Mathematical Writing

Computational Mathematics II

Tip: click the ✏️ pen icon in the bottom toolbar to write on any slide.

Why bother?

> "Communicating mathematics well is an important part of doing mathematics."
>
> Francis Su (2015), MAA FOCUS

> "If I can't explain an idea in writing, then I don't understand it."
>
> Kevin Houston (2009), *How to Write Mathematics*

> "Easy reading is damn hard writing."
>
> Attributed to Nathaniel Hawthorne; quoted by Dimitri Bertsekas (2002)

- Writing clarifies **your own** thinking, not just the reader's.
- Your reader is not a mind-reader: the responsibility for communication lies with **you**.

Source: Su (2015), p. 20; Houston (2009), ch. 3; Bertsekas (2002), slide 2.

Where today's advice comes from

On writing mathematics

- K. Houston (2009), *How to Write Mathematics* (chs 3–4 of *How to Think Like a Mathematician*, CUP)
- D. P. Bertsekas (2002), *Ten Simple Rules for Mathematical Writing*, MIT
- F. E. Su (2015), "Some Guidelines for Good Mathematical Writing", *MAA FOCUS*
- N. J. Higham (2020), *Handbook of Writing for the Mathematical Sciences*, 3rd ed., SIAM

On figures and plots

- N. P. Rougier, M. Droettboom & P. E. Bourne (2014), "Ten Simple Rules for Better Figures", *PLoS Comput. Biol.* 10(9)

How this lecture works

Ten times today you will see two versions **A** and **B** of the same mathematics.

1. Decide which is better.
2. Say **why**: name the rule it breaks.

Source: Full references are on the final slides.

Part 1

Sentences and symbols

Know your audience

- Knowing your audience is *"the most important consideration for writers"*.
- Choose a target level and write for it: don't over-explain, don't under-explain.
- **A good default for coursework:** a fellow student on the module who has not yet done this problem.
  - Remind them of recent results: *"Recall that …"*
  - Define notation they might not share with you.
- Set an inviting tone: present tense, *"we"*, and gentle directions such as *"let"*, *"consider"*, *"recall"*.

Source: Su (2015), "Know your audience", "Set an invitational tone"; Bertsekas (2002), Rule 6 "Don't overexplain, don't underexplain".

Write in sentences

- Houston's first rule, repeated three times for emphasis: **write in sentences.**
- Symbols are shorthand for words. They must sit inside sentences to mean anything.
- Displayed equations are part of a sentence, so they take **commas and full stops**.
- Use words to give equations context. Compare:

Let $A = 5$.	**Suppose** $A = 5$.	**Therefore** $A = 5$.

…and on its own, "$A = 5$" is ambiguous.

Source: Houston (2009), ch. 3 "Write in sentences", "Use punctuation"; Su (2015), "Use complete sentences", "Use words to give context to equations" (A = 5 example).

Which is better? 1 / 10

Find and classify the stationary points of $f(x) = x^3 - 3x$.

A

$$f' = 3x^2 - 3 = 0 = 3(x-1)(x+1) \quad x = \pm 1$$
$$f'' = 6x \Rightarrow x = 1 \text{ min} \quad x = -1 \text{ max}$$

B

Differentiating gives $f'(x) = 3x^2 - 3 = 3(x-1)(x+1)$, so the stationary points are $x = -1$ and $x = 1$.

Since $f''(x) = 6x$, we have $f''(1) = 6 > 0$ and $f''(-1) = -6 < 0$. Hence f has a local minimum at $x = 1$ and a local maximum at $x = -1$.

Source: Original example, illustrating Houston (2009), ch. 3 “Write in sentences”, and Su (2015), “Use complete sentences”.

Which is better? 1 / 10

Find and classify the stationary points of $f(x) = x^3 - 3x$.

A

$$f' = 3x^2 - 3 = 0 = 3(x-1)(x+1) \quad x = \pm 1$$
$$f'' = 6x \Rightarrow x = 1 \text{ min} \quad x = -1 \text{ max}$$

B

Differentiating gives $f'(x) = 3x^2 - 3 = 3(x-1)(x+1)$, so the stationary points are $x = -1$ and $x = 1$.

