

# [301] Iteration

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# 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

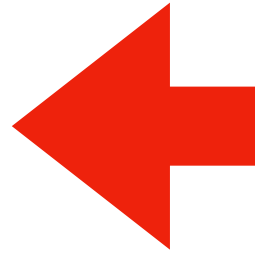
continue to loop body

loop body

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# Today's Outline

Control Flow Diagrams

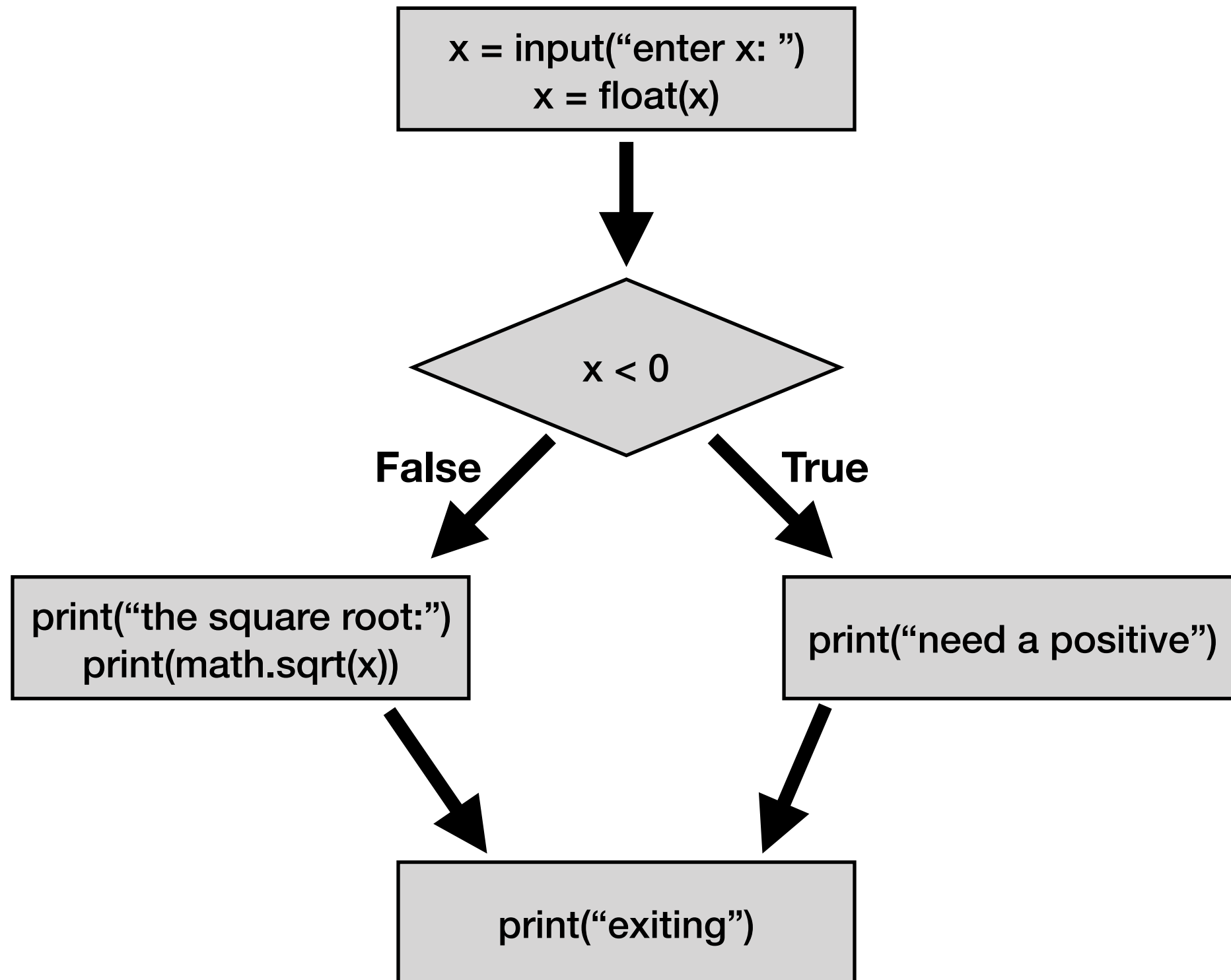


Basic syntax for “while”

