Untitled

standard normal distribution (mean $= 0$, standard deviation $= 1$)

```
stdnormal_rnd(1,5)
#> ans =
#>
#>   -0.308048  -0.857498   1.519004  -0.676947   0.090308
```

$\mu = 2, \sigma = 4$ standard deviation sigma

```
%% copy from https://stackoverflow.com/questions/13735096/python-vs-octave-random-generator
function state = mtstate(seed)
state = uint32(zeros(625,1));
state(1) = uint32(seed);
for i=1:623,
    tmp = uint64(1812433253)*uint64(bitxor(state(i),bitshift(state(i),-30)))+i;
    state(i+1) = uint32(bitand(tmp,uint64(intmax('uint32'))));
end
state(625) = 1;
end

rand('state',mtstate(4));
rand(1,5)
rand('state',mtstate(4));
rand(1,5)
#> ans =
#>
#>    0.96703   0.54723   0.97268   0.71482   0.69773
#>
#> ans =
#>
#>    0.96703   0.54723   0.97268   0.71482   0.69773
```

```
help('modules')
#>
#> Please wait a moment while I gather a list of all available modules...
#>
#> DEBUG:pip.utils:lzma module is not available
#> DEBUG:pip.vcs:Registered VCS backend: git
#> DEBUG:pip.vcs:Registered VCS backend: hg
#> DEBUG:pip.vcs:Registered VCS backend: svn
#> DEBUG:pip.vcs:Registered VCS backend: bzr
#> BaseHTTPServer       ast                imaplib              select
#> Bastion              asynchat           imghdr               sets
#> CDROM                asyncore           imp                  setuptools
#> CGIHTTPServer        atexit             importlib            sgmllib
#> Canvas               audiodev           imputil              sha
#> ConfigParser         audioop            inspect              shelve
#> Cookie               base64             io                   shlex
#> Crypto               bdb                ipaddress            shutil
#> DLFCN                binascii           itertools            signal
#> Dialog               binhex             json                 signatures
#> DocXMLRPCServer      bisect             keyring              site
```

