61A Lecture 17

Friday, October 7

Today is Ada Lovelace Day

Images from Wikipedia

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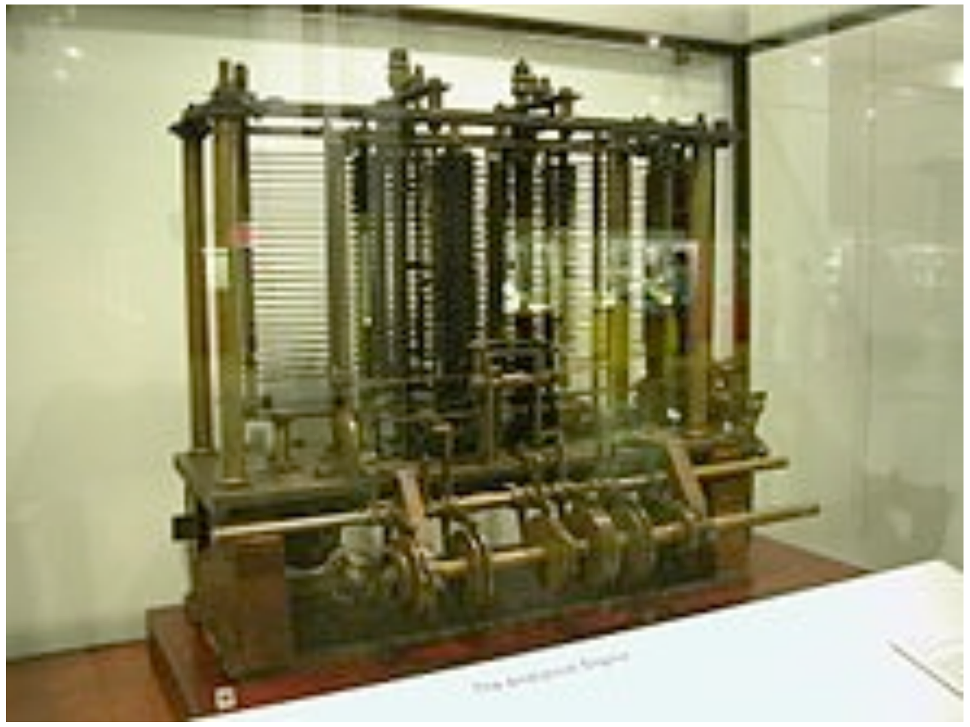

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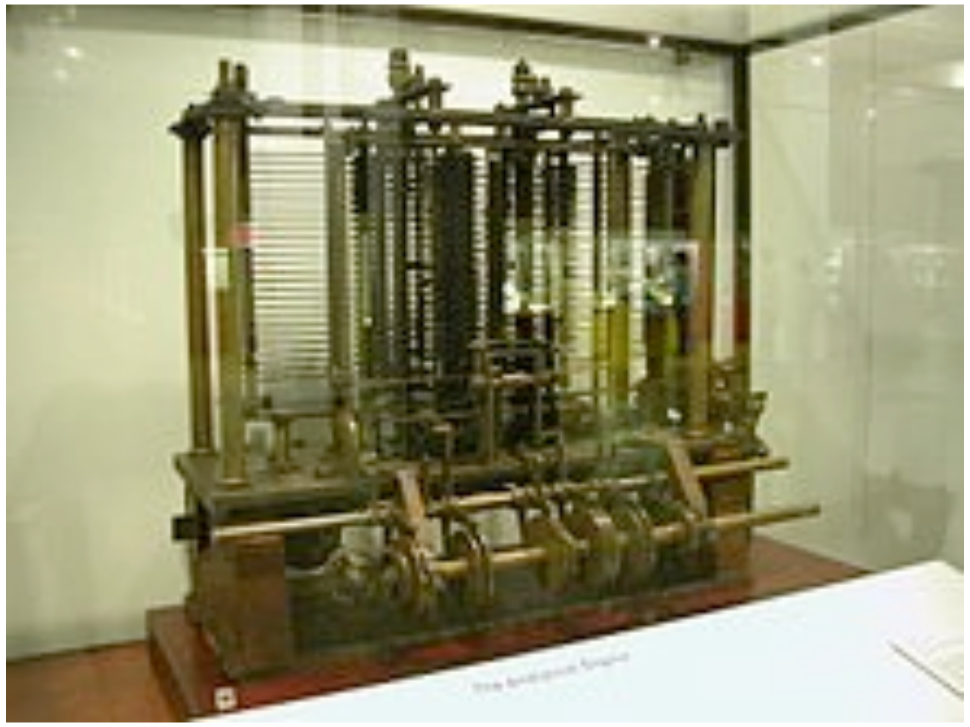
Ada wrote its first program (to compute Bernoulli numbers)



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Generic Functions

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- Multiple representations of abstract data types
- Property methods

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Strings are important: they represent *language* and *programs*

In Python, all objects produce two string representations

- The "str" is legible to **humans**
- The "repr" is legible to the **Python interpreter**

When the "str" and "repr" **strings are the same,** we're doing **something right** in our programming language!

The "repr" String for an Object

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```
  >>> repr(min)
  '<built-in function min>'
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Demo

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Message passing allows **different data types** to respond to the **same message**

A shared message that elicits similar behavior from different object classes is a powerful method of abstraction

An *interface* is a **set of shared messages,** along with a specification of **what they mean**

Classes that implement __repr__ and __str__ methods *that return Python- and human-readable strings* thereby **implement an interface** for producing Python string representations

Multiple Representations of Abstract Data

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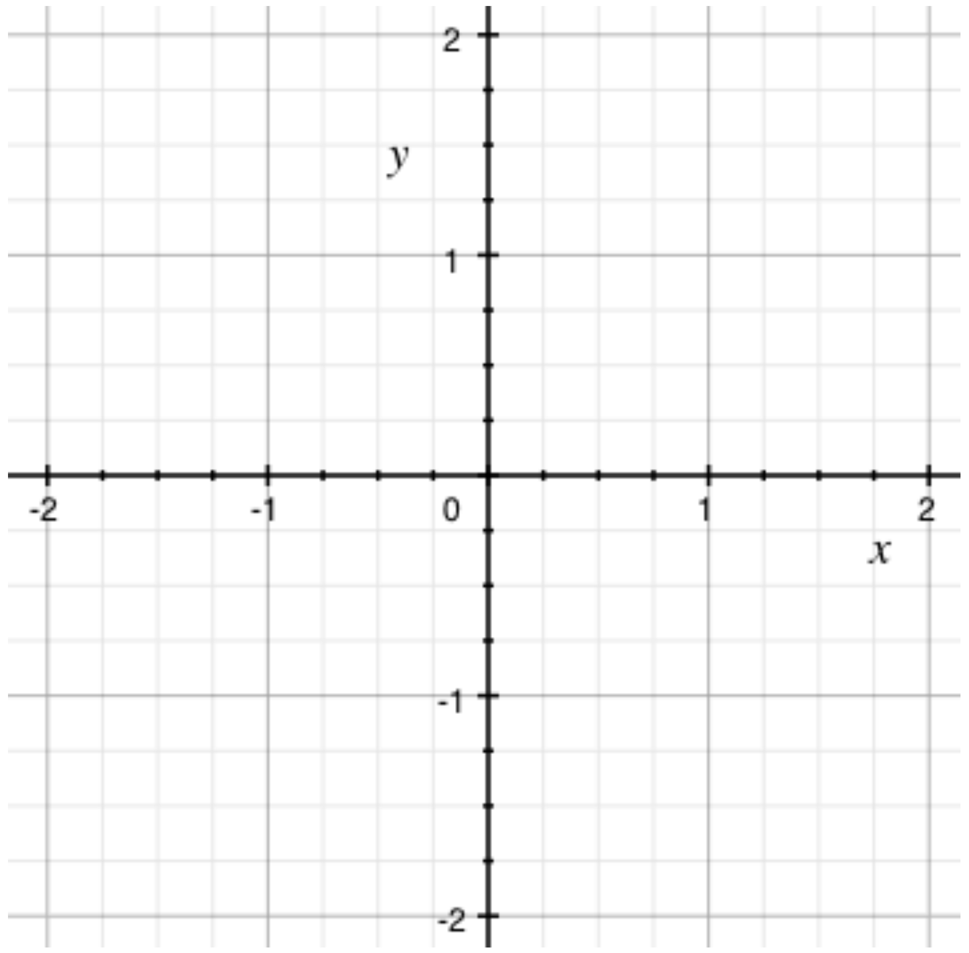
Rectangular and polar representations for complex numbers

Multiple Representations of Abstract Data

`Rectangular and polar representations for complex numbers`



Multiple Representations of Abstract Data

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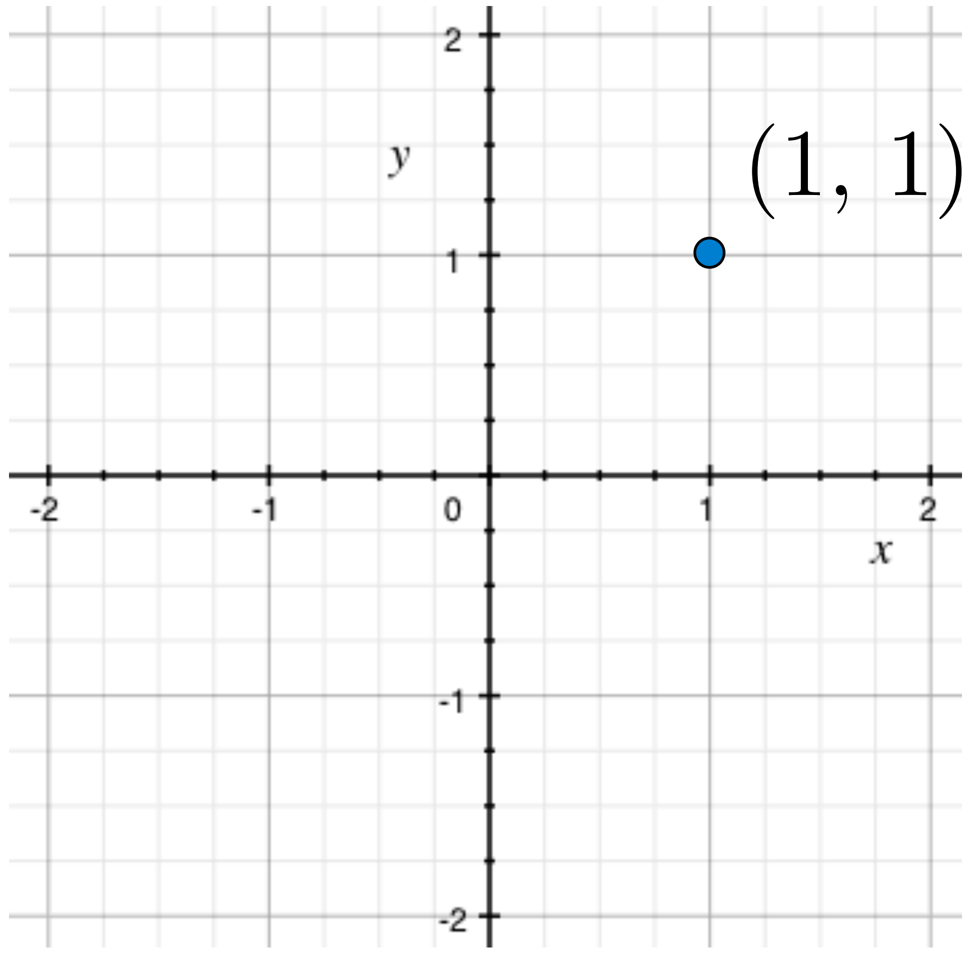