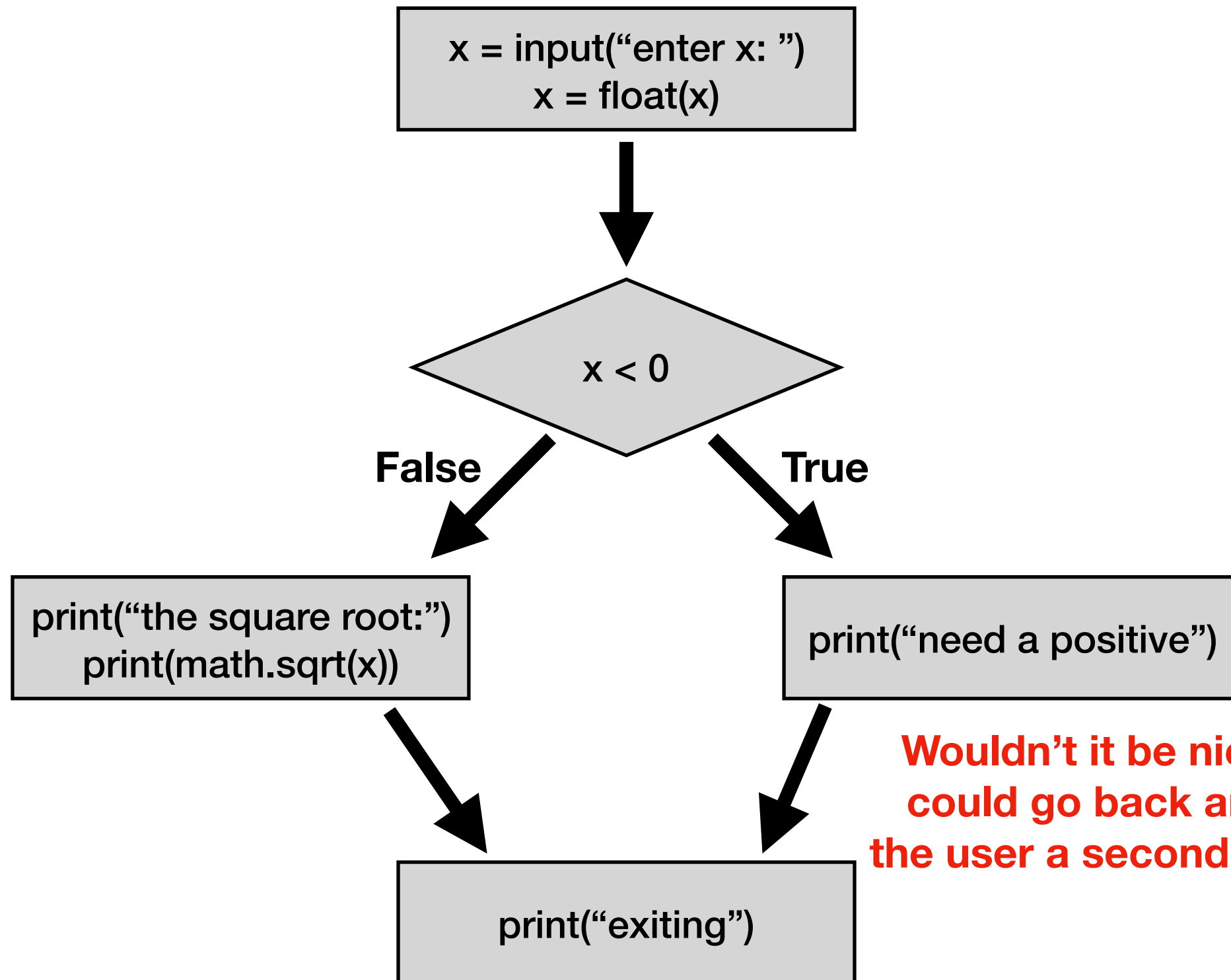
*Demos*



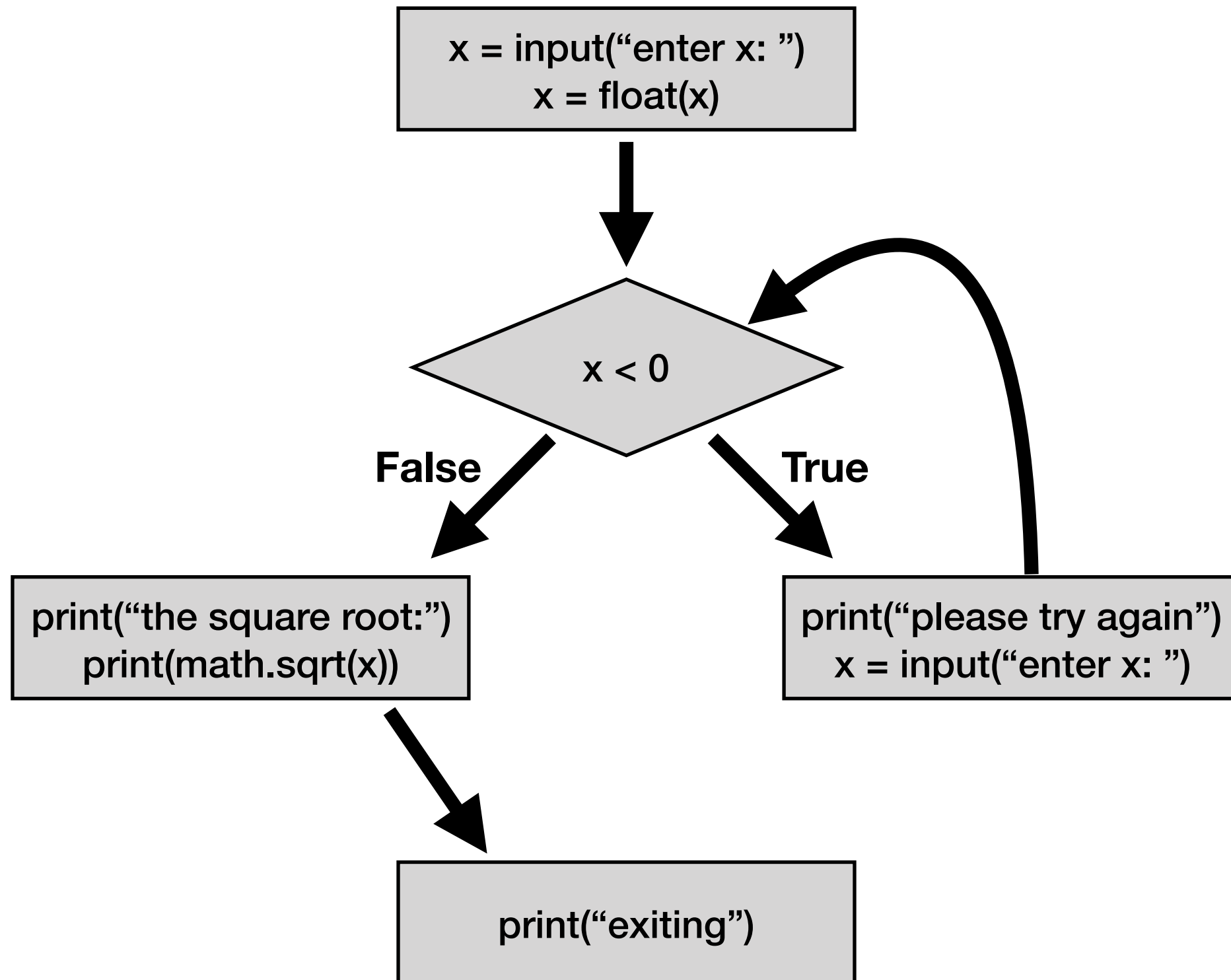
# Control Flow Diagrams: “if”



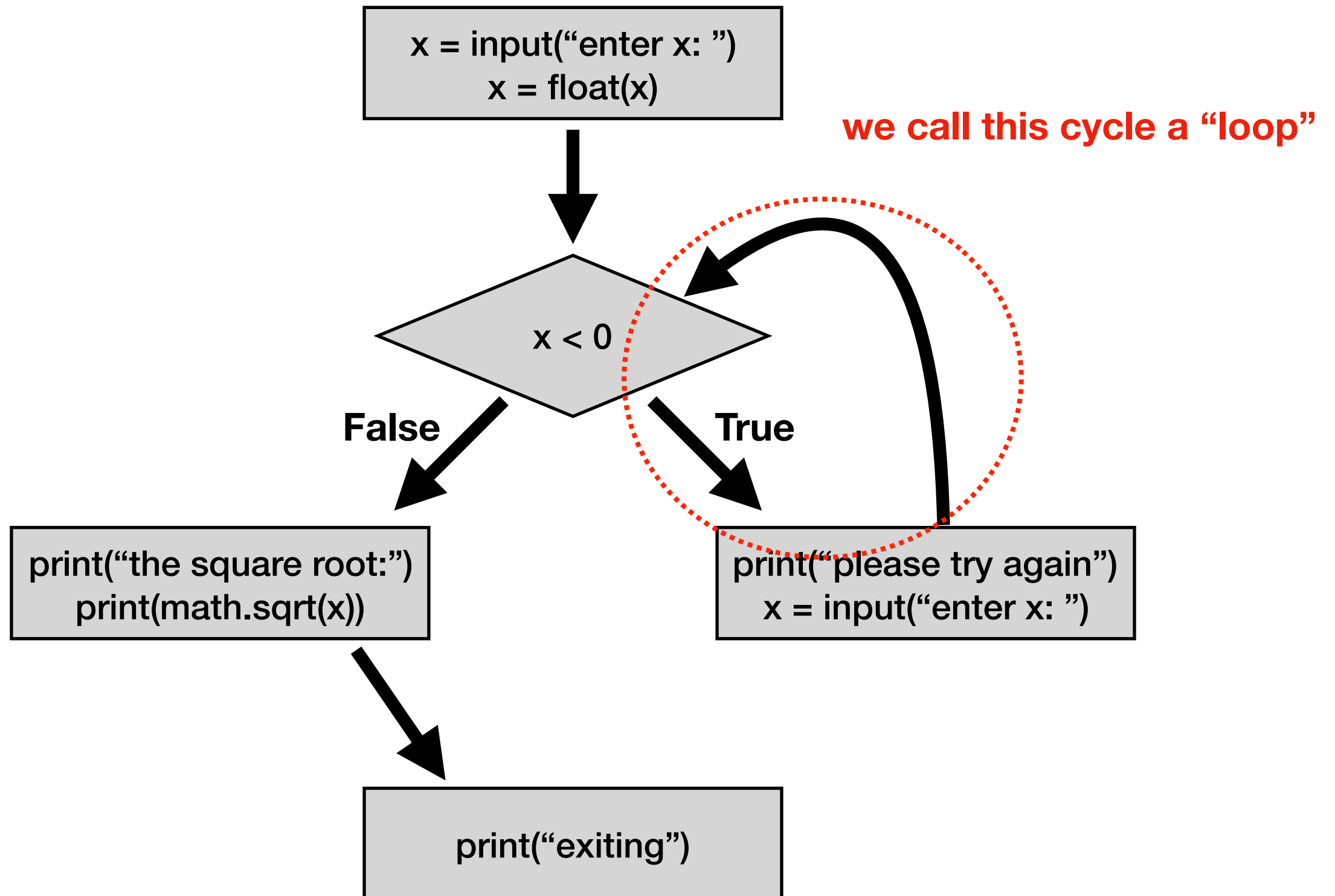
# Control Flow Diagrams: “if”



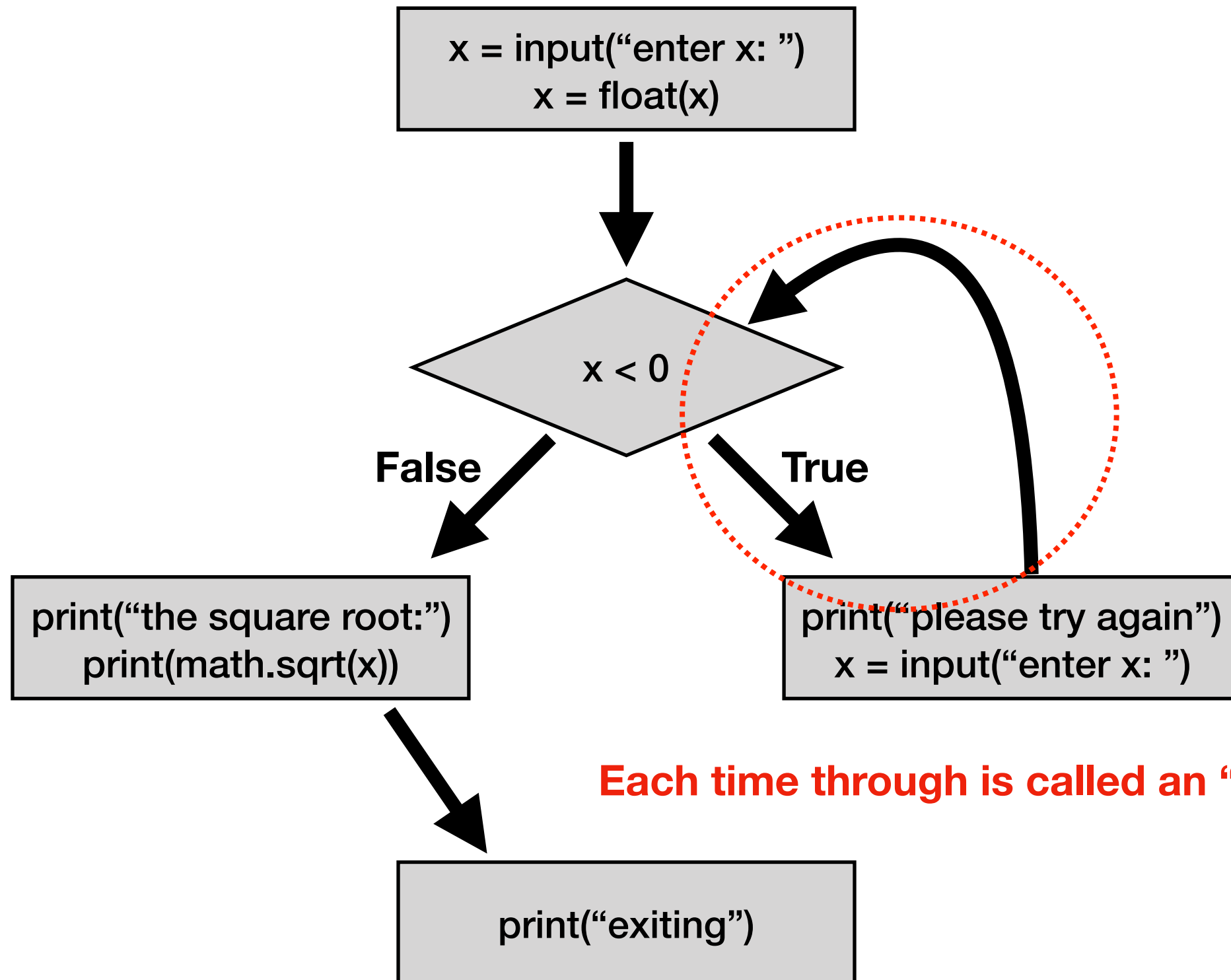
# Control Flow Diagrams: “while”



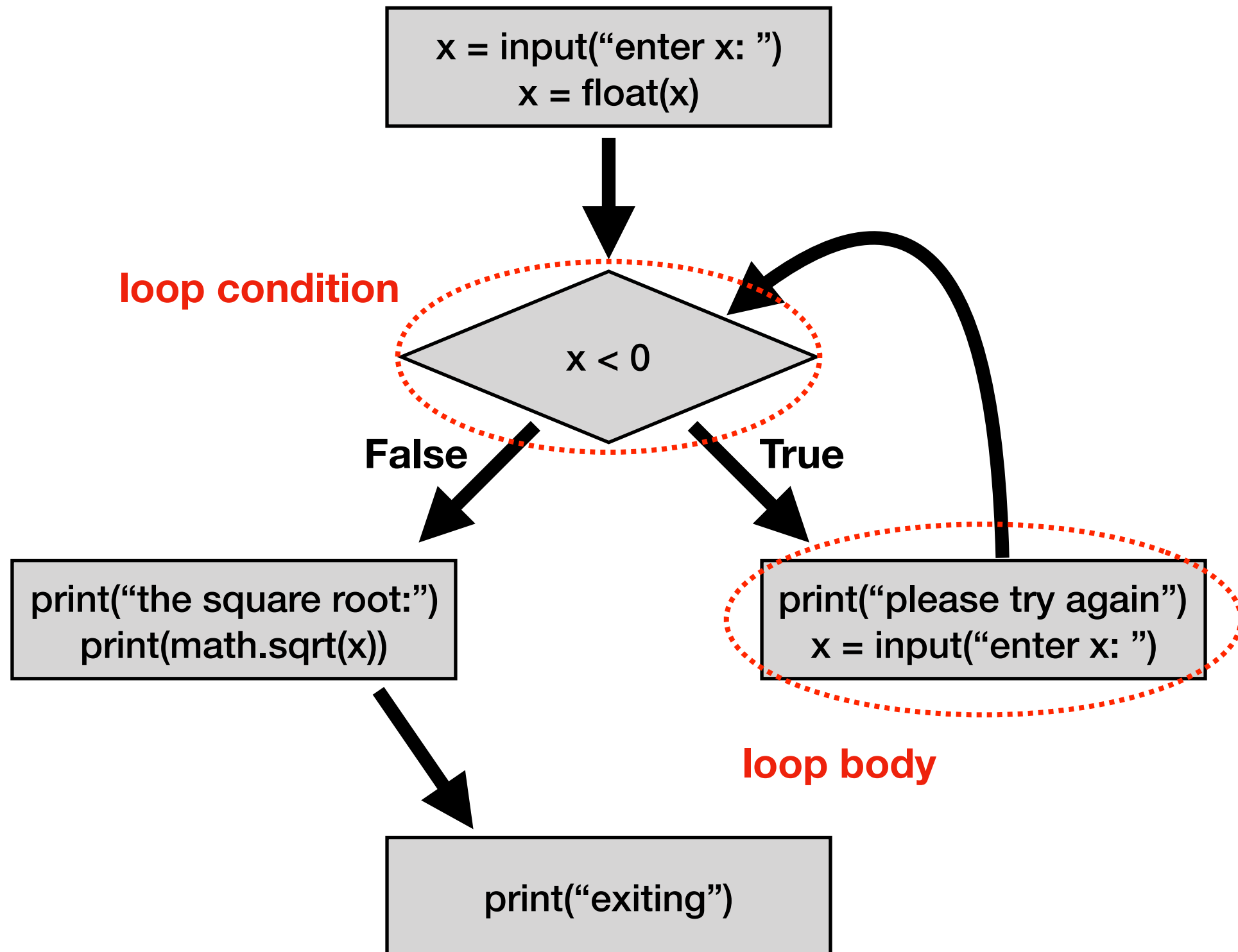
# Control Flow Diagrams: “while”



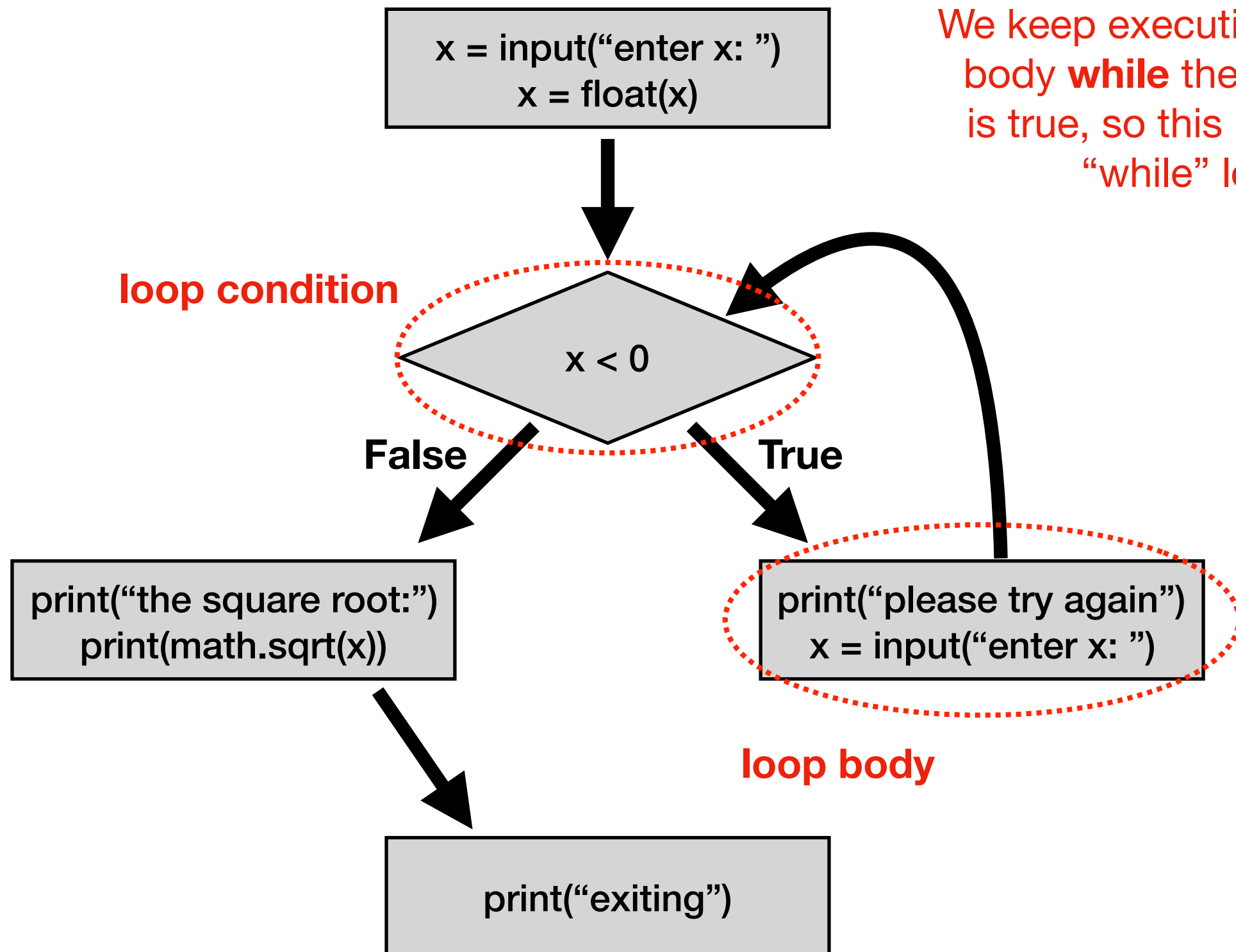
# Control Flow Diagrams: “while”



