

1. A very powerful approximation for π was developed by a brilliant mathematician named Srinivasa Ramanujan. The approximation is the following:

$$\frac{1}{\pi} \approx \frac{2\sqrt{2}}{9801} \sum_{k=0}^N \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

Use Ramanujan's formula for $N=0$ and $N=1$ to approximate π . Be sure to use format long. Compare your approximation with Python's stored value for π . Hint: $0! = 1$ by definition.

2. The hyperbolic sin or sinh is defined in terms of exponentials as

$$\sinh(x) = \frac{\exp(x) - \exp(-x)}{2}$$

Compute sinh for $x=2$ using the above formula. Verify that the result is indeed the hyperbolic sine function using Python's sinh in the math module

3. Verify that $\sin^2(x) + \cos^2(x) - 1 = 0$ for $x = \pi, \pi/2, \pi/4, \pi/6$

4. Write a Python statement that generates the following error: `AttributeError: module 'math' has no attribute 'sni'`

5. If P is a logical expression, the law of noncontradiction states that $P \text{ AND } (\text{NOT } P)$ is always false. Verify this for $P \text{ true}$ and $P \text{ false}$.

6. Do the following logical and comparison operations:

You may assume P and Q are logical expressions.

For $P=1$ and $Q=1$; compute $\text{NOT}(P) \text{ AND } \text{NOT}(Q)$.

For $a=10$ and $b=25$; compute $(a < b) \text{ AND } (a == b)$

7. Create one tuple with element 'One', 1 and assign it to `tuple_a`

8. Assign (2, 3, 2) to `set_a`, and (1, 2, 3) to `set_b`. Get the following:

- union of `set_a` and `set_b`
- intersection of `set_a` and `set_b`
- difference of `set_a` to `set_b` using *difference* method

9. Write a block of code to sort a tuple of tuples by the second item:

```
tuple_1 = (('a', 23), ('b', 37), ('c', 11), ('d', 29))
```

10. Run the following program and explain the outcome:

```
from copy import deepcopy
#create a tuple
t = ("Tutor", 'J', 23, 56.67, [23,12], True)
print(t)
#make a copy of a tuple using deepcopy() function
tc = deepcopy(t)
tc[4].append(50)
print(tc)
print(t)
```

Why was deepcopy used?