4/25 QUIZ NR 11 **Math118, O.Knill**

Name:

1) True or False: there are always equilibrium solutions to the Newtonian n-body problem.

2) What is the minimal number of bodies for which one can prove that an escape to infinity in finite time is possible?

a) 2
b) 3
c) 4
d) 5

3) Which of the following problems are considered "restricted three body problems":

a) The Earth-Moon-Sun system.
b) The Sitnikov problem.
c) A planet moving in the influence of a uniformly rotating binary star system.
d) The Kepler problem.

4) Who was the first to find non-collision singularities of the Newtonian n-body problem?

a) Joseph Gerver
b) Jeff Xia
c) Jürgen Moser
d) Henri Poincare

5) If for all t, we have a skew-symmetric matrix $B(t)$ and $S(t)$ satisfies the matrix differential equation $\dot{S} = BS$ with the initial condition $S(0) = I$, then S is

a) orthogonal
b) skew symmetric
c) symmetric
d) the identity matrix

6) Which of the following are ingredients of the proof of chaotic orbits in the Sitnikov problem

a) A horse shoe construction.
b) Stable and instable manifolds
c) The Jacobi integral.
d) The Poincare return map.
e) The Poincare recurrence theorem.
f) Continued fraction expansion.

7) Which of the following statements is called the third Kepler law:

a) The radius vector covers equal area in equal time.
b) Each of the bodies moves on an ellipse.
c) T^2/a^3 is constant.

8) The solar system is a dynamical system which shows very weak type of chaos. If one knows the position of the earth with accuracy $1km$, how long does one have to wait until the uncertainty of the orbit has grown to about 1 astronomical unit (the mean distance of the earth to the sun)?

a) 10'000 years
b) 1 Million years
c) 100 Million years
d) 10 Billion years

9) Which periodic three body solution has been observed in our solar system?

a) Euler motion.
b) Lagrange motion.
c) Hills solutions.
d) Moore choreographies.

10) How many integrals can one find for a general n-body problem:

a) 1
b) 10
c) 3n
d) 6n

11) How many integrals (conserved quantities) did you find for the n-body Toda system?

b) 2
b) n
c) $2n$

12) Which of the following forces occur in a rotating coordinate system and depend on the angular speed of the rotation?

a) Centrifugal force
b) Coriolis force