```python
print("=== Python 基本資料型態 ===")

print("\n1. 整數型態:")
x = 3
print(f"x = {x}")
print(f"type(x) = {type(x)}")

print("\n2. 浮點數型態:")
y = 2.5
print(f"y = {y}")
print(f"type(y) = {type(y)}")

print("\n3. 複數型態:")
z1 = 1 + 2j
print(f"z1 = {z1}")
print(f"type(z1) = {type(z1)}")

z2 = complex(1, 2)
print(f"z2 = {z2}")
print(f"type(z2) = {type(z2)}")

print("\n4. 布林值型態:")
bool_true = True
print(f"bool_true = {bool_true}")
print(f"type(bool_true) = {type(bool_true)}")

bool_false = False
print(f"bool_false = {bool_false}")
print(f"type(bool_false) = {type(bool_false)}")
```

```python
print("\n5. 字串型態:")
str1 = "Hello"
print(f'str1 = "{str1}"')
print(f"type(str1) = {type(str1)}")

str2 = "你好"
print(f'str2 = "{str2}"')
print(f"type(str2) = {type(str2)}")

print("\n=== 資料型態轉換 ===")

print(f"float(1) = {float(1)}")
print(f"int(3.1) = {int(3.1)}")
print(f"int(3.6) = {int(3.6)}")

print(f"bool(1) = {bool(1)}")
print(f"bool(0) = {bool(0)}")
print(f"bool(1.0) = {bool(1.0)}")
print(f"bool(0.0) = {bool(0.0)}")

print(f"str(100) = '{str(100)}'")
print(f"str(3.1416) = '{str(3.1416)}'")

print("\n=== 變數記憶體位址 ===")
x = 1
y = 2
print(f"x = {x}, id(x) = {id(x)}")
print(f"y = {y}, id(y) = {id(y)}")
```

```python
print("\n=== 基本數學運算 ===")
print(f"2 + 3 = {2 + 3}")
print(f"10 - 3 = {10 - 3}")
print(f"3 * 4 = {3 * 4}")
print(f"1 / 10 = {1 / 10}")
print(f"123 / 999 = {123 / 999}")
print(f"100 // 3 = {100 // 3}")
print(f"100 % 3 = {100 % 3}")
print(f"2 ** 5 = {2 ** 5}")

print("\n=== 指定運算子 ===")
x = 1
print(f"初始 x = {x}")

x += 1
print(f"x += 1 後，x = {x}")

x *= 2
print(f"x *= 2 後，x = {x}")

y = 7
y //= 2
print(f"y = 7, y //= 2 後，y = {y}")

z = 100
z %= 3
print(f"z = 100, z %= 3 後，z = {z}")

```

```python
print("\n=== 變數交換 ===")
x, y = 1, 2
print(f"交換前: x = {x}, y = {y}")

temp = x
x = y
y = temp
print(f"交換後: x = {x}, y = {y}")

x, y = y, x
print(f"再次交換: x = {x}, y = {y}")

print("\n=== 字串比較 (ASCII碼) ===")
print(f'"A" > "a" = {"A" > "a"}')
print(f'"A" < "a" = {"A" < "a"}')
print(f'"A" == "a" = {"A" == "a"}')
print(f'"A" != "a" = {"A" != "a"}')
print(f'"Apple" == "Orange" = {"Apple" == "Orange"}')
print(f'"Apple" != "Orange" = {"Apple" != "Orange"}')

print("\n=== 邏輯運算子 ===")
print(f"True and False = {True and False}")
print(f"True or False = {True or False}")
print(f"not True = {not True}")
print(f"not False = {not False}")

print(f"(5 > 3) and (2 < 4) = {(5 > 3) and (2 < 4)}")
print(f"(5 > 3) or (2 > 4) = {(5 > 3) or (2 > 4)}")
print(f"not (5 > 3) = {not (5 > 3)}")
```

```python

print(f"(5 > 3) and (2 < 4) = {(5 > 3) and (2 < 4)}")
print(f"(5 > 3) or (2 > 4) = {(5 > 3) or (2 > 4)}")
print(f"not (5 > 3) = {not (5 > 3)}")

print("\n=== 德摩根定律 (De Morgan's Law) ===")
print("not (p and q) 等價於 (not p) or (not q)")
print("not (p or q) 等價於 (not p) and (not q)")

x = True
y = True
print(f"\n當 x = {x}, y = {y} 時:")
print(f"not (x and y) = {not (x and y)}")
print(f"(not x) or (not y) = {(not x) or (not y)}")

x = False
y = False
print(f"\n當 x = {x}, y = {y} 時:")
print(f"not (x or y) = {not (x or y)}")
print(f"(not x) and (not y) = {(not x) and (not y)}")

print("\n=== 位元運算子 ===")
x = 6
y = 10

print(f"x = {x} (二進位: {bin(x)})")
print(f"y = {y} (二進位: {bin(y)})")

