Permutations

List all possible permutations.

1)  1, 2, 3  
2)  T, V, W, taken two at a time

3)  ☺, ☀, ♥, ▲, taken two at a time  
4)  A, B, C, D

Evaluate each expression.

5)  \(4P_2\)  
6)  \(5P_1\)

7)  \(6P_2\)  
8)  \(6P_6\)

9)  \(-4 + 7P_4\)  
10)  \(5 \cdot 6P_5\)

Find the number of unique permutations of the letters in each word.

11)  DESIGN  
12)  MATH

13)  CHEESE  
14)  FURTHER

15)  BALLISTICS  
16)  BILLIONAIRE

Critical thinking questions:

17)  Write a word for which there are 30 unique permutations of the letters.  
18)  Simplify \(xP_{x-2}\)
Permutations

List all possible permutations.

1)  1, 2, 3
   123   213   312
   132   231   321

2)  T, V, W, taken two at a time
   TV  VT  WT
   TW  VW  WV

3)  ☺, ☼, ♥, ▲, taken two at a time
   ☺☼  ☺♥  ☺▲  ☼☺  ☼♥  ☼▲  ♥☺  ♥☼  ♥▲  ▲☺  ▲☼  ▲♥

4)  A, B, C, D
   ABCD  BACD  CABD  DABC
   ABDC  BADC  CADB  DACB
   ACBD  BCAD  CBDA  DBAC
   ACDB  BCDA  CBDA  DBCA
   ADBC  BDAC  CDAB  DCAB
   ADCB  BDCA  CDBA  DCBA

Evaluate each expression.

5)  \(4P_2\)
   12

6)  \(5P_1\)
   5

7)  \(6P_2\)
   30

8)  \(6P_6\)
   720

9)  \(-4 + 7P_4\)
   836

10)  \(5 \cdot 6P_5\)
    3,600

Find the number of unique permutations of the letters in each word.

11)  DESIGN
     720

12)  MATH
     24

13)  CHEESE
     120

14)  FURTHER
     2,520

15)  BALLISTICS
     453,600

16)  BILLIONAIRE
     3,326,400

Critical thinking questions:

17)  Write a word for which there are 30
     unique permutations of the letters.
     LEVEL

18)  Simplify \(xP_{x-2}\)
    \(x(x - 1)\)