

Problem YE

Source Filename: examples/publishing.py

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1. Here Is a Top-Level Heading

And here is some text. An equation:

$$x^2 = \int_0^t \Phi(t - \tau) Bu(\tau) d\tau.$$

And whatnot.

```
import numpy as np
```

2. Introduction

This program defines several mathematical functions as vectorized functions that can handle NumPy array inputs.

3. $f(x) = x^2 + 3x + 9$

```
def f(x: np.ndarray) -> np.ndarray:  
    return x**2 + 3 * x + 9
```

4. $g(x) = 1 + \sin^2 x$

```
def g(x: np.ndarray) -> np.ndarray:  
    return 1 + np.sin(x) ** 2
```

5. $h(x, y) = e^{-3x} + \ln y$

```
def h(x: np.ndarray, y: np.ndarray) -> np.ndarray:
    return np.exp(-3 * x) + np.log(y)
```

6. $F(x, y) = \lfloor x/y \rfloor$

```
def F(x: np.ndarray, y: np.ndarray) -> np.ndarray:
    return np.floor(x / y)
```

7. $G(x, y) = \begin{cases} x^2 + y^2 & \text{if } x > y \\ 2x & \text{otherwise} \end{cases}$

```
def G(x: np.ndarray, y: np.ndarray) -> np.ndarray:
    return np.where(x > y, x**2 + y**2, 2 * x)
```

8. Call Functions and Print

```
functions_args = (
    (f, 1),
    (g, 1),
    (h, 2),
    (F, 2),
    (G, 2),
) # (fun, nargs)
x = np.array([1, 5, 10, 20, 30])
y = np.array([2, 7, 5, 10, 30])
print(f"x = {x}\ny = {y}")

for function_args in functions_args:
    if function_args[1] == 1:
        printable = np.array2string(function_args[0](x), precision=3)
        print(f"{function_args[0].__name__}(x) =", printable)
    elif function_args[1] == 2:
        printable = np.array2string(function_args[0](x, y), precision=3)
        print(f"{function_args[0].__name__}(x, y) =", printable)
```

```
x = [ 1  5 10 20 30]
y = [ 2  7  5 10 30]
f(x) = [ 13  49 139 469 999]
g(x) = [1.708 1.92  1.296 1.833 1.976]
h(x, y) = [0.743 1.946 1.609 2.303 3.401]
F(x, y) = [0. 0. 2. 2. 1.]
G(x, y) = [ 2  10 125 500 60]
```