

[220] Iteration

Meena Syamkumar
Mike Doescher

- **Exam I next Friday evening**
- **Exam Conflict Form**
- **Partner matching**
- **Where is my exam – Exam location updated on website**

Cheaters caught: 0
Piazza Enrollment 439 / 446

Learning Objectives Today

Reason about loops

- Motivation: need for repetition
- Condition and body of loop
- “while” syntax
- loops inside loops

Chapter 7 of Think Python

Understand common use cases

- Taking input from a user
- Computing over ranges of numbers

Learn to avoid pitfalls

- Infinite loops (when unintentional)
- Off-by-one mistakes

Worksheet

State:

N

4

total

0

answer

0

6

Code:

1. Put 1 in the “total” box
2. If “N” equals 1, skip to step 6, otherwise continue to step 3
3. Multiply the value in “total” by the value in “N”, and put the result back in “total”
4. Decrease the value in “N” by 1
5. Go to step 2
6. Copy the value in total to the answer box

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Combination of conditionally skipping forward (2) with going back is (5) is called a “while loop”

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loop condition

loop body

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loop body

going back will be implicit in Python, and will happen right after loop body.
you can identify the loop body because it will be indented

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loop condition

skip past loop body

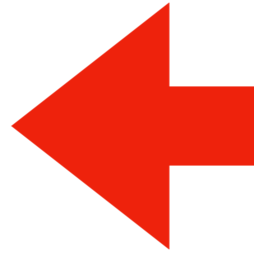
continue to loop body

loop body

going back will be implicit in Python, and will happen right after loop body. you can identify the loop body because it will be indented

Today's Outline

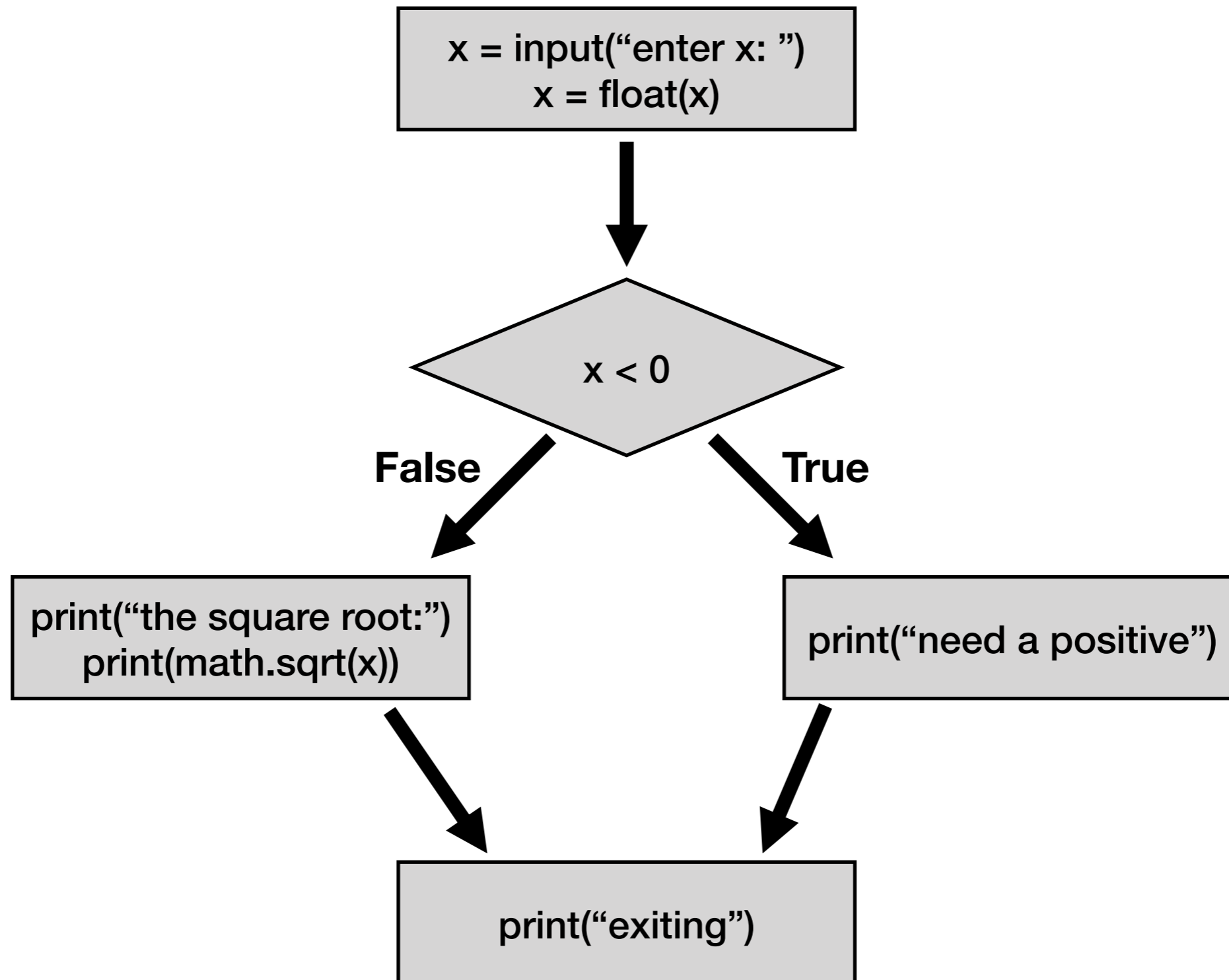
Control Flow Diagrams



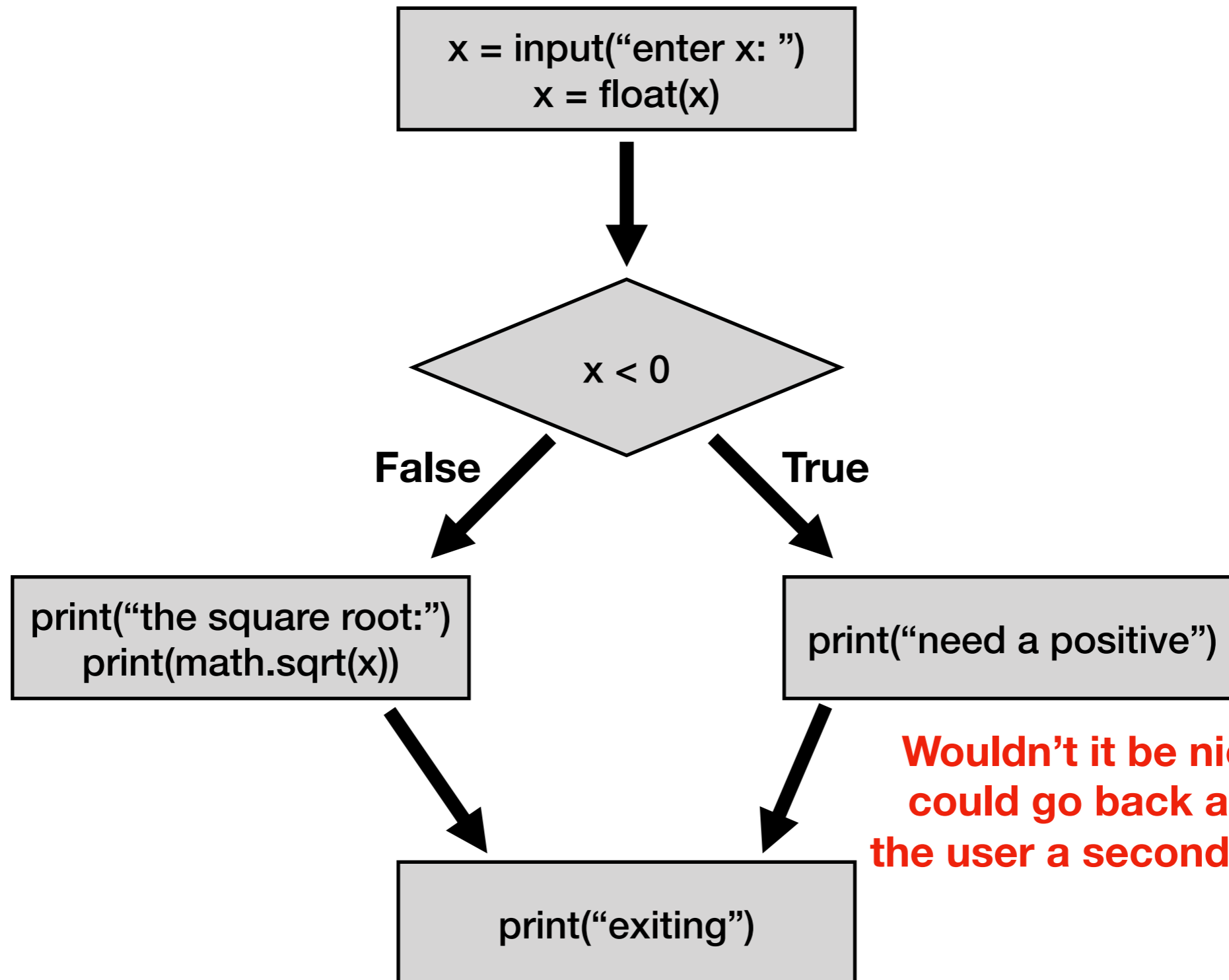
Basic syntax for “while”

Demos

Control Flow Diagrams: "if"

