripts. Try to get the roman d in $\mathrm{d}u$.

5. Use the math superscript operator to create things like

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

   Hint: the "th" etc. must be roman.

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

7. Use the `array` or `pmatrix` 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 (center) $\cdots$
`\ldots`	Horizontal (bottom) $\ldots$
`\vdots`	Vertical $\vdots$
`\ddots`	Diagonal $\ddots$

8. Typeset:

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

9. Typeset with `\align*`:

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

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,* $\mathrm{Fork}\,(f)$ *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

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

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