

♠ NEW! ♠  
♣ Problem of the Week ♣  
Due at noon on 4/20/2012

**Problem:**

Let  $\pi : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$  be a function such that

1.  $\pi(x, 0) = x$  for all points  $x$  in  $\mathbb{R}$ .
2.  $\pi(\pi(x, t_1), t_2) = \pi(x, t_1 + t_2)$  for all points  $x, t_1$ , and  $t_2$  in  $\mathbb{R}$ .
3.  $\pi$  is continuous.

Show that for a fixed  $t \in \mathbb{R}$  the map  $\pi^t = \pi(x, t)$  is one-to-one.

**Rules:** This contest is open to Cumberland University students only. Solutions must be submitted by the deadline indicated. The first student to submit a correct answer wins the prize (\$10.00). Any outside sources must be cited. All work must be shown. Work will initially be judged by Dr. Gammon. Disputes will be sent to another mathematician for a second opinion. Submit your solutions either typed in e-mail to [kgammon@cumberland.edu](mailto:kgammon@cumberland.edu) or written legibly to Dr. Gammon, Memorial Hall room 310 A.