

# 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  $n \rightarrow \infty$ ,  $a_{n,k} \rightarrow 0$  for each  $k$ , and  $\gamma_n = \sum_{k=0}^{\infty} (a_{n,k+1} - a_{n,k})^+ \rightarrow 0$ . 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 L<sup>A</sup>T<sub>E</sub>X parameters govern mathematical displays.<sup>1</sup> 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.

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<sup>1</sup> L<sup>A</sup>T<sub>E</sub>X 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  $z \rightarrow \infty$  inside a cone  $\Gamma_\varepsilon = \{z \in \mathbb{C}_+ : 0 < \varepsilon \leq \arg z \leq \pi - \varepsilon\}$  then

$$a_1 = -\lim_{z \rightarrow \infty, z \in \Gamma_\varepsilon} z^2 f'(z). \quad (2)$$

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

$$f(1/z) = a_0 + a_1 z + o(z). \quad (3)$$

Fix  $z \in \bar{\Gamma}_\varepsilon$ , 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

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

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

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

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

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

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.  $x = 2t - 1, \quad y = 2 - t,$   
 $-3 \leq t \leq 3$
3.  $x = 3t^2, \quad y = 2 + 5t,$   
 $0 \leq t \leq 2$
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.  $x = \sin \theta, \quad y = \cos \theta,$   
 $0 \leq \theta \leq \pi$
8.  $x = 3 \cos \theta, \quad y = 2 \sin \theta,$   
 $0 \leq \theta \leq 2\pi$
9.  $x = \sin^2 \theta, \quad y = \cos^2 \theta$
10.  $x = \sec \theta, \quad y = \tan \theta,$   
 $-\pi/2 < \theta < \pi/2$
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.  $x = \sin \theta, \quad y = \cos \theta,$   
 $0 \leq \theta \leq \pi$
15.  $x = 3 \cos \theta, \quad y = 2 \sin \theta,$   
 $0 \leq \theta \leq 2\pi$

## 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  $n \rightarrow \infty$ ,  $a_{n,k} \rightarrow 0$  for each  $k$ , and  $\gamma_n = \sum_{k=0}^{\infty} (a_{n,k+1} - a_{n,k})^+ \rightarrow 0$ . 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  $\frac{1}{2}$ , **BLACKBOARD BOLD**, and *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.