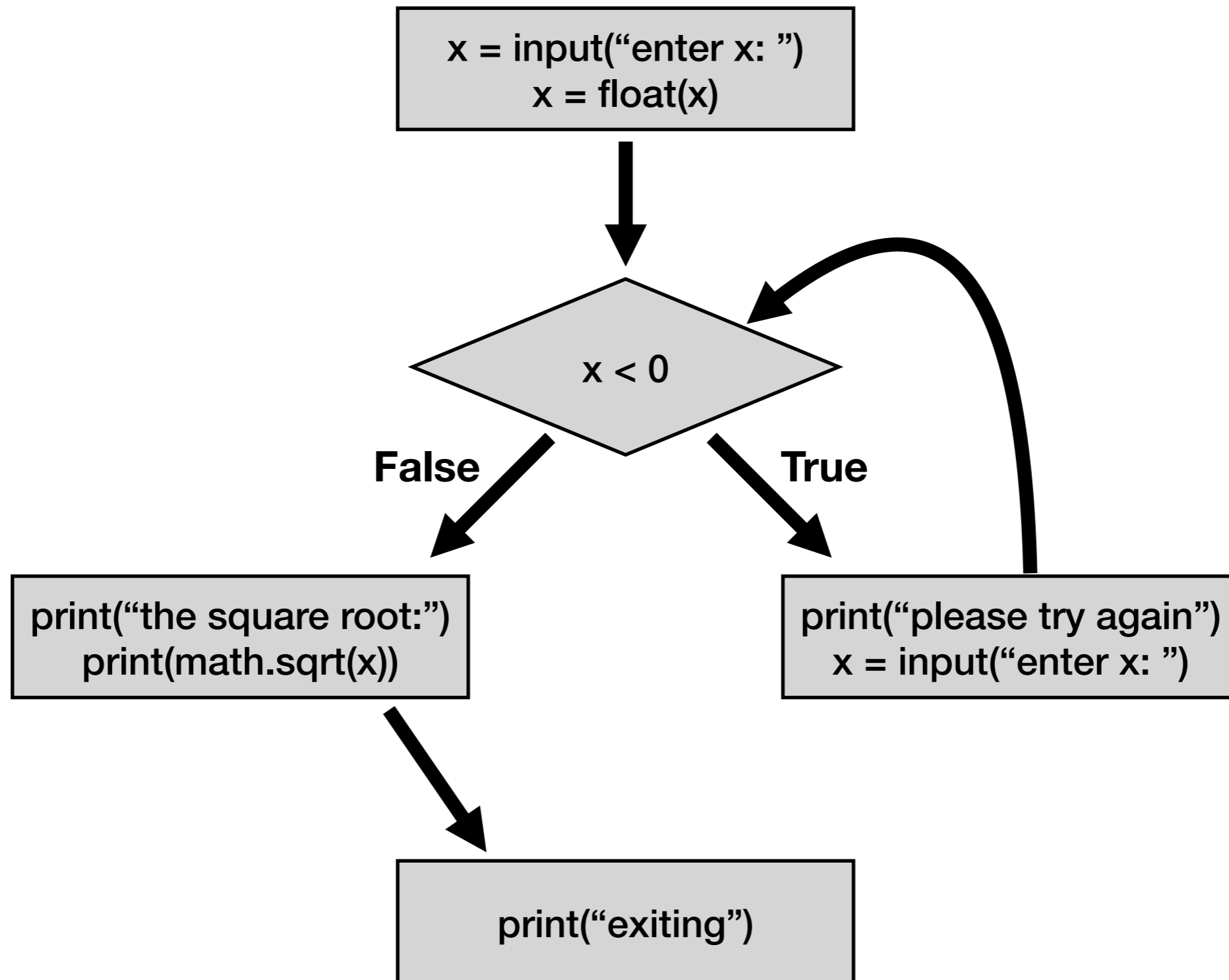


Control Flow Diagrams: “if”

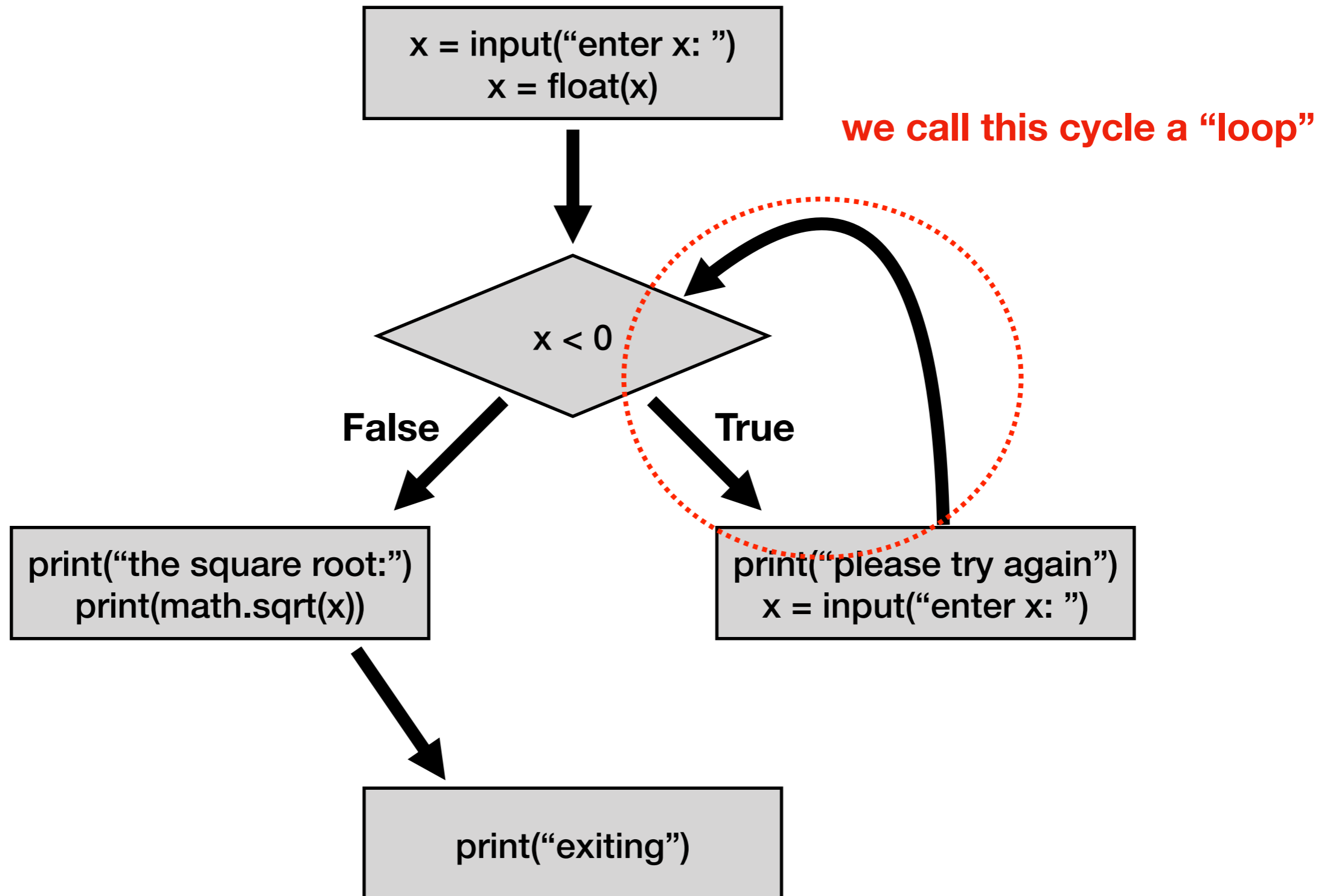


Wouldn't it be nice if we could go back and give the user a second chance?

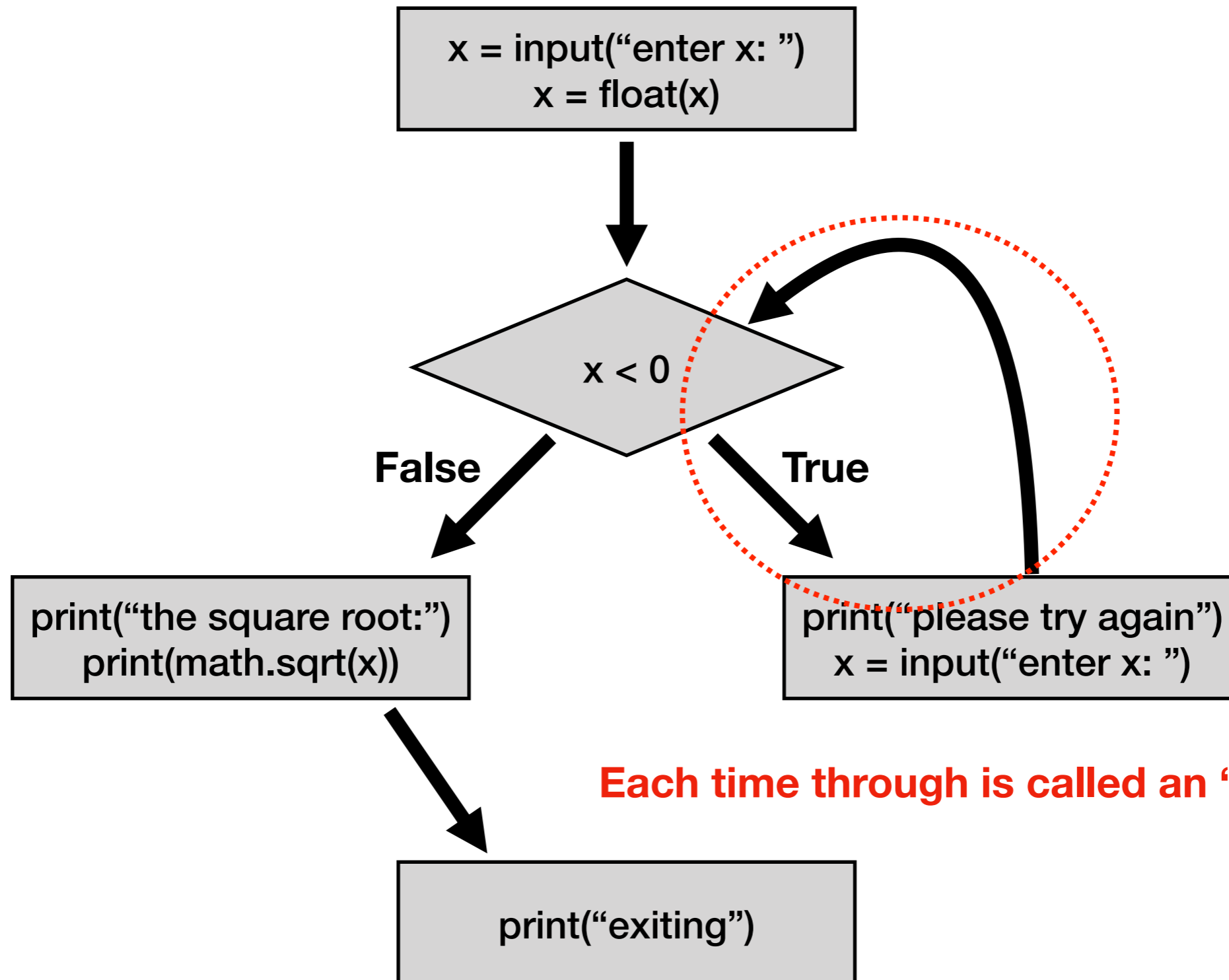
Control Flow Diagrams: “while”



