

Introduction to R Software

Basics of Calculations

:::

R as Calculator, Built in Functions and Assignments

Shalabh

Department of Mathematics and Statistics

Indian Institute of Technology Kanpur

Integer Division %/%

Integer Division: Division in which the fractional part (remainder) is discarded

```
> c(2,3,5,7) %/% 2  
[1] 1 1 2 3
```

$2\% / \%2, 3\% / \%2, 5\% / \%2, 7\% / \%2$

R Console

```
> c(2,3,5,7) %/% 2  
[1] 1 1 2 3
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Integer Division %/%

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> c(2,3,5,7) %/% c(2,3)
[1] 1 1 2 2
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$2\% / \%2, 3\% / \%3, 5\% / \%2, 7\% / \%3$

 R Console

```
> c(2,3,5,7) %/% c(2,3)
[1] 1 1 2 2
```

Modulo Division ($x \bmod y$) `%%`:

$x \bmod y$: modulo operation finds the remainder after division of one number by another

```
> c(2,3,5,7) %% 2  
[1] 0 1 1 1
```

$2\%2$, $3\%2$, $5\%2$, $7\%2$

 R Console

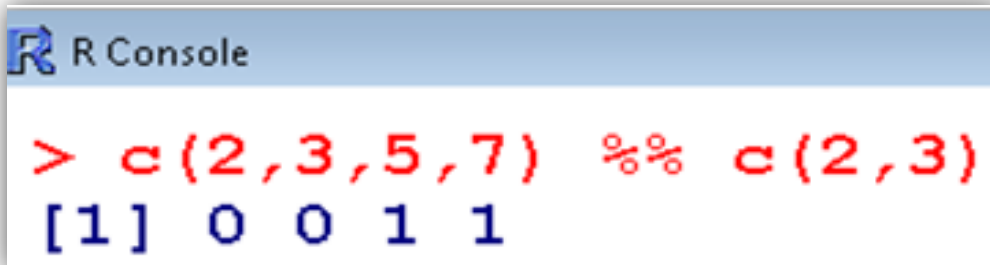
```
> c(2,3,5,7) %% 2  
[1] 0 1 1 1
```

Modulo Division ($x \bmod y$) `%%`:

$x \bmod y$: modulo operation finds the remainder after division of one number by another

```
> c(2,3,5,7) %% c(2,3)
[1] 0 0 1 1
```

$2\%2$, $3\%3$, $5\%2$, $7\%3$

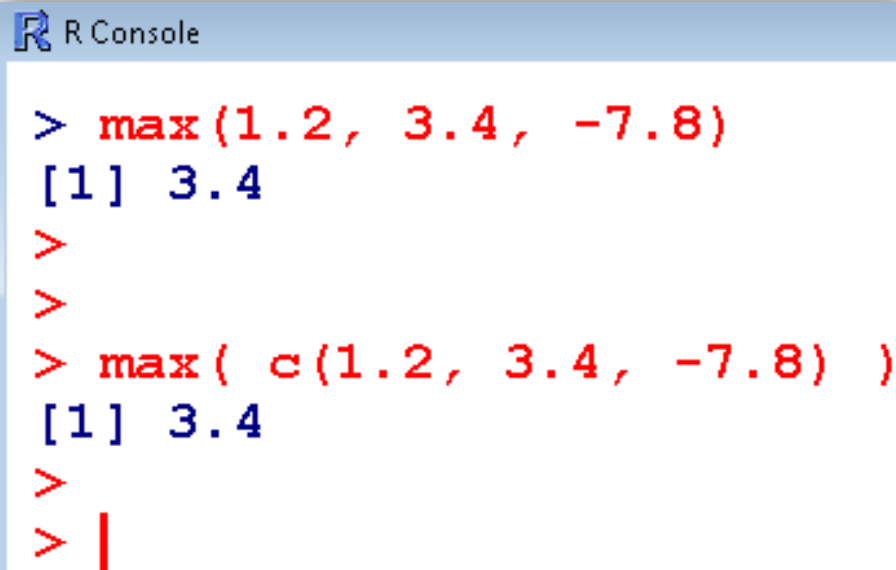


The screenshot shows the R Console window with the command `> c(2,3,5,7) %% c(2,3)` and its output `[1] 0 0 1 1`. The prompt and command are in red, and the output is in blue.

