



**INSTANT**

Short | Fast | Focused

# SymPy Starter

Learn to use SymPy's symbolic engine to simplify Python calculations

Ronan Lamy

**[PACKT]**  
PUBLISHING

# Instant SymPy Starter

Learn to use SymPy's symbolic engine to simplify Python calculations

Ronan Lamy



BIRMINGHAM - MUMBAI

# Instant SymPy Starter

Copyright © 2013 Packt Publishing

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, without the prior written permission of the publisher, except in the case of brief quotations embedded in critical articles or reviews.

Every effort has been made in the preparation of this book to ensure the accuracy of the information presented. However, the information contained in this book is sold without warranty, either express or implied. Neither the author, nor Packt Publishing, and its dealers and distributors will be held liable for any damages caused or alleged to be caused directly or indirectly by this book.

Packt Publishing has endeavored to provide trademark information about all of the companies and products mentioned in this book by the appropriate use of capitals. However, Packt Publishing cannot guarantee the accuracy of this information.

First published: May 2013

Production Reference: 1170513

Published by Packt Publishing Ltd.  
Livery Place  
35 Livery Street  
Birmingham B3 2PB, UK.

ISBN 978-1-78216-362-6

[www.packtpub.com](http://www.packtpub.com)

# Credits

**Author**

Ronan Lamy

**Project Coordinator**

Sherin Padayatty

**Reviewer**

Douglas B. Meade

**Proofreader**

Aaron Nash

**Acquisition Editor**

Mary Jasmine Nadar

**Production Coordinator**

Conidon Miranda

**Commissioning Editors**

Maria D'souza

Sruthi Kutty

**Cover Work**

Conidon Miranda

**Technical Editor**

Jalasha D'costa

**Cover Image**

Conidon Miranda

# About the Author

To obtain his Ph.D. in Physics, **Ronan Lamy** spent four years analyzing data in a proprietary computer algebra system. This taught him the power of symbolic computation. After quitting academia, and losing access to all his work, he discovered the beauty of Python and understood, a little late, the benefits of using a well-designed, general-purpose programming language with a free license.

He is now an open source developer and Python consultant, and remains fascinated by symbolic computation. He has been a core developer of SymPy since 2009.

# About the Reviewer

**Douglas B. Meade** is an Associate Professor and Director of Undergraduate Studies in the Department of Mathematics at The University of South Carolina in Columbia, SC. His research interests include numerical PDEs, mathematical modeling, and applications of computer algebra. He has been using symbolic mathematics, primarily Maple, for more than 25 years. He is a co-author of *Getting Started with Maple* (2009, third edition, Wiley, ISBN: 978-0470455548).

Prof. Meade's current project is Maplets for Calculus, a collection of drill-and-practice maplets on nearly 200 topics from precalculus through vector calculus. He is intrigued by the possibilities of SymPy to facilitate the use of symbolic mathematics to an even wider range of academic and educational applications.

# www.packtpub.com

## Support files, eBooks, discount offers and more

You might want to visit [www.packtpub.com](http://www.packtpub.com) for support files and downloads related to your book.

Did you know that Packt offers eBook versions of every book published, with PDF and ePub files available? You can upgrade to the eBook version at [www.packtpub.com](http://www.packtpub.com) and as a print book customer, you are entitled to a discount on the eBook copy. Get in touch with us at [service@packtpub.com](mailto:service@packtpub.com) for more details.

At [www.packtpub.com](http://www.packtpub.com), you can also read a collection of free technical articles, sign up for a range of free newsletters and receive exclusive discounts and offers on Packt books and eBooks.

# packtlib.packtpub.com

Do you need instant solutions to your IT questions? PacktLib is Packt's online digital book library. Here, you can access, read and search across Packt's entire library of books.

## Why Subscribe?

- ◆ Fully searchable across every book published by Packt
- ◆ Copy and paste, print and bookmark content
- ◆ On demand and accessible via web browser

## Free Access for Packt account holders

If you have an account with Packt at [www.packtpub.com](http://www.packtpub.com), you can use this to access PacktLib today and view nine entirely free books. Simply use your login credentials for immediate access.





# Table of Contents

<b>Instant SymPy Starter</b>	<b>1</b>
<b>So, what is SymPy?</b>	<b>3</b>
<b>Installation</b>	<b>4</b>
Step 1 – Trying it out online	4
Step 2 – Installing the environment	5
Step 3 – Installing SymPy	6
Step 4 – Configuring the notebook	7
And that's it	8
<b>Quick start – Automated curve sketching</b>	<b>9</b>
Step 1 – Handling the input	9
Step 2 – Finding the domain of definition	11
Step 3 – Finding the local extrema	12
Step 4 – Computing the asymptotes	12
Step 5 – Plotting the curve	13
Step 6 – Building the figure	14
<b>Top 5 features you'll want to know about</b>	<b>17</b>
Creating expressions	17
Symbols	19
Functions	21
Manipulating expressions	22
The structure of expressions	22
Querying properties	24
Substitution	25
Simplification	26
Checking for mathematical equality	28
Numerical evaluation	28
Floating-point numbers	28
Compiling expressions	29