

# Package: refer (via r-universe)

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**Type** Package

**Title** Create Object References

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**Description** Allows users to easily create references to R objects then 'dereference' when needed or modify in place without using reference classes, environments, or active bindings as workarounds. Users can also create expression references that allow subsets of any object to be referenced or expressions containing references to multiple objects.

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---

decr

*Decrease Value In Place*


---

### Description

Decrease the value of an object on the search path. Equivalent to `x--` or `x -= by` in other languages. See [incr](#) for details on implementation.

### Usage

```
decr(x, by = 1)
```

### Arguments

`x` object to be decreased; can be a symbol, character, or extraction language object.  
`by` value to decrease `x` by; defaults to 1.

### Value

the value of `x` decreased by `by`, invisibly

### Examples

```
z <- 1:10

incr(z)
identical(z, 2:11)      # TRUE

incr(z[1:3], by=2)
identical(z[1:3], 4:6) # TRUE

l <- list(a = 1, b = 2)
decr(l$a)
l$a == 0 # TRUE

decr(l$b, by = 4)
l$b == -2 # TRUE
```

---

deref

*Dereference Object*

---

### Description

Return object from a [ref](#). `!`` can also be used to dereference an object. See [ref](#) for more details.

### Usage

```
deref(x)

## S3 method for class 'ref'
!x
```

### Arguments

x                   reference object

### Details

`deref` is used to obtain the object originally referenced from [ref](#). NULL is returned if the object is no longer available. `ref` objects are automatically dereferenced when using generic functions such as arithmetic operators. Dereferencing a non-`ref` object just returns the object.

### Value

R Obj or NULL

## Examples

```
# Create a vectors of random numbers
x <- rnorm(10)
y <- runif(10)

# Create a reference to the random numbers
ref_to_x <- ref(x)
ref_to_y <- ref(y)

# Place references in a list
list_of_refs <- list(x = ref_to_x, y = ref_to_y)

# Check sum of refs 'x' and 'y'
# Note that both `+` and `sum` automatically deref
sum1 <- sum(list_of_refs$x + list_of_refs$y)

# Update 'x' and calculate new sum
x <- rnorm(10)
sum2 <- sum(list_of_refs$x + list_of_refs$y)

# check diff in sums to see if 'list_of_refs' updated
sum2 - sum1

# Obtain a reference to an expression
ref_to_part <- ref(x[2:5] + 3)
deref(ref_to_part)

# Another expression reference
refs_to_list <- ref(list(x, y))
deref(refs_to_list)

x <- "hello"
y <- "world"

deref(refs_to_list)

# Alternative, `!` can be used for dereferencing
!refs_to_list

identical(!refs_to_list, deref(refs_to_list))

# Referencing data.frame columns
dat <- data.frame(first = 1:4, second = 5:8)
ref_to_first <- ref(dat$first)
mean1 <- mean(!ref_to_first)

dat$first <- dat$first * 4
mean2 <- mean(!ref_to_first)

mean2 == 4*mean1

# Many operations automatically dereference
```

```
ref_to_first * 5
ref_to_x == ref_to_y
cos(ref_to_first)
max(ref_to_first)
```

---

Extract

*Extract or Replace Parts of a Referenced Object*

---

## Description

Operators acting on a [ref](#) object that extract part of the underlying object at the supplied indices, or replaces parts. These operators modify or extract from the object that is referenced, not the reference! Use [sref](#) if this behavior is undesirable.

