Sample Multiple Choice Question from
Preparing for the CSET – Mathematics Subtest 2

A bag contains 5 red, 4 black, and 6 blue marbles. If 4 marbles are chosen at
random, what is the probability of choosing 2 red and 2 blue?
a)   .0110
b)   .1099
c)   .1333
d)   .2667

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Solution

Probability is defined as a fraction in which the numerator is the number of ways that the successful outcome can occur and the denominator is the total number of outcomes.

First find the numerator:

In this problem, success is defined as choosing 2 red and 2 blue marbles. The 2 red marbles are chosen from the 5 red marbles that are available, and the 2 blue marbles are chosen from the 6 blue marbles that are available.

We use Combinations to solve this problem:

$$_nC_r = \frac{n!}{r!(n-r)!}$$ where **n** is the total items available, **r** is how many we want, and the

! means "factorial": for example, $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

For our numerator, we have

$$_5C_2 \cdot {}_6C_2 = \frac{5!}{2!(5-2)!} \cdot \frac{6!}{2!(6-2)!} = \frac{5!}{2!(3)!} \cdot \frac{6!}{2!(4)!} = 10 \cdot 15 = 150$$

For the denominator, we also use combinations; but we use the total number of items without regard to what type they are. In other words, we are choosing 4 total marbles from 15 total marbles available.

$$_{15}C_4 = \frac{15!}{4!(15-4)!} = \frac{15!}{4!(11)!} = 1365$$

So the probability of choosing 2 red and 2 blue marbles is

$$\frac{_5C_2 \cdot {}_6C_2}{_{15}C_4} = \frac{150}{1365} = .1099 \qquad \text{which is answer B.}$$

These values could be calculated by multiplying out the factorials, but it is much faster using the $_nC_r$ button on the calculator. On a TI-83, enter the value of **n**, press the "MATH" button, arrow over to "PRB" on the display, then arrow down to "$_nC_r$" on the display. Press "ENTER", then enter the value of **r** and press "ENTER".