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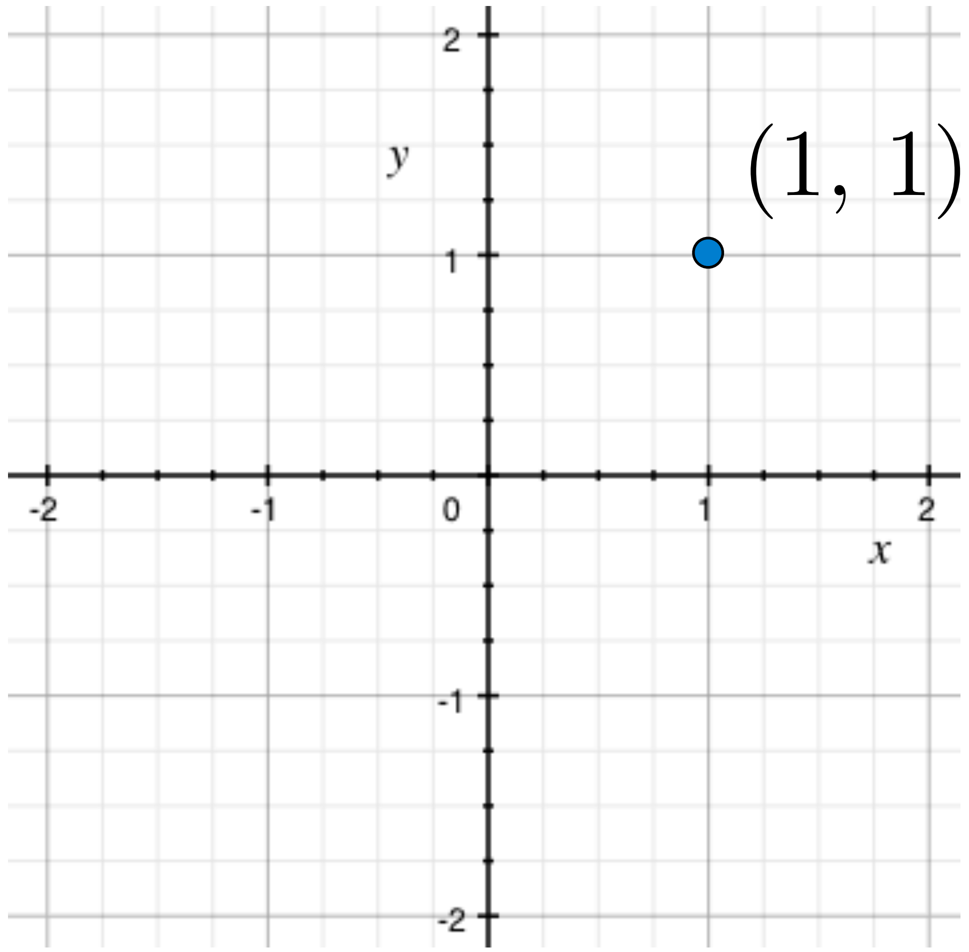

