

Pensieve header: January 13: Textbook (EIWL) chapters 1-4, evaluated.

## I. Starting Out: Elementary Arithmetic

$$2 + 2$$

4

$$1234 + 56784363489638498968932468923898958968934689$$

56784363489638498968932468923898958968935923

$$1230000000000000004 * 567984672387468364893746897468$$

698621147036586088821580622575189873459574987589872

$$2 \times 2$$

4

$$(2 + 2) 2$$

8

$$t = 2/3 + 1/4$$

$\frac{11}{12}$

12

$$t // N$$

0.916667

$$N[t]$$

0.916667

$$N@t$$

0.916667

$$? N$$

$N[expr]$  gives the numerical value of  $expr$ .

$N[expr, n]$  attempts to give a result with  $n$ -digit precision. >>

$$Pi$$

$\pi$

$$N[Pi]$$

3.14159

**N[Pi, 1000]**

```
3. 14159265358979323846264338327950288419716939937510582097494459230781640628620899862803
482534211706798214808651328230664709384460955058223172535940812848111745028410270193852
110555964462294895493038196442881097566593344612847564823378678316527120190914564856692
346034861045432664821339360726024914127372458700660631558817488152092096282925409171536
436789259036001133053054882046652138414695194151160943305727036575959195309218611738193
261179310511854807446237996274956735188575272489122793818301194912983367336244065664308
602139494639522473719070217986094370277053921717629317675238467481846766940513200056812
714526356082778577134275778960917363717872146844090122495343014654958537105079227968925
892354201995611212902196086403441815981362977477130996051870721134999999837297804995105
973173281609631859502445945534690830264252230825334468503526193118817101000313783875288
658753320838142061717766914730359825349042875546873115956286388235378759375195778185778
0532171226806613001927876611195909216420199
```

**N@π**

```
3. 14159
```

**π ~ N ~ 50**

```
3. 1415926535897932384626433832795028841971693993751
```

**π // N[#, 50] &**

```
3. 1415926535897932384626433832795028841971693993751
```

**(N[#, 50] &) [2 π]**

```
6. 2831853071795864769252867665590057683943387987502
```

## 2. Introducing Functions

Should have been: “introducing expressions”

**Should have been**

been have Should

**Plus [3, 4]**

```
7
```

**Hold [1 + 1]**

```
Hold [1 + 1]
```

**Hold [1 + 1] // FullForm**

```
Hold [Plus [1, 1 ]]
```

**Plus [1, 2, 3]**

```
6
```

**Times [2, 3]**

```
6
```

```
Times[2, Plus[2, 3]]
```

```
10
```

```
Max[2, 7, 3]
```

```
7
```

```
RandomInteger[100]
```

```
85
```

```
BesselK[ $\pi$ , 3] // N
```