Since $f''(x) = 6x$, we have $f''(1) = 6 > 0$ and $f''(-1) = -6 < 0$. Hence f has a local minimum at $x = 1$ and a local maximum at $x = -1$.

B. It is written in sentences, so we can see what is assumed, what is computed and what is concluded. A chains different statements with "=" (read literally, it claims $f' = 0$ everywhere) and leaves the reader to reconstruct the argument.

Source: Original example, illustrating Houston (2009), ch. 3 "Write in sentences", and Su (2015), "Use complete sentences".

Which is better?

Introducing Euler's method in a project report.

A

Let $h > 0$ be the step size and $t_n = nh$. Euler's method approximates the solution of $y' = f(t, y)$, $y(0) = y_0$, by

$$y_{n+1} = y_n + h\, f(t_n, y_n), \qquad n = 0, 1, 2, \ldots,$$

where $y_n \approx y(t_n)$.

B

Euler

$$y_{n+1} = y_n + hf(t_n, y_n)$$

h = step size, $t_n = nh$, $y_n = y(t_n)$

Source: Original example, illustrating Houston (2009), ch. 3 "Use punctuation", "Equals means equals", and ch. 4 "Define your symbols and notation".

Which is better?

Introducing Euler's method in a project report.

A

Let $h > 0$ be the step size and $t_n = nh$. Euler's method approximates the solution of $y' = f(t, y)$, $y(0) = y_0$, by

$$y_{n+1} = y_n + h\, f(t_n, y_n), \qquad n = 0, 1, 2, \ldots,$$

where $y_n \approx y(t_n)$.

B

Euler

$$y_{n+1} = y_n + hf(t_n, y_n)$$

h = step size, $t_n = nh$, $y_n = y(t_n)$

A. One punctuated sentence; every symbol is defined *before* it is used; the problem being solved is stated. B writes $y_n = y(t_n)$, but y_n is only an *approximation*: equals means equals, so use $\approx$.

Source: Original example, illustrating Houston (2009), ch. 3 "Use punctuation", "Equals means equals", and ch. 4 "Define your symbols and notation".

Words or symbols?

- **Formal writing** (reports, dissertations, exam answers): write out *for all*, *there exists*, *implies*, *if and only if*, *such that*, *therefore*.
  - On the board or on scrap paper, shorthand like $\forall$, $\exists$, $\Rightarrow$, $\therefore$, "s.t." is fine.
- **Don't start a sentence with a symbol.** Write "The function f is continuous", not "f is continuous".
- **Make mathspeak readable:**
  - ✗ "Let $k > 0$ be an integer."
  - ✓ "Let k be a positive integer." or "Consider an integer $k > 0$."
- **Don't mix them awkwardly.** In "the number of people aged over $40 = 5$", the eye reads $40 = 5$.

Source: Su (2015), "Avoid shorthand in formal writing"; Houston (2009), ch. 3 "Words or symbols?", ch. 4 "Don't begin sentences with a symbol"; Bertsekas (2002), slide 8.

Which is better?

Stating the extreme value theorem in a written assignment.

A

f cts on $[a, b] \Rightarrow \exists\, c \in [a, b]$ s.t. $f(c) \geq f(x)\ \forall x \in [a, b]$
$\therefore$ max attained

B

If the function f is continuous on $[a, b]$, then there exists $c \in [a, b]$ such that $f(c) \geq f(x)$ for all $x \in [a, b]$. In other words, f attains its maximum on $[a, b]$.

Source: Original example, illustrating Su (2015), "Avoid shorthand in formal writing", and Houston (2009), ch. 4 "Don't begin sentences with a symbol".

Which is better? 3 / 10

Stating the extreme value theorem in a written assignment.

A

f cts on $[a, b] \Rightarrow \exists\, c \in [a, b]$ s.t. $f(c) \geq f(x)\ \forall x \in [a, b]$
$\therefore$ max attained

B

If the function f is continuous on $[a, b]$, then there exists $c \in [a, b]$ such that $f(c) \geq f(x)$ for all $x \in [a, b]$. In other words, f attains its maximum on $[a, b]$.

