

# MSCS Mess

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## This Week's Colloquium

There will not be a colloquium this week.

## Problem of the Week

The following problem is taken from *The Moscow Puzzles* by Boris A. Kordemsky:

Find the smallest possible integer such that when divided by 3, gives a remainder of 1; when divided by 4, gives a remainder of 2; when divided by 5, gives a remainder of 3, and when divided by 6, gives a remainder of 4.

Please e-mail the solution, and how you derived the solution, to [jacobsoj@stolaf.edu](mailto:jacobsoj@stolaf.edu)

## Millenium Prize Problem

### NAVIER-STOKES EXISTENCE AND SMOOTHNESS

The Navier-Stokes equations were derived independently in the early 1800s by French physicist Claude-Louis Navier and English mathematical physicist Sir George Stokes. From the field of fluid dynamics, these equations describe the motion of a fluid in space. The equations are:

$$\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} = -\frac{\nabla P}{\rho} + \nu \nabla^2 \mathbf{u}$$

where  $\nabla$  is the symbol for the gradient,  $\mathbf{u}$  is the velocity of the fluid,  $P$  is pressure,  $\rho$  is the fluid density, and  $\nu$  is the kinematic viscosity.

The easiest way to define the problem is as follows:

*Prove or give a counter-example of the following statement:*

In three space dimensions and time, given an initial velocity field, there exists a vector velocity and a scalar pressure field, which are both smooth and globally defined, that solve the Navier–Stokes equations.

However, if you wish to see a more formal definition of the problem, please see [http://www.claymath.org/millennium/Navier-Stokes\\_Equations/navierstokes.pdf](http://www.claymath.org/millennium/Navier-Stokes_Equations/navierstokes.pdf)

These equations are extremely useful and have many practical implications because fluids are all around us. They can be used to model the weather, air flow around an object, water flow, etc. These equations are also used in CGI in order to achieve a realistic environment in video games. With these equations, video game makers and movies using CGI can create water flows and fires that look much more realistic. A solution to this problem will allow us to learn much more about many physical processes.

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*If you would like to submit an article or math event to be published in the Math Mess, e-mail [jacobsoj@stolaf.edu](mailto:jacobsoj@stolaf.edu).*