## Usage

```
## S3 method for class 'ref'
x$name

## S3 method for class 'sref'
x$..., value

## S3 replacement method for class 'ref'
x$name <- value

## S3 replacement method for class 'sref'
x$... <- value

## S3 method for class 'ref'
x[...]

## S3 method for class 'sref'
x[..., value]

## S3 replacement method for class 'ref'
x[...] <- value

## S3 replacement method for class 'sref'
x[...] <- value

## S3 method for class 'ref'
x[[...]]

## S3 method for class 'sref'
x[[..., value]]
```

```
## S3 replacement method for class 'ref'  
x[[...]] <- value  
  
## S3 replacement method for class 'sref'  
x[[...]] <- value
```

### Arguments

x	object of class "ref"
name	literal character string or a name
...	values passed to the function after dereferencing
value	object, usually of a similar class as the dereferenced value of x, used for assigning in place

### Value

Object of class "ref"

### Examples

```
x <- list(  
  a = 1,  
  b = "hello",  
  "world"  
)  
ref_to_x <- ref(x)  
  
# Extract parts of 'x' from the reference  
ref_to_x$a  
ref_to_x[2:3]  
ref_to_x[["b"]]  
  
# Replace parts of 'x' through the reference  
ref_to_x[["a"]] <- 100  
x$a == 100  
  
ref_to_x$b <- "bye"  
x$b == "bye"  
  
ref_to_x[2:3] <- list(2, 3)  
print(x)
```

---

getEnv	<i>Extract or Set Reference Environment</i>
--------	---

---

**Description**

Functions to obtain or set the environment to which a [ref](#) or [sref](#) object points.

**Usage**

```
getEnv(x)

setEnv(x, e)
```

**Arguments**

x	object of class "ref" or "sref"
e	new environment to which the reference points

**Value**

environment for getEnv or reference object for setEnv

**Examples**

```
x <- 1:10
ref_to_x <- ref(x)
ref_env <- getEnv(ref_to_x)
ref_sym <- getSym(ref_to_x)

identical(ref_env, .GlobalEnv)
identical(ref_sym, "x")

e <- new.env()
e$x <- 100
ref_to_x <- setEnv(ref_to_x, e)
!ref_to_x
```

---

getIndex	<i>Extract or Set Slice Index</i>
----------	-----------------------------------

---

**Description**

Functions to obtain or set the index to which a [slice](#) object points.

**Usage**

```
getIndex(x)

setIndex(x, ...)
```

**Arguments**

```
x          object of class "slice"
...        objects compatible with extracting or replacing a vector
```

**Value**

object of class "slice"

**Examples**

```
x <- matrix(1:9, nrow=3)
slice_x <- slice(x, 2:3, 1)
identical(getIndex(slice_x), list(2:3, 1)) # TRUE

setIndex(slice_x, list(1, substitute()))
identical(!slice_x, c(1, 4, 7)) # TRUE
```

---

getSym

*Extract or Set Reference Symbol*

---

**Description**

Functions to obtain or set the object name to which a [ref](#) or [sref](#) object points.

**Usage**

```
getSym(x)

setSym(x, sym)
```

**Arguments**

```
x          object of class "ref"
sym        symbol or character naming the object to which the reference points
```

**Value**

character of length 1



**Examples**

```
x <- 1:10
ref_to_x <- ref(x)
ref_env <- getEnv(ref_to_x)
ref_sym <- getSym(ref_to_x)

identical(ref_env, .GlobalEnv)
identical(ref_sym, "x")

y <- 500
ref_to_x <- setSym(ref_to_x, y)
!ref_to_x
```

---

incr

*Increment Value In Place*


---

**Description**

Increase the value of an object on the search path. Equivalent to `x++` or `x += by` in other languages.

**Usage**

```
incr(x, by = 1)
```

**Arguments**

<code>x</code>	object to be incremented; can be a symbol, character, or extraction language object.
<code>by</code>	value to increase <code>x</code> by; defaults to 1.

**Details**

`incr` quotes object `x`, then attempts to determine the primary object to be modified. For example, `z` will be the 'primary object' in `incr(z[1:4])`. `incr` then searches for the primary object in the search path and records the environment. `x <- x + by` is then evaluated within the recorded environment.