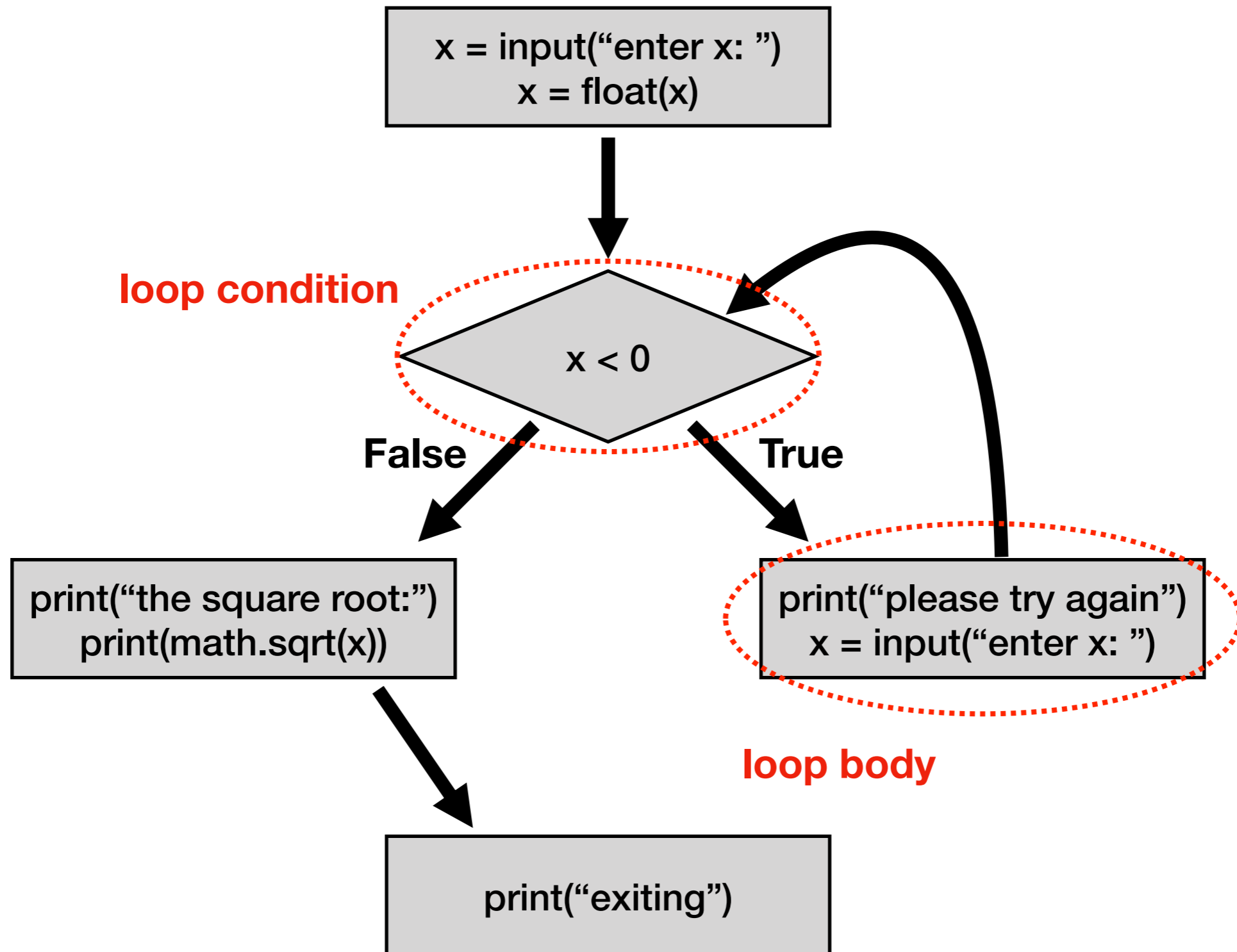
Control Flow Diagrams: “while”



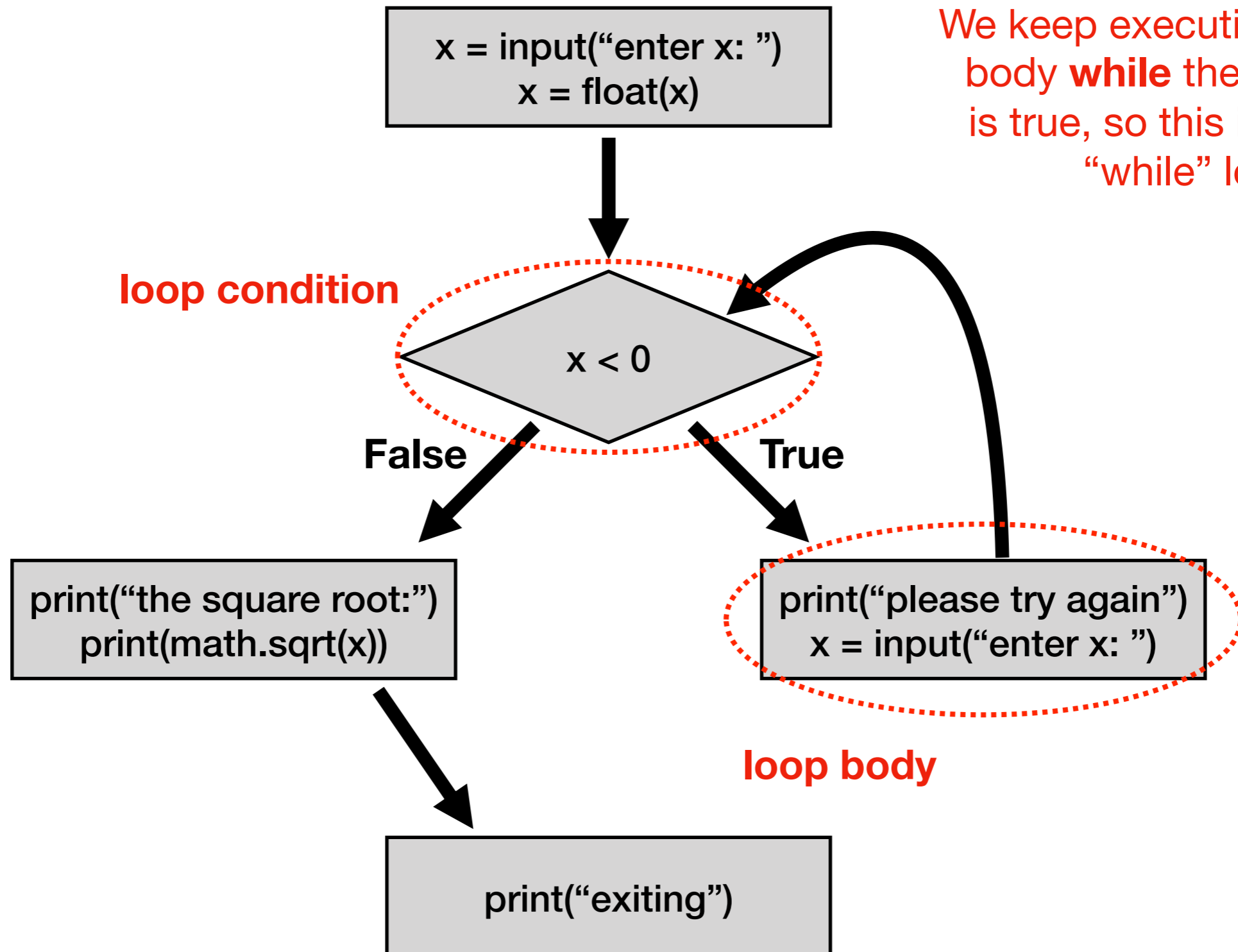
Control Flow Diagrams: “while”