B. Formal writing spells out the quantifiers and connectives. A also starts with a symbol, uses the abbreviation "cts", and has no full stop. A is a perfectly good **board note**; it is not a written answer.

Source: Original example, illustrating Su (2015), "Avoid shorthand in formal writing", and Houston (2009), ch. 4 "Don't begin sentences with a symbol".

Equals means equals

- "$=$" asserts that two objects are **exactly** the same: not nearly the same, and not "the next step".
  - $\times\ x^3 = 3x^2 \quad \checkmark\ \dfrac{d}{dx}\left(x^3\right) = 3x^2$
  - $\times\ \pi = 3.14 \quad \checkmark\ \pi \approx 3.14$
- A function equals a function and a set equals a set: "Factors: $6 = 2$ and 3" is false.
- $\Rightarrow$ **joins statements**: "x is odd $\Rightarrow$ x^2 is odd". It is not a substitute for "$=$" or "next". Read it aloud as *implies*.
- Long calculations go **down the page**, with reasons on the right:

$$\begin{aligned}(x+3)^2 + x^2 &= x^2 + 6x + 9 + x^2 \\ &= 2x^2 + 6x + 9.\end{aligned}$$

Source: Houston (2009), ch. 3 "Equals means equals", "Displaying results with the equals sign"; ch. 4 "The curse of the implication symbol" (examples from Houston).

Which is better? 4 / 10

Finding the positive root of $x^2 - 2 = 0$.

A

The equation $x^2 - 2 = 0$ factorises as $(x - \sqrt{2})(x + \sqrt{2}) = 0$, so its positive root is

$$x = \sqrt{2} \approx 1.414.$$

B

$$x^2 - 2 = 0 = (x - \sqrt{2})(x + \sqrt{2}) = \sqrt{2} = 1.414$$

Source: Original example, illustrating Houston (2009), ch. 3 “Equals means equals”, and ch. 4 “Decimal approximations”.

Which is better? 4 / 10

Finding the positive root of $x^2 - 2 = 0$.

A

The equation $x^2 - 2 = 0$ factorises as $(x - \sqrt{2})(x + \sqrt{2}) = 0$, so its positive root is

$$x = \sqrt{2} \approx 1.414.$$

B

$$x^2 - 2 = 0 = (x - \sqrt{2})(x + \sqrt{2}) = \sqrt{2} = 1.414$$

A. Read B literally: it asserts $0 = \sqrt{2}$ and $\sqrt{2} = 1.414$, both false. Here "=" has been used to mean "and then". A uses words for the logic and $\approx$ for the decimal approximation.

Source: Original example, illustrating Houston (2009), ch. 3 "Equals means equals", and ch. 4 "Decimal approximations".

Say what you mean

- **If you use "if", then use "then".** What does "If $a > 0, b > 0, a + b > 0$" mean?
- **Quantify.** "$f(x) = 5$": for some x? For all x? Say which.
- **Explain your assertions:** *because*, *since*, *by the Chain Rule*, *using Theorem 2*. For example, "$x^3 > 0$ because x is positive."
- **Avoid "it"** when the reader could ask *"what is it?"*
- **Be bold:** not "it should be possible to show". Either it is possible or it isn't.
- **Call things by their names:** an *expression* ($3x^2 - 7x$), an *equation* ($3x^2 - 7x = 4x$), an *inequality* ($x \leq 5$), a *function* f and its *value* $f(x)$.

Source: Houston (2009), ch. 3 "Say what you mean", "Explain your assertions", "Explain what you are doing"; ch. 4 "If you use 'if', then use 'then'", "Avoid 'it'", "Not everything is a 'formula'" (examples from Houston).

Which is better?

Stating an error bound for a numerical method with step size h.

A

If h small, $|e_h| \leq Ch^2$.

B

There exist constants $C > 0$ and $h_0 > 0$, independent of h, such that

$$|e_h| \leq Ch^2 \quad \text{for all } h \in (0, h_0].$$

Source: Original example, illustrating Houston (2009), ch. 3 “Say what you mean” (quantifiers), and ch. 4 “If you use ‘if’, then use ‘then’”.