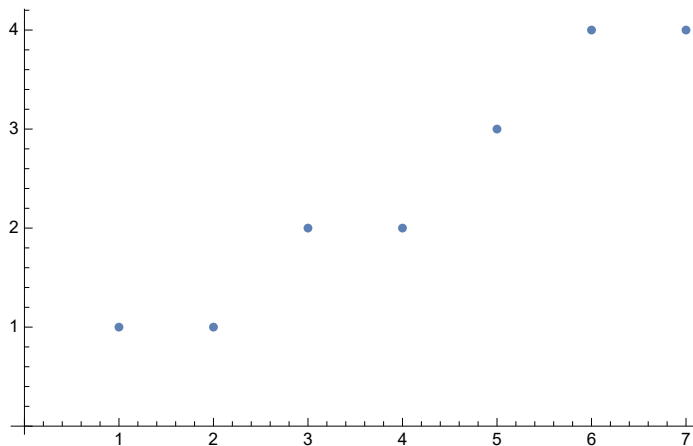
```
0.137273
```

### 3. First Look at Lists

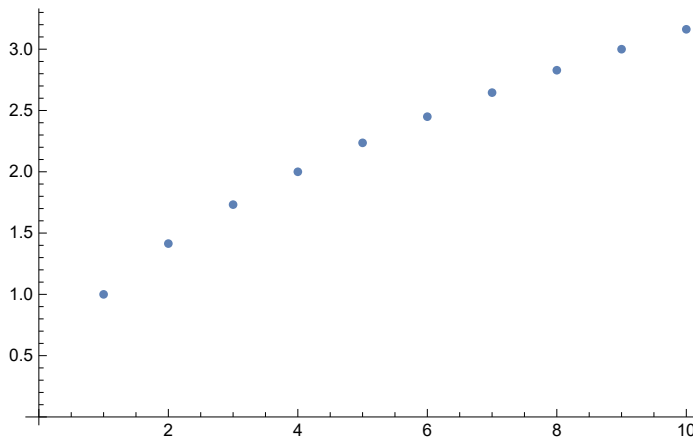
```
{1, 2, 3, 4, a, b, c} // FullForm
```

```
List[1, 2, 3, 4, a, b, c]
```

```
ListPlot[{1, 1, 2, 2, 3, 4, 4}]
```



```
ListPlot[Sqrt[{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}]]
```



**Range[10]**

{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

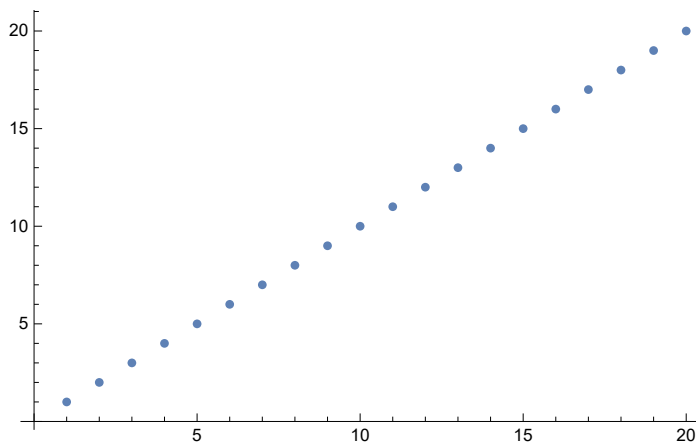
**Range[20] // Sqrt**

{1,  $\sqrt{2}$ ,  $\sqrt{3}$ , 2,  $\sqrt{5}$ ,  $\sqrt{6}$ ,  $\sqrt{7}$ ,  $2\sqrt{2}$ , 3,  $\sqrt{10}$ ,  
 $\sqrt{11}$ ,  $2\sqrt{3}$ ,  $\sqrt{13}$ ,  $\sqrt{14}$ ,  $\sqrt{15}$ , 4,  $\sqrt{17}$ ,  $3\sqrt{2}$ ,  $\sqrt{19}$ ,  $2\sqrt{5}$ }

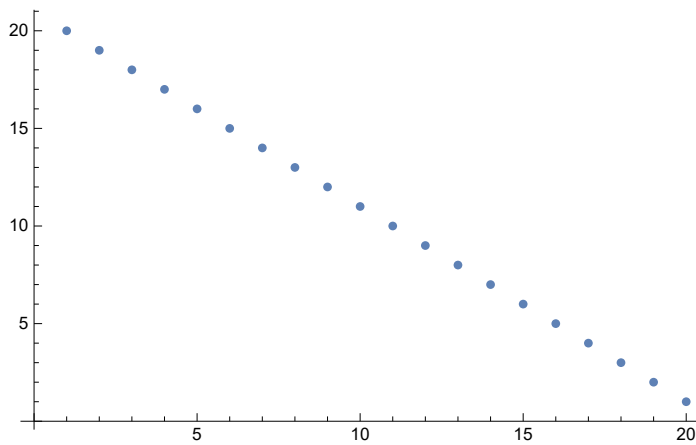
**Range[20] // Sqrt // N**

{1., 1.41421, 1.73205, 2., 2.23607, 2.44949, 2.64575, 2.82843, 3., 3.16228,  
 3.31662, 3.4641, 3.60555, 3.74166, 3.87298, 4., 4.12311, 4.24264, 4.3589, 4.47214}