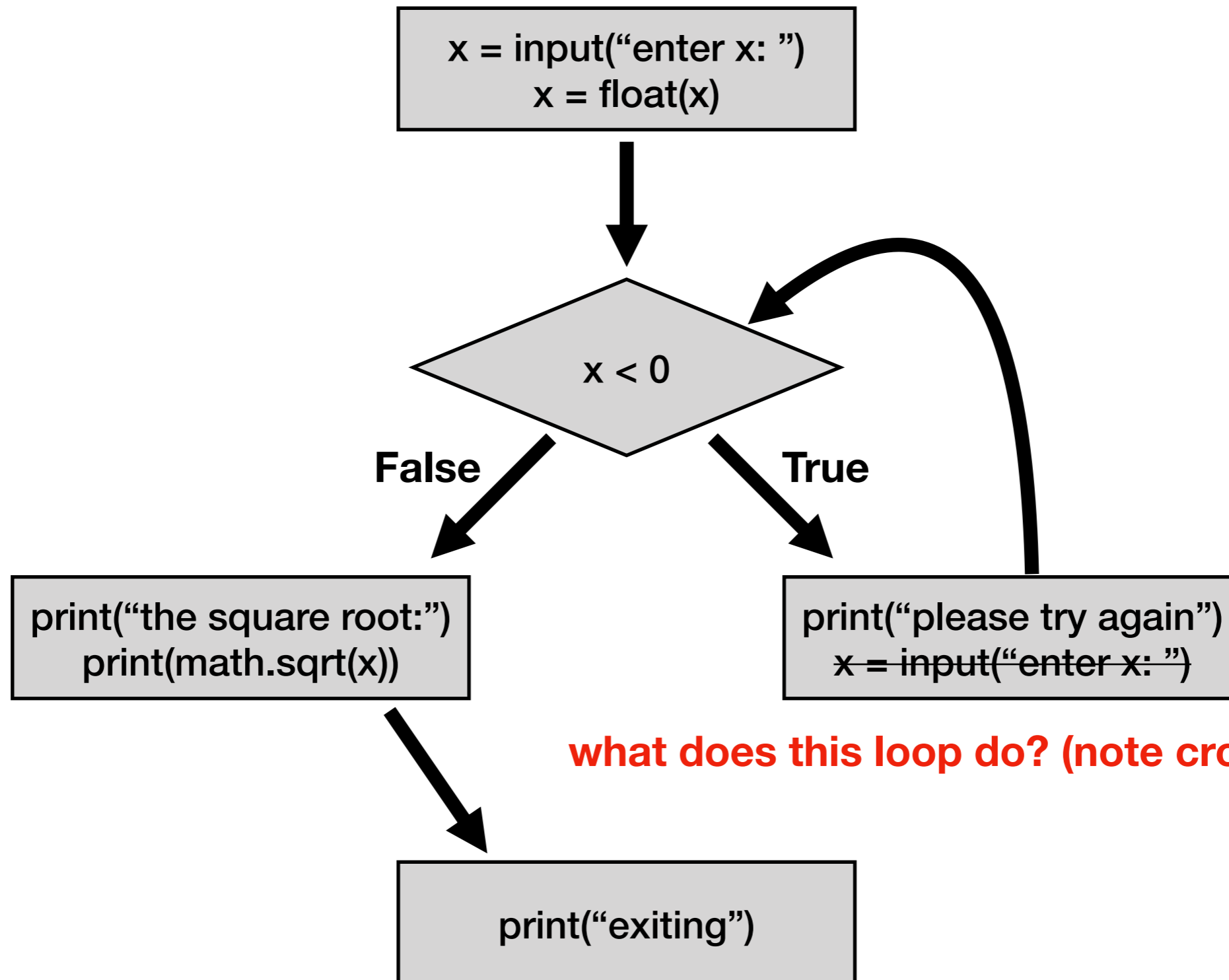
Control Flow Diagrams: "while"



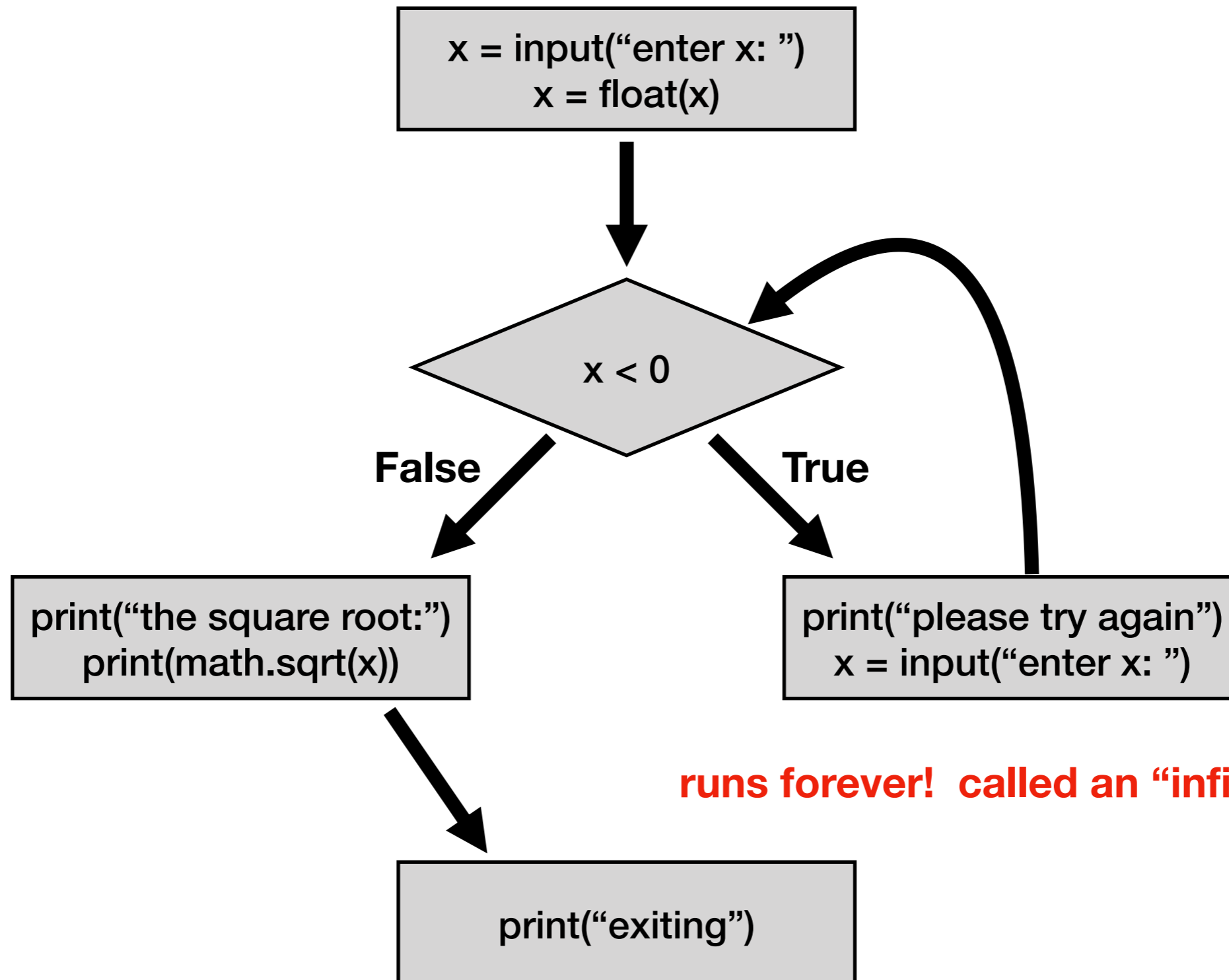
Control Flow Diagrams: “while”



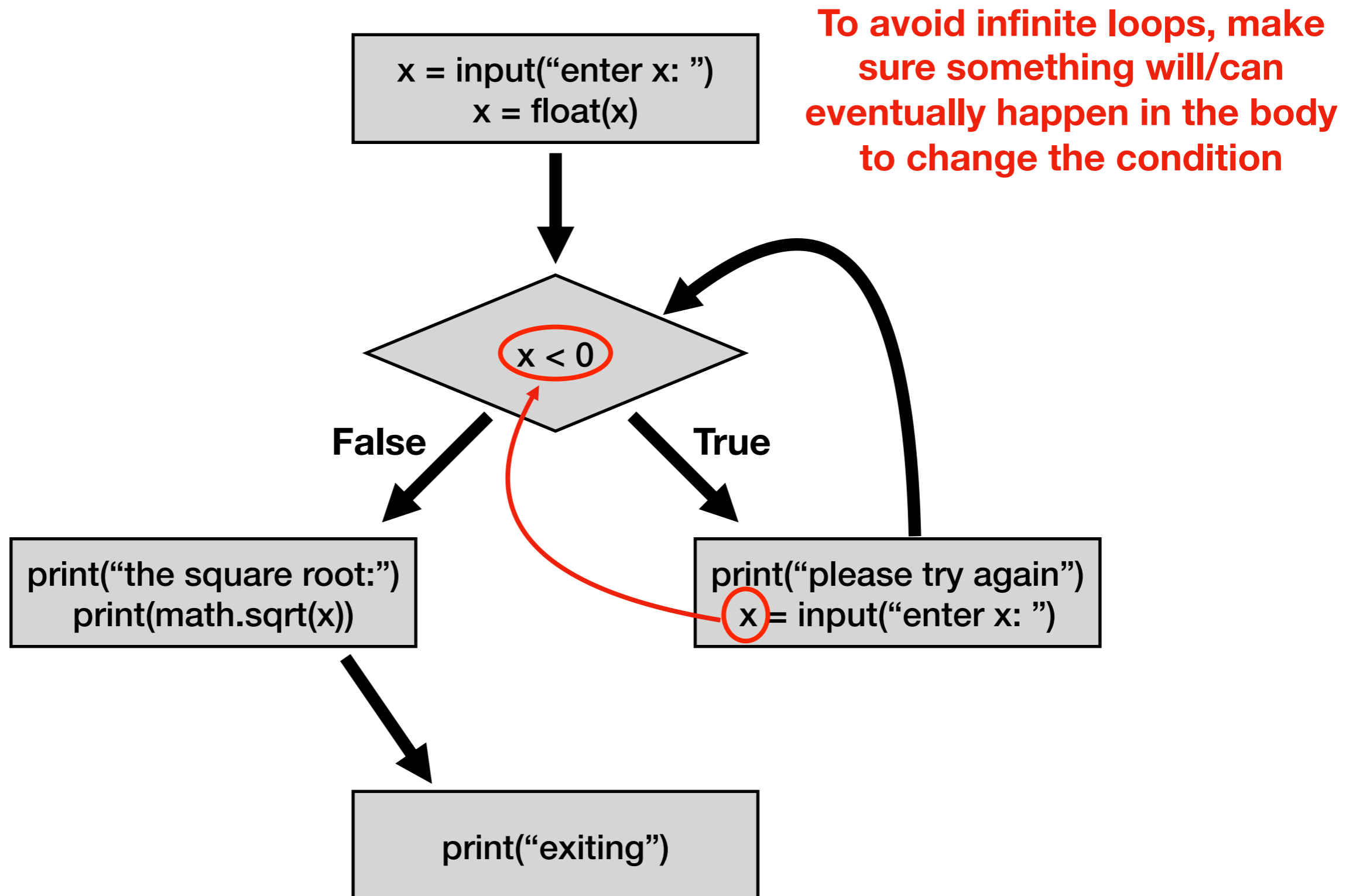
Control Flow Diagrams: “while”