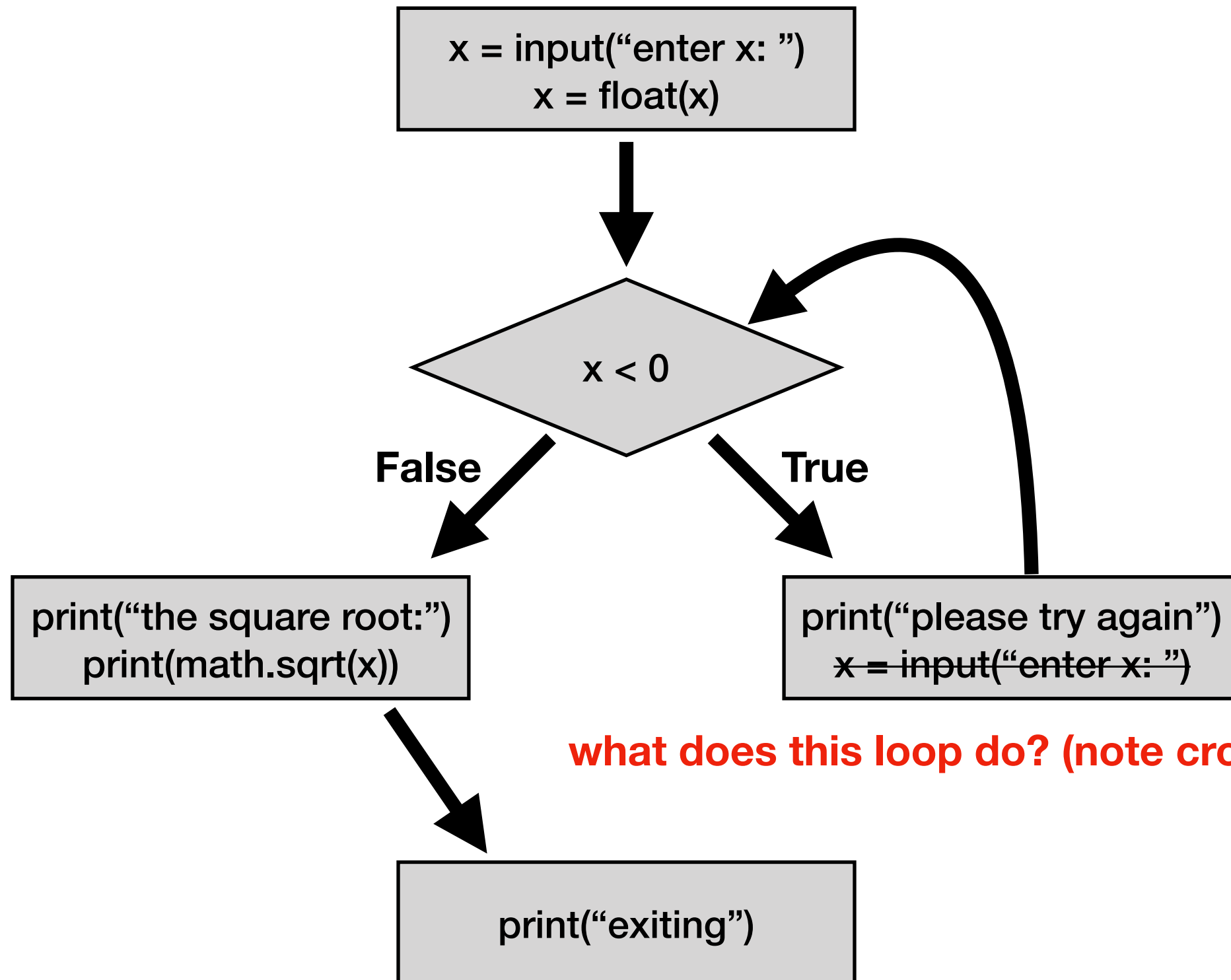
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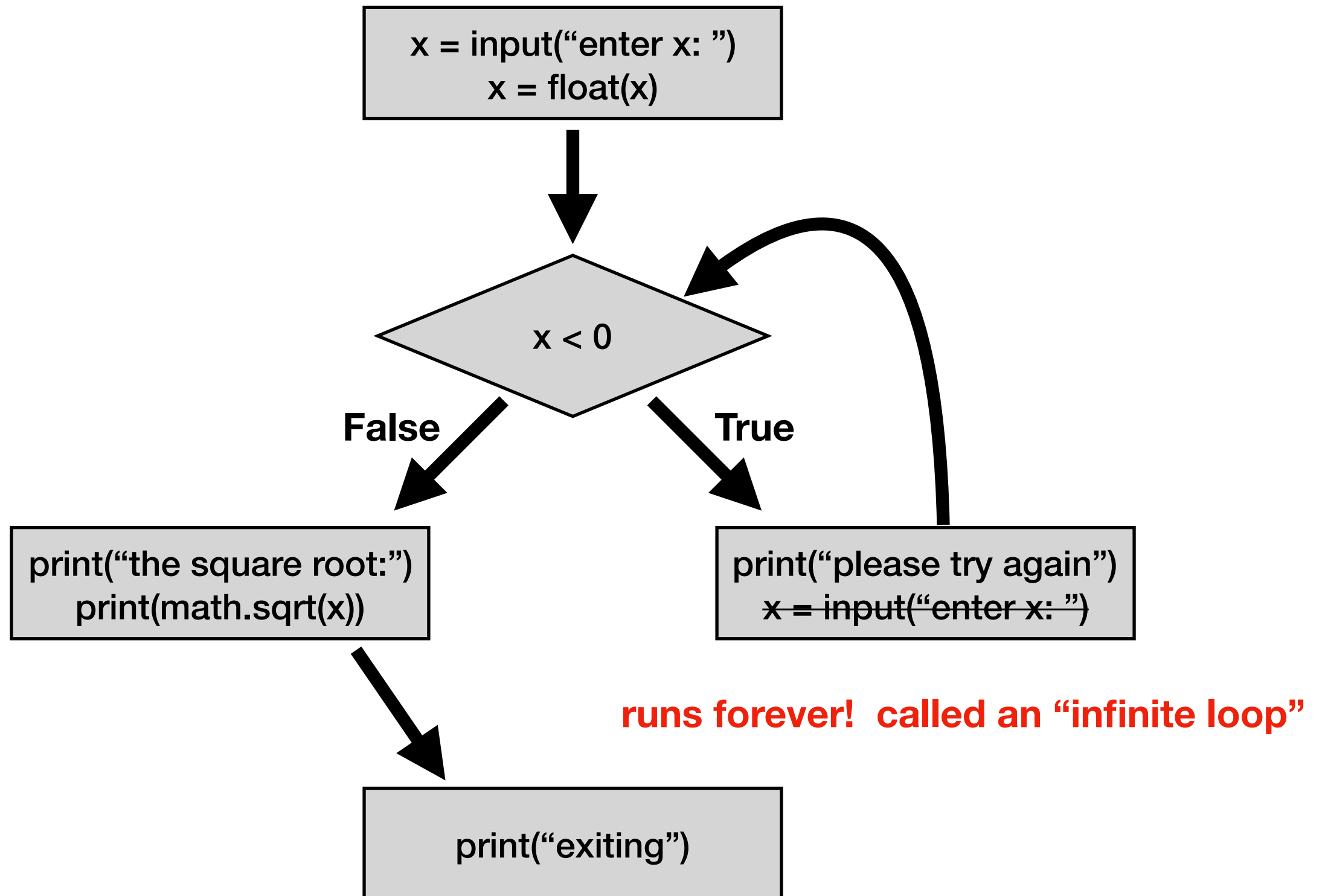
# Control Flow Diagrams: “while”