**ListPlot[Range[20]]**



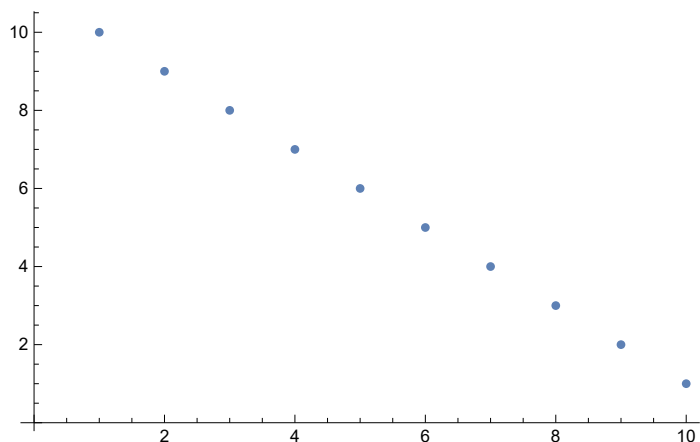
**ListPlot[Range[20, 1, -1]]**



**Reverse[{1, 2, 3, 4}]**

{4, 3, 2, 1}

`ListPlot[Reverse[Range[10]]]`



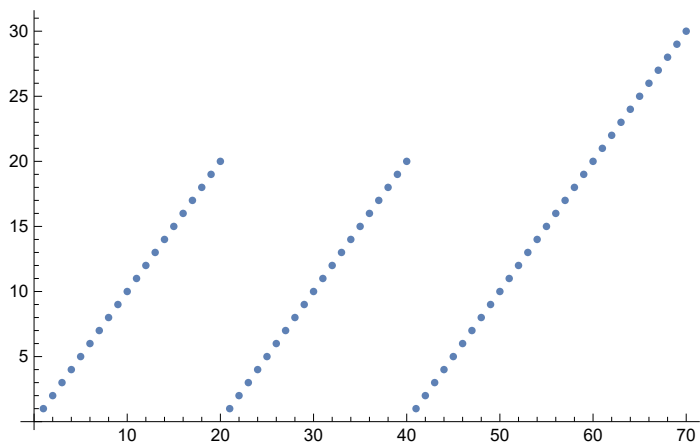
`Join[{1, 2, 3}, {4, 5}, {6, 7}]`

`{1, 2, 3, 4, 5, 6, 7}`

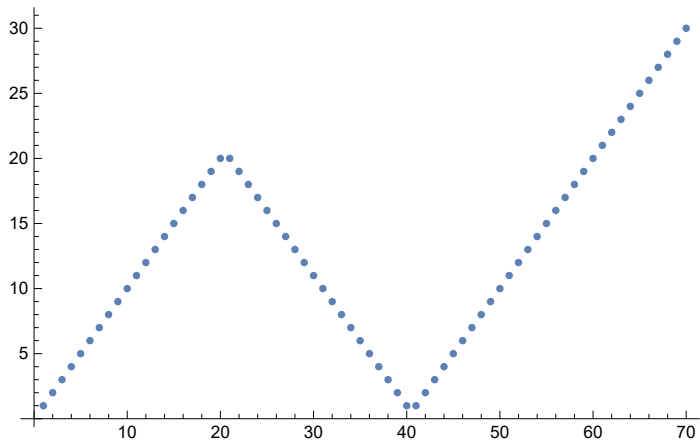
`{apple, orange,  $\pi$ } ~ Join ~ {1, 2, 3}`

`{apple, orange,  $\pi$ , 1, 2, 3}`

`ListPlot[Join[Range[20], Range[20], Range[30]]]`

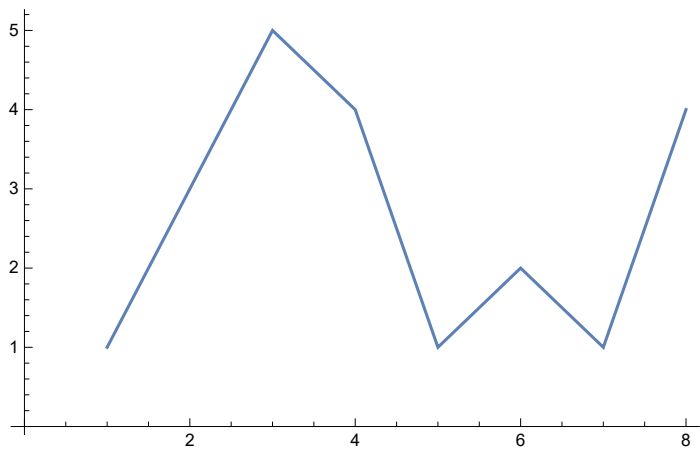


`ListPlot[Join[Range[20], Reverse[Range[20]], Range[30]]]`

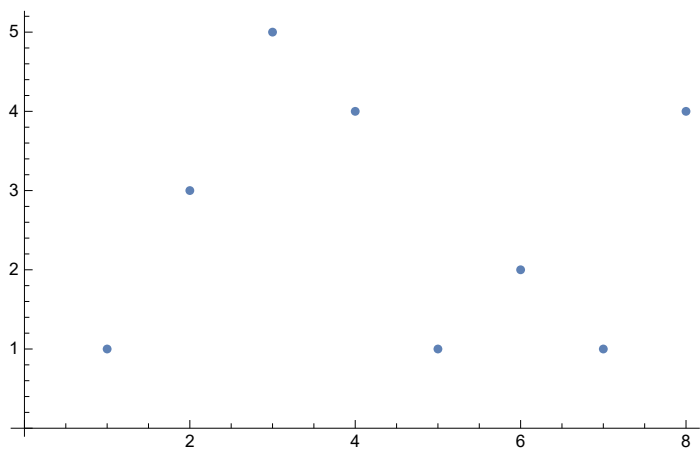


## 4. Displaying Lists

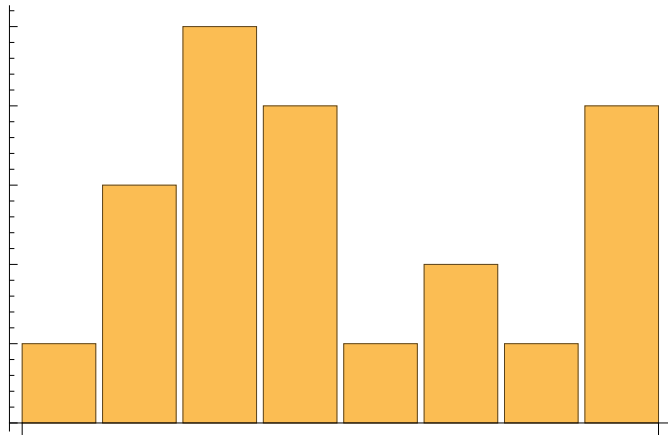
`ListLinePlot[{1, 3, 5, 4, 1, 2, 1, 4}]`



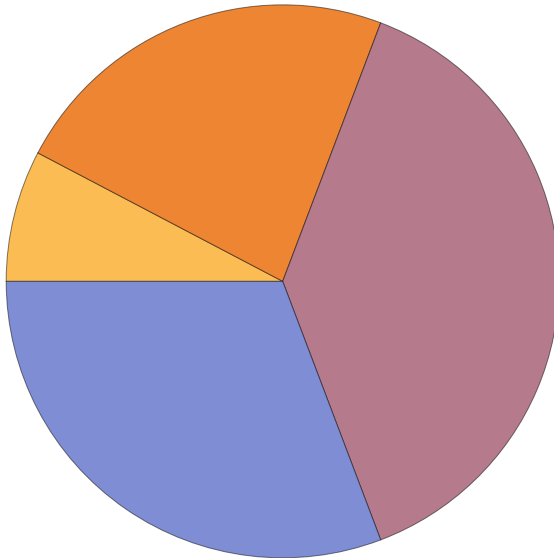
`ListPlot[{1, 3, 5, 4, 1, 2, 1, 4}]`



**BarChart** [{1, 3, 5, 4, 1, 2, 1, 4}]



**PieChart** [{1, 3, 5, 4}]

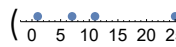


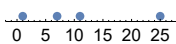
**NumberLinePlot** [{1, 7, 11, 25}]