Control Flow Diagrams: “while”



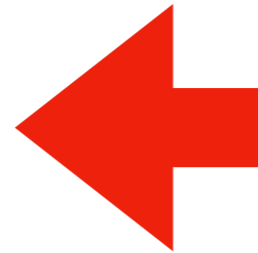
Control Flow Diagrams: “while”



Today's Outline

Control Flow Diagrams

Basic syntax for “while”



Demos

Syntax

```
x = int(input("enter x: "))
```

```
if x < 0:
```

```
    x = int(input("please try again: "))
```

Syntax for "if"

Syntax

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x = int(input("enter x: "))
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if x < 0:
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    x = int(input("please try again: "))
```

Syntax for "if"

Syntax

```
x = int(input("enter x: "))
```

```
while x < 0:  
    x = int(input("please try again: "))
```

Syntax for “while loop” is just like for “if”, just replace “if” with “while”

Syntax

```
x = int(input("enter x: "))
```

```
while x < 0:
```

```
    x = int(input("please try again: "))
```

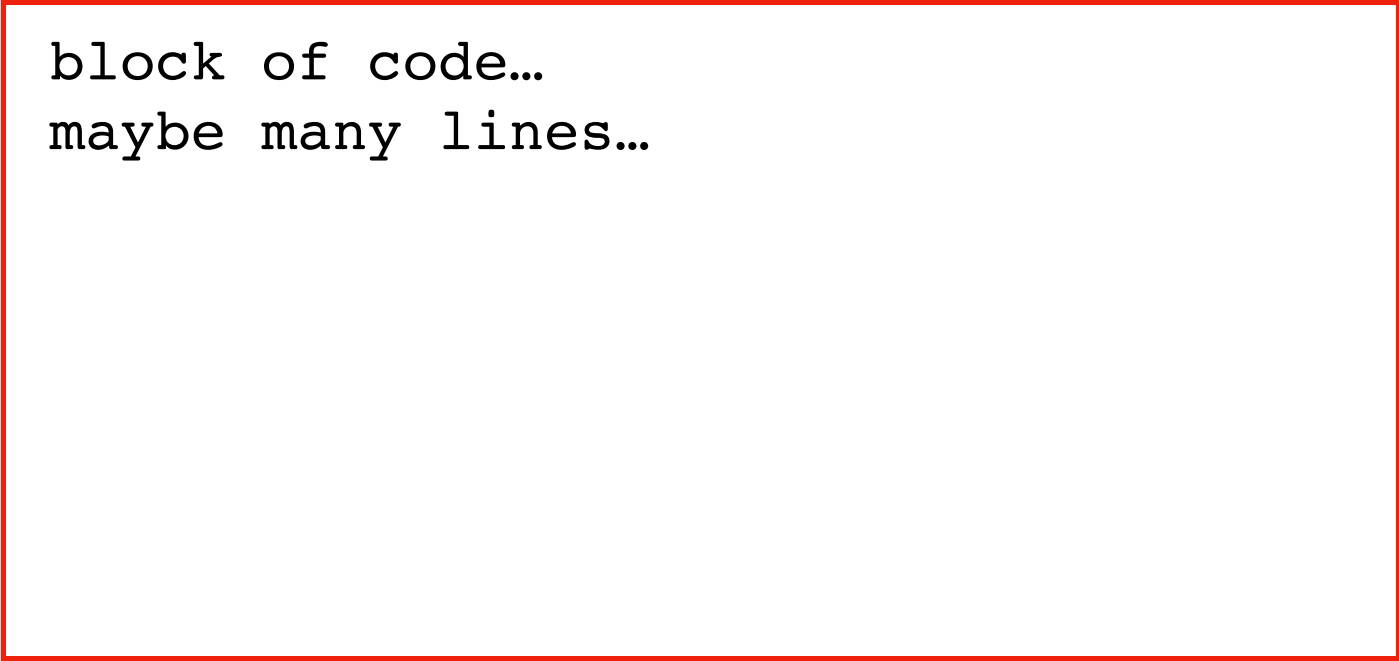
**this example gives user an arbitrary number of tries
until they get it right**

Control Flow

```
while CONDITION:  
    # your code
```


Control Flow

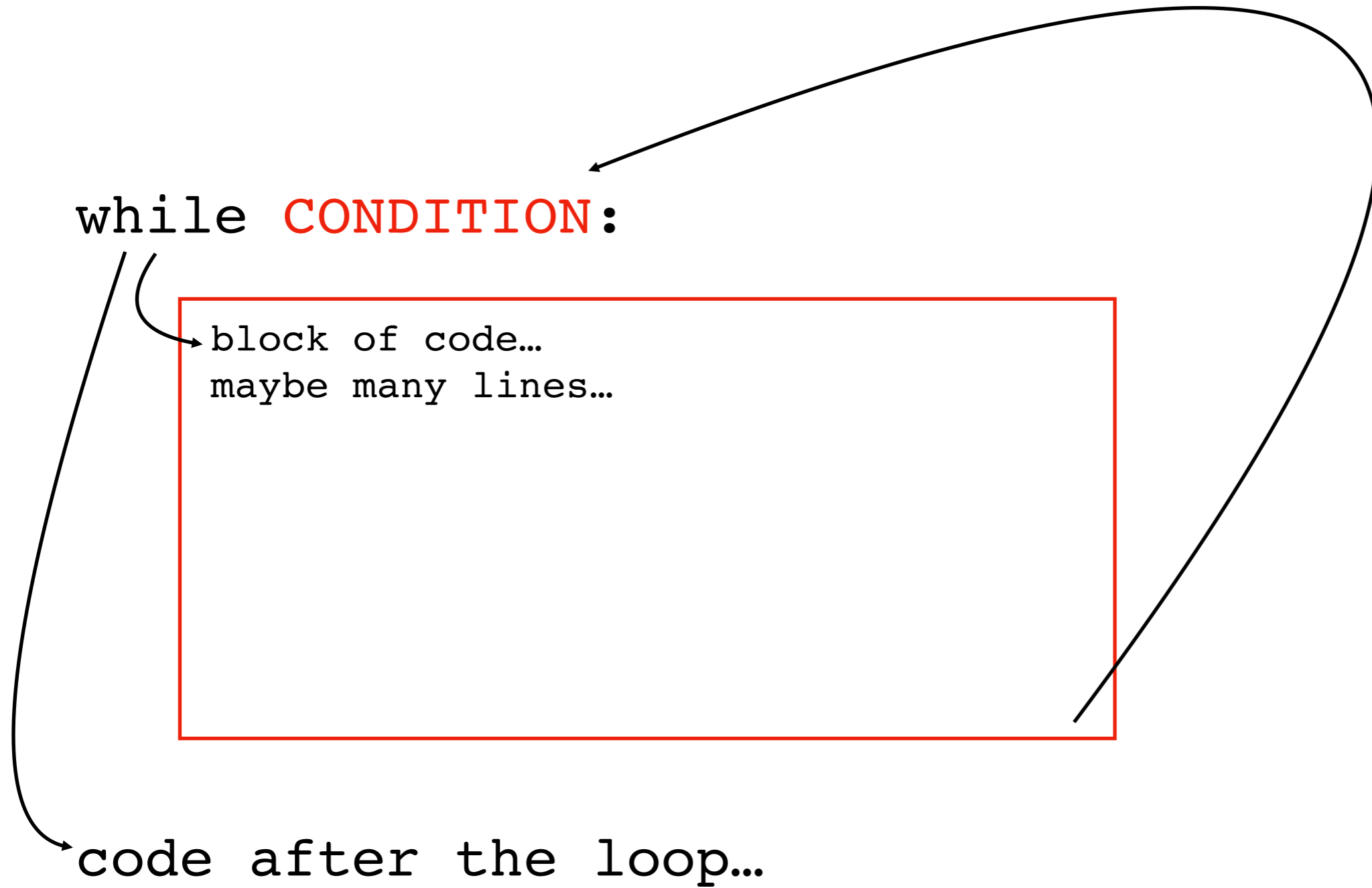
`while` **CONDITION**:



```
block of code...  
maybe many lines...
```

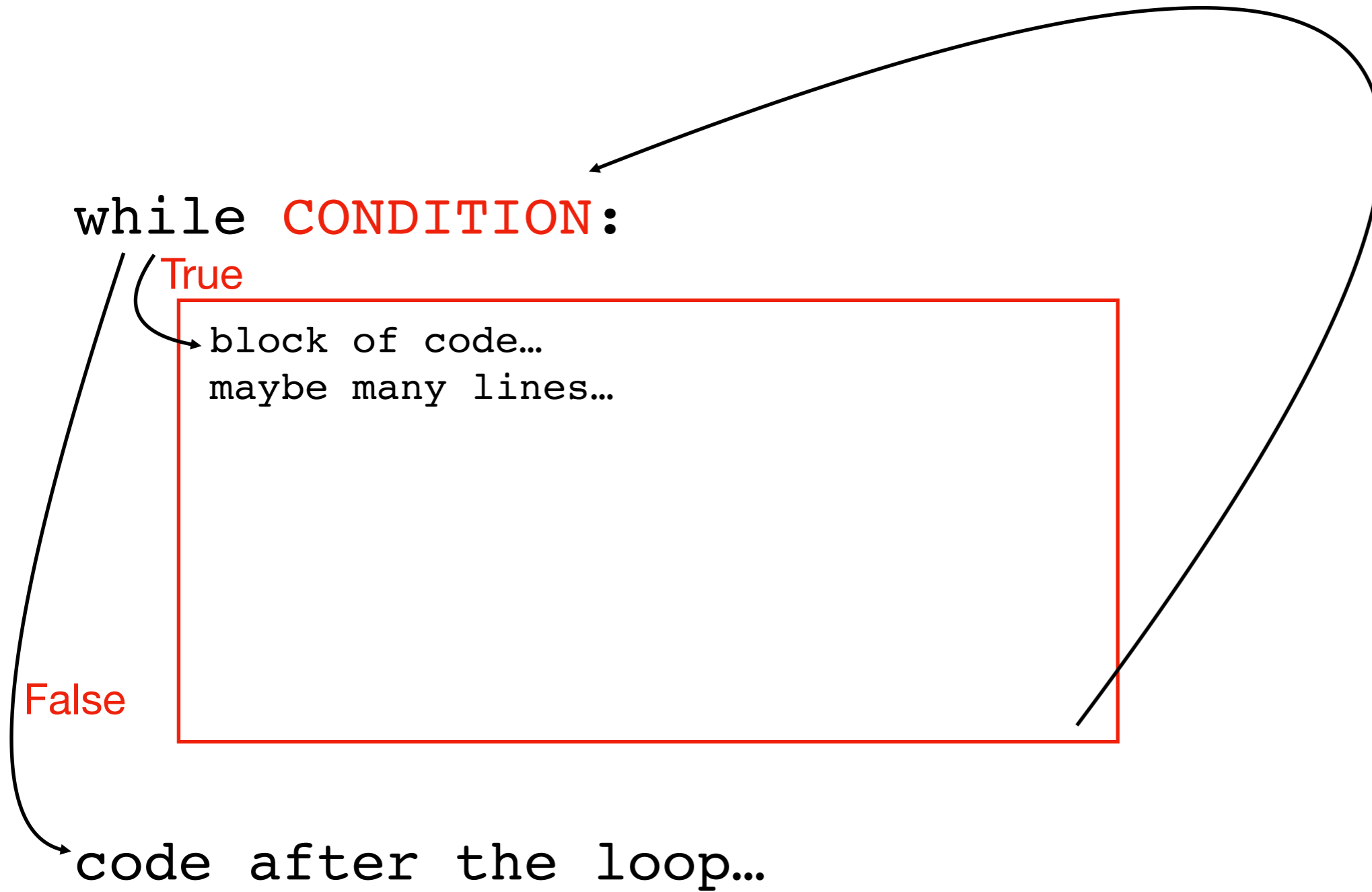
`code after the loop..`

Control Flow



Control Flow

at end, always go
back to condition check



Congrats!

You now understand the 4 key **Flow of Execution** ideas, in the context of Python.

1. **generally, proceed forward, one step at a time**

2. sometimes go run a “mini program” somewhere else before continuing to the next line

- This is a **function call**

3. sometimes skip forward over some lines of code

- **Conditional** or **while loop**, when the condition is false

4. sometimes go back to a previous line of code

- **while loop**. When at the end of body, always go back to condition

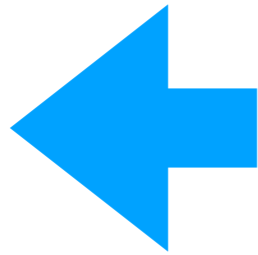
three primary exceptions to the general case (1)

Today's Outline

Control Flow Diagrams

Basic syntax for “while”

Demos



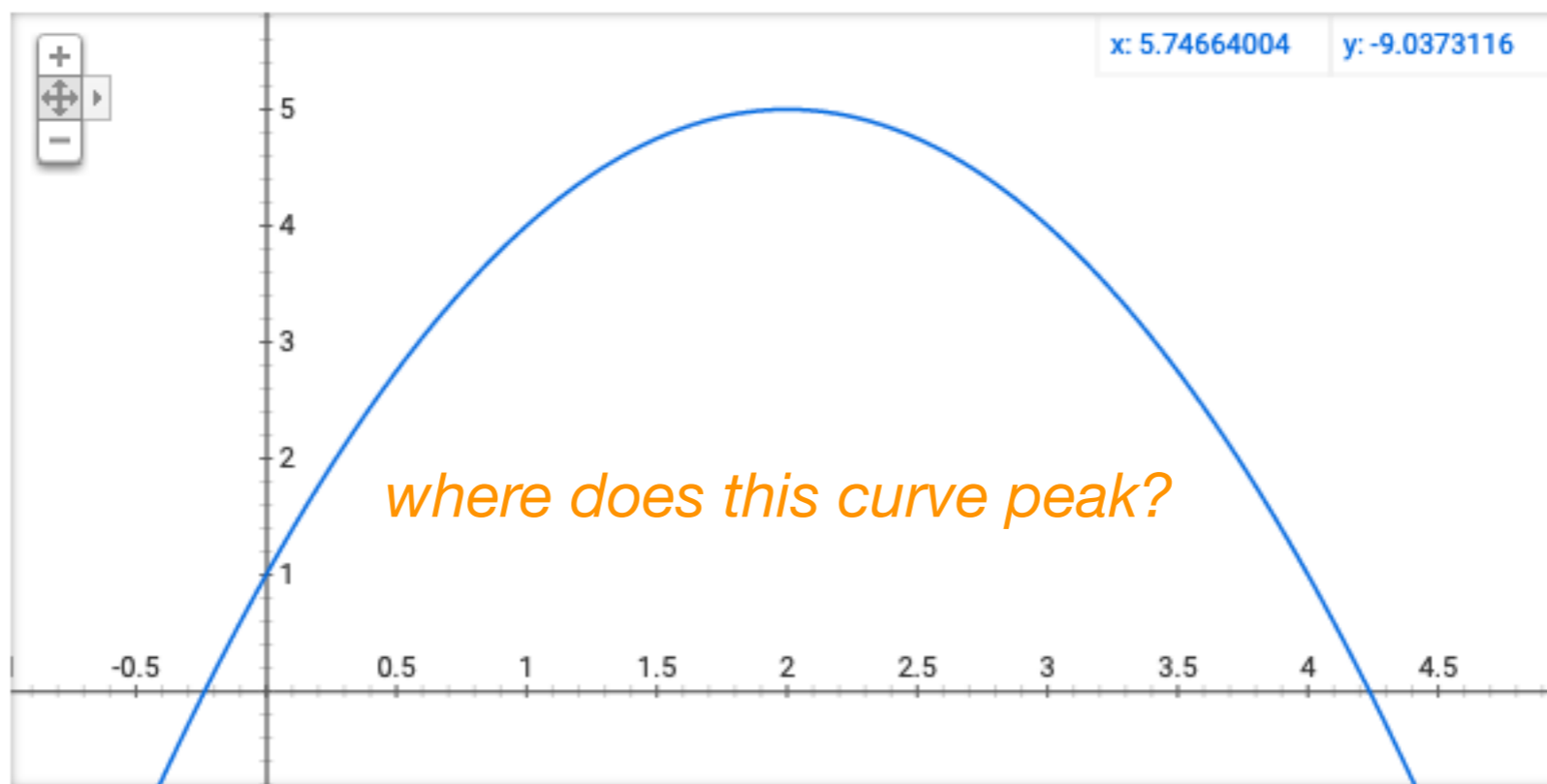
Demo: Maximum (Finding the Peak)

$y = 5 - (x - 2)^{**} 2$  

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About 16,290,000,000 results (0.65 seconds)

Graph for $5 - (x - 2)^2$



[More info](#)

Demo: Countdown Timer

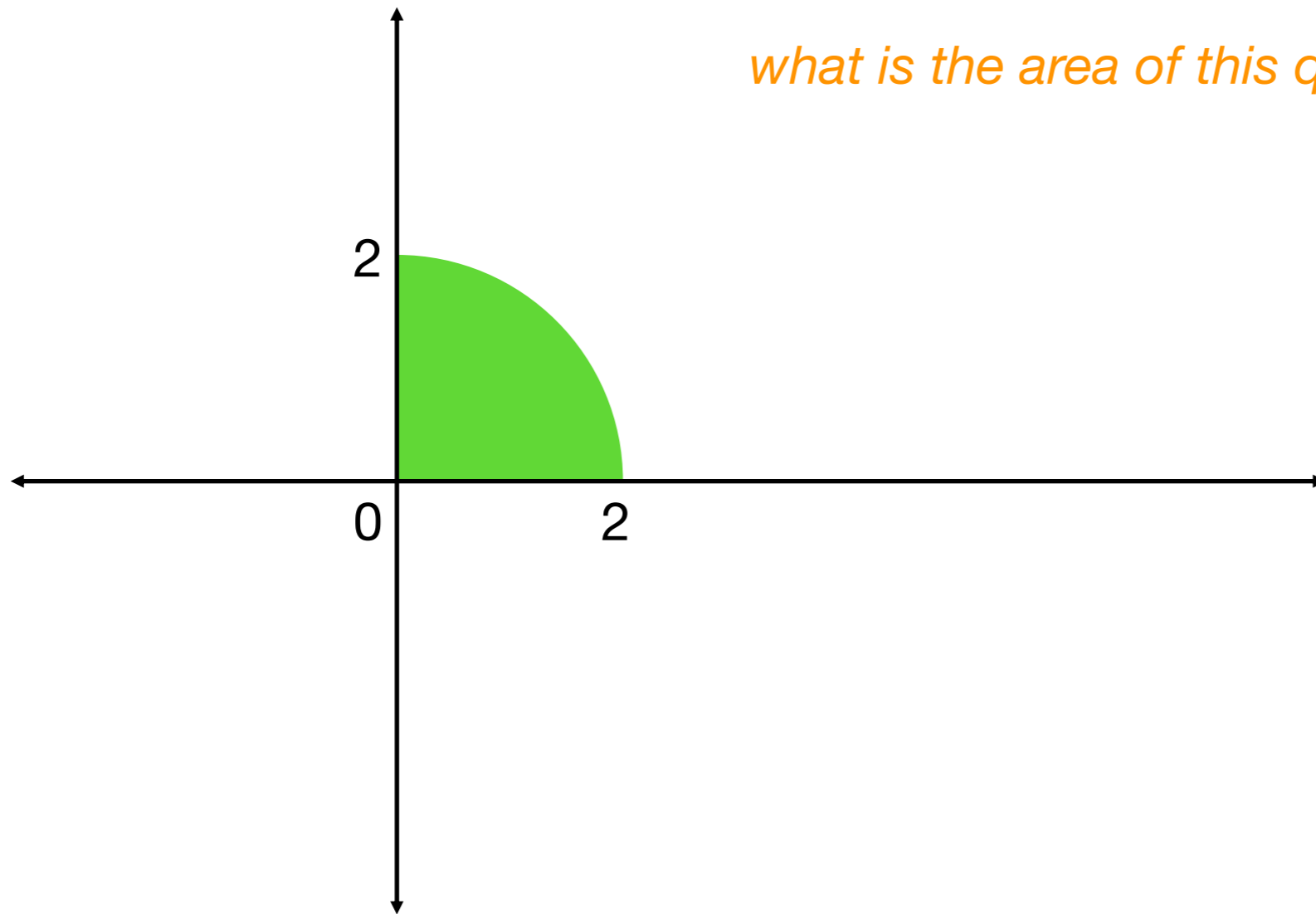
use `time.sleep(1)` →