Which is better?

Stating an error bound for a numerical method with step size h.

A

If h small, $|e_h| \leq Ch^2$.

B

There exist constants $C > 0$ and $h_0 > 0$, independent of h, such that

$$|e_h| \leq Ch^2 \quad \text{for all } h \in (0, h_0].$$

B. A does not say how small h must be, has no "then", and never says whether C may depend on h. If it may, A says **nothing**: just take $C = |e_h|/h^2$. The quantifiers carry the mathematics.

Source: Original example, illustrating Houston (2009), ch. 3 "Say what you mean" (quantifiers), and ch. 4 "If you use 'if', then use 'then'".

Part 2

Structure and elegance

Structure: make it easy for the reader

Bertsekas' composition rules (selection)

1. Organise in *segments*: units read comfortably from start to finish.
2. Write segments *linearly*: put arguments close to where they are used.
3. Use **consistent notation**.
4. **State results consistently.**
5. *Tell them what you'll tell them*, then tell them what you told them.
6. Use *suggestive references*: "by the weak duality theorem", not just "by (3.17)".

Su's advice on structure

- For a long argument, give an outline at the start, then show the reader where they are.
- Make the first sentence of each paragraph carry the flow. Someone who reads only the first sentences should still follow you.

Houston

- Name or number results you reuse, instead of drawing arrows across the page.

Source: Bertsekas (2002), Rules 1, 2, 4, 5, 7, 8 (slides 13–25); Su (2015), "Highlight structure", "Use paragraphs…"; Houston (2009), ch. 3 "Don't draw arrows everywhere".

Which is better? 6 / 10

Two results stated in the same report.

A

Theorem 1. If f is sufficiently smooth, then Euler's method converges with order 1.

Theorem 2. If f is sufficiently smooth, then Heun's method converges with order 2.

B

Theorem 1. If f is sufficiently smooth, then Euler's method converges with order 1.

Proposition 2. Second-order convergence holds for scheme (2.7), assuming φ is regular enough.

Source: Original example, modelled on Bertsekas (2002), Rule 5 "State results consistently" (slide 22); also Rules 4 and 8.

Which is better? 6 / 10

Two results stated in the same report.

A

Theorem 1. If f is sufficiently smooth, then Euler's method converges with order 1.

Theorem 2. If f is sufficiently smooth, then Heun's method converges with order 2.

B

Theorem 1. If f is sufficiently smooth, then Euler's method converges with order 1.

Proposition 2. Second-order convergence holds for scheme (2.7), assuming φ is regular enough.

A. Parallel statements let the reader see at a glance that only the method and the order change. B changes the format, the label, and the name of the function (f becomes φ), and it refers to a method by an equation number instead of its name.

Source: Original example, modelled on Bertsekas (2002), Rule 5 "State results consistently" (slide 22); also Rules 4 and 8.

Towards elegance

- **Decide what's important to say.** Your main job is to give insight, not every detail.
- **Avoid red herrings.** Every hypothesis you state hints that you will use it. If you never use it, delete it.
- **Step back and simplify.** Did you use every tool you pulled out?
- **Choose good examples**, and counterexamples that show why the assumptions are needed.
- **Don't underexplain, don't overexplain.** Skip routine algebra the reader can check, but show the crucial step.

Source: Su (2015), "Toward Elegance"; Bertsekas (2002), Rules 6 and 9.

Which is better?

Claim. If 6 divides an integer n, then n is even.

A

Proof. Suppose, for a contradiction, that n is odd. Since 6 divides n, write $n = 6k$, where k is an integer with $|k| \leq |n|$. Then $n = 2(3k)$, so n is even. This contradicts our assumption. $\square$

B

Proof. Since 6 divides n, we have $n = 6k$ for some integer k. Hence $n = 2(3k)$ is even. $\square$

Source: Adapted from Su (2015), "Step back and simplify" (Su uses "4 divides n") and "Avoid red herrings!".

Which is better?

Claim. If 6 divides an integer n, then n is even.

A

Proof. Suppose, for a contradiction, that n is odd. Since 6 divides n, write $n = 6k$, where k is an integer with $|k| \leq |n|$. Then $n = 2(3k)$, so n is even. This contradicts our assumption. $\square$

B

Proof. Since 6 divides n, we have $n = 6k$ for some integer k. Hence $n = 2(3k)$ is even. $\square$

B. In A the assumption "n is odd" is never used, so this is a direct proof in disguise. The bound $|k| \leq |n|$ is a **red herring**: it is stated and never used. Delete the first and last sentences of A, and the red herring, and you get B.

Source: Adapted from Su (2015), "Step back and simplify" (Su uses "4 divides n") and "Avoid red herrings!".

Part 3

Figures and plots

Visualisation: two sets of rules

Bertsekas, Rule 10: use visualisation when possible

- Keep figures simple and uncluttered.
- Use substantial captions.
- Captions should reinforce and add to the text, not repeat it.
- A figure can show the main idea of a proof without formal constraints.
- Prefer graphs to tables.

Rougier, Droettboom & Bourne: ten simple rules for better figures

1. Know your audience
2. Identify your message
3. Adapt the figure to the support medium
4. Captions are not optional
5. Do not trust the defaults
6. Use color effectively
7. Do not mislead the reader
8. Avoid “chartjunk”
9. Message trumps beauty
10. Get the right tool

Source: Bertsekas (2002), slide 27; Rougier, Droettboom & Bourne (2014), *PLoS Comput. Biol.* 10(9): e1003833 (rule titles quoted; article is public domain, CC0).

Figures in computational mathematics

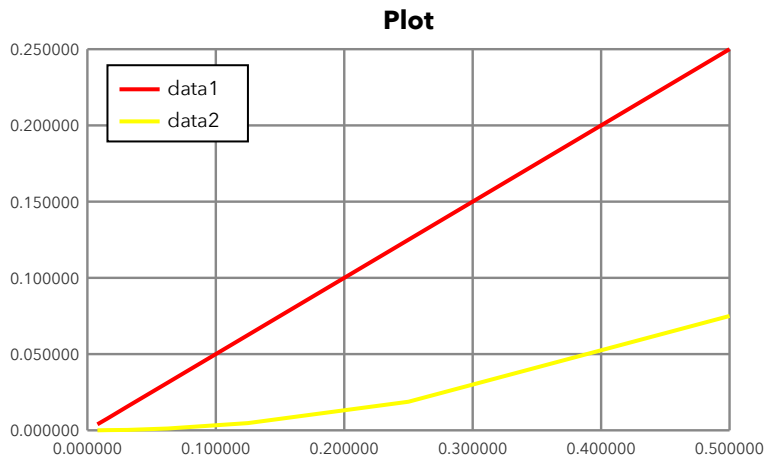
- **Identify your message first.** For example: *"Heun converges at order 2, Euler at order 1."* Then design the plot to show it.
- **Pick axes that show the message.** If $e \approx Ch^p$, then $\log e \approx \log C + p \log h$, so on **log–log axes** the order is the slope.
- **Label axes** with quantities (and units, if any), and use readable tick labels.
- **Don't trust the defaults**: line widths, font sizes, tick precision, legend text such as "data1".
- **Colour**: use colour-blind-safe palettes, with distinct markers as well as colours. Check that the figure still works in greyscale.
- **Don't mislead**, and **avoid chartjunk**: no 3-D effects, no decoration, no heavy grids.
- **Size for the medium**: fonts on a slide must be bigger than fonts in a report.

Source: Rougier, Droettboom & Bourne (2014), Rules 2 "Identify your message", 3 "Adapt the figure to the support medium", 5 "Do not trust the defaults", 6 "Use color effectively", 7 "Do not mislead the reader", 8 "Avoid chartjunk". The log–log remark is standard numerical-analysis practice.