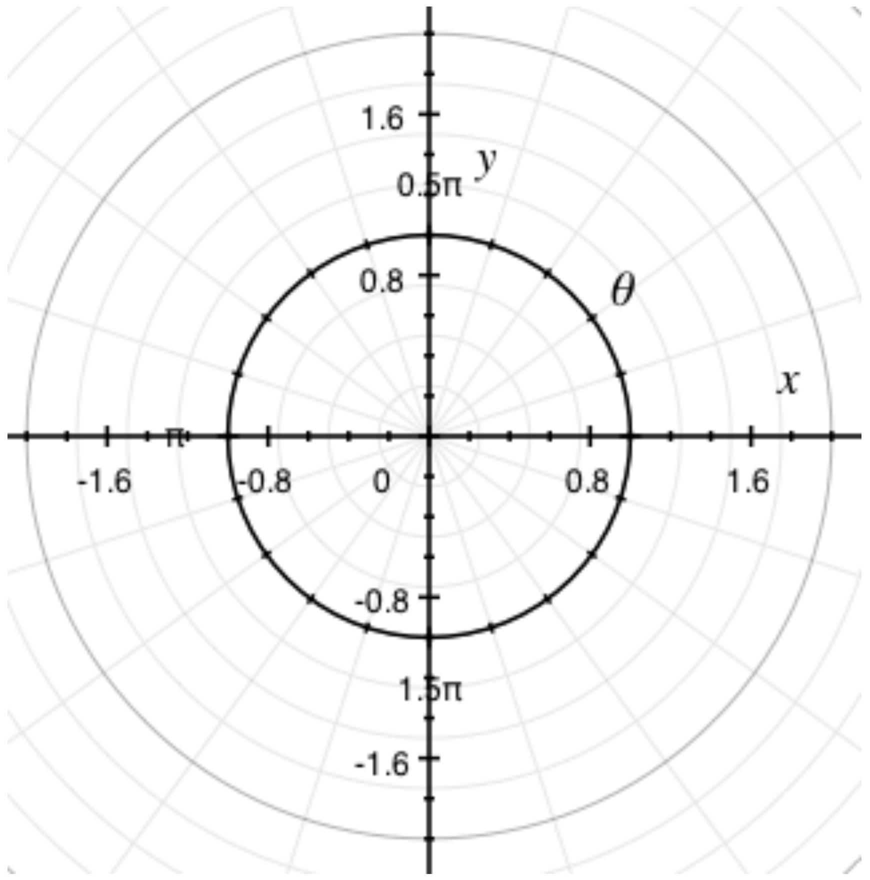

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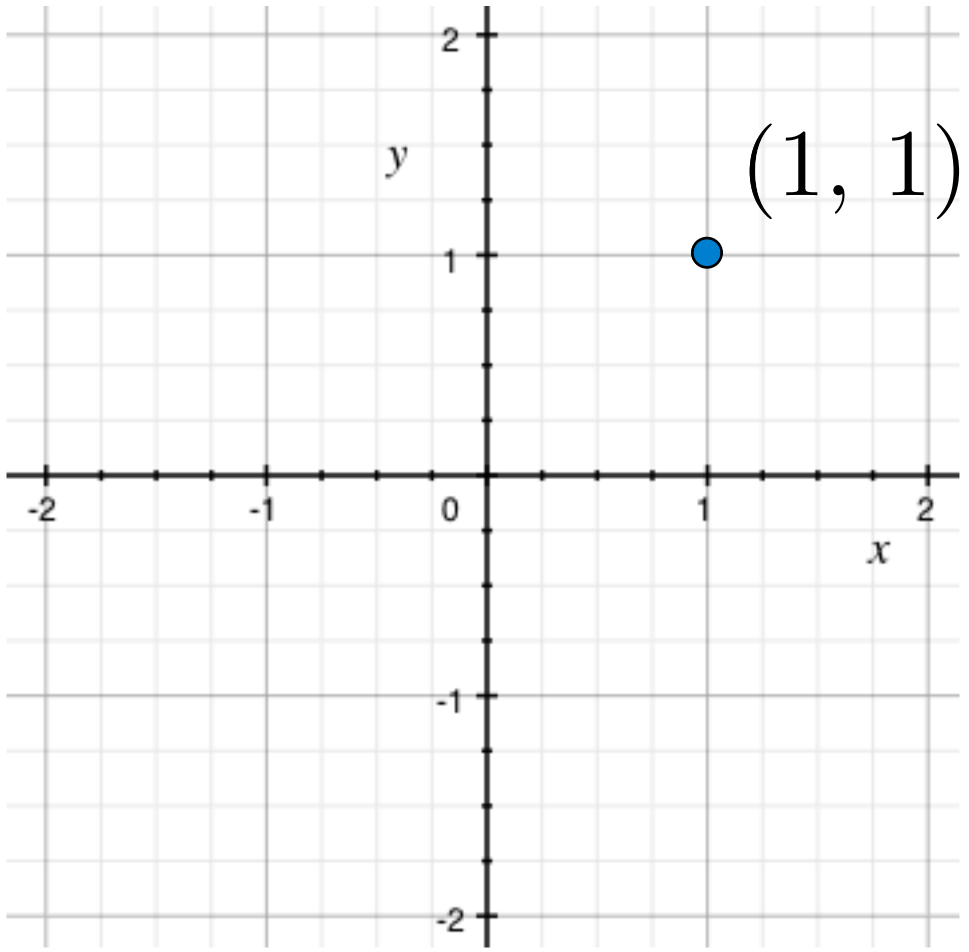