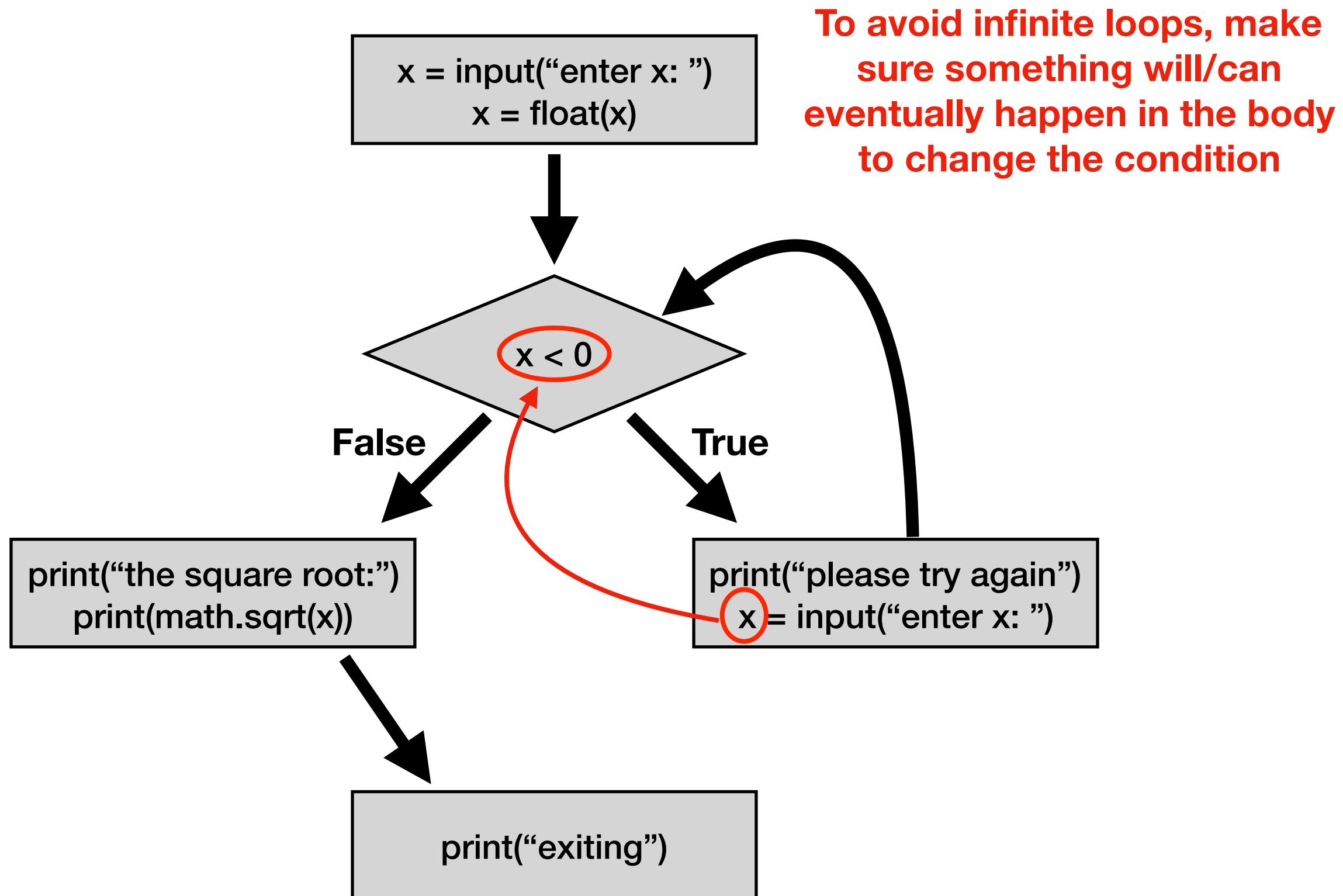
what does this loop do? (note crossed out line)



# Control Flow Diagrams: “while”



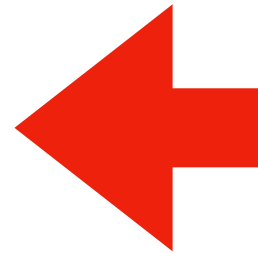
# Control Flow Diagrams: “while”



# 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”**

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**Syntax for “if”**

# Syntax

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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**

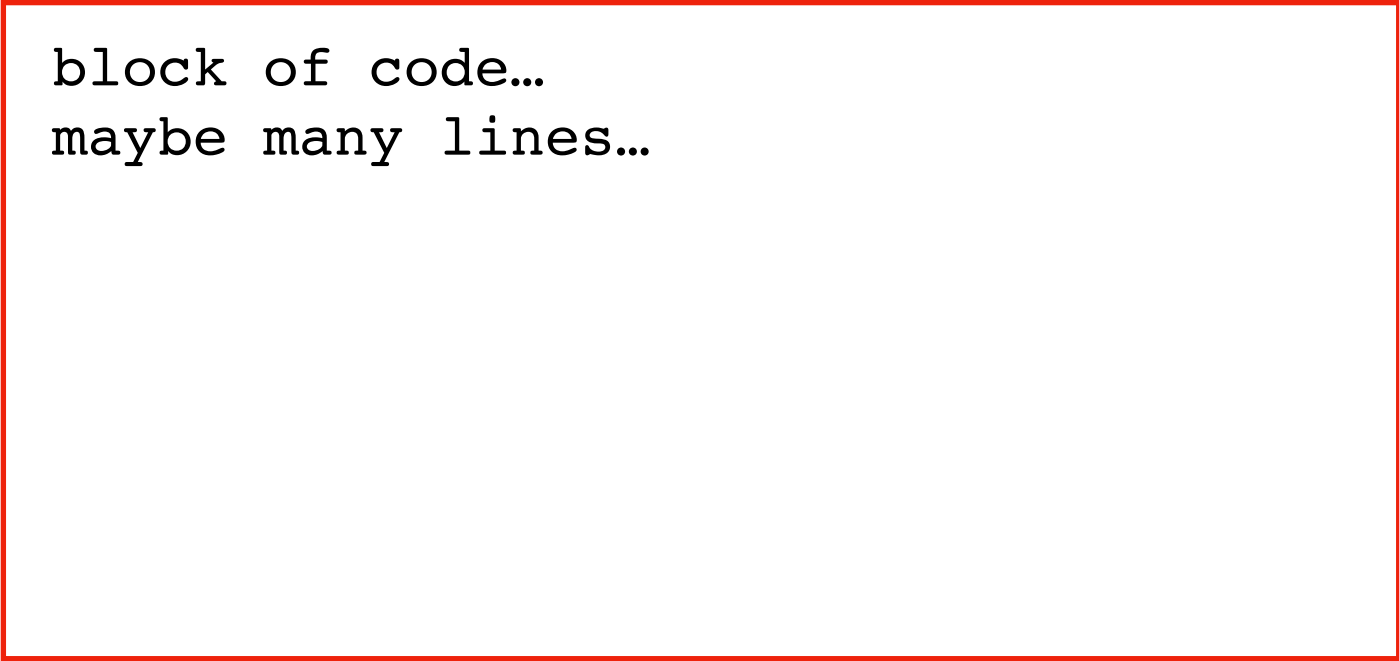
# Control Flow

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



# Control Flow

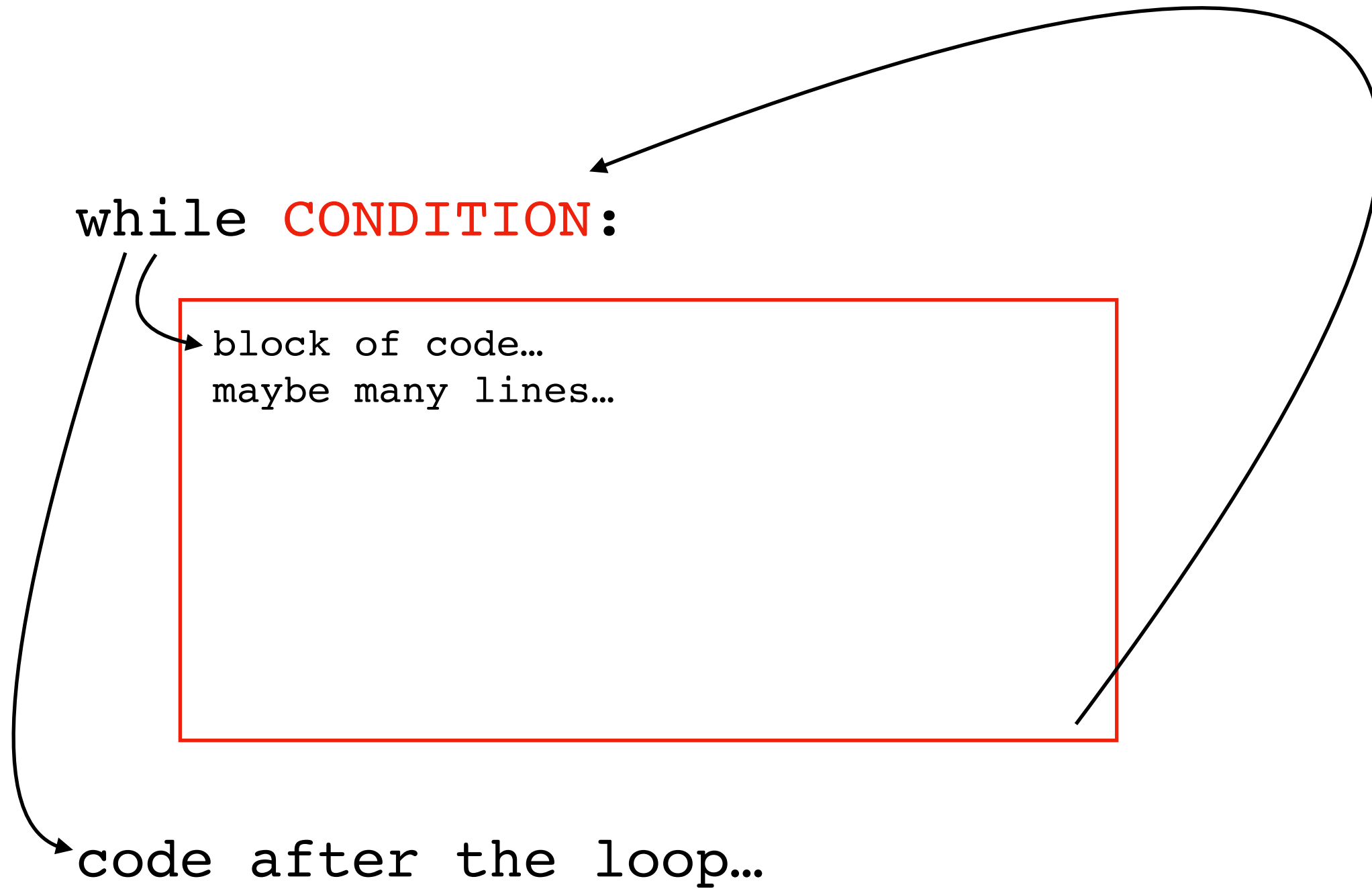
`while` **CONDITION**:



