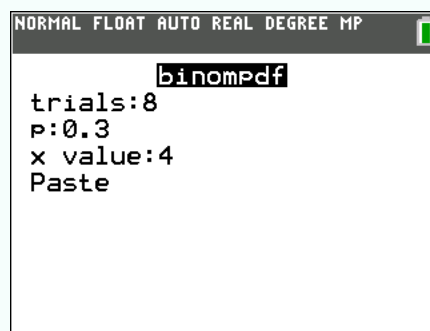## 4.8 Binomial distribution

Consider $X \sim \mathcal{B}(8, 0.3)$.

4.8.1 Compute $\mathbf{P}(X = a)$ with `binompdf` function
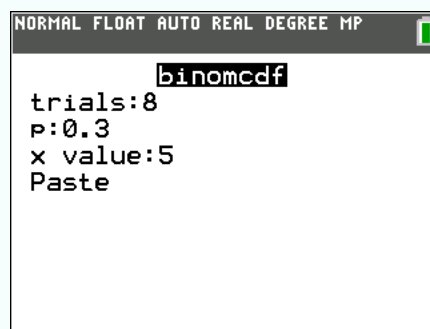
Consider $X \sim \mathcal{B}(8, 0.3)$. Suppose you want to compute $\mathbf{P}(X = 4)$. To do this, press `2nd` , `vars` (distr), `binompdf(`. Choose `x value:4`:

```
NORMAL FLOAT AUTO REAL DEGREE MP

            binompdf
trials:8
p:0.3
x value:4
Paste
```

Press `Paste`, `enter` (entry solve) . The result should be 0.136 (rounded).

4.8.2 Compute $\mathbf{P}(X \leq a)$ with `binomcdf` function

Consider $X \sim \mathcal{B}(8, 0.3)$. Say you want to compute $\mathbf{P}(X \leq 5)$. To do this, press `2nd` , `vars` (distr) , `binomcdf(`. Choose `x value:5`:

```
NORMAL FLOAT AUTO REAL DEGREE MP

            binomcdf
trials:8
p:0.3
x value:5
Paste
```

Press `Paste`, `enter` (entry solve) . The result should be 0.989 (rounded).

NB: If you wanted to compute $\mathbf{P}(X < 5)$ instead, you would calculate $\mathbf{P}(X \leq 4)$ (since the binomial distribution is discrete).
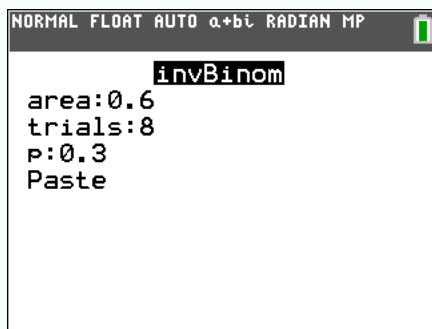
4.8.3 Find x when $\mathbf{P}(X \leq x) = c$ with `invBinom` function

> ⚠ Some calculators may not have this functionality

Consider $X \sim \mathcal{B}(8, 0.3)$. Suppose you want to find **the smallest** x for which $\mathbf{P}(X \leq x) \geq 0.6$. Press `2nd`, `vars`, `invBinom(`, and fill the parameters as follows:

```
NORMAL FLOAT AUTO a+bi RADIAN MP
           invBinom
area:0.6
trials:8
p:0.3
Paste
```

Press `enter`. The result should be 3.

> ⚠ Note that `binomcdf(8,0.3,3)=0.806`, which is **not** 0.6. But since `binomcdf(8,0.3,2)=0.552` is smaller than 0.6, `invBinom` gives us 3 (even though 2 gives an area closer to 0.6, the calculator gives the first integer that gives an area bigger or equal to 0.6)

4.8.4 Plot a binomial distribution

To plot a binomial distribution, we will create two lists, one being the possible amount of successful trials, and the other their probability, and then plot it.

① Create a list L_1 of integers from 0 to n (here: $n = 8$) (press `stat`, `Edit...` to enter the list). Place the cursor on L_2 and press `2nd`, `vars`, `binompdf`. Choose L_1 (by pressing `2nd`, `1`) for `x value`:

```
NORMAL FLOAT AUTO REAL DEGREE MP
           binompdf
trials:8
p:0.3
x value:L₁■
Paste
```

Press **Paste** and $\overset{\text{entry solve}}{\boxed{\text{enter}}}$. The following should be displayed:

② Press $\boxed{\text{2nd}}$, $\overset{\text{stat plot f1}}{\boxed{\text{y=}}}$ **1:** to be able to plot the binomial distribution. Choose the following as parameters:

Color can be changed

Press $\overset{\text{table f5}}{\boxed{\text{graph}}}$ (see 2.3.2 on page 24 if it is not displayed correctly). The following should be displayed: