6 Two distributions

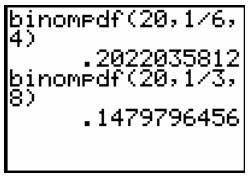
6.1 The binomial distribution

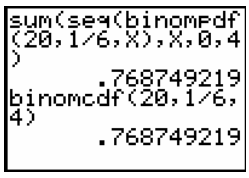
Suppose we throw a dice 20 times and the random variable *X* counts the number of times six spots appear. *X* has a binomial distribution with parameters *n* = 20, the number of trials, and $p = \frac{1}{6}$, the probability of success, six spots. The probability to have after 20 throws:

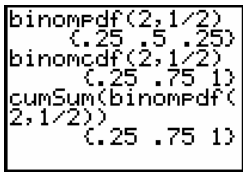
- exactly 4 times six spots, is: $\mathrm{P}(X = 4) = \binom{20}{4}\left(\frac{1}{6}\right)^4\left(\frac{5}{6}\right)^{16} = 0.202$,
- exactly 8 times "six or three": $\binom{20}{8}\left(\frac{1}{3}\right)^8\left(\frac{2}{3}\right)^{12} = 0.148$,
- maximum 4 times a six: $\mathrm{P}(X \le 4) = \sum_{x=0}^{4}\binom{20}{x}\left(\frac{1}{6}\right)^x\left(\frac{5}{6}\right)^{20-x} = 0.769$.

The **TI-83 Plus** can replace the distribution table or the calculation above by the following commands:

2nd[DISTR] 0:binompdf(and **2nd[DISTR] A:binomcdf(**





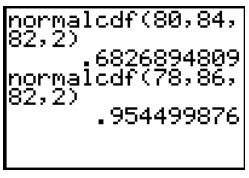


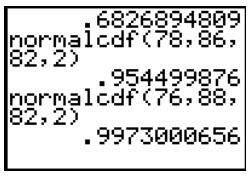
6.2 The normal distribution

Suppose that the weight X of a group of students has a normal distribution with mean $\mu = 82$ kg and standard deviation $\sigma = 2$ kg – $X \sim N(82,2)$.

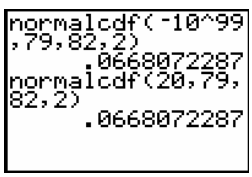
We will check the "68-95-99,7 rule" with the **normalcdf** command. This rule tells us that the surface under the graph of a normal distribution function between:

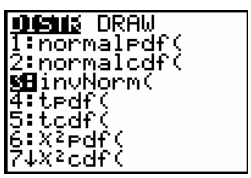
$\mu \pm \sigma$ is equal to 0,68269 ≈ 68%
$\mu \pm 2\sigma$ is equal to 0,95450 ≈ 95%
$\mu \pm 3\sigma$ is equal to 0,99730 ≈ 99,7%

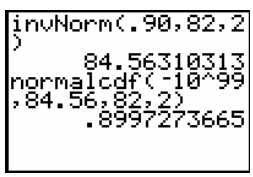




We will determine successively the percentage of students with a weight less than 79 kg and the weight below which 90% of the students' weights are situated. This weight is called the 90th percentile of the distribution.







With the **normalcdf** command you can plot normal distribution functions.

Define **Y1** as **normalpdf(X,82,2)** and plot **Y1** with the window setting below.

It's also possible to shade a region under the graph of a normal distribution function.

2nd[DISTR]<DRAW> 1:ShadeNorm(80,84,82,2) gives you a graphical representation of the fact that the surface under the graph between $\mu \pm \sigma$ is equal to 68%.