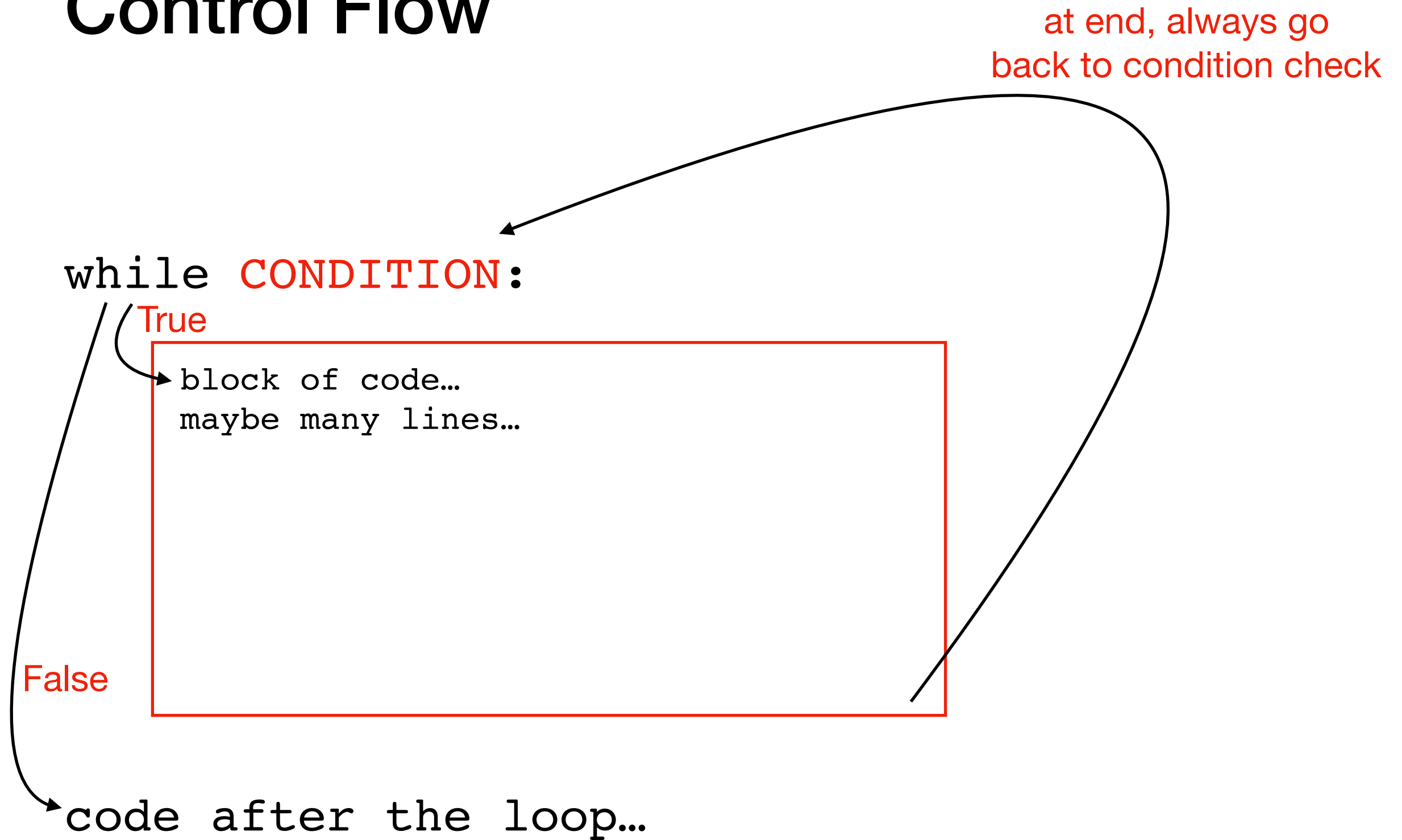
block of code...  
maybe many lines...

code after the loop...

# Control Flow



# Control Flow



# 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

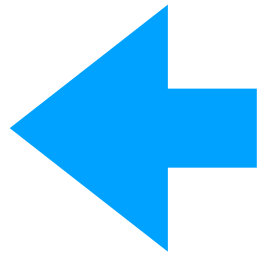
three primary exceptions to the general case (1)

# Today's Outline

Control Flow Diagrams

Basic syntax for “while”

*Demos*



# Demo: Maximum (Finding the Peak)

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

All

Shopping

Videos

Images

News

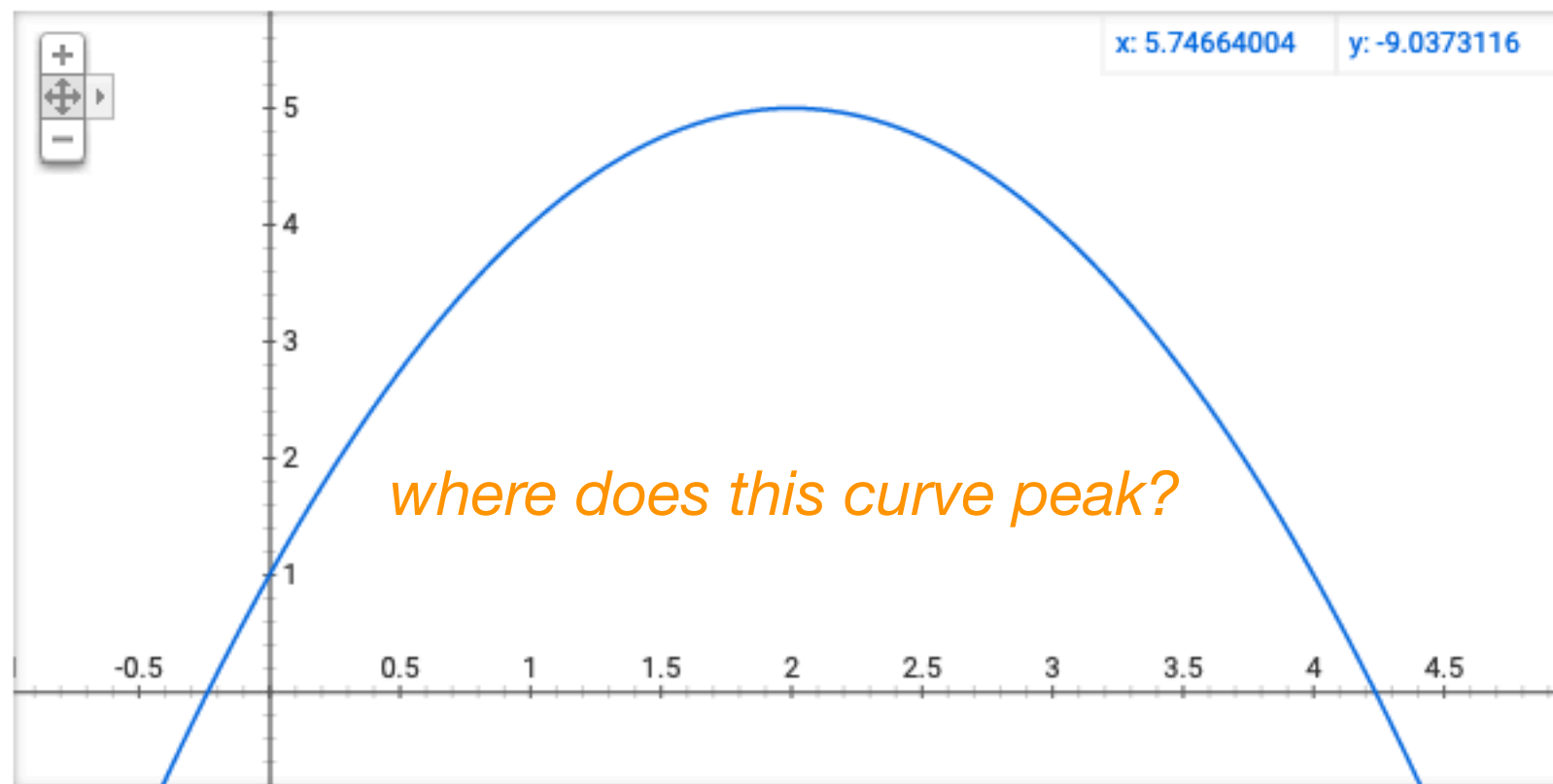
More

Settings

Tools

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

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



[More info](#)