The quoted object can be a symbol or character object. It can also be language object, though the primary call must be either ``$``, ``[``, or ``[[``. These can be nested. For example, `x[1]` or `x[2, 1][3]` is acceptable, but `sqrt(x)` is not.

See [decr](#) to decrease the value.

**Value**

the value of `x` incremented by `by`, invisibly

**Examples**

```
z <- 1:10

incr(z)
identical(z, as.numeric(2:11))    # TRUE

incr(z[1:3], by=2)
identical(z[1:3], as.numeric(4:6)) # TRUE

l <- list(a = 1, b = 2)
decr(l$a)
l$a == 0    # TRUE

decr(l$b, by = 4)
l$b == -2   # TRUE
```

---

is.nullref	<i>Is Reference Null?</i>
------------	---------------------------

---

**Description**

Check whether a [ref](#) points to a NULL object or an object that no longer exists.

**Usage**

```
is.nullref(x)
```

**Arguments**

x                    object of class "ref"

**Value**

TRUE if x is not a reference or points to an object that does not exist; otherwise FALSE.

**Examples**

```
# Create a vectors of random numbers and a reference
x <- rnorm(10)
ref_to_x <- ref(x)

# Delete 'x' and check if NULL
is.nullref(ref_to_x) # FALSE
rm(x)
is.nullref(ref_to_x) # TRUE
```

---

`is.ref`*Is Object a Reference?*

---

**Description**

Check whether an R Object inherits a reference class.

**Usage**`is.ref(x)``is.sref(x)``is.rfexpr(x)``is.slice(x)``is.a.ref(x)`**Arguments**

`x` object of any class

**Value**

TRUE if `x` is a reference object, otherwise FALSE

**Functions**

- `is.sref`: check whether object is an 'sref' object
- `is.rfexpr`: check whether object is a reference expression
- `is.slice`: check whether object references a slice of a vector
- `is.a.ref`: check whether object is any type of reference class

**Examples**

```
# Create a vectors of random numbers
x <- rnorm(10)

# Create a reference to the random numbers
ref_to_x <- ref(x)

is.ref(ref_to_x) # TRUE
```

---

`iter.ref`*Convert Reference to Iterable Object*

---

**Description**

`ref` methods for use with `iter` in the `eList` package. It allows `ref` objects to be used with the different vector comprehensions in the package and with functions such as `lapply` in base R.

**Usage**

```
## S3 method for class 'ref'  
iter(x)  
  
## S3 method for class 'slice'  
iter(x)  
  
## S3 method for class 'rfexpr'  
iter(x)
```

**Arguments**

`x` object to be looped across

**Value**

a vector

**Examples**

```
x <- sample(1:10, 5, replace=TRUE)  
slice_x <- slice(x, 1:2)  
  
lapply(eList::iter(slice_x), print)
```

---

`match_cond.ref`*Check and Evaluate Match Condition*

---

**Description**

`ref` methods for use with `Match` in the `matchr` package.

**Usage**

```
## S3 method for class 'ref'
match_cond(cond, x, do, ...)

## S3 method for class 'sref'
match_cond(cond, x, do, ...)

## S3 method for class 'slice'
match_cond(cond, x, do, ...)

## S3 method for class 'rfexpr'
match_cond(cond, x, do, ...)
```

**Arguments**

cond	match condition
x	object being matched
do	return expression associated with the condition. If cond is matched with x, then do should be evaluated and returned in a list with TRUE: <code>list(TRUE, eval(do))</code> .
...	arguments passed to evaluation

**Details**

See [Match](#) for details about the implementation of `match_cond`. When matching, `ref` conditions check whether `x` is a `ref` object. If so, then a match occurs if the condition and `x` point to the same object. Otherwise, the condition is dereferenced and the resulting value is checked using the appropriate match condition. Note that a `slice` is never matched with a `ref` and vice versa, though `ref` and `sref` objects may match if they point to the same object.

**Value**

FALSE if no match, or a list containing TRUE and the evaluated expression

**Examples**

```
x <- 1:10
ref_to_x <- ref(x)

matchr::Match(
  x,
  is.character -> "is a character",
  ref_to_x     -> "same as reference", # <- MATCH
  .           -> "anything else"
)
```

**Description**

These functions automatically call `deref` when applied to a `ref` or `"rfexpr"` object. Therefore, there is no need to explicitly call `deref`. `sref` objects will need to be explicitly dereferenced before applying these functions. All functions are from base R.

**Usage**

```
## S3 method for class 'ref'
Math(x, ...)

## S3 method for class 'ref'
Ops(e1, e2)

## S3 method for class 'ref'
Complex(z)

## S3 method for class 'ref'
Summary(..., na.rm = FALSE)

## S3 method for class 'rfexpr'
Math(x, ...)

## S3 method for class 'rfexpr'
Ops(e1, e2)

## S3 method for class 'rfexpr'
Complex(z)

## S3 method for class 'rfexpr'
Summary(..., na.rm = FALSE)

## S3 method for class 'ref'
all.equal(target, current, ...)

## S3 method for class 'ref'
anyDuplicated(x, incomparables = FALSE, ...)

## S3 method for class 'ref'
as.character(x, ...)

## S3 method for class 'ref'
as.data.frame(x, row.names = NULL, optional = FALSE, ...)
```

```
## S3 method for class 'ref'  
as.Date(x, ...)  
  
## S3 method for class 'ref'  
as.double(x, ...)  
  
## S3 method for class 'ref'  
as.function(x, ...)  
  
## S3 method for class 'ref'  
as.list(x, ...)  
  
## S3 method for class 'ref'  
as.matrix(x, ...)  
  
## S3 method for class 'ref'  
as.POSIXct(x, tz = "", ...)  
  
## S3 method for class 'ref'  
as.POSIXlt(x, tz = "", ...)  
  
## S3 method for class 'ref'  
as.single(x, ...)  
  
## S3 method for class 'ref'  
as.table(x, ...)  
  
## S3 method for class 'ref'  
c(...)  
  
## S3 method for class 'ref'  
cut(x, ...)  
  
## S3 method for class 'ref'  
diff(x, ...)  
  
## S3 method for class 'ref'  
dim(x)  
  
## S3 method for class 'ref'  
droplevels(x, ...)  
  
## S3 method for class 'ref'  
duplicated(x, incomparables = FALSE, ...)  
  
## S3 method for class 'ref'  
format(x, ...)
```

```
## S3 method for class 'ref'  
isSymmetric(object, ...)  
  
## S3 method for class 'ref'  
kappa(z, ...)  
  
## S3 method for class 'ref'  
labels(object, ...)  
  
## S3 method for class 'ref'  
length(x)  
  
## S3 method for class 'ref'  
levels(x)  
  
## S3 method for class 'ref'  
mean(x, ...)  
  
## S3 method for class 'ref'  
merge(x, y, ...)  
  
## S3 method for class 'ref'  
qr(x, ...)  
  
## S3 method for class 'ref'  
rep(x, ...)  
  
## S3 method for class 'ref'  
rev(x)  
  
## S3 method for class 'ref'  
round(x, digits = 0)  
  
## S3 method for class 'ref'  
row.names(x)  
  
## S3 method for class 'ref'  
solve(a, b, ...)  
  
## S3 method for class 'ref'  
sort(x, decreasing = FALSE, ...)  
  
## S3 method for class 'ref'  
aggregate(x, ...)  
  
## S3 method for class 'ref'  
coef(object, ...)
```



```
## S3 method for class 'ref'  
confint(object, parm, level = 0.95, ...)  
  
## S3 method for class 'ref'  
fitted(object, ...)  
  
## S3 method for class 'ref'  
median(x, na.rm = FALSE, ...)  
  
## S3 method for class 'ref'  
model.frame(formula, ...)  
  
## S3 method for class 'ref'  
model.matrix(object, ...)  
  
## S3 method for class 'ref'  
na.omit(object, ...)  
  
## S3 method for class 'ref'  
plot(x, y, ...)  
  
## S3 method for class 'ref'  
predict(object, ...)  
  
## S3 method for class 'ref'  
residuals(object, ...)  
  
## S3 method for class 'ref'  
summary(object, ...)  
  
## S3 method for class 'ref'  
terms(x, ...)  
  
## S3 method for class 'ref'  
vcov(object, ...)  
  
## S3 method for class 'ref'  
window(x, ...)  
  
## S3 method for class 'rfexpr'  
all.equal(target, current, ...)  
  
## S3 method for class 'rfexpr'  
anyDuplicated(x, incomparables = FALSE, ...)  
  
## S3 method for class 'rfexpr'  
as.character(x, ...)
```

```
## S3 method for class 'rfexpr'  
as.data.frame(x, row.names = NULL, optional = FALSE, ...)  
  
## S3 method for class 'rfexpr'  
as.Date(x, ...)  
  
## S3 method for class 'rfexpr'  
as.double(x, ...)  
  
## S3 method for class 'rfexpr'  
as.function(x, ...)  
  
## S3 method for class 'rfexpr'  
as.list(x, ...)  
  
## S3 method for class 'rfexpr'  
as.matrix(x, ...)  
  
## S3 method for class 'rfexpr'  
as.POSIXct(x, tz = "", ...)  
  
## S3 method for class 'rfexpr'  
as.POSIXlt(x, tz = "", ...)  
  
## S3 method for class 'rfexpr'  
as.single(x, ...)  
  
## S3 method for class 'rfexpr'  
as.table(x, ...)  
  
## S3 method for class 'rfexpr'  
c(...)  
  
## S3 method for class 'rfexpr'  
cut(x, ...)  
  
## S3 method for class 'rfexpr'  
diff(x, ...)  
  
## S3 method for class 'rfexpr'  
dim(x)  
  
## S3 method for class 'rfexpr'  
droplevels(x, ...)  
  
## S3 method for class 'rfexpr'  
duplicated(x, incomparables = FALSE, ...)
```

```
## S3 method for class 'rfexpr'  
format(x, ...)  
  
## S3 method for class 'rfexpr'  
isSymmetric(object, ...)  
  
## S3 method for class 'rfexpr'  
kappa(z, ...)  
  
## S3 method for class 'rfexpr'  
labels(object, ...)  
  
## S3 method for class 'rfexpr'  
length(x)  
  
## S3 method for class 'rfexpr'  
levels(x)  
  
## S3 method for class 'rfexpr'  
mean(x, ...)  
  
## S3 method for class 'rfexpr'  
merge(x, y, ...)  
  
## S3 method for class 'rfexpr'  
qr(x, ...)  
  
## S3 method for class 'rfexpr'  
rep(x, ...)  
  
## S3 method for class 'rfexpr'  
rev(x)  
  
## S3 method for class 'rfexpr'  
round(x, digits = 0)  
  
## S3 method for class 'rfexpr'  
row.names(x)  
  
## S3 method for class 'rfexpr'  
solve(a, b, ...)  
  
## S3 method for class 'rfexpr'  
sort(x, decreasing = FALSE, ...)  
  
## S3 method for class 'rfexpr'  
aggregate(x, ...)
```

```
## S3 method for class 'rfexpr'  
coef(object, ...)  
  
## S3 method for class 'rfexpr'  
confint(object, parm, level = 0.95, ...)  
  
## S3 method for class 'rfexpr'  
fitted(object, ...)  
  
## S3 method for class 'rfexpr'  
median(x, na.rm = FALSE, ...)  
  
## S3 method for class 'rfexpr'  
model.frame(formula, ...)  
  
## S3 method for class 'rfexpr'  
model.matrix(object, ...)  
  
## S3 method for class 'rfexpr'  
na.omit(object, ...)  
  
## S3 method for class 'rfexpr'  
plot(x, y, ...)  
  
## S3 method for class 'rfexpr'  
predict(object, ...)  
  
## S3 method for class 'rfexpr'  
residuals(object, ...)  
  
## S3 method for class 'rfexpr'  
summary(object, ...)  
  
## S3 method for class 'rfexpr'  
terms(x, ...)  
  
## S3 method for class 'rfexpr'  
vcov(object, ...)  
  
## S3 method for class 'rfexpr'  
window(x, ...)
```