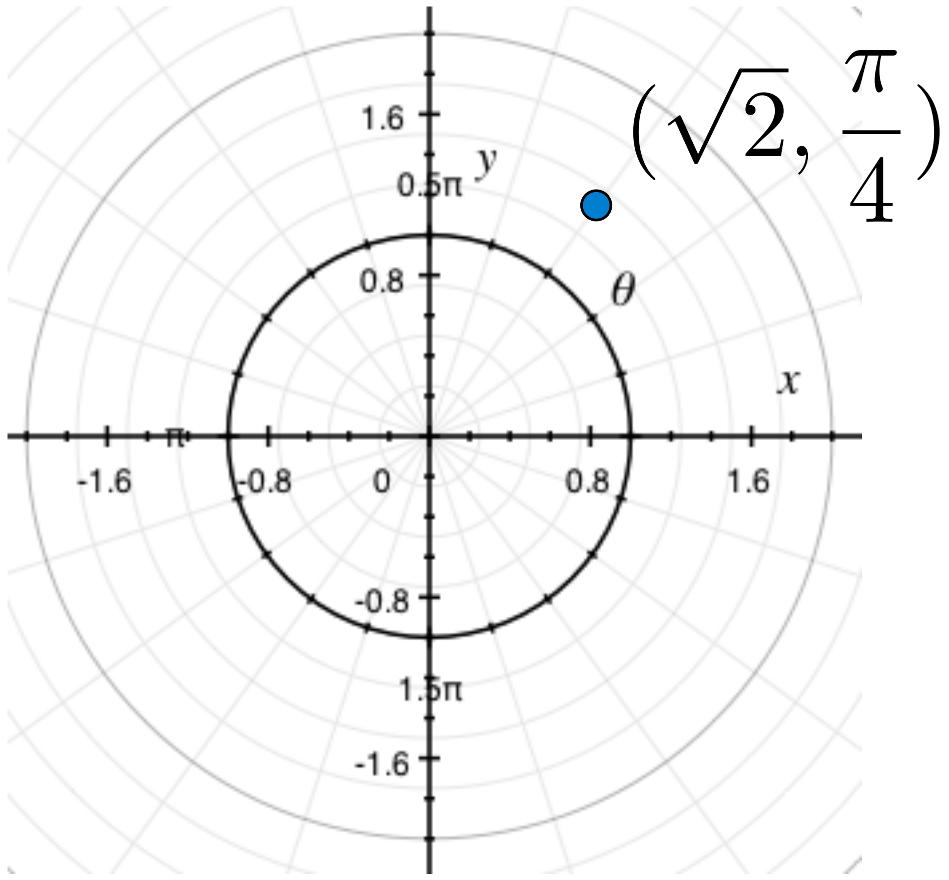

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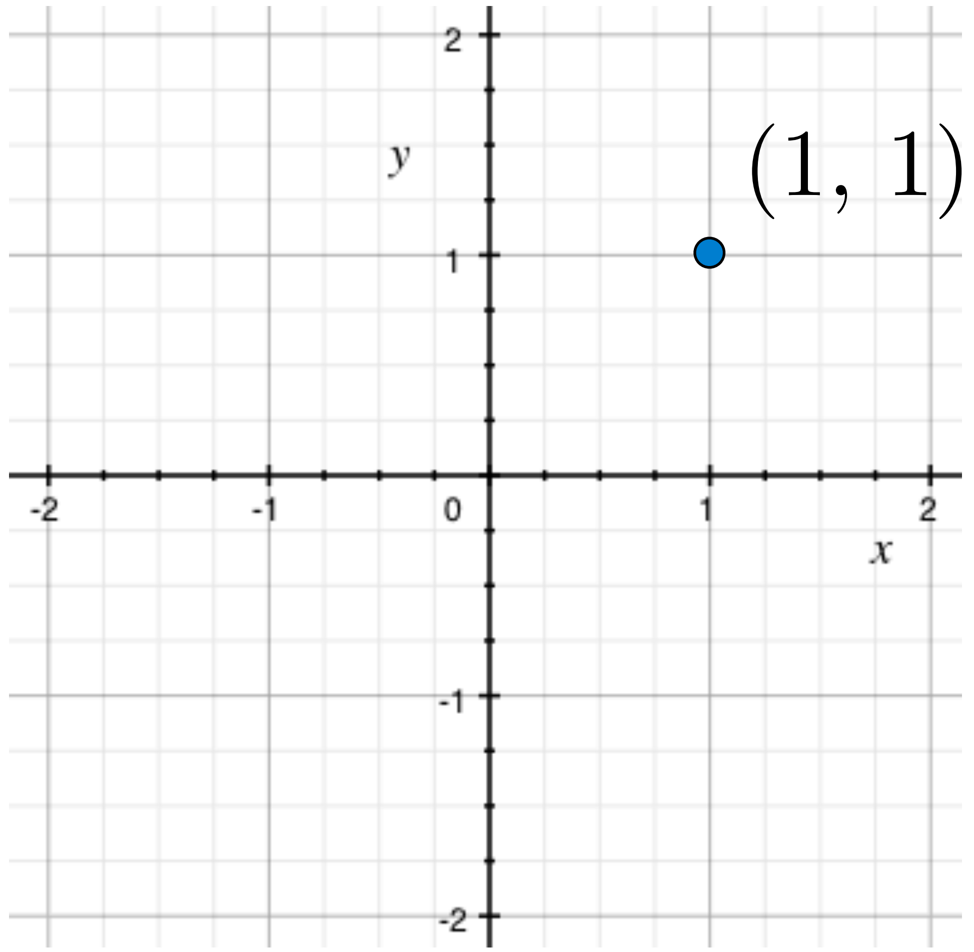

