Math 52 Binomial Probabilities on the TI 83/TI84 (Plus)

A binomial experiment is an experiment that satisfies all of the following conditions:

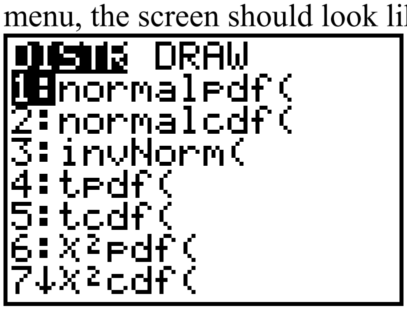
1. The experiment must have a fixed number of trials (n trials).
2. The trials must be independent.
3. Each trial must have the outcomes classified into 2 categories (success or failure)
4. The probabilities must remain the constant for each trial
   (P(success) = p, P(failure) = 1 – p = q.

Suppose the experiment is to roll a single standard die 20 times, a success will be if a 5 appears and a failure will be when something other than a 5 appears. So n = 20, p = 1/6 and q = 5/6. If we want to find the probability of a 5 appearing in exactly 8 of the 20 rolls, we would be looking for

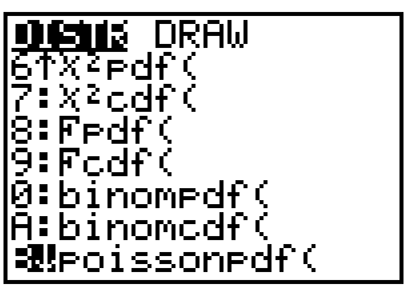
P(number of successes = 8) = P(x = 8) =

$$\frac{20!}{(20-8)!8!}\left(\frac{1}{6}\right)^{8}\left(\frac{5}{6}\right)^{12} = (125970)(.0000005953741)(.1121566548) = .008411669$$

To do this on the calculator, press the [2nd] and [VARS] keys to access the [DISTR] menu, the screen should look like:



use the down arrow key to scroll down until you see the following choices:



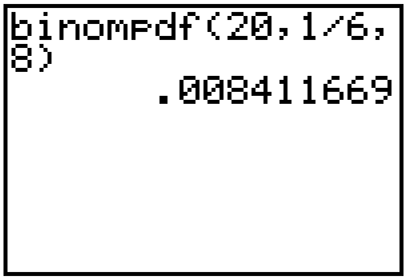
the choices **0:binompdf(** and **A:binomcdf(** are the two we will be using.
The open parentheses indicate that the command requires some additional input to work correctly. In both cases, you need to enter n, p and x (number of trials, prob. of a single success, and number of successes)

> binompdf stands for binomial probability density function and
> binomcdf stands for binomial cumulative density function.

To find the previous probability of P(x = 8) using the calculator, we will use the binompdf choice as follows

1. scroll down to choice 0:binompdf and press [ENTER]

2. type : binompdf(20, 1/6, 8) and press [ENTER]
you should get the following:



note this is the same answer that was already found.

Note n = 20, p = 1/6 and x = 8 (the number if successes)

If we want to find the probability that the number of 5's that appear is at most 3, that would include the cases where x = 0, 1, 2, 3. To do this by hand we would be finding

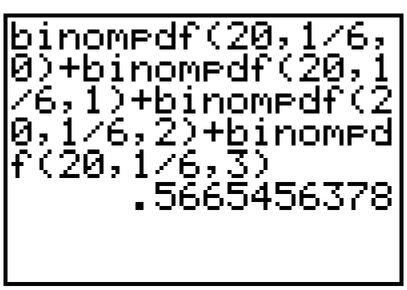
$$P(x \le 3) = P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3) =$$

$$\frac{20!}{(20-0)!0!}\left(\frac{1}{6}\right)^{0}\left(\frac{5}{6}\right)^{20} + \frac{20!}{(20-1)!1!}\left(\frac{1}{6}\right)^{1}\left(\frac{5}{6}\right)^{19}$$
$$+\frac{20!}{(20-2)!2!}\left(\frac{1}{6}\right)^{2}\left(\frac{5}{6}\right)^{18} + \frac{20!}{(20-3)!3!}\left(\frac{1}{6}\right)^{3}\left(\frac{5}{6}\right)^{17} = .5665456388$$

(=.0260840533+.1043362132+.1982388051+.2378865661)

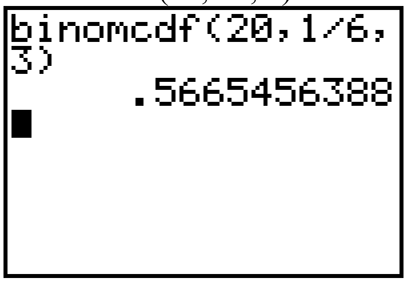
We can do this two ways on the calculator

1. binompdf(20,1/6,0) + binompdf(20,1/6,1) + binompdf(20,1/6,2) + binompdf(20,1/6,3)



OR

2. binomcdf(20,1/6, 3)

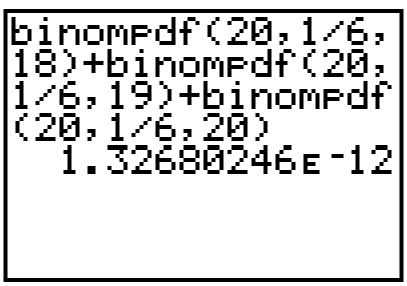


in both cases you should get a probability of .5665456388

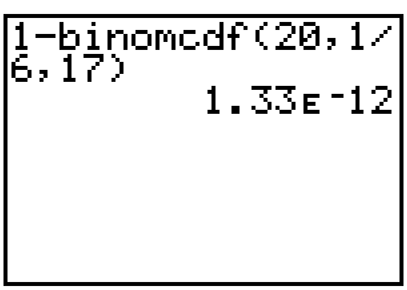
the binomcdf is a cumulative probability, so binomcdf(n,p,x) will find the cumulative probabilities from 0 to the value of x. binompdf is an exact probability so binompdf(n,p,x) finds the probability for exactly x successes.

If we wanted to find the probability that the number of 5 that appear is at least 18 we can do this two ways:

1. $P(x \geq 18) = P(x = 18) + P(x = 19) + P(x = 20)$



2. $1 – P(x < 18) = 1 – (P(x = 0) + P(x = 1) + . . . + P(x = 17))$



notice in both cases the probability is approx. .0000000000133
(so not very likely)

So to summarize the use of the binompdf/binomcdf commands

1. To find P(exactly x successes in n trials) use binompdf(n, p x)

2. To find P(at most x successes in n trials) use binomcdf(n, p, x)

3. To find P(at least x successes in n trials) use 1- binomcdf(n, p, x-1).

You should be able to find almost any binomial probabilities by using one or more above commands.