### Arguments

x, y, e1, e2, z, target, current, object, a, b, formula  
objects of class "ref"  
... other objects passed to the function

incomparables, digits, tz, row.names, optional, decreasing, na.rm, parm,  
level

function specific arguments. See the relevant functions for more details

### Value

An R object depending on the function.

---

modify_by	<i>Modify an Object In Place</i>
-----------	----------------------------------

---

### Description

Update the value pointed to by a [ref](#) object. If the new value is a function, the old values will be applied to the function and overwritten.

### Usage

```
modify_by(x, value, ...)
```

### Arguments

x	object of class "ref"
value	new value or function applied to the object at the referenced location
...	additional arguments passed to the function

### Value

object of class "ref"

### Examples

```
x <- 1:10
ref_to_x <- ref(x)

# Apply the square root function
modify_by(ref_to_x, sqrt)
print(x)

# Overwrite the original values
modify_by(ref_to_x, "hello world!")
print(x)
```

---

ref	<i>Create Reference to an Object</i>
-----	--------------------------------------

---

**Description**

Create a reference to an arbitrary R object. Use [deref](#) or ``!`` to obtain the values within the referenced object. Use [sref](#) to create a safer reference that limits modification in place.

**Usage**

```
ref(x)
```

**Arguments**

x	object to be referenced. x can be a symbol, character, or an expression containing a symbol.
---	--

**Details**

Since R does not have reference semantics outside of environments, `ref` records the environment location of an object rather than its memory address. `ref(x)` searches for object with name "x" within the search path. If found, a reference to the environment and the name "x" are recorded. Otherwise, an error is returned.

`ref` can also create a reference to objects within an expression. `ref` searches the uncalled names within the expression and replaces them with a reference to the object and a call to `deref`. For example, `ref(x[[y]][2])` inserts a reference to variable x and variable y from the search path into the expression then wraps the expression into an object of class "ref\_exp". These objects are dereferenced by evaluating the expression. An error is returned only if the corresponding variables cannot be found along the search path.

[deref](#) can be used to find the objects at the referenced location. This usually results in a copy of the objects. If the object is no longer available, NULL will be returned. Generic functions on a ref object, such as arithmetic or ``sqrt``, will automatically dereference the object before applying the generic function. See [Methods](#) and [Extract](#) for a list of available functions where explicit dereferencing is not needed. If this behavior is not desired, then [sref](#) can be used to force the explicit use of `deref`.

See [Extract](#) and [modify\\_by](#) for functions that modify the underlying value in place.

An active binding could also be used instead of creating a reference. Active bindings, though, can be more difficult to pass around and may have additional overhead since they are functions.

`ref` can provide unsafe or inconsistent code that is susceptible to side-effects. Apply caution and restraint with its use and be sure to `deref` before exporting any ref objects.

