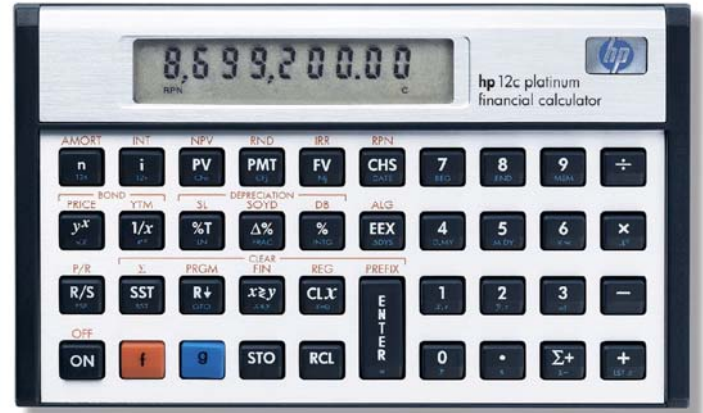




## hp calculators

HP 12C Platinum  
Statistics - rearranging items



HP12C Platinum Statistics

Rearranging items

Practice solving problems involving rearranging items

## Rearranging items

Statistics can be understood as a set of tools that involve the study of methods and procedures used for collecting, classifying, and analyzing data. Statistical tools also offer the means for making scientific inferences from such resulting summarized data. Some statistics applications involve rearranging items. Rearranging items is a matter of determining the number of ways a group of items can be separated or ordered. Probability analysis extensively uses rearranging calculations. There are three basic calculations normally performed when rearranging items: simple rearranging (factorial), combinations and permutations.

### Rearranging items with the HP12C Platinum

To determine the number of ways that  $n$  items in a group can be rearranged, simply calculate  $n!$ , or factorial of  $n$ . To calculate the factorial of  $n$  on the HP12C Platinum, given that  $n$  is an integer and  $n \leq 69$ , simply key  $n$  in and press  $\boxed{g} \boxed{n!}$ .

In probability analysis, combining subgroups of a specific number of  $r$  items separated from a larger group with  $n$  items allows determining the number of different events that can be observed. The combination formula shown in figure 1 below indicates the combinations of  $n$  items taken  $r$  at a time.

$${}^n C_r = \frac{n!}{r!(n-r)!} \quad \text{Figure 1}$$

The combination of ordered subgroups of a specific number of  $r$  items separated from a larger group with  $n$  items allows determining another number of different events that can be observed. The permutation formula shown in figure 2 below indicates the ordered permutations of  $n$  items taken  $r$  at a time.

$${}^n P_r = \frac{n!}{(n-r)!} \quad \text{Figure 2}$$

Factorial calculations are performed with  $\boxed{g} \boxed{n!}$  in the HP12C Platinum.  $\boxed{g} \boxed{n!}$  returns a valid result for any integer  $x$  given that  $x \leq 69$ . The following keystroke sequence calculates  $69!$

$\boxed{6} \boxed{9} \boxed{g} \boxed{n!}$



Figure 3

This is equivalent to  $1.711224524 \times 10^{98}$  (to see the 10-digit mantissa, press  $\boxed{f} \boxed{\text{PREFIX}}$  while the previous result is in the display). The HP12C Platinum returns  $9.999999999 \times 10^{99}$  in any attempt to calculate factorials of integers greater than 69.

### Practice solving problems involving rearranging items

Example 1: How many different ways could 4 people be seated at a table?

Solution: Use the following keystroke sequence:

4 g n!



Figure 4

Answer: 24 different ways.

Example 2: How many different hands of 5 cards could be dealt from a standard deck of 52 cards? Assume the order of the cards in the hand does not matter.

Solution: Since the order of the cards in the hand does not matter, the problem is solved as a combination.

In RPN mode: 5 2 g n! 5 g n! 5 2 g LSTx - g n! X ÷  
 In algebraic mode: 5 2 - 5 = g n! X 5 g n! = ÷ 5 2 g n! x=y =



Figure 5

Answer: 2,598,960 different hands.

Example 3: John has had a difficult week at work and is standing in front of the doughnut display at the local grocery store. He is trying to determine the number of ways he can fill his bag with his 5 doughnuts from the 20 varieties in the display case. He considers the order in which the doughnuts are placed into the bag to be unimportant. How many different ways can he put them in his bag?

