# 1 Advanced Algebra

This section tests for knowledge of algebraic symbols, elementary functions and their inverses.

 $\frac{\ln(x)^2}{3} = y$ 

Solve for x.

a)  $x = e^{\sqrt{3y}}$ b)  $x = \sqrt{\frac{3y}{\ln}}$ c)  $x = \frac{\ln(y)^2}{3}$ d)  $x = \sqrt{e^{3y}}$ 

### 2 Linear Algebra

This section tests for knowledge of matrices and matrix operations.

Compute the determinant of the following sum.

$$\begin{bmatrix} 1 & 8 & 11 \\ 2 & -1 & 3 \\ 0 & 5 & 1 \end{bmatrix} + \begin{bmatrix} 2 & 2 & 1 \\ 1 & -1 & 1 \\ -1 & 3 & -1 \end{bmatrix}$$
  
a) 
$$\begin{bmatrix} 3 & 10 & 12 \\ 3 & -2 & 4 \\ -1 & 8 & 0 \end{bmatrix}$$
  
b) 
$$\begin{bmatrix} 3 & 3 & -1 \\ 10 & -2 & 8 \\ 12 & 4 & 0 \end{bmatrix}$$
  
c) 128  
d) 76

### 3 Probability

This section tests for interpreting probabilities from scenarios, Bayes' theorem, and the central limit theorem.

If a six sided die is rolled six times, what is the probability that the number 1 was rolled exactly once?

a) 100%

b) 40.1%

c) 16.6%

d) 6.7%

#### 4 Statistics

This section tests for knowledge of random variable, point estimates, and calculating z-scores.

What is the mean of the following data set?

[3, 4, 4, 5, 8, 10, 15]

a) 5

b) 8

c) 12

d) 7

## 5 Differential Calculus

This section tests for the ability to compute limits and derivatives and knowledge of Taylor series.

Given: 
$$f(x) = \frac{e^x}{x^2}$$
, find  $f'(x)$   
a)  $\frac{e^x - (x-2)}{x^4}$   
b)  $x^2 e^x$   
c)  $\frac{e^x (x-2)}{x^3}$   
d)  $\frac{e^x}{(x-2)^3}$ 

## 6 Integral Calculus

This section tests for the ability to evaluate integrals and anti-derivatives.

Evaluate:

$$\int_{-\pi}^{\pi/2} 3\sin(x) + \cos(3x)$$

- a)  $\frac{-10}{3}$
- b) -4
- c) 4
- d)  $\frac{-8}{3}$

#### 7 Differential Equations

This section tests for the ability to solve differential and partial differential equations.

Find the solution to the following differential equation given: y(0) = 2 and y'(0) = -10

$$y'' + 6y' + 9y = 0$$

- a)  $y(t) = 2e^{-3t} 4te^{-3t}$
- b)  $y(t) = 2e^{-3t}$
- c)  $y(t) = e^{-3t}$
- d)  $y(t) = 2e^{-3t} 12te^{-3t}$

#### 8 Discrete Mathematics

This section tests for knowledge of number theory and function notation.

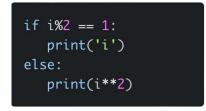
If  $n^2$  is a multiple of 12 then which of the following is n NOT necessarily a multiple of.

- a) 3
- b) 2
- c) 6
- d) 4

## 9 Python Programming

This section tests for basic python knowledge and the ability to parse python code.

What is the output of the following code if the variable i is set to 7?



a) 7

- b) i
- c) 14
- d) 49

#### 10 Python Data

This section tests for knowledge of Python data structures and how to generate and read from them.

Which of the following is NOT a method of dictionaries in Python?

- a) keys()
- b) values()
- c) elements()
- d) items()