**Value**

a list of class "ref" containing a reference to the environment of the object and the name of the object to be found within the environment, or an expression of class "ref\_expr" containing references

**Examples**

```
# Create a vectors of random numbers
x <- rnorm(10)
y <- runif(10)

# Create a reference to the random numbers
ref_to_x <- ref(x)
ref_to_y <- ref(y)

# Place references in a list
list_of_refs <- list(x = ref_to_x, y = ref_to_y)

# Check sum of refs 'x' and 'y'
# Note that both `+` and `sum` automatically deref
sum1 <- sum(list_of_refs$x + list_of_refs$y)

# Update 'x' and calculate new sum
x <- rnorm(10)
sum2 <- sum(list_of_refs$x + list_of_refs$y)

# check diff in sums to see if 'list_of_refs' updated
sum2 - sum1

# Obtain a reference to an expression
ref_to_part <- ref(x[2:5] + 3)
deref(ref_to_part)

# Another expression reference
refs_to_list <- ref(list(x, y))
deref(refs_to_list)

x <- "hello"
y <- "world"

deref(refs_to_list)

# Alternative, `!` can be used for dereferencing
!refs_to_list

identical(!refs_to_list, deref(refs_to_list))

# Referencing data.frame columns
dat <- data.frame(first = 1:4, second = 5:8)
ref_to_first <- ref(dat$first)
mean1 <- mean(!ref_to_first)

dat$first <- dat$first * 4
mean2 <- mean(!ref_to_first)

mean2 == 4*mean1

# Many operations automatically dereference
```

```
ref_to_first * 5
ref_to_x == ref_to_y
cos(ref_to_first)
max(ref_to_first)
```

---

ref_list	<i>Create A List of References</i>
----------	------------------------------------

---

## Description

Create a list of references or referenced expressions. See [ref](#) for more details.

## Usage

```
ref_list(...)
```

## Arguments

... objects to be referenced, possibly named.

## Value

a list containing object references

## Examples

```
x <- 1
y <- "hello"
z <- list(a = 1, b = 2, c = 3)

new_list <- ref_list(x, second = y, z)

!new_list[[1]]
(!new_list$second) == y # TRUE

y <- 18
(!new_list$second) == 18 # TRUE
```



---

`slice`*Create a Reference Slice to a Vector*

---

### Description

Create a reference to a 'part' of an R object. Use `deref` or ``!`` to obtain the values within the referenced object.

### Usage

```
slice(x, ...)
```

### Arguments

<code>x</code>	object to be referenced; must be a symbol or character
<code>...</code>	objects passed to <code>x[...]</code> when dereferenced

### Details

`slice` is similar to `ref`; it creates a reference to another R object. There are two main differences with `ref`. First, `slice` only accepts names or characters instead of expressions. Second, `slice` records a part of the underlying object. `slice(x, 1:2, 3)` is equivalent to the reference of `x[1:2, 3]`. This is similar to `ref(x[1:2, 3])`, though the implementation is different. `ref` would create an expression with a reference to `x`, while `slice(x, 1:2, 3)` creates a list with a reference to `x` and the extract inputs. `slice` is more efficient, but is limited in its capabilities.

### Value

object of class "slice" and "ref"

### Examples

```
## Vector Slice
x <- 10:1

slice_x <- slice(x, 2:4)
identical(!slice_x, 9:7) # TRUE

x <- x - 2
identical(!slice_x, 7:5) # TRUE

## Matrix Slice
y <- matrix(1:9, nrow=3)
slice_y <- slice(y, 2, 3)

identical(!slice_y, y[2, 3]) # TRUE
```

---

sref

*Create a Safer Reference to an Object*

---

## Description

Create a reference to an arbitrary R object. See [ref](#) for more details. `sref` behaves similar to `ref`, but does not have support for direct operations on the referenced object.

## Usage

```
sref(x)
```

## Arguments

`x` object to be referenced. `x` can be a symbol, character, or an expression containing a symbol.

## Details

`sref` is similar to [ref](#); it accepts either an R object or an expression, then records its location. `ref` objects prioritize convenience, while `sref` objects prioritize clarity and safety. For example, ``[`` and ``$`` can be used on a `ref` object to access the elements of the underlying object, while ``[<-`` and ``$<-`` can be used to overwrite elements within. These do not work for `sref` objects. Furthermore, base mathematical functions such as ``+`` and `sqrt` also will not automatically dereference before applying.