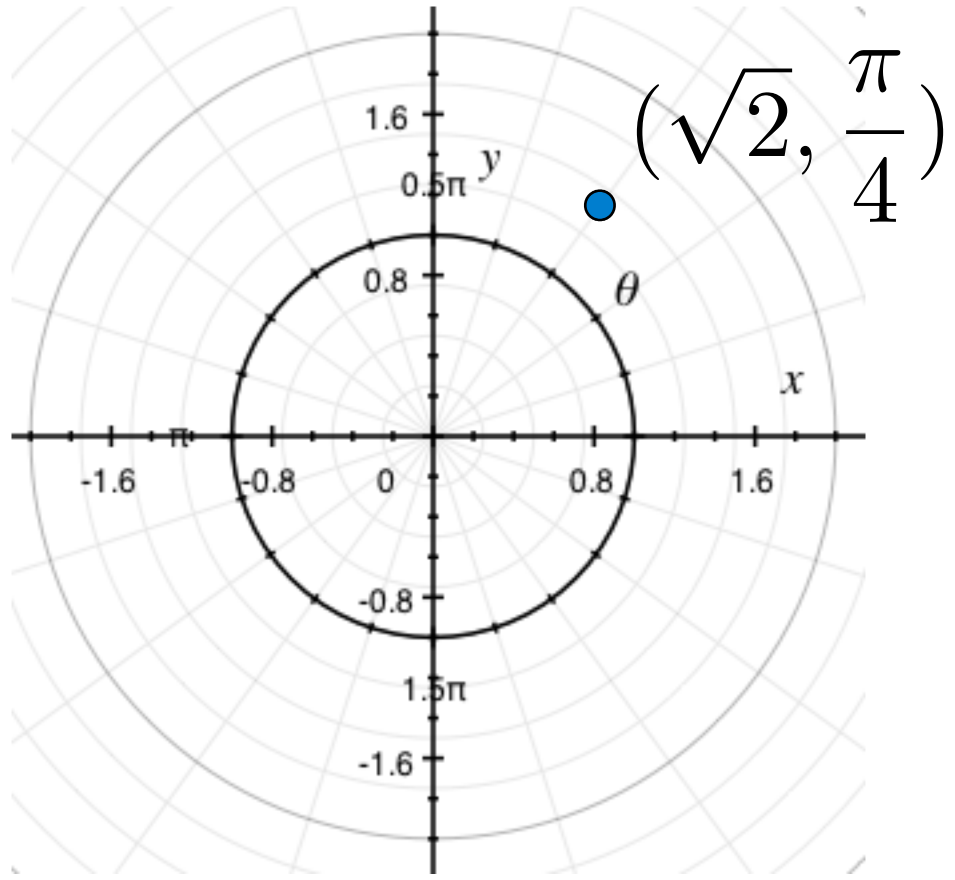

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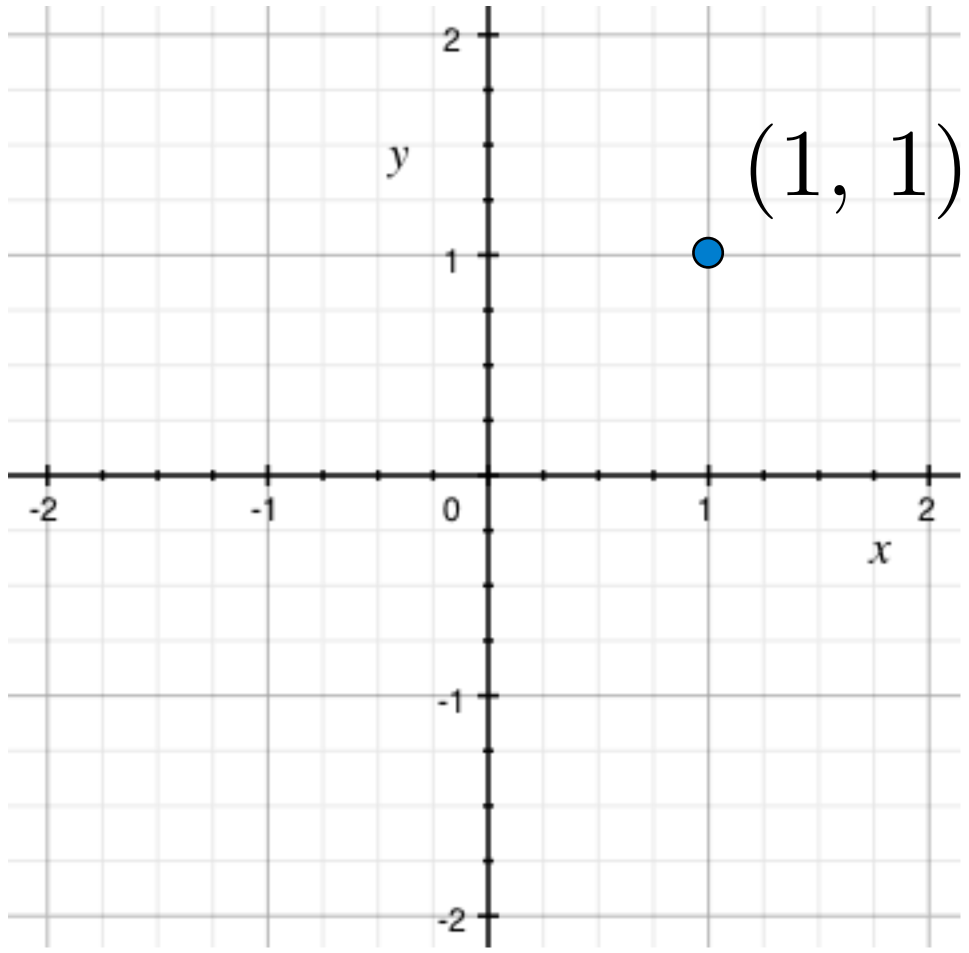

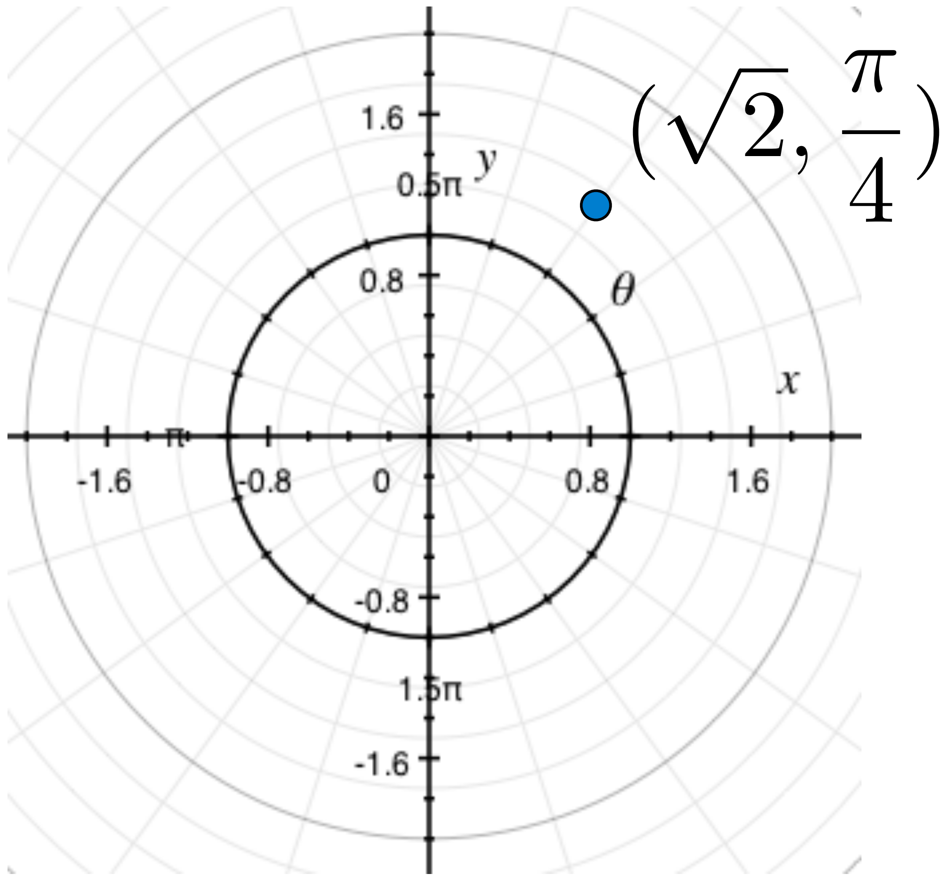

Most operations don't care about the representation

Some mathematical operations are easier on one than the other

Arithmetic Abstraction Barriers

Rectangular representation

Polar representation

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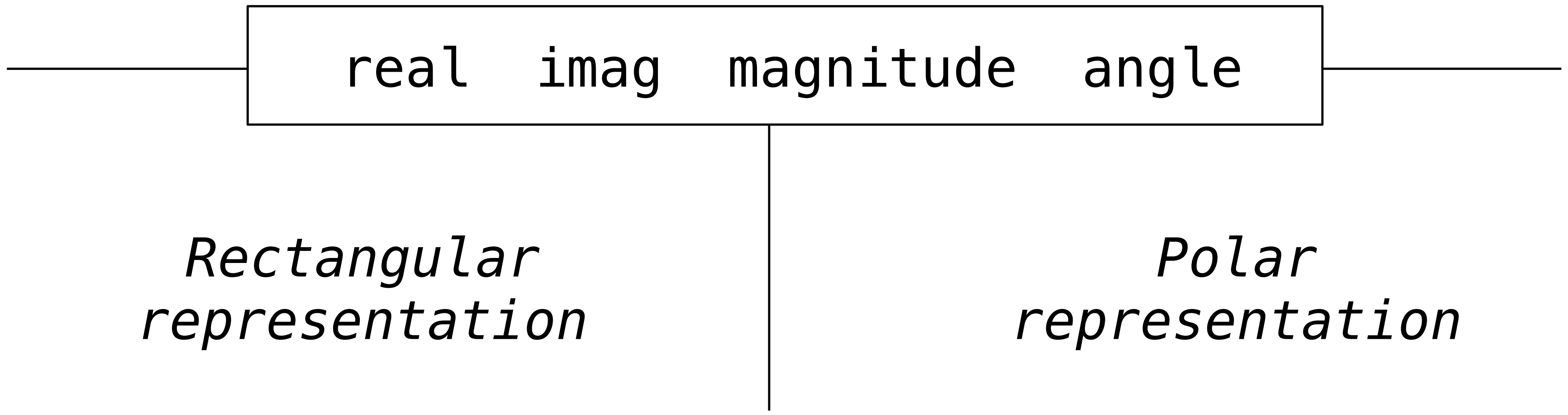