```
R Console
> c(2,3,5,7) %% c(2,3)
[1] 0 0 1 1
```

Maximum: max

```
> max(1.2, 3.4, -7.8)
[1] 3.4
```

A screenshot of an R Console window. The window has a title bar that says "R Console" with a small R logo icon. The console shows the following text: a red prompt character ">" followed by the command "max(1.2, 3.4, -7.8)" in red, then the output "[1] 3.4" in blue. Below this, there are two more red prompt characters ">" on separate lines. Then, another red prompt character ">" followed by the command "max(c(1.2, 3.4, -7.8))" in red, then the output "[1] 3.4" in blue. Finally, there are two more red prompt characters ">" on separate lines, with a vertical red bar character "|" appearing after the second one.

```
R Console
> max(1.2, 3.4, -7.8)
[1] 3.4
>
>
> max( c(1.2, 3.4, -7.8) )
[1] 3.4
>
> |
```

```
> max( c(1.2, 3.4, -7.8) )
[1] 3.4
```

Minimum : min

```
> min(1.2, 3.4, -7.8)
[1] -7.8
```

 R Console

```
> min(1.2, 3.4, -7.8)
[1] -7.8
>
> min( c(1.2, 3.4, -7.8) )
[1] -7.8
>
```

```
> min( c(1.2, 3.4, -7.8) )
[1] -7.8
```

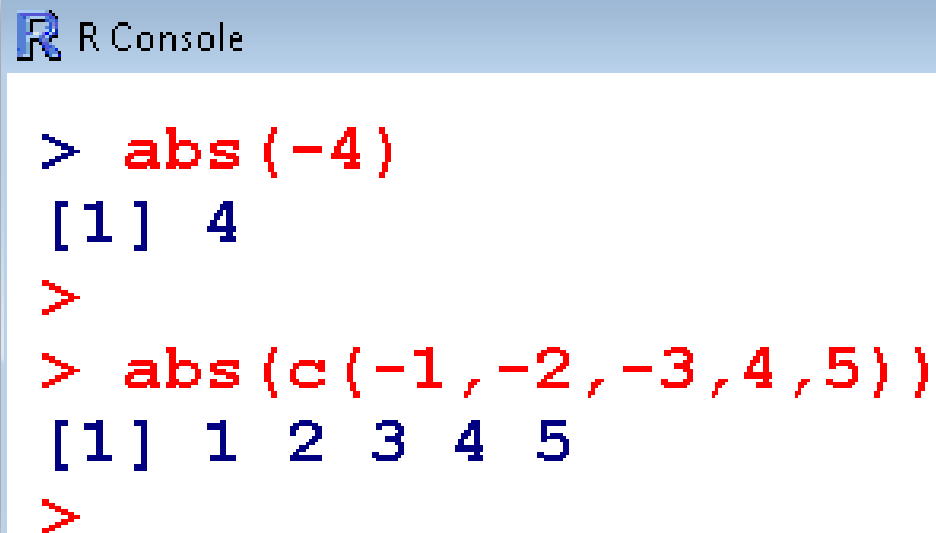
Overview Over Further Functions

<code>abs()</code>	Absolute value
<code>sqrt()</code>	Square root
<code>round()</code> , <code>floor()</code> , <code>ceiling()</code>	Rounding, up and down
<code>sum()</code> , <code>prod()</code>	Sum and product
<code>log()</code> , <code>log10()</code> , <code>log2()</code>	Logarithms
<code>exp()</code>	Exponential function
<code>sin()</code> , <code>cos()</code> , <code>tan()</code> , <code>asin()</code> , <code>acos()</code> , <code>atan()</code>	Trigonometric functions
<code>sinh()</code> , <code>cosh()</code> , <code>tanh()</code> , <code>asinh()</code> , <code>acosh()</code> , <code>atanh()</code>	Hyperbolic functions

Examples

```
> abs(-4)
[1] 4
```

```
> abs(c(-1,-2,-3,4,5))
[1] 1 2 3 4 5
```

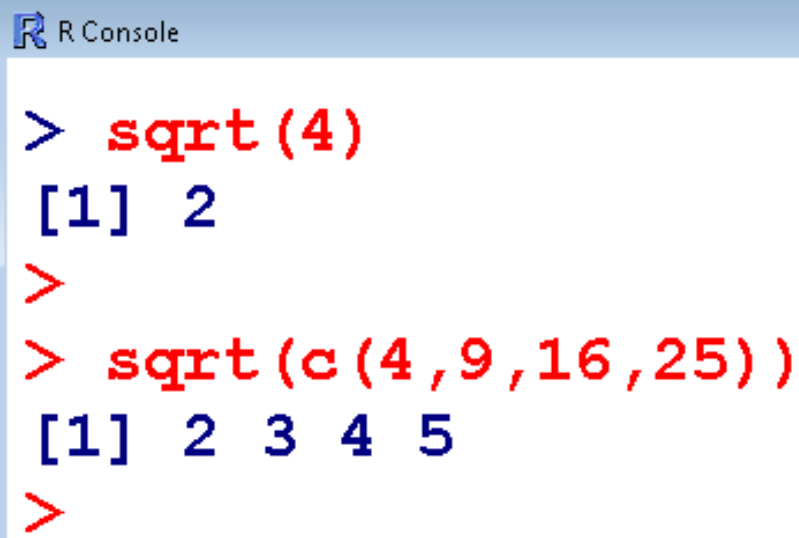


```
R Console
> abs(-4)
[1] 4
>
> abs(c(-1,-2,-3,4,5))
[1] 1 2 3 4 5
>
```

Examples

```
> sqrt(4)
[1] 2
```

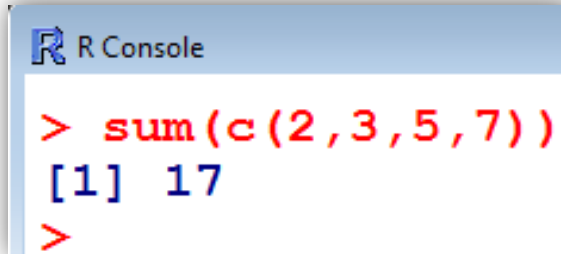
```
> sqrt(c(4,9,16,25))
[1] 2 3 4 5
```

A screenshot of an R Console window. The window has a title bar with the R logo and the text "R Console". The console shows the following commands and output:

```
> sqrt(4)
[1] 2
>
> sqrt(c(4,9,16,25))
[1] 2 3 4 5
>
```

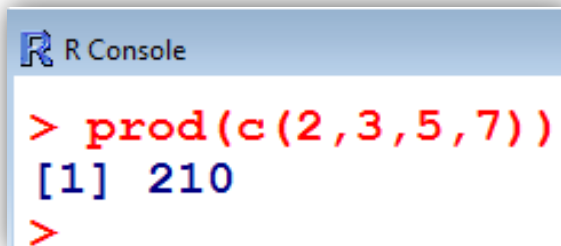
Examples

```
> sum(c(2,3,5,7))  
[1] 17
```



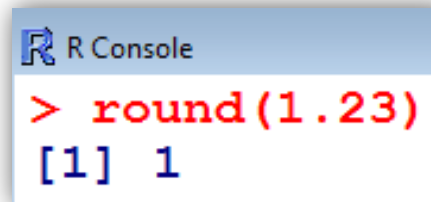
A screenshot of an R console window. The title bar is light blue with the R logo and the text "R Console". The console area is white and contains the following text: a red prompt character ">", the command "sum(c(2,3,5,7))" in red, the output "[1] 17" in blue, and another red prompt character ">" at the bottom.

```
> prod(c(2,3,5,7))  
[1] 210
```



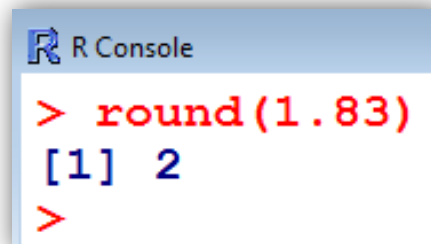
A screenshot of an R console window. The title bar is light blue with the R logo and the text "R Console". The console area is white and contains the following text: a red prompt character ">", the command "prod(c(2,3,5,7))" in red, the output "[1] 210" in blue, and another red prompt character ">" at the bottom.

```
> round(1.23)  
[1] 1
```



A screenshot of an R console window. The title bar is light blue with the R logo and the text "R Console". The console area is white and contains the following text: a red prompt character ">", the command "round(1.23)" in red, the output "[1] 1" in blue, and another red prompt character ">" at the bottom.

