BREAKING INTO QUANT FINANCE

A Step-by-Step Guide

Free Resources · Expert Recommendations · Clear Roadmap

Three Required Skill Areas

Core Competencies

Three areas you must develop for any quant role

STEP 1

Mathematics

- Calculus
- Linear Algebra
- Probability & Statistics

STEP 2

Programming

- Python
- C++
- Projects

STEP 3

Finance

- Time Value of Money
- Derivatives
- Portfolio Theory

All resources listed are free

Required Mathematical Knowledge

These three areas form the mathematical foundation

Calculus	Linear Algebra	Probability
Derivatives pricing, optimization	Portfolio optimization, PCA	Risk modeling, statistics

Applications:

- Derivatives pricing uses stochastic calculus
- Portfolio optimization uses linear algebra
- Risk modeling uses probability theory

1.1 Calculus

Required Topics

Single and multivariable calculus

Topics:

- **Derivatives** — Greeks in options pricing
- **Integrals** — Probability densities, accumulation
- **Multivariable Calculus** — Gradients, partial derivatives
- **Optimization** — Finding maxima/minima

Book:

- **Calculus** by James Stewart
- Comprehensive coverage
- Extensive problem sets

Free Resource:

- **MIT OpenCourseWare**
  https://ocw.mit.edu
- Video lectures
- Problem sets with solutions

1.2 Linear Algebra

Required Topics

Vectors, matrices, and decompositions

Topics:

- **Vectors & Matrices** — Portfolio weights, data representation
- **Linear Systems** — Numerical methods
- **Eigenvalues & Eigenvectors** — PCA, covariance matrices
- **Matrix Decompositions** — SVD, Cholesky decomposition

Book:

- **Introduction to Linear Algebra** by Gilbert Strang
- Standard textbook
- Applications-focused

Free Resource:

- **MIT 18.06 Course**
  `https://ocw.mit.edu`
- Gilbert Strang lectures
- Full course materials

1.3 Probability & Statistics

Required Topics

Probability theory and statistical inference

Topics:

- **Random Variables** — Discrete and continuous distributions
- **Expectation & Variance** — Risk measures, moments
- **Probability Distributions** — Normal, log-normal, fat-tailed
- **Statistical Inference** — Hypothesis testing, confidence intervals

Book:

- **All of Statistics** by Larry Wasserman
- Comprehensive
- ML foundations included

Free Resource:

- **Harvard Stat 110**
  https://projects.iq.harvard.edu/stat110
- Joe Blitzstein's course
- Full video lectures

Two Languages Required

Python for research, C++ for production systems

Python

Start Here

Use Cases:

- Research & backtesting
- Data analysis
- Machine learning

C++

For Speed

Use Cases:

- High-frequency trading
- Low-latency systems

Learn Python first, then add C++ for quant dev roles

Required Skills

Core Python and scientific computing libraries

Essential Skills:

- **Core Python** — Data structures, functions, OOP
- **NumPy & Pandas** — Numerical computing, data manipulation
- **Matplotlib & Seaborn** — Visualization
- **SciPy & Statsmodels** — Scientific computing, statistics
- **Scikit-learn** — Machine learning

Book:

- **Python for Finance** by Yves Hilpisch
- Finance-focused
- Practical examples

Free Resource:

- **Real Python**
  https://realpython.com
- High-quality tutorials
- Finance applications

Required Skills

Core C++ and performance optimization

Essential Skills:

- **Core C++** — Pointers, memory management, STL
- **Object-Oriented Design** — Classes, inheritance, polymorphism
- **Templates** — Generic programming
- **Multithreading** — Concurrent programming
- **Performance Optimization** — Cache efficiency, complexity analysis

Book:

- **Programming: Principles & Practice Using C++** by Bjarne Stroustrup
- Comprehensive

Free Resource:

- **LearnCpp.com**
  https://www.learncpp.com
- Structured curriculum
- Practice exercises

Step 3: Finance Knowledge

Required Finance Topics

Three core areas of quantitative finance

Time Value	Derivatives	Portfolio Theory
Discounting, present value	Options, futures, swaps	Risk management, optimization

Why This Matters:

- Understand what you're modeling
- Identify unrealistic assumptions
- Communicate with traders and portfolio managers
- Progress beyond implementation roles

3.1 Time Value of Money

Required Topics

Discounting and valuation fundamentals

Topics:

- **Present Value & Future Value** — Discounting cash flows
- **Net Present Value** — Investment decisions
- **Interest Rates & Compounding** — Continuous vs. discrete
- **Yield Curves** — Term structure of rates
- **Bond Pricing** — Fixed income basics

Book:

- **Principles of Corporate Finance** by Brealey, Myers, Allen
- Comprehensive

Free Resource:

- **Khan Academy Finance**
  https://khanacademy.org
- Video tutorials
- Interactive exercises

Required Topics

Options, futures, and pricing models

Topics:

- **Options** — Calls, puts, Greeks (delta, gamma, vega, theta)
- **Futures & Forwards** — Linear instruments, basis
- **Swaps** — Interest rate swaps, CDS
- **Black-Scholes Model** — Option pricing
- **Exotic Options** — Barriers, Asians, digitals

Book:

- **Options, Futures, and Other Derivatives** by John C. Hull
- Standard textbook
- Used in every MFE program

Free Resource:

- **CBOE**
  https://www.cboe.com
- Educational materials
- Market data

3.3 Portfolio Theory & Risk Management

Required Topics

Portfolio optimization and risk measures

Topics:

- **Expected Return & Variance** — Risk-return tradeoff
- **Correlation & Diversification** — Portfolio construction
- **Efficient Frontier** — Optimal portfolios
- **CAPM** — Beta, alpha, systematic risk
- **Risk Measures** — Sharpe ratio, VaR, CVaR

Book:

- **Investment Science** by David G. Luenberger
- Mathematical rigor
- Portfolio optimization

Alternative:

- **Active Portfolio Management** by Grinold & Kahn
- Industry standard
- Quantitative methods

Step 4: Industry Experts to Follow

LinkedIn Professionals

Follow these people for industry insights and hiring trends

Value of Following Experts:

- Real-world insights and methodologies
- Career guidance and hiring tips
- Industry trends (AI, ML, alternative data)
- Networking opportunities
- Learn from their experiences

Seven experts who consistently share valuable content

LinkedIn Experts (1/2)

1. Giuseppe Paleologo

- Hiring tips, industry updates
- Job seekers and practitioners

2. Ernest Chan

- Beginner-friendly advice, generative AI applications
- Aspiring quants and ML enthusiasts

3. Marcos López de Prado

- Advanced methodologies, research
- Practitioners and researchers

4. Jean-Philippe Bouchaud

- Deep theoretical insights
- Posts infrequently but high value

LinkedIn Experts (2/2)

5. Mehul Mehta

- Quant methods with beginner-friendly explanations
- Career changers

6. Dimitri Bianco, FRM

- YouTube content, events, landscape insights
- Video learners and networking

7. Tribhuvan Bisen

- Easy-to-digest quant finance content
- Daily learning

Connect with all seven on LinkedIn