# Demo: Countdown Timer

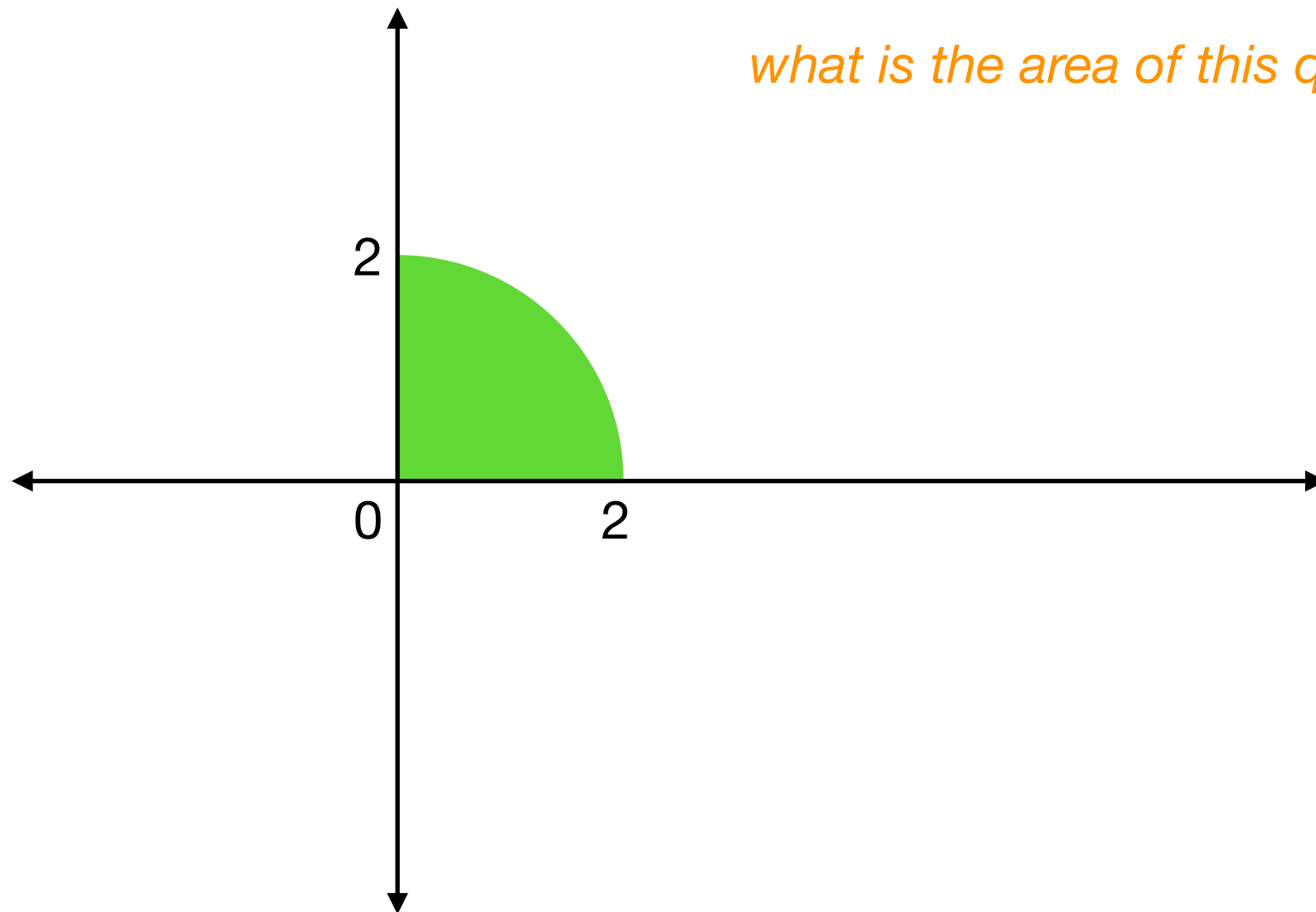
use `time.sleep(1)` →

```
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!!!

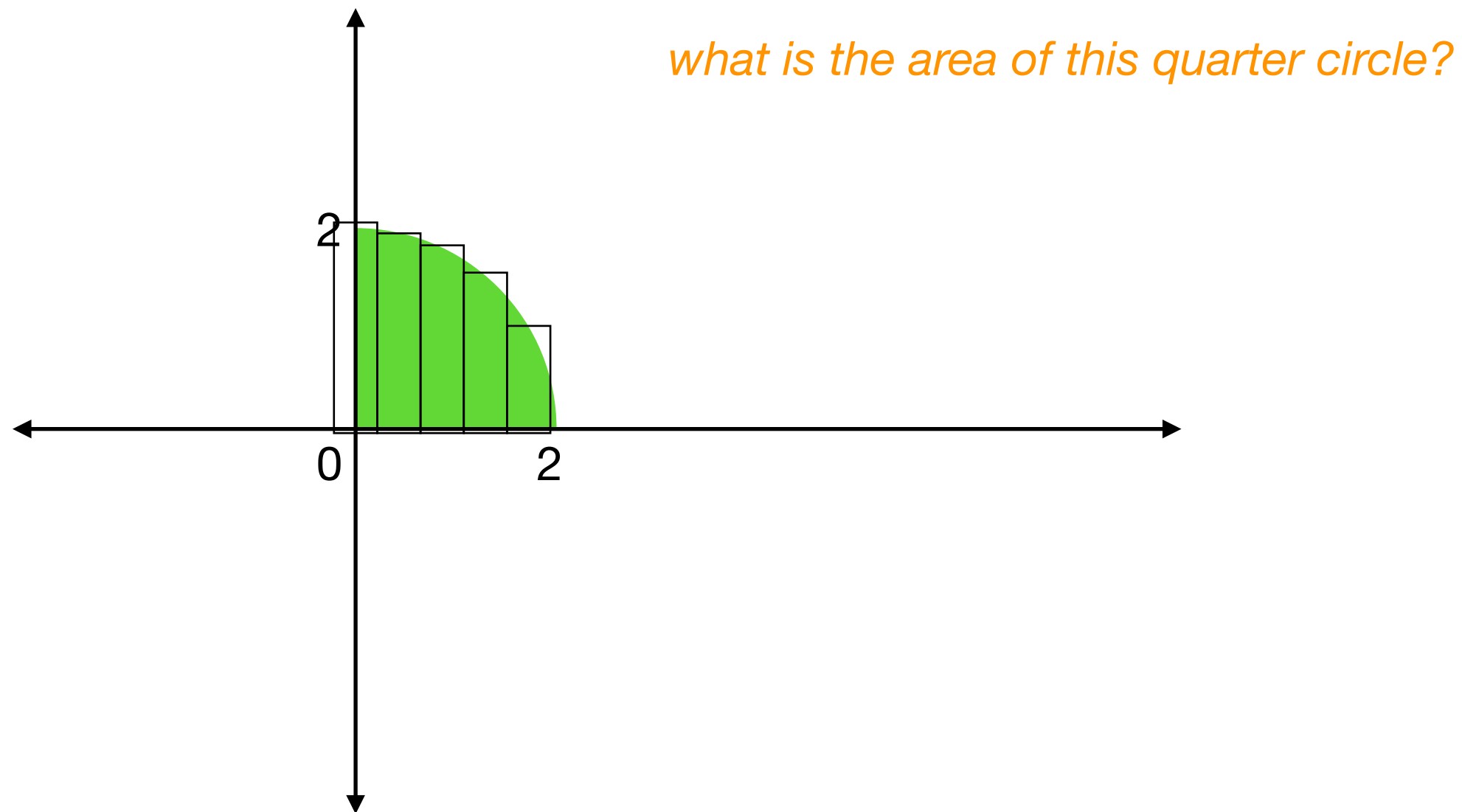
# Demo: Integration (Finding the area)



*what is the area of this quarter circle?*

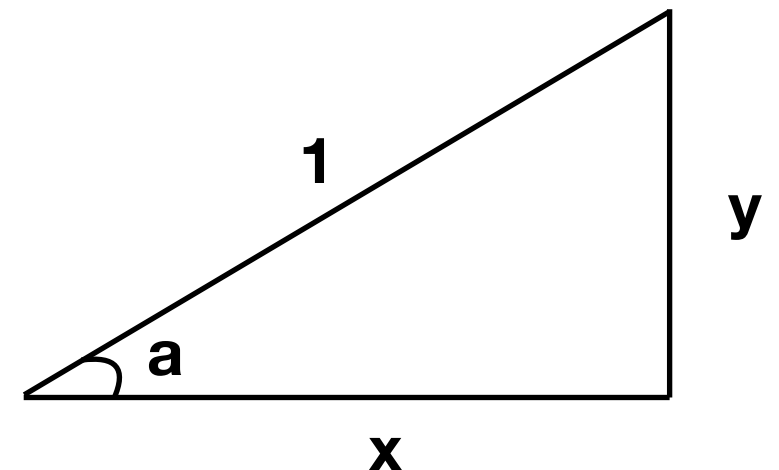
