

1 Advanced Algebra

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

Solve for x .

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

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?

```
if i%2 == 1:  
    print('i')  
else:  
    print(i**2)
```

- 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()