# Answer on Question #68373- Math - Differential Equations.

**Question**: Form partial differential equation of $u = f(x-3y) + g(2x+y)$ .

**Solution:** We will look for the PDE in the form

$$\alpha u_{xx} + \beta u_{xy} + \gamma u_{yy} = 0,$$

where $\alpha, \beta$ and $\gamma$ are constants.

Direct calculations show that

$$u_{xx} = f''(x-3y) + 4g''(2x+y),$$

$$u_{xy} = -3f''(x-3y) + 2g''(2x+y),$$

$$u_{yy} = 9f''(x-3y) + g''(2x+y).$$

Then

$$\alpha u_{xx} + \beta u_{xy} + \gamma u_{yy} = (\alpha - 3\beta + 9\gamma)f''(x-3y) + (4\alpha + 2\beta + \gamma)g''(2x+y) = 0.$$

We set

$$\begin{cases} \alpha - 3\beta + 9\gamma = 0, \\ 4\alpha + 2\beta + \gamma = 0. \end{cases} \to \begin{cases} \alpha - 3\beta + 9\gamma = 0, \\ 14\beta - 35\gamma = 0. \end{cases}$$

The triple $(3, -5, -2)$ is a solution of the system. Therefore, the function

$$u(x,y) = f(x-3y) + g(2x+y)$$

is a solution of the equation

$$3u_{xx} - 5u_{xy} - 2u_{yy} = 0$$

for all pairs $(f, g)$ of $C^2$-functions.

**Answer:** $3u_{xx} - 5u_{xy} - 2u_{yy} = 0.$

When we toss five coins simultaneously, the corresponding sample space $S$ is

where $H$ is denoted for head and $T$ is denoted for tail.

The dimension of the sample space $|S| = 2^5 = 32$.

If we denote by random variable $X$ the number of heads, then $X$ takes the values $\{0,1,2,3,4,5\}$ with the corresponding probabilities

$$P\{X = k\} = \binom{5}{k}\left(\frac{1}{2}\right)^k \left(\frac{1}{2}\right)^{5-k} = \binom{5}{k}\left(\frac{1}{2}\right)^5, k \in \{0,1,2,3,4,5\}.$$