

## Quant Background Assessment – Baruch MFE Program

### Topics to Review

#### QBA – Calculus Review Topics

- Gradients and Hessian matrices of multivariable functions
- Gradients of vector valued functions
- Implicit differentiation
- Infinite Series
- Jacobian matrices
- Limits; l'Hôpital's rule
- Local and global minima and maxima
- Newton's method recursion
- Partial derivatives
- Volumes of three dimensional objects

#### QBA – Probability Review Topics

- Axioms and basic properties of a probability measure
- Basic properties of commonly used distributions (Bernoulli, Binomial, Geometric, Negative Binomial, Poisson, Uniform, Normal, Exponential, Gamma)
- Central limit theorem and applications
- Computations involving multivariate normal distributions
- Computations using Cumulative Distribution Functions (CDF)
- Computations using Moment Generating Functions (MGF)
- Computations using Probability Density Functions (PDF)
- Conditional probabilities, independence of events
- Covariance and correlation
- Expectation, Mean, Variance, and higher moments of random variables
- Independence of random variables
- Joint distribution of several random variables
- Laws of large numbers (weak and strong)
- Random variables and their distributions

#### QBA – Linear Algebra Review Topics

- Characteristic polynomial
- Covariance and correlation matrices
- Determinant and trace of a matrix
- Diagonal form of a matrix

- Eigenvalues, multiplicities, eigenvectors
- Existence of linear systems solutions
- Inner products and vector norms
- Matrix rank
- Orthogonal vectors and matrices
- Symmetric positive definite matrices

#### **QBA - Finance Review Topics**

- Compounding interest
- Convexity of option values and arbitrage
- Daily, monthly, yearly portfolio returns
- Maximum return portfolios and minimum variance portfolios
- Payoffs at maturity and PnL of options strategies (straddles, strangles, butterflies, bull spreads, bear spreads)
- Plain vanilla European call and put options
- Put-Call parity and arbitrage
- Value at Risk
- Weighted average portfolio returns