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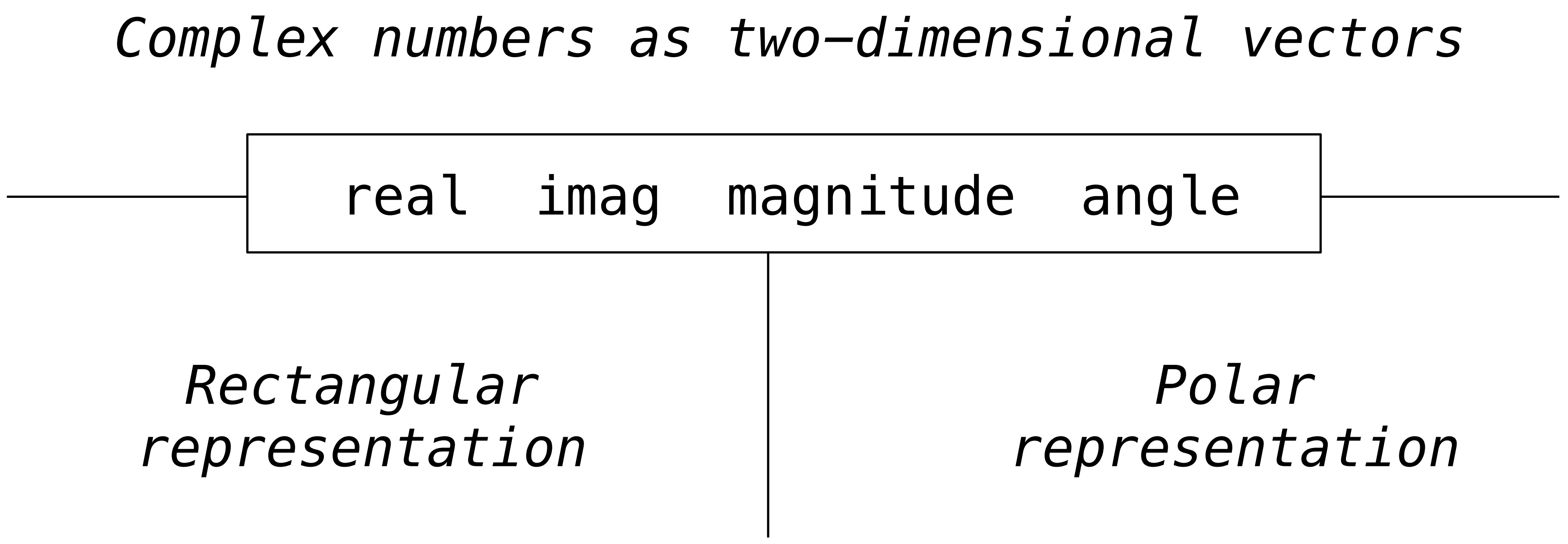
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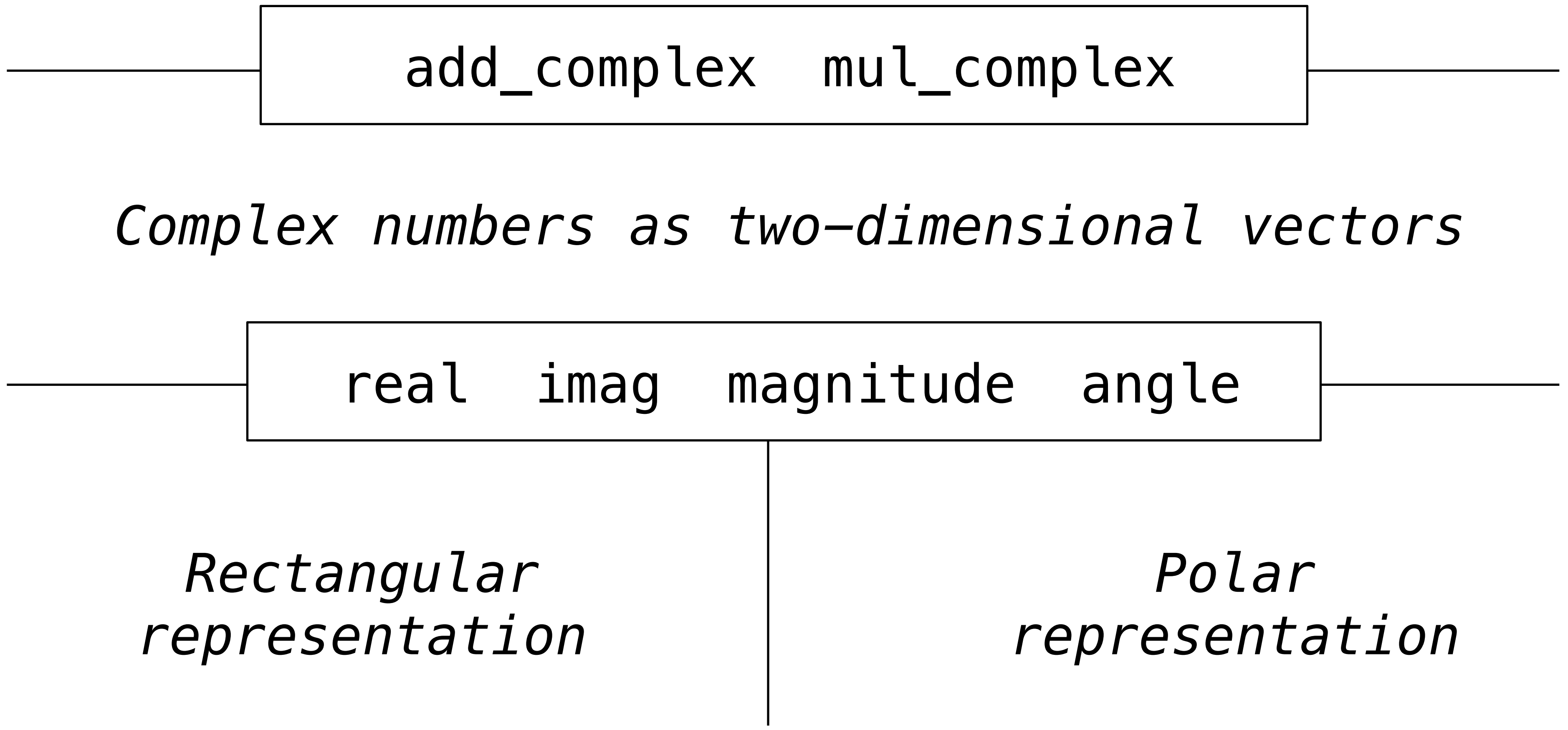
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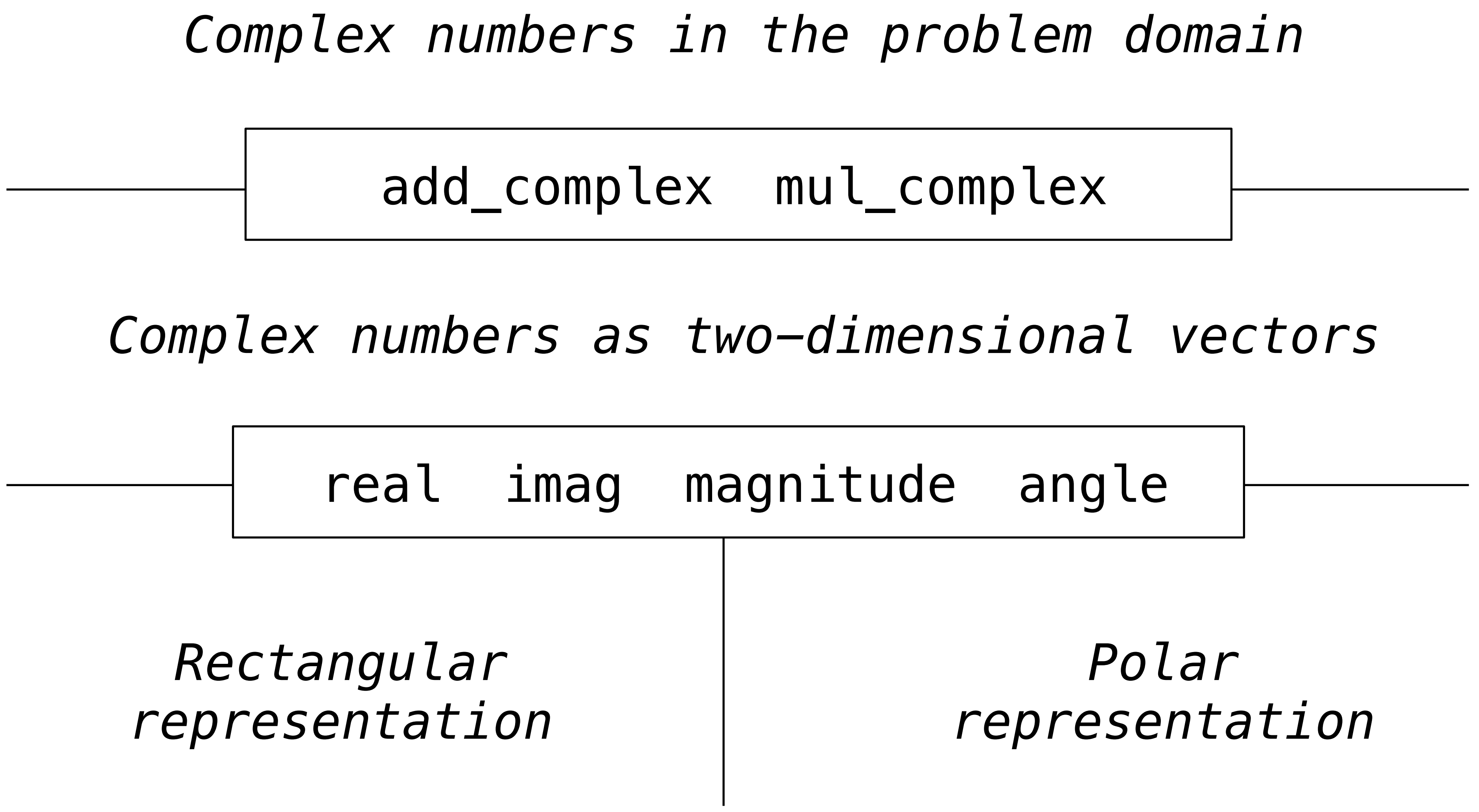
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class ComplexRI(object):

    def __init__(self, real, imag):
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    @property
    def magnitude(self):
        return (self.real ** 2 + self.imag ** 2) ** 0.5
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math.atan2(y,x): Angle between x-axis and the point (x,y)

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    def angle(self):
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    def __repr__(self):
        return 'ComplexRI({0}, {1})'.format(self.real,
                                             self.imag)
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class ComplexMA(object):

    def __init__(self, magnitude, angle):
        self.magnitude = magnitude
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    @property
    def real(self):
        return self.magnitude * cos(self.angle)
```

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class ComplexMA(object):

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        self.magnitude = magnitude
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    def real(self):
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>>> add_complex(ComplexRI(1, 2), ComplexMA(2, pi/2))
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ComplexMA(1.0, 3.141592653589793)
```

Special Methods

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`Adding instances of user-defined classes use __add__ method`

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http://diveintopython3.org/special-method-names.html

http://docs.python.org/py3k/reference/datamodel.html#special-method-names