Binomial Distribution

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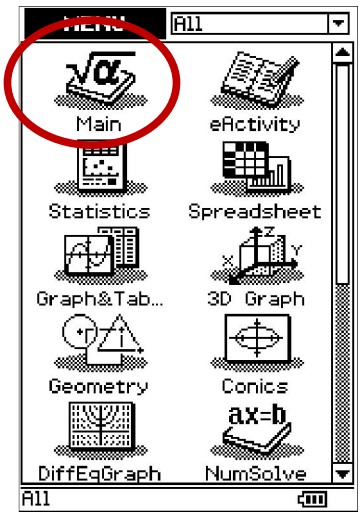


The Binomial Distribution is a discrete probability distribution used to find the probability of an event happening if:

- *the number of observations is fixed.*
- *each observation is independent.*
- *each observation represents one of two outcomes ("success" or "failure").*
- *the probability of "success" p is the same for each outcome.*

Derived from Bernoulli trials, experiments where an event, with a fixed probability (p) of success in any given trial (x) with a fixed number of trials (n). The Binomial distribution is linked to Pascal's Triangle numbers that describe the different combinations that successes and failures can happen.

The Binomial Distribution formula is given by:

$$P(X = x) = \binom{n}{x}\pi^x(1-\pi)^{n-x}$$

$$\mu = n\pi, \qquad \sigma = \sqrt{n\pi(1-\pi)}$$

where the random variable X, with the parameters n *(number of trials)* and π *(probability of a success)*, has the value x *(Number of successes desired)*.

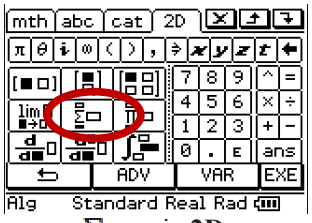
The ClassPad allows the user to define functions. On the ClassPad from the **MAIN MENU** go to the **Main** to solve a problem where you need to compute the number of trials (n) given the other parameters, you can proceed as follows. The ClassPad allows the user to define any function.
For example:

$$\text{Define binpd}(r,n,p) = nCr(n,r)\times p^r\times(1-p)^{n-r}$$

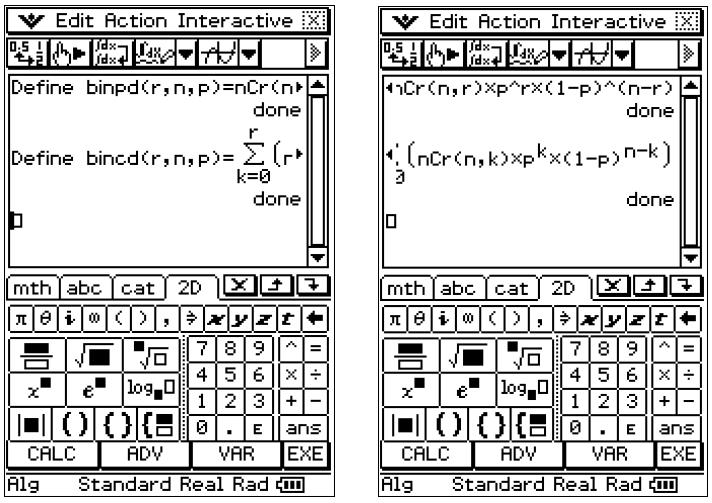
$$\text{Define bincd}(r,n,p) = \sum_{k=0}^{r}\left(nCr(n,k)\times p^k\times(1-p)^{n-k}\right)$$

Once defined, these functions are ready for use and can be typed into the working window.

Define, via **cat**alogue.



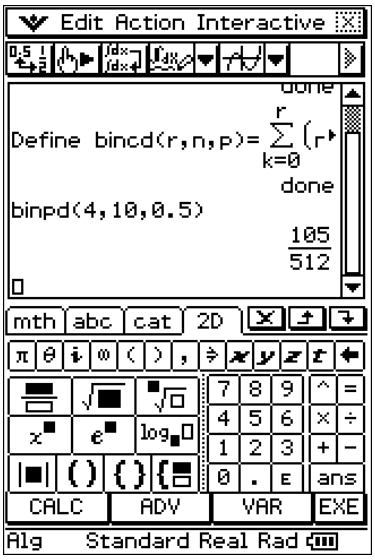
$\sum$, via **2D**.

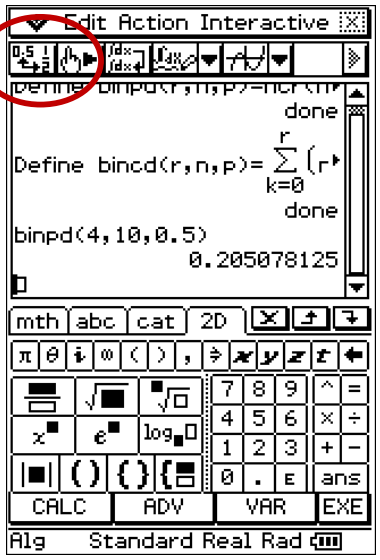


Defining the Binomial PD and CD displayed above.

Example 1: What is the probability for flipping a fair coin (Heads, Tails) ten times and four heads are recorded.

Answer: n (number of trials) = 10
π (probability of a success) = 0.5
x (Number of successes desired) = 4





Convert from fraction to decimal, tap the  **icon**

Prob(exactly 4 heads) = $\frac{105}{512} = 0.2051$ (4 d.p.)

Example 2: A basketball player misses 30% of her free throw shots in a typical game. During one particular game, she attempts 15 free throw shots and misses 7 of the 15. All of her free throw shots are independent events and the probability that she makes a single free throw is 0.70.

(a) What is the probability that she will miss exactly 7 free throws in a game?

(b) What is the probability that she will miss 8 or more free throws in a game?

Answer:

(a) Prob(exactly 7 free throws in a game) = 0.0811 (4 d.p.)

(b) Prob(miss 8 or more free throws in a game) = 1 - 0.9499874 = 0.0500 (4 d.p.)