```
how many seconds? 5
5
4
3
2
1
DING DING DING DING DING!
how many seconds? 2
2
1
0
DING DING DING DING DING!
how many seconds? q
good bye!
```

← exit program

this program will involve a nested loop!!!

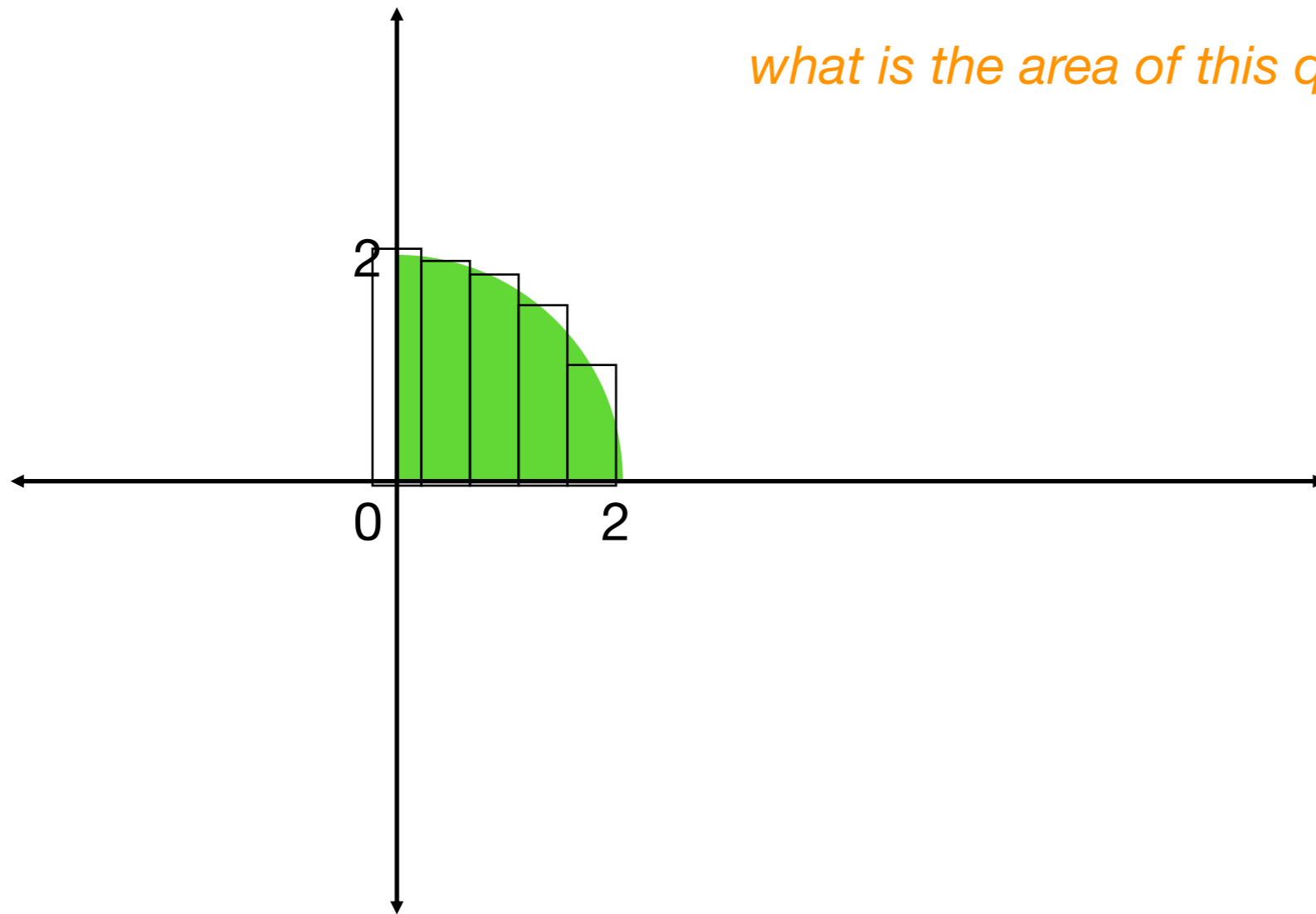
Demo: Integration (Finding the area)



what is the area of this quarter circle?

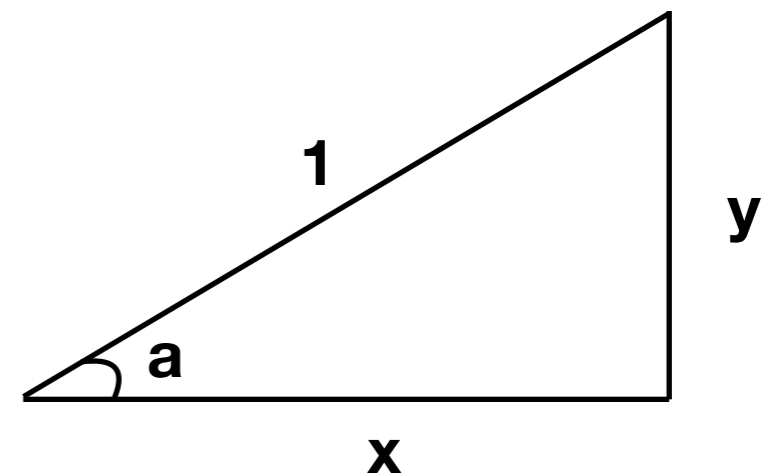
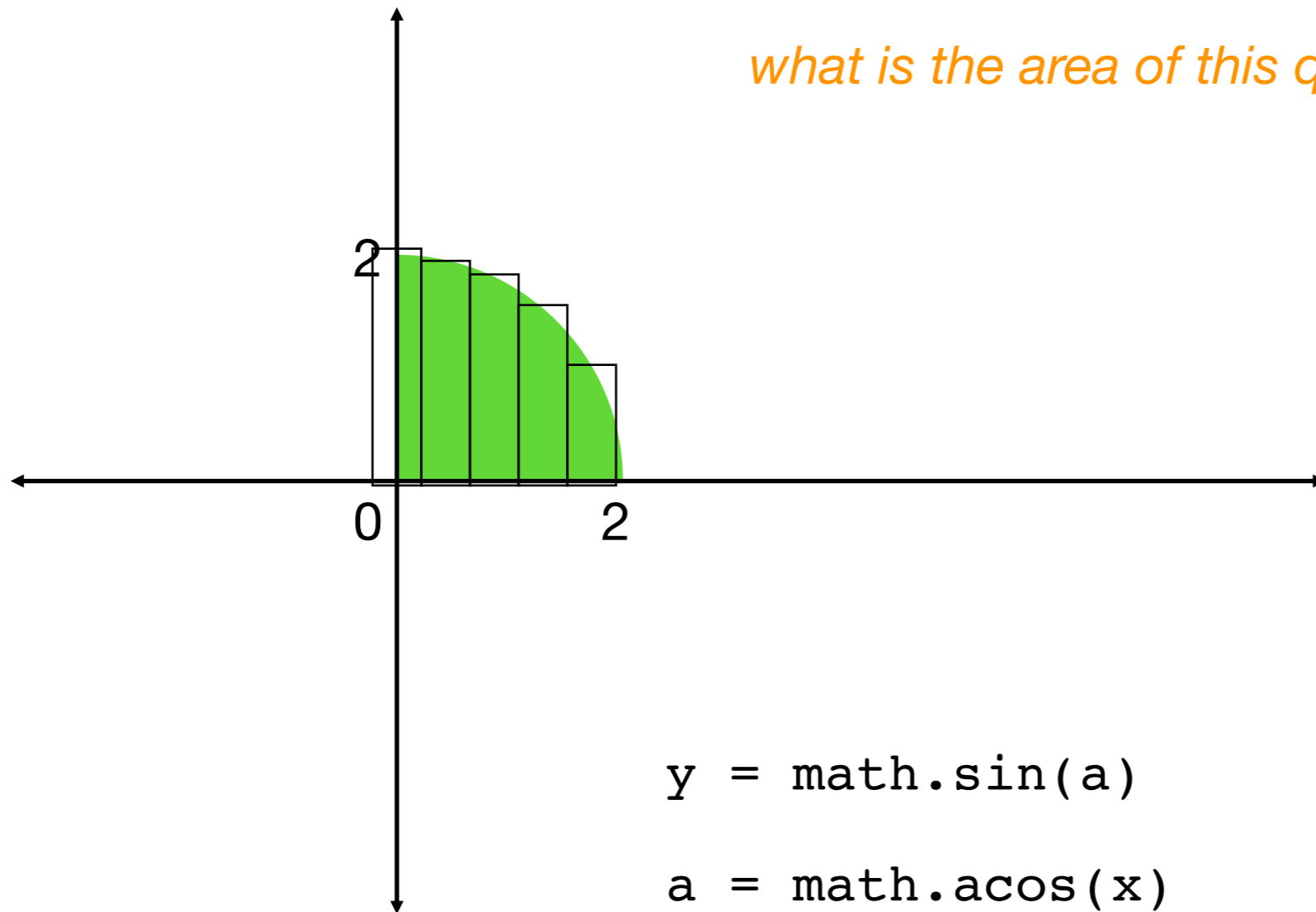
Demo: Integration (Finding the area)

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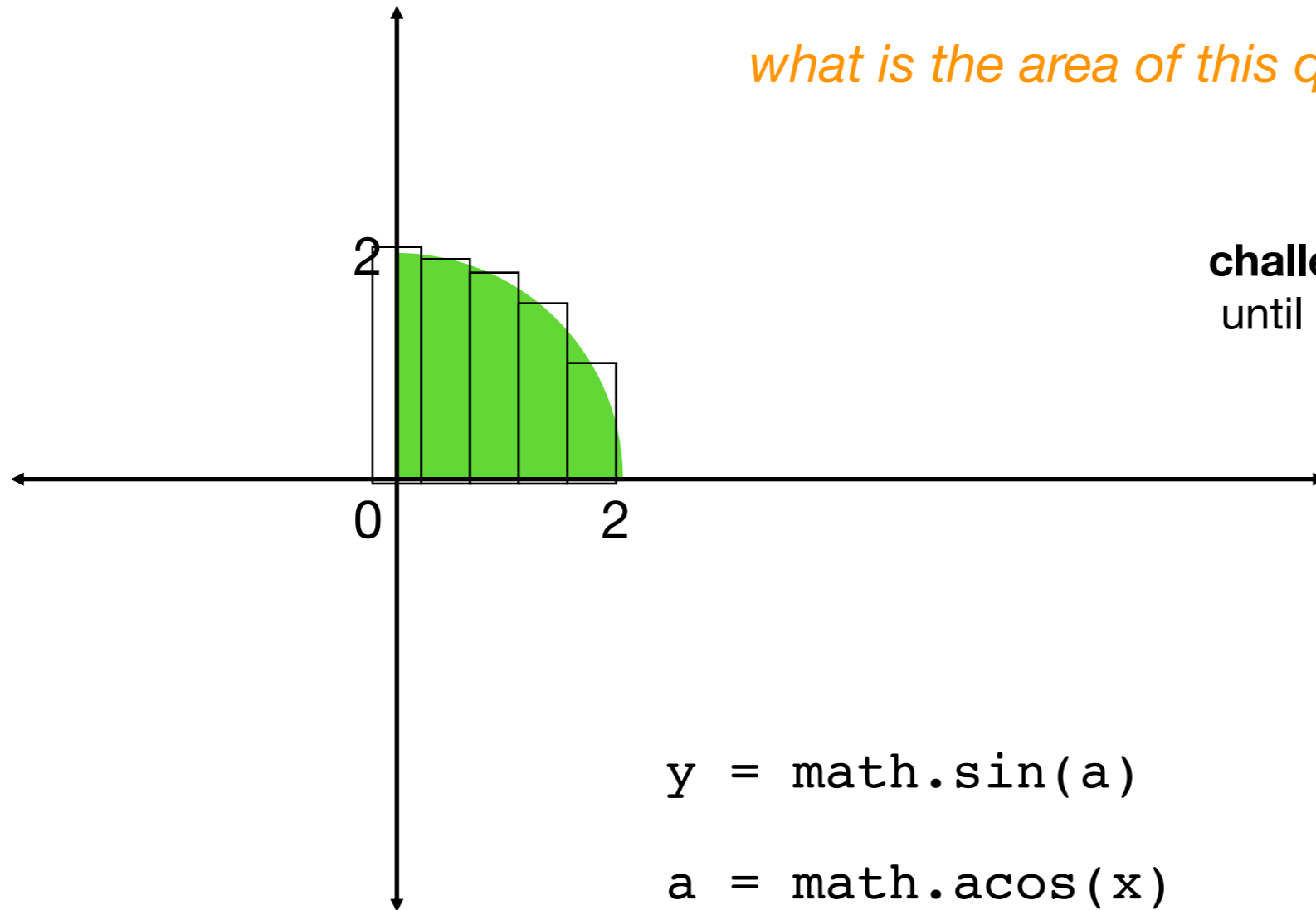
Demo: Integration (Finding the area)

