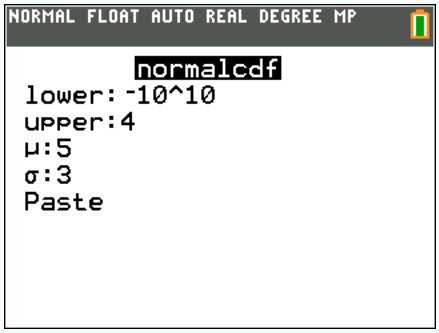
4.9 Normal distribution

In the following subsections, we will only compute probabilities involving "$\leq$". However, since the normal distribution is continuous, you could replace all the "$\leq$" by a "$<$", and the result would be the same. To have a user-friendly interface of the normal distribution functions, see 4.4.1 on page 63.

4.9.1 Compute $\mathbf{P}(X \leq a)$ with `normalcdf` function

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$.[3] Suppose you want to compute $\mathbf{P}(X \leq 4)$.

Press 2nd , distr vars , `normalcdf(`, choose a huge negative value for `lower` (like -10^{10}), and `upper:4` (here $\mu = 5$ and $\sigma = 3$):



Press then on `Paste` and entry solve enter .

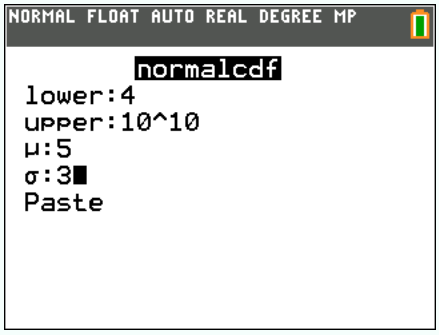
Here the result should be 0.369 (rounded).

4.9.2 Compute $\mathbf{P}(X \geq a)$ with `normalcdf` function

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Suppose you want to compute $\mathbf{P}(X \geq 4)$.

Press 2nd , distr vars , `normalcdf(`, choose `lower:4`, and a huge positive value for `upper` (like 10^{10}) (here $\mu = 5$ and $\sigma = 3$):

[3] The IB notation for the normal distribution is $\mathcal{N}(\mu, \sigma^2)$, but the TI-84 works with σ. We write 3^2 to express that $\sigma = 3$.

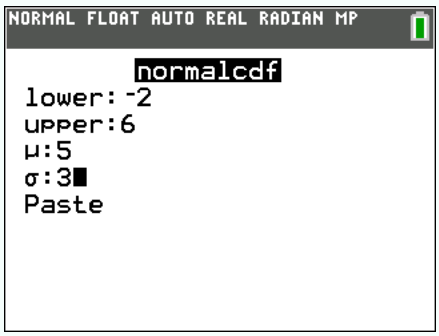


Press then on `Paste` and entry solve enter .

Here the result should be 0.631 (rounded).

4.9.3 Compute $\mathbf{P}(a \leq X \leq b)$ with `normalcdf` function

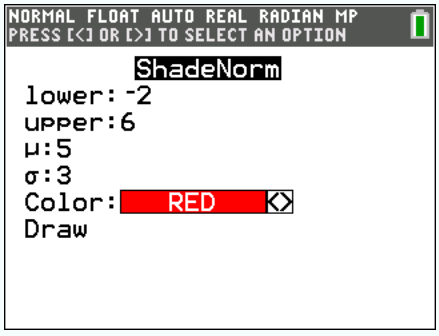
Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Suppose you want to compute $\mathbf{P}(-2 \leq X \leq 6)$. Press 2nd , distr vars , `normalcdf(`, and set `lower:-2` and `upper:6`:



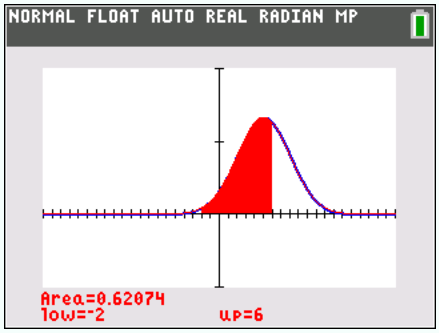
Press `Paste` and entry solve enter . The result should be 0.621 (rounded).

4.9.4 Draw $\mathbf{P}(a \leq X \leq b)$ with `ShadeNorm` function

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Consider again $\mathbf{P}(-2 \leq X \leq 6)$. Press 2nd , distr vars , `DRAW`, `ShadeNorm(`, and choose `lower:-2` and `upper:6` (here $\mu = 5$ and $\sigma = 3$):



Press then on **Draw** and entry solve enter . The following should be displayed:

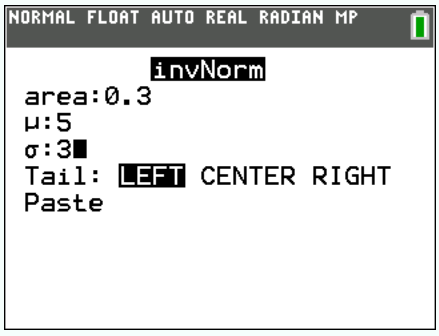


The area is $\mathbf{P}(-2 \leq X \leq 6)$

4.9.5 Find x when $\mathbf{P}(X \leq x) = c$ with invNorm function

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Suppose you want to know for what x we have $\mathbf{P}(X \leq x) = 0.3$.

Press 2nd , distr vars and **invNorm(**, choose as **area:0.3**, and **tail:LEFT**[4] (the tail is at left because our area starts at $-\infty$):



Press then **paste** and entry solve enter . The result should be $x = 3.43$ (rounded).

Use **tale:CENTER** if the question is $\mathbf{P}(x_1 \leq X \leq x_2) = c$. You should get in this example $\{x_1, x_2\} = \{3.84, 6.16\}$ (rounded). Use **tale:RIGHT** if the question is $\mathbf{P}(x \leq X) = c$. You should get in this example x =6.57 (rounded).

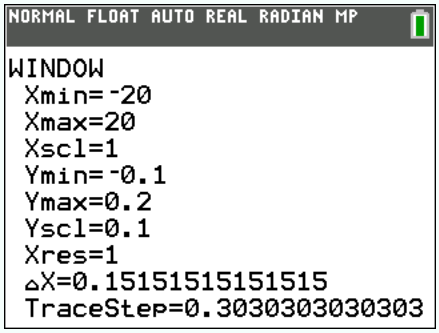
4.9.6 Plot a normal distribution

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$.

[4] some calculators do not have this option

① To plot the distribution in the calculator, press stat plot f1 y= , 2nd , distr vars , normalpdf(. Press link X,T,θ,n for the x value, select μ and σ according to your problem (here, $\mu = 5$ and $\sigma = 3$), and validate by pressing paste.

② choose an appropriate window (see 2.3.2 on page 36 to do so). Here we chose the following:



The graph should look like this: