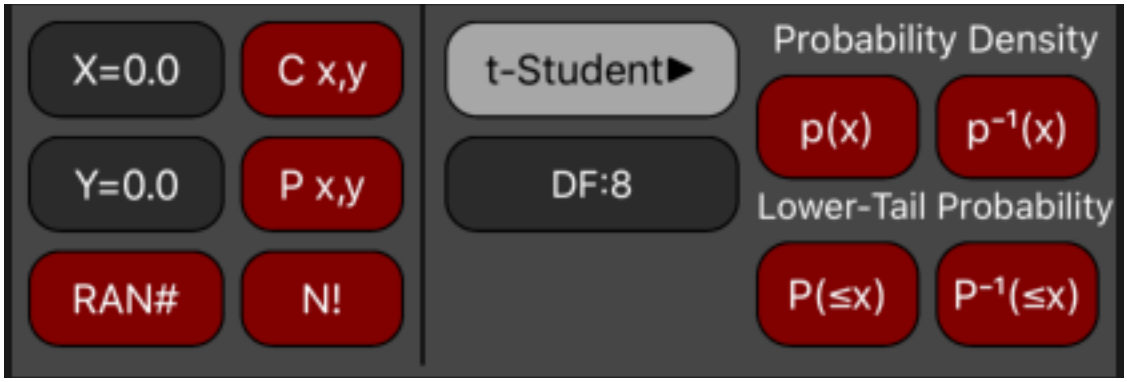
Probability Menu

This menu combines in one view the Combinations & Permutations menu with an additional Probability Distributions calculations. To show it, touch the **[MATH]** button in the main menu and **[PROB]** tap or touch the **[SCI▶]** menu and select the "Probability" option.



Button	Combinations & Permutations
[X]	Stores the number of total items for the combinations and permutations calculations.
[Y]	Stores the number of items to be taken for the combinations and permutations calculations.
[C x,y]	Calculates the number of combinations. **Cx,y = x! / [y! • (x - y)!]**
[P x,y]	Calculates the number of permutations. **Px,y = x! / (x - y)!**
[RAN#]	Enters a random number in the range $0 \leq x < 1$
N!	Calculates the factorial of the current number.

Button	Probability Distributions
[Distribution▶]	Shows the list of available Probability Distribution functions to select (Exponential, Normal, t-Student or Weibull).
[p(x)]	Calculates the distribution probability density of the current number.
[p^{-1}(x)]	Calculates the distribution inverse probability density of the current number.
[P(≤x)]	Calculates the distribution lower-tail cumulative probability of the current number.
[P^{-1}(≤x)]	Calculates the distribution inverse lower-tail cumulative probability of the current number.

Example: Combinations

Using 10 colored balls, how many different color combinations of three balls can be chosen?

Keystrokes	Description
10 **[X]**	Type the number of total items (10 colored balls).
3 **[Y]**	Type the size os the sample (3 balls)
[Cy,x]	Calculate the number of possible combinations. **Result = 120.00**

Example: Permutations

Using 5 books labeled A, B, C, D and E, how many different ways can three books be placed on a shelf?

Keystrokes	Description
5 **[X]**	Type the number of total items (5 books).
3 **[Y]**	Type the size os the sample (3 books).
[Py,x]	Calculate the number of possible permutations. **Result = 60.00**

Example: Random Number Generator

Store a seed value of 42 and generate a sequence of 5 random numbers.

Keystrokes	Description
42 **[STO]** **[RAN#]**	Store the initial random seed. **Seed = 42.0000**
[RAN#]	Generate the 1st random number. **RAN# = 0.7431**
[RAN#]	Generate the 2nd random number. **RAN# = 0.0673**
[RAN#]	Generate the 3rd random number. **RAN# = 0.1505**
[RAN#]	Generate the 4th random number. **RAN# = 0.9077**

Exponential Probability Distribution

When the Exponential probability density function is selected, the distribution "rate parameter" (λ) can be entered in the corresponding button.

The Probability Density Function is: **p(x) =** $\lambda e^{-\lambda x}$

Example: Exponential Distribution

Consider an Exponential random variable with a rate of 10.

1. What is the probability for a value equal to 0.2 => p(0.2) = ?
2. If the probability is 5%, what is the value => $p^{-1}(0.05)$ = ?
3. What is the probability of a value ≤ 0.2 => P(x ≤ 0.2) = ?
4. What is the value 'z' for probability of x ≤ z is 5% => $P^{-1}(x \le z) = 0.05$?