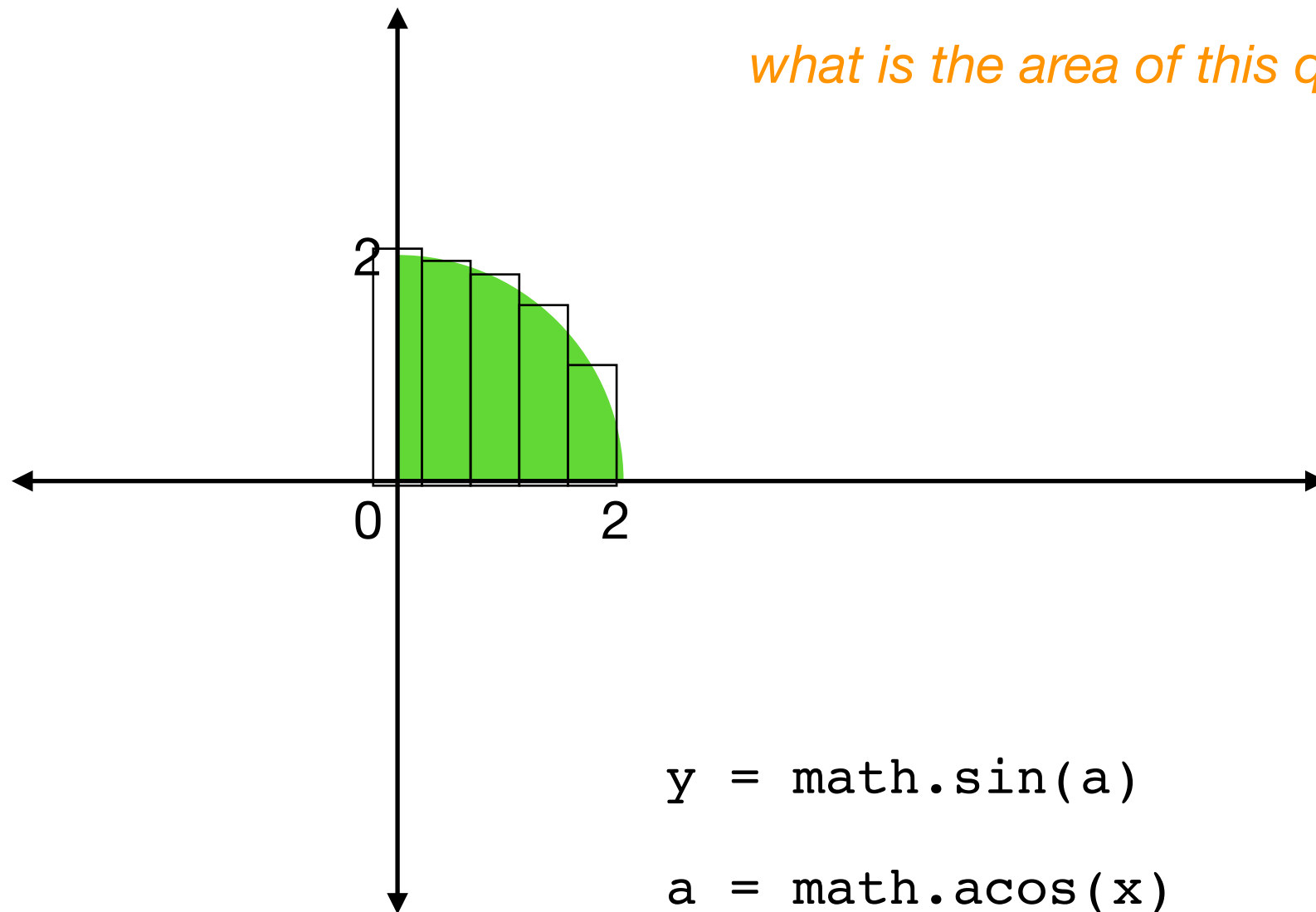


# Demo: Integration (Finding the area)

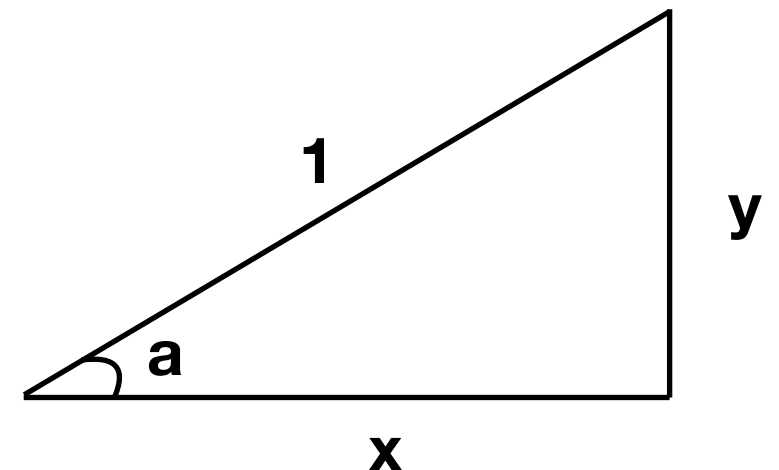
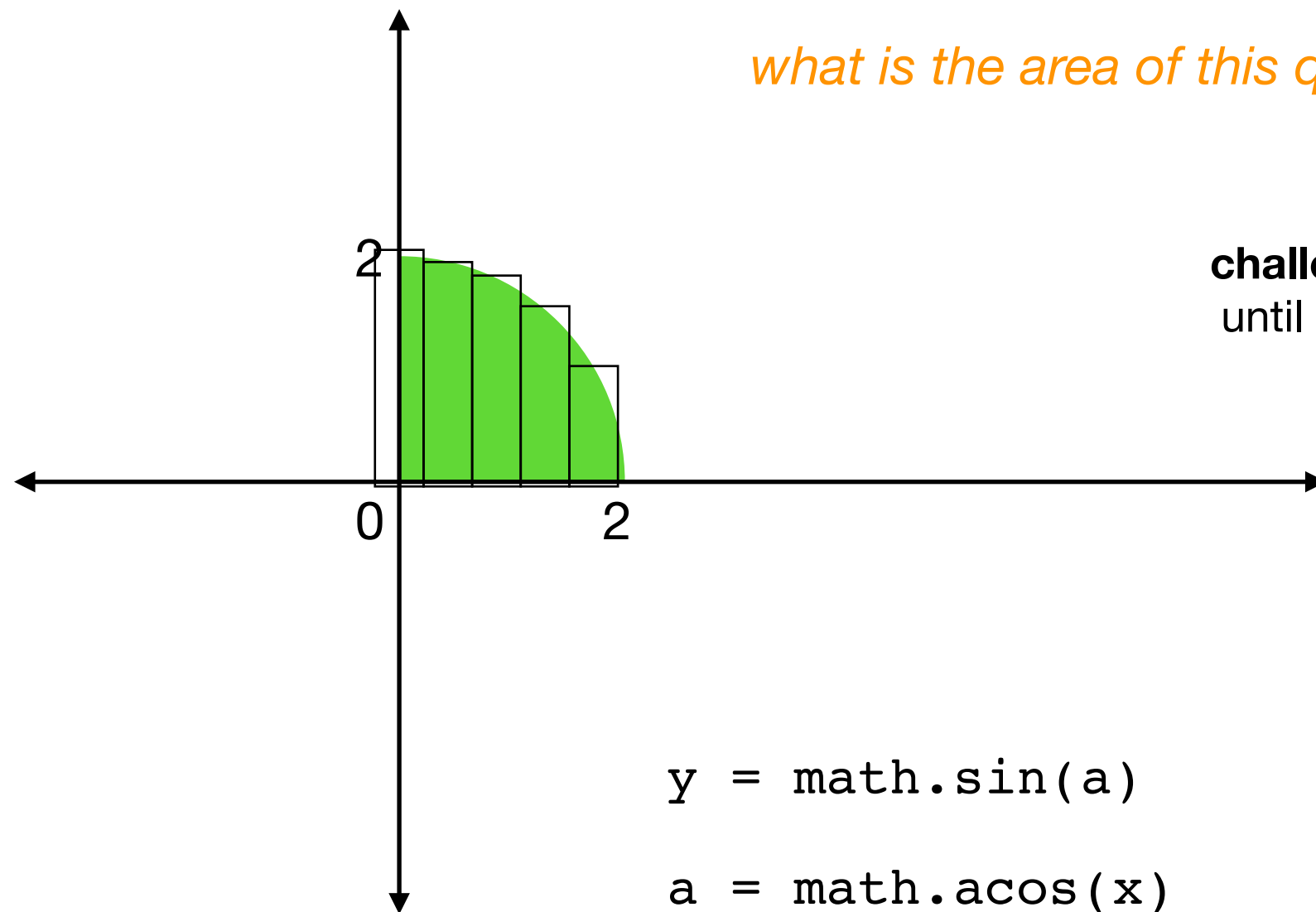


# Demo: Integration (Finding the area)

*what is the area of this quarter circle?*



# Demo: Integration (Finding the area)



# 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: .

```