1.0 Mathematics in This Shell

The expression $\sum_{i=1}^{\infty} a_i$ is in-line mathematics, while the numbered equation

$$\sum_{i=1}^{\infty} a_i \tag{1}$$

is displayed and automatically numbered as equation 1.

Let H be a Hilbert space, C be a closed bounded convex subset of H, T a non-expansive self map of C. Suppose that as $n \to \infty$, $a_{n,k} \to 0$ for each k, and $\gamma_n = \sum_{k=0}^{\infty} (a_{n,k+1} - a_{n,k})^+ \to 0$. Then for each x in C, $A_n x = \sum_{k=0}^{\infty} a_{n,k} T^k x$ converges weakly to a fixed point of T .

Two sets of LaTeX parameters govern mathematical displays.[1] The spacing above and below a display depends on whether the lines above or below are short or long, as shown in the following examples.

A short line above:

$$x^2 + y^2 = z^2$$

and a short line below.

A long line above may depend on your margins

$$\sin^2 \theta + \cos^2 \theta = 1$$

as will a long line below. This line is long enough to illustrate the spacing for mathematical displays, regardless of the margins.

[1] LaTeX automatically selects the spacing depending on the surrounding line lengths.

1.1 Theorems, Lemmata, and Other Theorem-like Environments

A number of theorem-like environments is available. The following lemma is a well-known fact on differentiation of asymptotic expansions of analytic functions.

Lemma 1 Let $f(z)$ be an analytic function in $\mathbb{C}_+$. If $f(z)$ admits the representation

$$f(z) = a_0 + \frac{a_1}{z} + o\left(\frac{1}{z}\right),$$

for $z \to \infty$ inside a cone $\Gamma_\varepsilon = \{z \in \mathbb{C}_+ : 0 < \varepsilon \le \arg z \le \pi - \varepsilon\}$ then

$$a_1 = -\lim z^2 f'(z),\ z \to \infty,\ z \in \Gamma_\varepsilon. \tag{2}$$

Proof. Change z for $1/z$. Then $\Gamma_\varepsilon \to \overline{\Gamma}_\varepsilon = \{z \in \mathbb{C}_- : \overline{z} \in \Gamma_\varepsilon\}$ and

$$f(1/z) = a_0 + a_1 z + o(z). \tag{3}$$

Fix $z \in \overline{\Gamma}_\varepsilon$, and let $C_r(z) = \{\lambda \in \mathbb{C}_- : |\lambda - z| = r\}$ be a circle with radius $r = |z| \sin \varepsilon/2$. It follows from (3) that

$$\frac{1}{2\pi i}\int_{C_r(z)} \frac{f(\lambda)\,d\lambda}{(\lambda - z)^2} = \sum_{m=0}^{1} a_m \frac{1}{2\pi i}\int_{C_r(z)} \frac{(\lambda - z_0)^m\,d\lambda}{(\lambda - z)^2} + R(z), \tag{4}$$

where for the remainder $R(z)$ we have

$$\begin{aligned} |R(z)| &\le r^{-1} \max_{\lambda \in C_r(z)} o(|z|) = r^{-1} \max_{\lambda \in C_r(z)} |\lambda| \cdot O(|z| + r) \\ &= \frac{|z| + r}{r} \cdot O(|z| + r) = \frac{1 + \sin\varepsilon}{\sin\varepsilon} \cdot O(|z|). \end{aligned} \tag{5}$$

Therefore $R(z) \to 0$ as $z \to \infty$, $z \in \overline{\Gamma}_{\varepsilon/2}$, and hence by the Cauchy theorem (4) implies

$$\frac{d}{dz} f(1/z) = a_1 + R(z) \to a_1, \text{ as } z \to \infty,\ z \in \overline{\Gamma}_{\varepsilon/2}, \tag{6.}$$

that implies (2) by substituting $1/z$ back for z. ■

2.0 Manual Numbering

In the book production process, automatic numbering causes problems because there is the chance that some editing change in the source file will change the number of a section, equation, list item, etc. This can lead to inaccuracies or missed corrections during copy-editing.