#> FileDialog	bsddb	keyrings	sitecustomize
#> FixTk	bz2	keyword	six
#> HTMLParser	cPickle	lib2to3	smtpd
#> IN	cProfile	linecache	smtplib
#> MimeWriter	cStringIO	linuxaudiodev	sndhdr
#> Queue	cachecontrol	locale	socket
#> ScrolledText	caches	lockfile	spwd
#> SimpleDialog	calendar	logging	sqlite3
#> SimpleHTTPServer	cgi	lsb_release	sre
#> SimpleXMLRPCServer	cgitb	macpath	sre_compile
#> SocketServer	chunk	macurl2path	sre_constants
#> StringIO	cmath	mailbox	sre_parse
#> TYPES	cmd	mailcap	ssl
#> Tix	code	markupbase	stat
#> Tkconstants	codecs	marshal	statvfs
#> Tkdnd	codeop	math	string
#> Tkinter	collections	md5	stringold
#> UserDict	colorsys	mhlib	stringprep
#> UserList	command	mimetools	strop
#> UserString	commands	mimetypes	struct
#> _LWPCookieJar	compileall	mimify	subprocess
#> _MozillaCookieJar	compiler	mmap	sunau
#> __builtin__	contextlib	modulefinder	sunaudio
#> __future__	contrib	multifile	symbol
#> _abcoll	cookielib	multiprocessing	symtable
#> _ast	copy	mutex	sys
#> _backport	copy_reg	netrc	sysconfig
#> _bisect	crypt	new	syslog
#> _bsddb	cryptography	nis	tabnanny
#> _cffi_backend	csv	nntplib	talloc
#> _codecs	ctypes	ntpath	tarfile
#> _codecs_cn	curses	nturl2path	telnetlib
#> _codecs_hk	datetime	numbers	tempfile
#> _codecs_iso2022	dbhash	numpy	termios
#> _codecs_jp	dbm	opcode	test
#> _codecs_kr	dbus	operator	textwrap
#> _codecs_tw	debconf	optparse	this
#> _collections	decimal	os	thread
#> _csv	difflib	os2emxpath	threading
#> _ctypes	dircache	ossaudiodev	time
#> _ctypes_test	dis	packages	timeit
#> _curses	distlib	packaging	tkColorChooser
#> _curses_panel	distutils	parser	tkCommonDialog
#> _dbus_bindings	doctest	pdb	tkFileDialog
#> _dbus_glib_bindings	dumbdbm	pickle	tkFont
#> _elementtree	dummy_thread	pickletools	tkMessageBox
#> _functools	dummy_threading	pip	tkSimpleDialog
#> _hashlib	easy_install	pipes	toaiff
#> _heapq	email	pkg_resources	token
#> _hotshot	encodings	pkgutil	tokenize
#> _io	ensurepip	platform	tool
#> _json	enum	plistlib	trace
#> _locale	errno	popen2	traceback

```
#> _lsprof              exceptions        poplib            ttk
#> _md5                 extern            posix             tty
#> _multibytecodec      fcntl             posixfile         turtle
#> _multiprocessing     filecmp           posixpath         types
#> _osx_support         fileinput         pprint            unicodedata
#> _pyio                fnmatch           profile           unittest
#> _random              formatter         pstats            urllib
#> _sha                 fpectl            pty               urllib2
#> _sha256              fpformat          pwd               urllib3
#> _sha512              fractions         py_compile        urlparse
#> _socket              ftplib            pyasn1            user
#> _sqlite3             functools         pyclbr            util
#> _sre                 future_builtins   pydoc             uu
#> _ssl                 gc                pydoc_data        uuid
#> _strptime            genericpath       pyexpat           warnings
#> _struct              getopt            pygtkcompat       wave
#> _symtable            getpass           quopri            weakref
#> _sysconfigdata       gettext           random            webbrowser
#> _sysconfigdata_nd    gi                re                wheel
#> _testcapi            glob              readline          whichdb
#> _threading_local     grp               repr              wsgiref
#> _warnings            gzip              resource          xdg
#> _weakref             hashlib           retrying          xdrlib
#> _weakrefset          heapq             rexec             xml
#> abc                  hmac              rfc822            xmllib
#> aifc                 hotshot           rlcompleter       xmlrpclib
#> antigravity          htmlentitydefs    robotparser       xxsubtype
#> anydbm               htmllib           rpytools          zipfile
#> appdirs              httplib           runpy             zipimport
#> argparse             idna              sched             zlib
#> array                ihooks            secretstorage
#>
#> Enter any module name to get more help.  Or, type "modules spam" to search
#> for modules whose descriptions contain the word "spam".
```

```r
library(extrafont)
library(xkcd)
# cairo_pdf(file = 'figures/xkcd.pdf',width = 6,height = 4)
ggplot(aes(mpg, wt), data = mtcars) + geom_point() +
    theme_xkcd()
# dev.off()
```

```r
x <- rnorm(10)
y <- x + rnorm(5, sd = 0.25)
model <- lm(y ~ x)
rsq <- summary(model)$r.squared
rsq <- signif(rsq, 4)
plot(x, y, main = "Hello \\LaTeX!", xlab = "$x$", ylab = "$y$",
     sub = "$\\mathcal{N}(\\mathbf{x};\\mu,\\Sigma)$")
abline(model, col = "red")
mtext(paste("Linear model: $R^{2}=", rsq, "$"), line = 0.5)
legend("bottomright", legend = paste0("$y = ",
                                round(coef(model)[2], 3),
                                "x +",
```
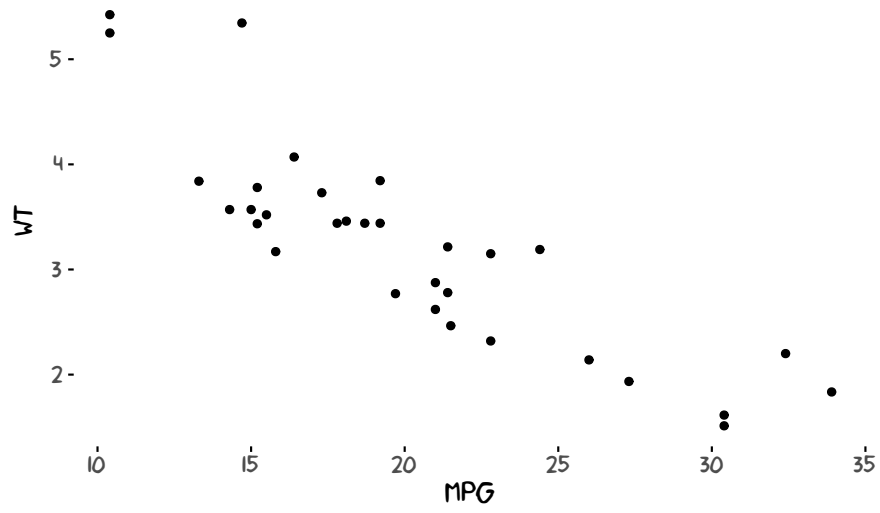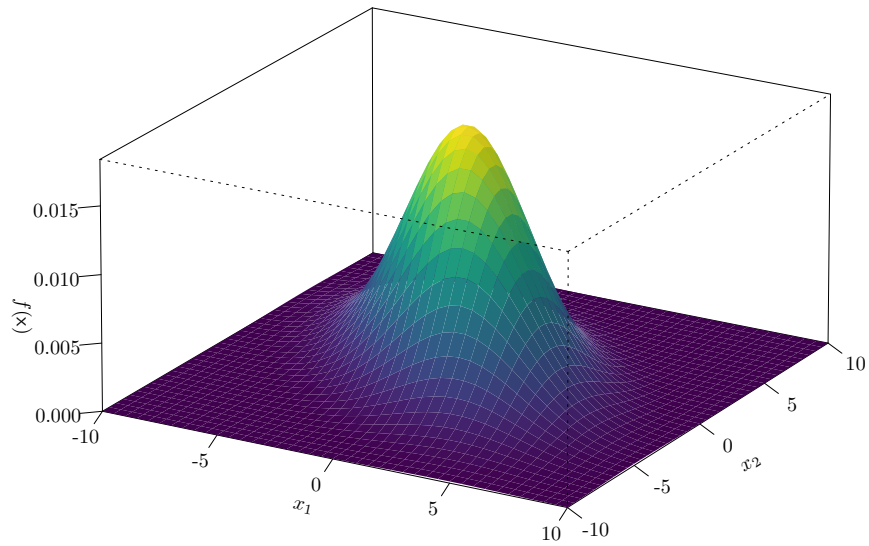
Figure 1: xkcd

