Python Practice Tasks

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1 Variables

1. The assignment operator $+=$ is used to modify (by incrementing by the value on the right) an already defined variable. Write a program that defines a variable, n, and then increases its value by 1.

Solution:

```
n = 1
n += 1
```

2. Write a program that asks for the user's name and then insults them.

Solution:

```
user_name = raw_input("enter your name: ")
print user_name, "you are a foolish scoundrel."
```

3. Write a program that asks a user for a number and prints the square of that number.

Solution:

```
number = float(raw_input("enter a number: "))
print "x^2=", number**2
```

4. Write a program that prints the roots of a quadratic equation if given, a, b, and c, where

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1.1}$$

Solution:

```
a = float(raw_input("enter a: "))
b = float(raw_input("enter b: "))
c = float(raw_input("enter c: "))

print "x=", (-b + (b**2 - 4 * a * c)**0.5) / (2 * a)
print "x=", (-b - (b**2 - 4 * a * c)**0.5) / (2 * a)
```

5. Modify the above program to print the roots of the quadratic equation if given q, e, r, and k where $(qx + e)(rx + k)$.

Solution: Firstly we need to do some maths to express x in terms of the variables given. There are two main ways to do this, using the quadratic formula or by setting brackets to zero. They give the same result.

Method 1: Quadratic Formula

Multiply the brackets.

$$0 = (qx + e)(rx + k) \tag{1.2}$$

$$0 = qrx^2 + qkx + erx + ek \tag{1.3}$$

$$0 = qrx^2 + (qk + er)x + ek \tag{1.4}$$

which if we compare to the quadratic equation, we get

$$a = qr \tag{1.5}$$
$$b = qk + er \tag{1.6}$$
$$c = ek \tag{1.7}$$

which we can put in the quadratic formula,

$$x = \frac{-qk - er \pm \sqrt{(qk + er)^2 - 4qrek}}{2qr} \tag{1.8}$$
$$x = \frac{-qk - er}{2qr} \pm \frac{\sqrt{q^2k^2 + 2qker + e^2r^2 - 4qker}}{2qr} \tag{1.9}$$
$$x = \frac{-qk - er}{2qr} \pm \frac{\sqrt{q^2k^2 - 2qker + e^2r^2}}{2qr} \tag{1.10}$$

which can be simplified using $(m-p)^2 = m^2 - 2mp + p^2$,

$$x = \frac{-qk - er}{2qr} \pm \frac{\sqrt{(qk - er)^2}}{2qr} \tag{1.11}$$
$$x = \frac{-qk - er}{2qr} \pm \frac{qk - er}{2qr} \tag{1.12}$$

which gives the two solutions as

$$x = \frac{-2er}{2qr} \tag{1.13}$$
$$x = \frac{-2qk}{2qr} \tag{1.14}$$

which simplify to

$$x = \frac{-e}{q} \tag{1.15}$$
$$x = \frac{-k}{r} \tag{1.16}$$

Method 2: Setting Brackets to 0

By setting one bracket to zero we can find an expression for x,

$$0 = (qx + e)(rx + k) \tag{1.17}$$
$$0 = qx + e \tag{1.18}$$
$$-e = qx \tag{1.19}$$
$$x = \frac{-e}{q} \tag{1.20}$$

The same argument for the other bracket gives

$$x = \frac{-k}{r} \tag{1.21}$$

A simple program can then be written,

```
q = float(raw_input('enter q: '))
e = float(raw_input('enter e: '))
r = float(raw_input('enter r: '))
k = float(raw_input('enter k: '))

print "x=", -e / q
print "x=", -k / r
```

Alternatively, if you just got as far as comparing coefficients and putting them in the quadratic equation you'd get a more cumbersome (but just as correct),

```
q = float(raw_input("enter q: "))
e = float(raw_input("enter e: "))
r = float(raw_input("enter r: "))
k = float(raw_input("enter k: "))

print "x=", (-q*k - e*r + ((q*k + e*r)**2 - 4*q*r*e*k)**0.5) / (2*q*r)
print "x=", (-q*k - e*r - ((q*k + e*r)**2 - 4*q*r*e*k)**0.5) / (2*q*r)
```