2.1 Graphing Calculator Section

Most graphing calculators and computer graphing programs can be used to graph curves defined by parametric equations. In fact, it is instructive to watch a parametric curve being drawn by a graphing calculator because the points are plotted in order as the corresponding parameter values increase.

Exercises 2.1

1–15 ■

(a) Sketch the curve represented by the parametric equations.

(b) Eliminate the parameter to find the Cartesian equation of the curve.

1. $x = 1 - t, \quad y = 2 + 3t$

2. $x = 2t - 1, \quad y = 2 - t, \quad -3 \le t \le 3$

3. $x = 3t^2, \quad y = 2 + 5t, \quad 0 \le t \le 2$

4. $x = 2t - 1, \quad y = t^2 - 1$

5. $x = \sqrt{t}, \quad y = 1 - t$

6. $x = t^2, \quad y = t^3$

7. $x = \sin\theta, \quad y = \cos\theta, \quad 0 \le \theta \le \pi$

8. $x = 3\cos\theta, \quad y = 2\sin\theta, \quad 0 \le \theta \le 2\pi$

9. $x = \sin^2\theta, \quad y = \cos^2\theta$

10. $x = \sec\theta, \quad y = \tan\theta, \quad -\pi/2 < \theta < \pi/2$

11. $x = 2t - 1, \quad y = t^2 - 1$

12. $x = \sqrt{t}, \quad y = 1 - t$

13. $x = t^2, \quad y = t^3$

14. $x = \sin\theta, \quad y = \cos\theta, \quad 0 \le \theta \le \pi$

15. $x = 3\cos\theta, \quad y = 2\sin\theta, \quad 0 \le \theta \le 2\pi$

3.0 Headings and Tags

Let H be a Hilbert space, C be a closed bounded convex subset of H, T a non-expansive self map of C. Suppose that as $n \to \infty$, $a_{n,k} \to 0$ for each k, and $\gamma_n = \sum_{k=0}^{\infty} (a_{n,k+1} - a_{n,k})^+ \to 0$. Then for each x in C, $A_n x = \sum_{k=0}^{\infty} a_{n,k} T^k x$ converges weakly to a fixed point of T .

Mathematics can appear in section heads. Note that mathematics in section heads may cause difficulties in typesetting styles with running headers or table of contents entries.

3.1 Section About Tags

Use the Section tag for major sections like this one. These text tags are available. You can apply the logical markup tag *Emphasized*.

You can apply the visual markup tags **Bold**, *Italics*, Roman, Sans Serif, *Slanted*, SMALL CAPS, and `Typewriter`.

You can apply the special, mathematics only, tags $\mathfrak{fraktur}$, $\mathbb{BLACKBOARD\ BOLD}$, and $\mathcal{CALLIGRAPHIC}$. Note that blackboard bold and calligraphic are correct only when applied to uppercase letters A through Z.

You can apply the size tags tiny, scriptsize, footnotesize, small, normalsize, large, Large, LARGE, huge and Huge.

This is a Body Math paragraph. Each time you press the Enter key, Scientific WorkPlace switches to mathematics mode. This is convenient for carrying out "scratchpad" computations. Following is a group of paragraphs marked as Body Quote. This environment is appropriate for a short quotation or a sequence of short quotations.

> The only thing we have to fear is fear itself. *Franklin D. Roosevelt,* Mar. 4, 1933
>
> Ask not what your country can do for you; ask what you can do for your country. *John F. Kennedy,* Jan. 20. 1961
>
> There is nothing wrong with America that cannot be cured by what is right with America. *William J. "Bill" Clinton,* Jan. 21, 1993

3.1.1 Subsection

This is some harmless text under a subsection.

3.1.1.1 Subsubsection

This is some harmless text under a subsubsection.