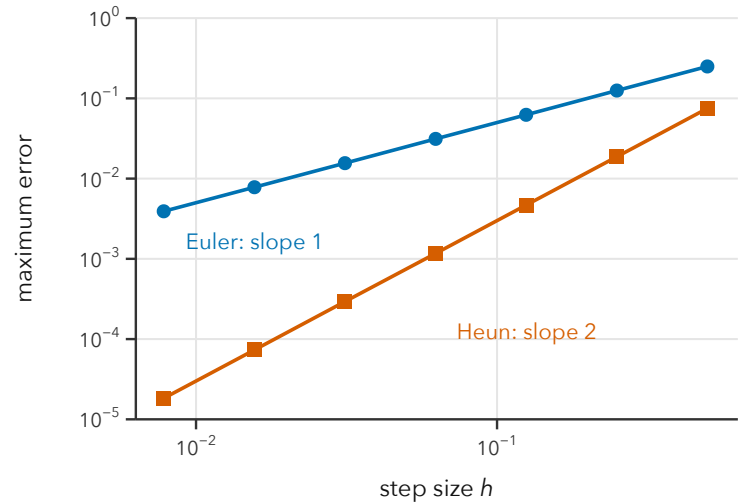
Which is better? 8 / 10

The same data in both: errors of Euler's and Heun's methods for seven step sizes.

A



B

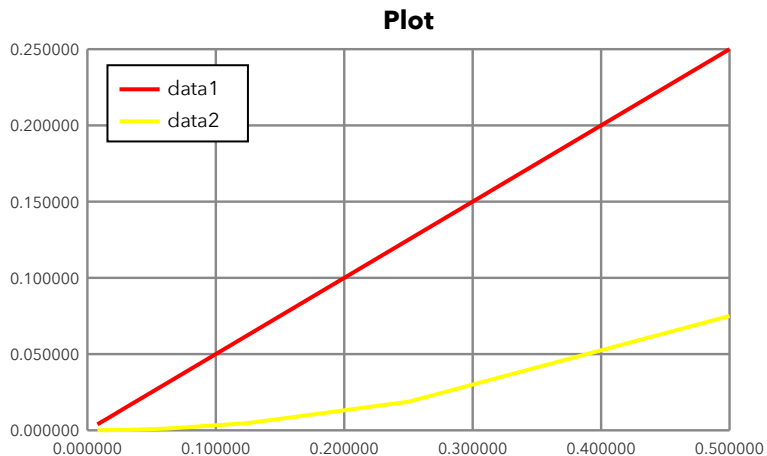


Source: Figures drawn for this lecture from synthetic data ($e = 0.5h$ and $e = 0.3h^2$). Rules: Rougier et al. (2014), Rules 2, 5, 6, 8; Bertsekas (2002), Rule 10.

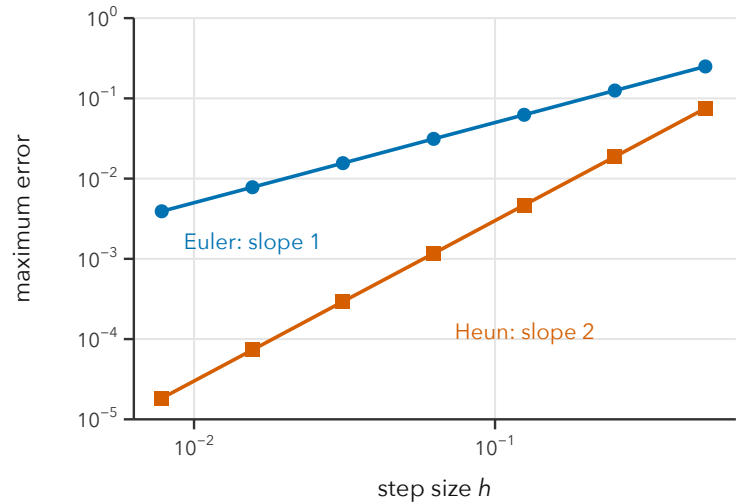
Which is better? 8 / 10

The same data in both: errors of Euler's and Heun's methods for seven step sizes.

A



B



B. Log–log axes turn $e \approx Ch^p$ into straight lines whose slope is the order p; on A's linear axes most points are squashed near zero. B also has labelled axes, markers, direct labels and colour-blind-safe colours. A has defaults everywhere, a meaningless legend, a yellow line that is invisible when projected, and a heavy grid.