print(f"~x = {~x} (位元 NOT 運算)")
```

```python

print(f"x = {x} (二進位: {bin(x)})")
print(f"y = {y} (二進位: {bin(y)})")

print(f"~x = {~x} (位元 NOT 運算)")
print(f"x & y = {x & y} (位元 AND 運算)")
print(f"x | y = {x | y} (位元 OR 運算)")
print(f"x ^ y = {x ^ y} (位元 XOR 運算)")

print("\n=== 運算子優先順序 ===")
print("Python運算子優先順序 (由高到低):")
print("1. () - 括號")
print("2. ** - 指數")
print("3. +, - - 正負號")
print("4. *, /, //, % - 乘除、整數除法取餘、取餘數")
print("5. +, - - 加減")
print("6. <<, >> - 位移")
print("7. &, |, ^ - 位元 AND、OR、XOR 運算")
print("8. >, <, >=, <=, ==, != - 比較運算")
print("9. not, and, or - 邏輯運算")

print("\n運算子優先順序範例:")
print(f"8 - 2 * 3 = {8 - 2 * 3}")
print(f"(1 + 2) * 3 - 4 = {(1 + 2) * 3 - 4}")
print(f"(1 + 2) ** 2 - 5 = {(1 + 2) ** 2 - 5}")
print(f"1 + 2 ** 3 // 2 = {1 + 2 ** 3 // 2}")
print(f"5 > 5 % 2 = {5 > 5 % 2}")
print(f"2 > 1 and 3 < 4 = {2 > 1 and 3 < 4}")
```

```
/usr/local/bin/python3.12 /Users/pengyenjia/Desktop/運算思維與程式設計/makeUp_Submission_py/3_11/課堂練習/11227130_資訊二甲_11227130_彭妍嘉 3_11.py
=== Python 基本資料型態 ===

1. 整數型態:
x = 3
type(x) = <class 'int'>

2. 浮點數型態:
y = 2.5
type(y) = <class 'float'>

3. 複數型態:
z1 = (1+2j)
type(z1) = <class 'complex'>
z2 = (1+2j)
type(z2) = <class 'complex'>

4. 布林值型態:
bool_true = True
type(bool_true) = <class 'bool'>
bool_false = False
type(bool_false) = <class 'bool'>

5. 字串型態:
str1 = "Hello"
type(str1) = <class 'str'>
str2 = "你好"
type(str2) = <class 'str'>

=== 資料型態轉換 ===
float(1) = 1.0
int(3.1) = 3
int(3.6) = 3
```

```
bool(1) = True
bool(0) = False
bool(1.0) = True
bool(0.0) = False
str(100) = '100'
str(3.1416) = '3.1416'

=== 變數記憶體位址 ===
x = 1, id(x) = 4329365872
y = 2, id(y) = 4329365904

=== 基本數學運算 ===
2 + 3 = 5
10 - 3 = 7
3 * 4 = 12
1 / 10 = 0.1
123 / 999 = 0.12312312312312312
100 // 3 = 33
100 % 3 = 1
2 ** 5 = 32

=== 指定運算子 ===
初始 x = 1
x += 1 後，x = 2
x *= 2 後，x = 4
y = 7, y //= 2 後，y = 3
z = 100, z %= 3 後，z = 1

=== 變數交換 ===
交換前: x = 1, y = 2
交換後: x = 2, y = 1
再次交換: x = 1, y = 2
```

```
=== 字串比較 (ASCII碼) ===
"A" > "a" = False
"A" < "a" = True
"A" == "a" = False
"A" != "a" = True
"Apple" == "Orange" = False
"Apple" != "Orange" = True

=== 邏輯運算子 ===
True and False = False
True or False = True
not True = False
not False = True
(5 > 3) and (2 < 4) = True
(5 > 3) or (2 > 4) = True
not (5 > 3) = False

=== 德摩根定律 (De Morgan's Law) ===
not (p and q) 等價於 (not p) or (not q)
not (p or q) 等價於 (not p) and (not q)

當 x = True, y = True 時:
not (x and y) = False
(not x) or (not y) = False

當 x = False, y = False 時:
not (x or y) = True
(not x) and (not y) = True

=== 位元運算子 ===
x = 6 (二進位: 0b110)
y = 10 (二進位: 0b1010)
```


```
not (x or y) = True
(not x) and (not y) = True
```


```
=== 位元運算子 ===
x = 6 (二進位: 0b110)
y = 10 (二進位: 0b1010)
~x = -7 (位元 NOT 運算)
x & y = 2 (位元 AND 運算)
x | y = 14 (位元 OR 運算)
x ^ y = 12 (位元 XOR 運算)

=== 運算子優先順序 ===
Python運算子優先順序 (由高到低):
1. () - 括號
2. ** - 指數
3. +, - - 正負號
4. *, /, //, % - 乘除、整數除法取餘、取餘數
5. +, - - 加減
6. <<, >> - 位移
7. &, |, ^ - 位元 AND、OR、XOR 運算
8. >, <, >=, <=, ==, != - 比較運算
9. not, and, or - 邏輯運算

運算子優先順序範例:
8 - 2 * 3 = 2
(1 + 2) * 3 - 4 = 5
(1 + 2) ** 2 - 5 = 4
1 + 2 ** 3 // 2 = 5
5 > 5 % 2 = True
2 > 1 and 3 < 4 = True

Process finished with exit code 0
```