Solution: Since the order in which the doughnuts are placed in the bag does not matter, the problem is solved as a combination.

In RPN mode: 2 0 g n! 5 g n! 2 0 g LSTx - g n! X ÷  
 In algebraic mode: 2 0 - 5 = g n! X 5 g n! = ÷ 2 0 g n! x=y =



Figure 6

Answer: 15,504 different ways.

Example 4: John has had a difficult week at work and is standing in front of the doughnut display at the local grocery store. He is trying to determine the number of ways he can fill his bag with his 5 doughnuts from the 20 varieties in the display case. He considers the order in which the doughnuts are placed into the bag to be quite important. How many different ways can he put them in his bag?

Solution: Since the order in which the doughnuts are placed in the bag matters, the problem is solved as a permutation.

In RPN mode:  $\boxed{2} \boxed{0} \boxed{g} \boxed{n!} \boxed{g} \boxed{LSTx} \boxed{5} \boxed{-} \boxed{g} \boxed{n!} \boxed{\div}$   
 In algebraic mode:  $\boxed{2} \boxed{0} \boxed{-} \boxed{5} \boxed{=} \boxed{g} \boxed{n!} \boxed{\div} \boxed{2} \boxed{0} \boxed{g} \boxed{n!} \boxed{x\approx y} \boxed{=}$



Figure 7

**Answer:** 1,860,480 different ways. John may be in front of the display case for some time.

**Example 5:** If you toss a die 8 times, what is the probability that it comes up the  $\boxed{\bullet}$  face exactly 3 times?

**Solution:** This is an example of the binomial probability distribution. The formula to find the answer is given by:

$$P(x) = nCx \times (p)^x \times (1 - p)^{(n-x)}$$

Figure 8

where  $P(x)$  is the probability of having  $x$  successes observed,  $nCx$  is the combination of  $n$  items taken  $x$  at a time, and  $p$  is the probability of a success on each trial. With the given data, we have the expression:

$$P(3) = \frac{8!}{3!(8-3)!} \times \left(\frac{1}{6}\right)^3 \times \left(1 - \frac{1}{6}\right)^{(8-3)}$$

Figure 9

where  $(1/6)$  is the probability of any of the six faces of the die. The following keystroke sequence can be used to evaluate the combination:

In RPN mode:  $\boxed{8} \boxed{g} \boxed{n!} \boxed{3} \boxed{g} \boxed{n!} \boxed{8} \boxed{g} \boxed{LSTx} \boxed{-} \boxed{g} \boxed{n!} \boxed{X} \boxed{\div}$   
 In algebraic mode:  $\boxed{8} \boxed{-} \boxed{3} \boxed{=} \boxed{g} \boxed{n!} \boxed{X} \boxed{3} \boxed{g} \boxed{n!} \boxed{=} \boxed{\div} \boxed{8} \boxed{g} \boxed{n!} \boxed{x\approx y} \boxed{=}$



Figure 10

To resume the calculation:

In RPN mode:  $\boxed{6} \boxed{\frac{1}{x}} \boxed{3} \boxed{y^x} \boxed{X} \boxed{1} \boxed{ENTER} \boxed{6} \boxed{\frac{1}{x}} \boxed{-} \boxed{8} \boxed{ENTER} \boxed{3} \boxed{-} \boxed{y^x} \boxed{X}$   
 In algebraic mode:  $\boxed{6} \boxed{\frac{1}{x}} \boxed{y^x} \boxed{3} \boxed{X} \boxed{x\approx y} \boxed{=} \boxed{1} \boxed{-} \boxed{6} \boxed{\frac{1}{x}} \boxed{=} \boxed{y^x} \boxed{5} \boxed{=} \boxed{X} \boxed{x\approx y} \boxed{=}$

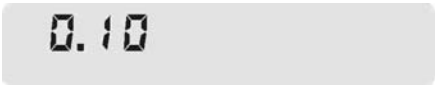


Figure 11

To express the probability as a percentage:

In RPN mode:  $\boxed{1} \boxed{0} \boxed{0} \boxed{X}$   
 In algebraic mode:  $\boxed{X} \boxed{1} \boxed{0} \boxed{0} \boxed{=}$



Figure 12

**Answer:** There is a 10.42% chance of seeing the  $\boxed{\bullet}$  face three times after tossing a dice eight times.