Source: Figures drawn for this lecture from synthetic data (e = 0.5h and e = 0.3h²). Rules: Rougier et al. (2014), Rules 2, 5, 6, 8; Bertsekas (2002), Rule 10.

Which is better? 9 / 10

The caption under figure B from the previous slide.

A

Figure 3. Maximum error of Euler's method (circles) and Heun's method (squares) against step size h, on log–log axes. The slopes, 1 and 2, agree with the theoretical orders of the two methods.

B

Figure 3. Error plot.

Source: Original example, illustrating Rougier et al. (2014), Rule 4 "Captions are not optional", and Bertsekas (2002), Rule 10 "Use substantial captions".

Which is better? 9 / 10

The caption under figure B from the previous slide.

A

Figure 3. Maximum error of Euler's method (circles) and Heun's method (squares) against step size h, on log–log axes. The slopes, 1 and 2, agree with the theoretical orders of the two methods.

B

Figure 3. Error plot.

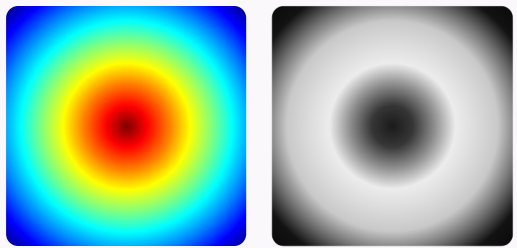
A. A caption should let the figure stand on its own. It says what is plotted, how to read it (markers, axes) and what the reader should take away. "Error plot" tells the reader nothing they could not already see.

Source: Original example, illustrating Rougier et al. (2014), Rule 4 "Captions are not optional", and Bertsekas (2002), Rule 10 "Use substantial captions".

Which is better? 10 / 10

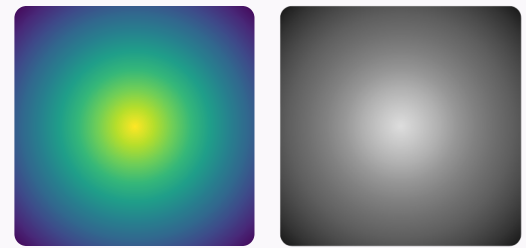
Colour map for a heat map of a solution $u(x, y)$. In each box, the right-hand square is the same map printed in greyscale.

A



colour greyscale

B



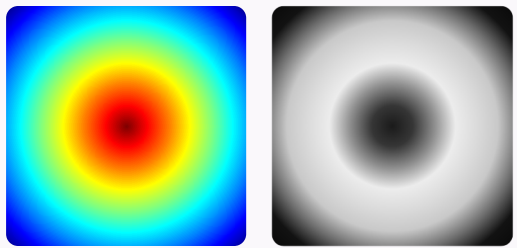
colour greyscale

Source: Illustrates Rougier et al. (2014), Rule 6 “Use color effectively”. Viridis is matplotlib’s default colour map from version 2.0.

Which is better? 10 / 10

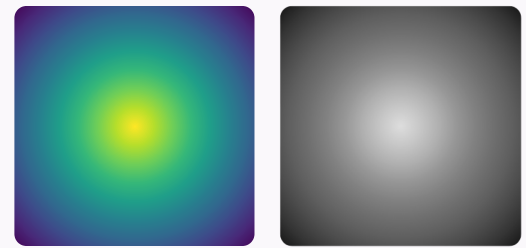
Colour map for a heat map of a solution $u(x, y)$. In each box, the right-hand square is the same map printed in greyscale.

A



colour greyscale

B



colour greyscale

B (*viridis*). Its lightness increases steadily with the value, so the order survives greyscale printing and most colour-vision deficiencies. A (*jet*) creates false bright bands (yellow, cyan) that look like features of the data, and in greyscale the high and low values look alike.

Source: Illustrates Rougier et al. (2014), Rule 6 “Use color effectively”. Viridis is matplotlib’s default colour map from version 2.0.

