

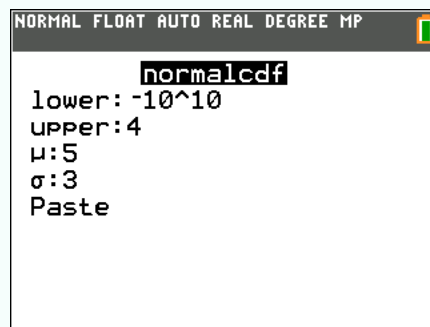
4.9 Normal distribution

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 64.

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

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

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`.

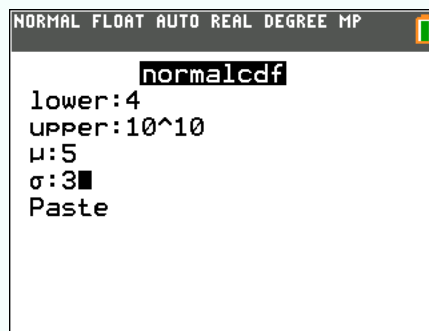
Here the result should be 0.369 (rounded).

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

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

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

³The 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 $\sigma = 3$.






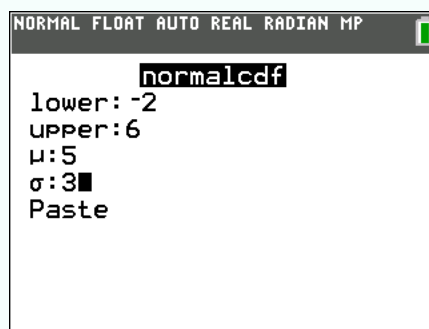
Press then on **Paste** and .


Here the result should be 0.631 (rounded).

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




Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Suppose you want to compute $P(-2 \leq X \leq 6)$.

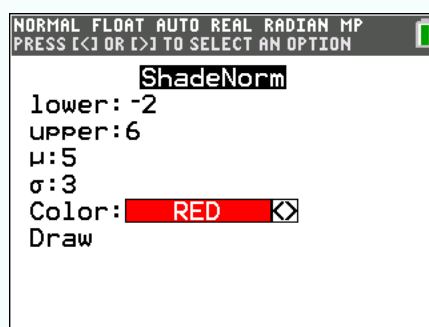
Press , , , `normalcdf(`, and set **lower**: -2 and **upper**: 6:



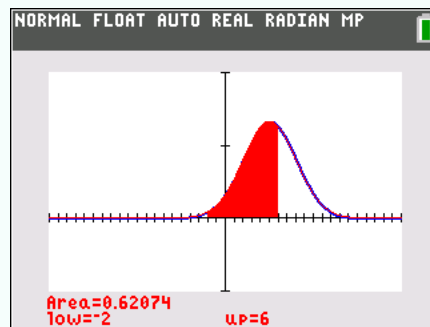
Press **paste** and . The result should be 0.621 (rounded).

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

Consider a random variable $X \sim \mathcal{N}(5, 3^2)$. Consider again $P(-2 \leq X \leq 6)$. Press , , , **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:

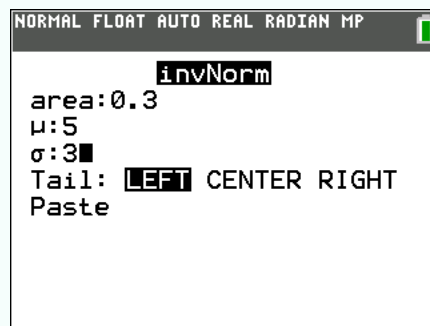


The area is $P(-2 \leq X \leq 6)$

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

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

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

4.9.6 Plot a normal distribution

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

⁴some calculators do not have this option

① To plot the distribution in the calculator, press **stat** **plot** **f1** , **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 37 to do so). Here we chose the following:

```
NORMAL FLOAT AUTO REAL RADIAN MP
WINDOW
Xmin=-20
Xmax=20
Xscl=1
Ymin=-0.1
Ymax=0.2
Yscl=0.1
Xres=1
ΔX=0.15151515151515
TraceStep=0.3030303030303
```

The graph should look like this:

