

UNIVERSITY OF NOWHERE
Mechanical Engineering
BIO 5678 - Applied Pyrohydrodynamics – Winter 2025-2026 (202525)
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ASSIGNMENT 1: RANDOM TOPICS
Due January 13, 2026

S O L U T I O N S

1. (25 pts.) **Simple Arithmetic.** Solve the following arithmetic problems:

- a. What is 12×3 ?
- b. What is $45 \div 5$?
- c. What is $7 + 8$?

SOLUTION

The answers are:

- a. 36
- b. 9
- c. 15

2. (25 pts.) **Simple Derivatives.** Compute the derivatives of the following functions:

- a. What is the derivative of $f(x) = 3x^3 + 2x^2 + x + 5$?
- b. What is the derivative of $f(x) = \sin(x) + x^2$?
- c. What is the derivative of $f(x) = e^{2x} + \ln(x)$?

SOLUTION

The derivatives are:

- a. $f'(x) = 9x^2 + 4x + 1$
- b. $f'(x) = \cos(x) + 2x$
- c. $f'(x) = 2e^{2x} + \frac{1}{x}$

3. (25 pts.) **Integration Problems.** Compute the following integrals:

- a. What is the indefinite integral of $f(x) = 3x^2 + 2x + 1$?
- b. What is the definite integral of $f(x) = \cos(x)$ from 0 to $\pi/2$?
- c. What is the indefinite integral of $f(x) = e^{3x}$?

SOLUTION

The integrals are:

- a. $\int f(x)dx = x^3 + x^2 + x + C$
- b. $\int_0^{\pi/2} \cos(x)dx = 1$
- c. $\int f(x)dx = \frac{1}{3}e^{3x} + C$

4. (25 pts.) **Numerics using Python.** Use Python to compute the roots of the following polynomial:

$$f(x) = x^3 - 3x + 2$$

SOLUTION

The following sequence of Python statements:

```
import numpy as np
r = np.roots([ 2, -3, 0, 1 ])
print(r)
```

Produces the output

[1, -2, 1]

So, the roots are 1, -2, 1.