Part 4

The process

Refine, refine, refine

- **Good writing is successive approximation.** Don't expect the first draft to be right.
- When you revise, ask: *What can I take away?* and *What should I add?*
- If a notation or definition turns out to be awkward, **go back and change it**.
- **Proofread one aspect at a time**:
  1. Accuracy: is it true?
  2. Spelling, typos, unclosed brackets.
  3. Order and flow.
- **Read it aloud**, slowly. Ask someone else to read it, but the responsibility stays with you.
- **Reflect:** put it away, and come back with fresh eyes.

Source: Su (2015), "Refine, refine, refine"; Houston (2009), ch. 3 "Proof read", "Reflection".

Checklist for your next report

Sentences and symbols

- Written in punctuated sentences, displays included
- Every symbol defined before use
- No sentence starts with a symbol
- $\forall$, $\exists$, $\Rightarrow$, $\therefore$ written as words
- "$=$" only for genuine equality; "$\approx$" for approximations
- Every "if" has a "then"; every claim is quantified

Structure and figures

- Audience chosen; the level matches it
- Roadmap at the start; results stated consistently
- No red herrings; argument simplified
- Each figure has a message, labelled axes, a caption
- Sensible scales (log–log for convergence)
- Colour-blind-safe; works in greyscale
- Proofread, read aloud, revised

Source: Compiled from Houston (2009), Bertsekas (2002), Su (2015) and Rougier et al. (2014).

To finish: Nick Higham, author of the *Handbook of Writing for the Mathematical Sciences*, was asked:

What advice would you give for writing in the mathematical sciences?

> 1. Get started (this is often the hardest part); lower your quality threshold and write something, indeed anything.
> 2. Repeat until converged: write, then revise what you've written.
> 3. Make your work available in some appropriate form, whether through a journal submission, a blog post, or a note on your web page.
>
> Nick Higham, interviewed in *SIAM News*, 6 January 2020: "Nick Higham Talks Mathematical Writing and Publishing with SIAM".

References

1. **Bertsekas, D. P.** (2002). *Ten Simple Rules for Mathematical Writing* [lecture slides]. Massachusetts Institute of Technology, April 2002. https://www.mit.edu/~dimitrib/Ten_Rules.pdf
2. **Higham, N. J.** (2020). *Handbook of Writing for the Mathematical Sciences* (3rd ed.). Philadelphia: SIAM. ISBN 978-1-611976-09-0.
3. **Houston, K.** (2009). *How to Write Mathematics* [booklet, University of Leeds, 22 September 2009], reproducing chapters 3–4 of **Houston, K.** (2009). *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics*. Cambridge: Cambridge University Press.
4. **Rougier, N. P., Droettboom, M. & Bourne, P. E.** (2014). Ten simple rules for better figures. *PLoS Computational Biology*, 10(9), e1003833. https://doi.org/10.1371/journal.pcbi.1003833
5. **SIAM News** (2020, 6 January). Nick Higham talks mathematical writing and publishing with SIAM [interview]. https://www.siam.org/publications/siam-news/articles/nick-higham-talks-mathematical-writing-and-publishing-with-siam
6. **Su, F. E.** (2015). Some guidelines for good mathematical writing. *MAA FOCUS*, August/September 2015, 20–22. https://math.hmc.edu/su/writing-math-well/

About the examples. Unless a slide says "adapted from", the A/B examples and both plots were written for this lecture to illustrate the cited guidelines. The plots use synthetic data. Short quotations are attributed where they appear.

Further reading

- **Halmos, P. R.** (1970). How to write mathematics. *L'Enseignement Mathématique*, 16, 123–152. The classic essay, cited by both Bertsekas and Su.
- **Higham, N. J.** (2020). *Handbook of Writing for the Mathematical Sciences* (3rd ed.), SIAM. Covers papers, theses, talks, LaTeX, English usage, refereeing and more.
- **Tufte, E. R.** (2001). *The Visual Display of Quantitative Information* (2nd ed.). Cheshire, CT: Graphics Press. The source of the term "chartjunk" used in Rougier et al.'s Rule 8.