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Demo: Integration (Finding the area)

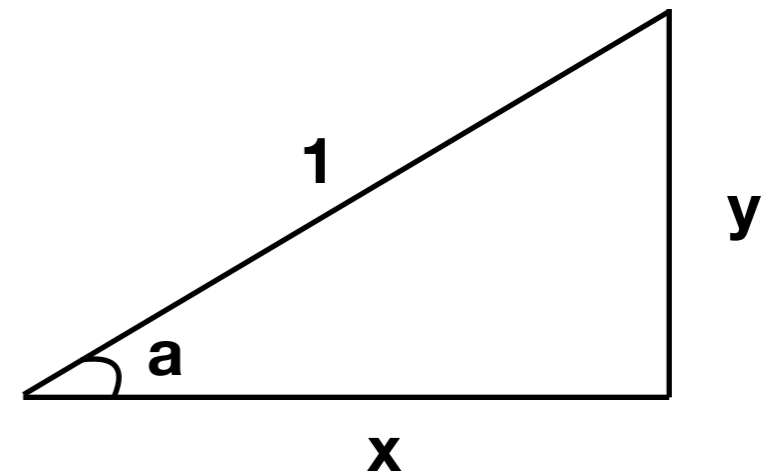
what is the area of this quarter circle?



challenge: keep using narrower slices until it doesn't make much difference

$$y = \text{math.sin}(a)$$

$$a = \text{math.acos}(x)$$



Demo: Prime Finder

Here are a "few" primes:

2

3

5

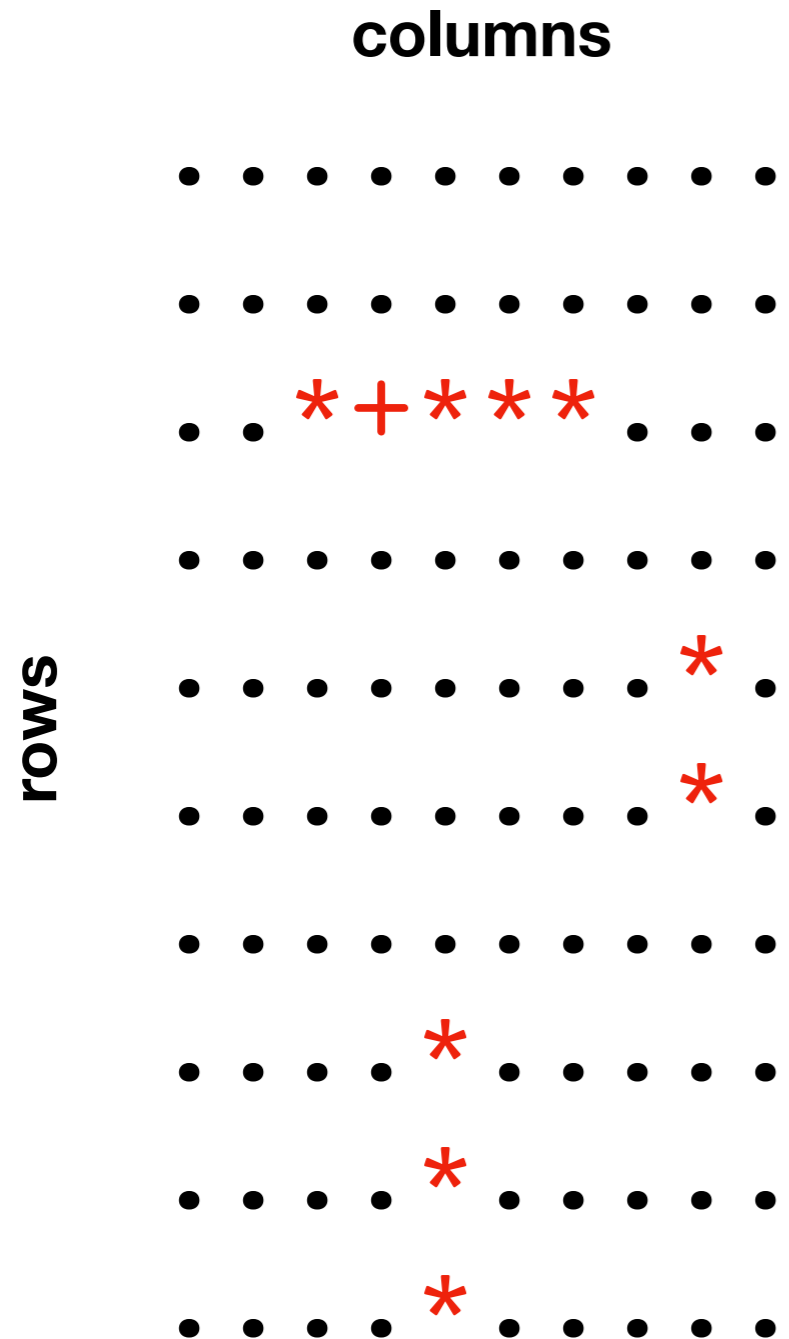
7

11

13

... runs forever ...

Demo: Battleship



show where ship(s) are after guess

guess and ship: +
just ship: *
guess and miss: -
blank spot: .