 // FullForm

```
Graphics[List[List[RGBColor[0.368417`, 0.506779`, 0.709798`],
  PointSize[Medium], AbsoluteThickness[1.6`], Point[List[1, 1]]],
  List[RGBColor[0.368417`, 0.506779`, 0.709798`], PointSize[Medium],
  AbsoluteThickness[1.6`], Point[List[7, 1]]],
  List[RGBColor[0.368417`, 0.506779`, 0.709798`], PointSize[Medium],
  AbsoluteThickness[1.6`], Point[List[11, 1]]],
  List[RGBColor[0.368417`, 0.506779`, 0.709798`], PointSize[Medium],
  AbsoluteThickness[1.6`], Point[List[25, 1]]]],
Rule[AspectRatio, Times[Rational[1, 10], Power[GoldenRatio, -1]]],
Rule[Axes, List[True, False]], Rule[AxesLabel, List[None]],
Rule[AxesOrigin, List[Automatic, Automatic]],
Rule[FrameTicks, List[List[Automatic, Automatic], List[Automatic, Automatic]]],
Rule[ImagePadding, All], Rule[PlotRange, List[List[1., 25.], List[0, 1]]],
Rule[PlotRangePadding, List[List[Scaled[0.1`], Scaled[0.1`]], List[0, 1]]],
Rule[Ticks, List[Automatic, Automatic]]]
```

 ^2

 ^2

**a**<sup>2</sup>

a<sup>2</sup>

7<sup>2</sup>

49

**1001**<sup>7</sup>

1 007 021 035 035 021 007 001

$\sqrt{49}$

7

**Column**[{100, 350, 502, 400}]

100

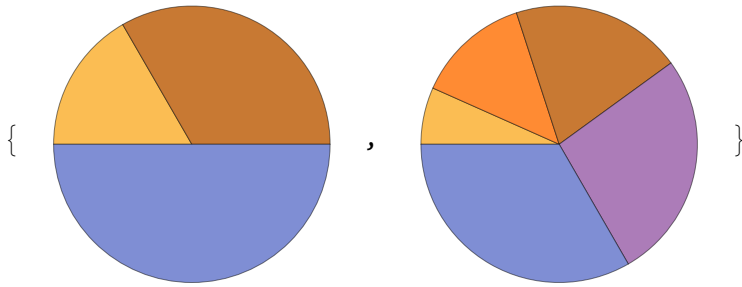
350

502

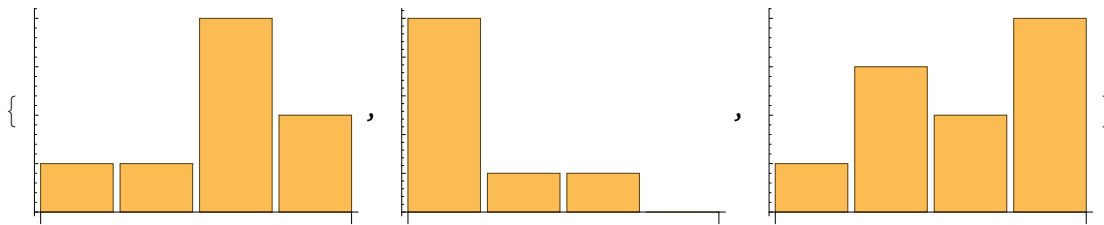
400



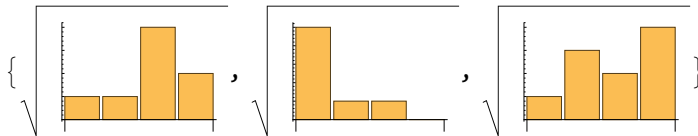
`{PieChart[Range[3]], PieChart[Range[5]]}`



`{BarChart[{1, 1, 4, 2}], BarChart[{5, 1, 1, 0}], BarChart[{1, 3, 2, 4}]}`



`% // Sqrt`



`(a + b)2`

`(a + b)2`

`(a + b)2 // Expand`

`a2 + 2 a b + b2`