Two dimensional Normal Distribution

$\mu_1 = 0, \mu_2 = 0, \sigma_{11} = 10, \sigma_{22} = 10, \sigma_{12} = 15, \rho = 0.5$

$$f(\mathsf{x}) = \frac{1}{2\pi\sqrt{\sigma_{11}\sigma_{22}(1-\rho^2)}} \exp\left\{-\frac{1}{2(1-\rho^2)}\left[\frac{(x_1-\mu_1)^2}{\sigma_{11}} - 2\rho\frac{(x_1-\mu_1)(x_2-\mu_2)}{\sqrt{\sigma_{11}}\sqrt{\sigma_{22}}} + \frac{(x_2-\mu_2)^2}{\sigma_{22}}\right]\right\}$$

Figure 2: tikz

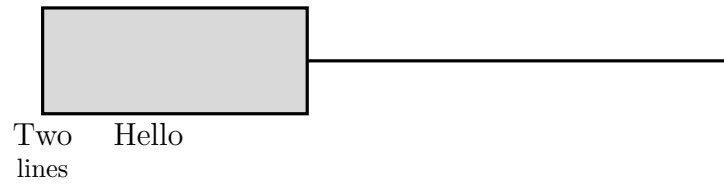Figure 3: tikz

```
                              round(coef(model)[1], 3),
                              "$"
                              ),
        bty = "n")
```

```
\begin{tikzpicture}[scale=.7]
\draw [fill=gray!30,very thick] (0,-1) rectangle (5,1);
\draw [very thick] (5, 0) -- (13,0);
\node [below] at (2,-1) {\large Hello};
\node [below, align=center] at (0,-1) {\large Two\\ lines};
\end{tikzpicture}
```