Keystrokes	Description
[Exponential▶]	Select the Exponential Probability Distribution
10 **[λ]**	Type the distribution rate and enter it. **λ = 10.0000**
0.2 **[p(x)]**	Calculate the probability. **p(x) = 1.3534**
0.05 **[p^{-1}(x)]**	Calculate the value. **p^{-1}(x) = 0.5298**
0.2 **[P(≤ x)]**	Calculate the probability. **P(≤ x) = 0.8647**
0.05 **[P^{-1}(≤ x)]**	Calculate the z-value. **P^{-1}(≤ x) = 0.0051**

Normal Probability Distribution

When the Normal probability density function is selected, the distribution "mean" (μ) and standard deviation (σ) can be entered in the corresponding buttons.

The Probability Density Function is: **p(x) =** $\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$

Example: Normal Distribution

For a Normal random variable with a mean of 7.35 and a std. dev. of 2.33.

1. What is the probability for a value equal to 5.35 => p(5.35) = ?
2. IF the probability is 5%, what is the value => $p^{-1}(0.05)$ = ?
3. What is the probability of a value ≤ 5.35 => P(x ≤ 5.35) = ?
4. What is the value 'z' for probability of x ≤ z is 5% => $P^{-1}(x \le z) = 0.05$?

Keystrokes	Description
[Normal▶]	Select the Normal Probability Distribution
7.35 **[μ]**	Input the mean of the distribution. **μ = 7.35**
2.33 **[σ]**	Input the distribution standard deviation. **σ = 2.33**
5.35 **[p(x)]**	Calculate the probability. **p(x) = 0.1185**
0.05 **[p^{-1}(x)]**	Calculate the value. **p^{-1}(x) = 11.0058**
5.35 **[P(≤ x)]**	Calculate the probability. **P(≤ x) = 0.1953**
0.05 **[P^{-1}(≤ x)]**	Calculate the z-value. **P^{-1}(≤ x) = 3.5175**

Weibull Probability Distribution

When the Weibull probability density function is selected, the distribution "shape" parameter (k) and the "scale" parameter (λ) can be entered in the corresponding buttons.

The Probability Density Function is: **p(x) =** $\frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k}$

Example: Weibull Distribution

For Weibull random variable with a shape factor of 20 and a scale factor of 100.

1. What is the probability for a value equal to 105 => p(105) = ?
2. IF the probability is 5%, what is the value => $p^{-1}(0.05)$ = ?
3. What is the probability of a value ≤ 90 => P(x ≤ 90) = ?
4. What is the value 'z' for probability of x ≤ z is 5% => $P^{-1}(x \le z) = 0.05$?

Keystrokes	Description
[Weibull▶]	Select the Weibull Probability Distribution
20 **[k]**	Input scale factor parameter. **k = 20.00**
100 **[λ]**	Input the shape factor parameter. **λ = 100.00**
105 **[p(x)]**	Calculate the probability. **p(x) = 0.0356**
0.05 **[p^{-1}(x)]**	Calculate the value. **p^{-1}(x) = 94.5842**
90 **[P(≤ x)]**	Calculate the probability. **P(≤ x) = 0.1145**
0.05 **[P^{-1}(≤ x)]**	Calculate the z-value. **P^{-1}(≤ x) = 86.1992**

t-Student Probability Distribution

When the t-Student probability density function is selected, the distribution "Degrees of Freedom" parameter (DF) can be entered in the corresponding button.

The Density Function is: **p(x) =** $$\frac{\Gamma(\frac{\nu+1}{2})}{\sqrt{\nu\pi}\,\Gamma(\frac{\nu}{2})}\left(1+\frac{t^2}{\nu}\right)^{-\frac{\nu+1}{2}}$$

Example: t-Student Distribution

For a t-Student random variable with 8 degrees of freedom.

1. What is the probability for a value equal to 0.5 => p(0.5) = ?
2. If the probability is 5%, what is the value => $p^{-1}(0.05)$ = ?
3. What is the probability of a value ≤ 90 => P(x ≤ 90) = ?
4. What is the value 'z' for probability of x ≤ z is 5% => $P^{-1}(x \le z) = 0.05$?

Keystrokes	Description
[t-Student▶]	Select the t-Student Probability Distribution
8 **[DF]**	Input de degrees of freedom. **DF = 8.00**
0.5 **[p(x)]**	Calculate the probability. **p(x) = 0.3367**
0.05 **[p^{-1}(x)]**	Calculate the value. **p^{-1}(x) = 2.1457**
0.9 **[P(≤ x)]**	Calculate the probability. **P(≤ x) = 0.8028**
0.05 **[P^{-1}(≤ x)]**	Calculate the z-value. **P^{-1}(≤ x) = -1.8595**