## Examples

```
x <- 1:10
ref_x <- ref(x)
sref_x <- sref(x)

## These operations will run:
ref_x + 5
ref_x[1:4]
ref_x[7] <- 5

## These operations will not run:
# sref_x + 5
# sref_x[1:4]
# sref_x[7] <- 5
```

---

sslice	<i>Create a Safer Reference Slice to a Vector</i>
--------	---

---

**Description**

Create a reference to a 'part' of an R object. `sslice` behaves similar to `slice`, but does not have support for direct operations on the referenced object. See `sref` for details about the behavior.

**Usage**

```
sslice(x, ...)
```

**Arguments**

<code>x</code>	object to be referenced; must be a symbol or character
<code>...</code>	objects passed to <code>x[...]</code> when dereferenced

**Value**

object of class "sslice" and "sref"

---

<code>%.*=%</code>	<i>Matrix Multiplication In Place</i>
--------------------	---------------------------------------

---

**Description**

Change the value of an object on the search path through matrix multiplication. Similar to '`*=`' in other languages, except with matrix multiplication. See `incr` for details on implementation.

**Usage**

```
x %.*=% value
```

**Arguments**

<code>x</code>	object to be modified; can be a symbol, character, or extraction language object.
<code>value</code>	value with which to change <code>x</code> by

**Value**

the new value of `x`, invisibly

**Examples**

```
x <- 1:5
x %.*=% 6:10
identical(x, 130) # TRUE
```

---

`%-=%`*Subtract In Place*

---

**Description**

Decrease the value of an object on the search path. Equivalent to '-=' in other languages. See [incr](#) for details on implementation.

**Usage**

```
x %-=% value
```

**Arguments**

x	object to be modified; can be a symbol, character, or extraction language object.
value	value with which to change x by

**Value**

the new value of x, invisibly

**Examples**

```
x <- 11:20
x %-=% 10
identical(x, 1:10) # TRUE
```

---

`%+=%`*Add In Place*

---

**Description**

Increase the value of an object on the search path. Equivalent to '+=' in other languages. See [incr](#) for details on implementation.

**Usage**

```
x %+=% value
```

**Arguments**

x	object to be modified; can be a symbol, character, or extraction language object.
value	value with which to change x by

**Value**

the new value of x, invisibly

### Examples

```
x <- 1:10
x %+=% 10
identical(x, 11:20) # TRUE
```

---

`%^=%`*Power In Place*

---

### Description

Change the value of an object on the search path through exponentiation Equivalent to '^=' in other languages. See [incr](#) for details on implementation.

### Usage

```
x %+=% value
```

### Arguments

<code>x</code>	object to be modified; can be a symbol, character, or extraction language object.
<code>value</code>	value with which to change x by

### Value

the new value of x, invisibly

### Examples

```
x <- 10
x %+=% 2
identical(x, 100) # TRUE
```

---

`%/=%`*Divide In Place*

---

### Description

Change the value of an object on the search path through division. Equivalent to '/=' in other languages. See [incr](#) for details on implementation.

### Usage

```
x %/= value
```

**Arguments**

x                    object to be modified; can be a symbol, character, or extraction language object.  
value                value with which to change x by

**Value**

the new value of x, invisibly

**Examples**

```
x <- 10  
x %*=% 2  
identical(x, 5) # TRUE
```

---

%\*=%

*Multiply In Place*

---

**Description**

Change the value of an object on the search path through multiplication. Equivalent to '\*' in other languages. See [incr](#) for details on implementation.

**Usage**

```
x %*=% value
```

**Arguments**

x                    object to be modified; can be a symbol, character, or extraction language object.  
value                value with which to change x by

**Value**

the new value of x, invisibly

**Examples**

```
x <- 5  
x %*=% 2  
identical(x, 10) # TRUE
```

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