# C12 - 11.9 - nPr nCr Algebra Notes

Solve for the missing variable

$${}_nC_2 = 10$$

$${}_nC_r = \frac{n!}{r!\,(n-r)!}$$

$${}_nC_2 = \frac{n!}{2!\,(n-2)!} = 10$$

$$\frac{n!}{2(n-2)!} = 10$$

$$\frac{n!}{(n-2)!} = 20$$

$$\frac{n(n-1)(n-2)!}{(n-2)!} = 20$$

$$n^2 - n = 20$$

$$n^2 - n - 20 = 0$$

$$(n-5)(n+4) = 20$$

$$n = 5 \quad n = -4$$

$${}_nP_2 = 42$$

$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nP_2 = \frac{n!}{(n-2)!} = 42$$

$$\frac{n!}{(n-2)!} = 42$$

$$\frac{n(n-1)(n-2)!}{(n-2)!} = 42$$

$$n^2 - n = 42$$

$$n^2 - n - 42 = 0$$

$$(n-7)(n+6) = 20$$

$$n = 7 \quad n = -6$$

$${}_nC_3 = 4$$

$${}_nC_r = \frac{n!}{r!\,(n-r)!}$$

$${}_nC_3 = \frac{n!}{3!\,(n-3)!} = 4$$

$$\frac{n!}{6(n-3)!} = 4$$

$$\frac{n!}{(n-3)!} = 24$$

$$\frac{n(n-1)(n-2)(n-3)!}{(n-3)!} = 24$$

$$n(n-1)(n-2) = 24$$

$$n(n^2 - 3n + 2) = 24$$

$$n^3 - 3n^2 + 2n - 24 = 0$$

See Cubic factoring or guess and check

$${}_5C_3 = 10$$

$${}_4C_3 = 4 \qquad n = 4$$

$${}_3C_r = 3$$

$${}_nC_r = \frac{n!}{r!\,(n-r)!}$$

$${}_3C_r = \frac{3!}{r!\,(3-r)!} = 3$$

$$\frac{6}{r!\,(3-r)!} = 3$$

$$\frac{6}{3} = r!\,(3-r)!$$

$$2 = r!\,(3-r)!$$

Nope! Guess and check

$${}_3C_3 = 1$$

$${}_3C_2 = 3 \qquad r = 2$$

$${}_3C_1 = 3 \qquad r = 1$$