```
> round(1.83)  
[1] 2
```



A screenshot of an R console window. The title bar is light blue with the R logo and the text "R Console". The console area is white and contains the following text: a red prompt character ">", the command "round(1.83)" in red, the output "[1] 2" in blue, and another red prompt character ">" at the bottom.

Assignments

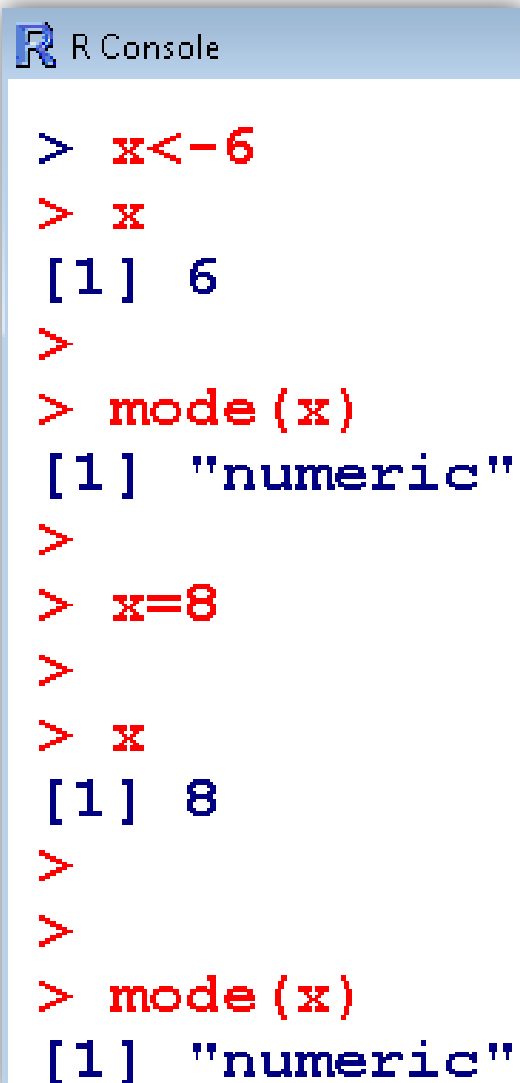
Assignments can be made in two ways:

```
> x<-6
> x
[1] 6

> mode(x)
[1] "numeric"

> x=8
> x
[1] 8

> mode(x)
[1] "numeric"
```



```
R Console
> x<-6
> x
[1] 6
>
> mode(x)
[1] "numeric"
>
> x=8
>
> x
[1] 8
>
>
> mode(x)
[1] "numeric"
```

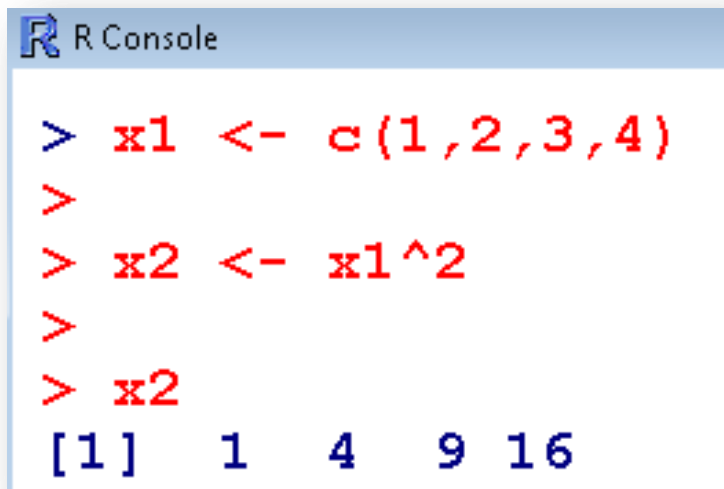
Assignments

An assignment can also be used to save values in variables:

```
> x1 <- c(1,2,3,4)
```

```
> x2 <- x1^2
```

```
> x2  
[1] 1 4 9 16
```



```
R Console  
  
> x1 <- c(1,2,3,4)  
>  
> x2 <- x1^2  
>  
> x2  
[1] 1 4 9 16
```

ATTENTION: R is case sensitive (X is not the same as x)