KANDIDATNUMMER:

EKSAMEN

EMNENAVN: Mathematics for Games Programming

EMNENUMMER: REA2061

EKSAMENSDATO: 06.01.14

KLASSE: 1st year Bachelor Games Programming

TID: 9-14

EMNEANSVARLIG: Bernt Tore Jensen (46250024)

ANTALL SIDER UTLEVERT: 3 pages (this one included)

TILLATTE HJELPEMIDLER: All written and printed aids. Calculator.

INNFØRING MED PENN.

Ved innlevering skilles hvit og gul besvarelse og legges i hvert sitt omslag.

Oppgavetekst, kladd og blå kopi beholder kandidaten.

Husk kandidatnummer på alle ark.

There are 5 problems, each contributing 20 percent towards your grade. Explanations must be included. Note that the problems vary considerably in difficulty, and so it is advisable to answer the easier problems first.

Problem 1.

You are throwing five dice with faces numbered 1 to 6. Calculate the probabilities of

a) throwing two sixes.
b) throwing at least one six.
c) throwing five different numbers.

Problem 2.

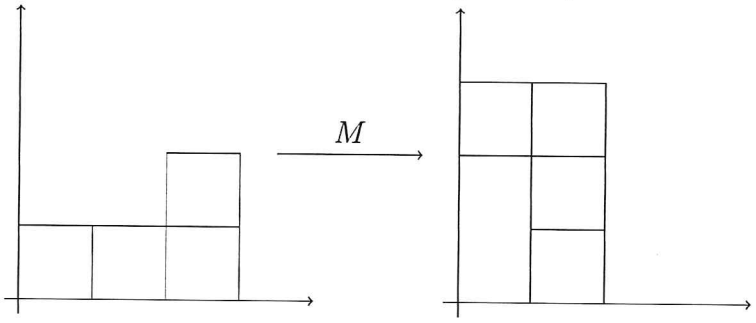
Find 4×4 transformation matrices which

a) rotates $30°$ around the x-axis.
b) rotates the vector $(1, 1, 1)^T$ so that it aligns with the x-axis.
c) uses a) and b) to rotate $30°$ around the axis through the origin with the direction $(1, 1, 1)^T$.

In b) and c) it suffices to write down the product of the relevant matrices in the correct order. You do not have to calculate the matrix products. Draw figures and explain.

Problem 3.

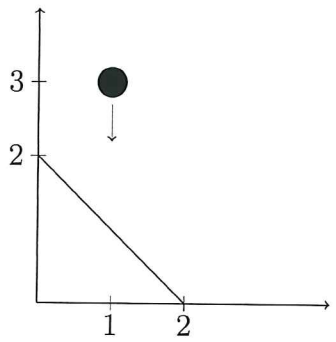
A transformation M does the following in the plane.



a) Find a 3×3 matrix for the transformation M.
b) Is it possible to perform the transformation M with a 2×2-matrix? Explain!

Problem 4.

A ball with radius $0.1m$ and center at $(1, 3)$ is dropped at time $t = 0s$. It hits a declining plane which intersects the ground at $(2, 0)$ forming an angle of $45°$.



The collision with the plane is elastic. You can ignore air-resistance and spin, and assume that the acceleration due to gravity is equal to $-10m/s^2$. In other words, the initial trajectory is $(1, 3 - \frac{10}{2}t^2)$.

a) Draw a figure explaining what happens with the ball as it hits the plane. In which direction will the ball move immediately after the collision?
b) Find the position of the center of the ball at the time it collides with the plane.
c) Find the velocity of the ball immediately after the collision with the plane.
d) Find the trajectory the ball follows after the collision with the plane, and until it's next collision. You do **not** have to calculate the time of the second collision.

Problem 5.

In a knight, knave and spy puzzle, the knight always tells the truth, the knave always lies, and the spy sometimes lies and sometimes tells the truth. A puzzle consists of three statements, one from each character, and it is the task of the solver to use these three statements to identify the three characters.

a) Create a knight, knave and spy puzzle.
b) Write down the solution to the problem you have created in a).