Compulsory Assignment MAT 1100, Fall 03

<u>Deadline</u>: *You must turn in your paper before 2.30 p.m., Friday, November 7th, at "Ekspedisjonskontoret", Mathematics Institute (7th floor NHA). As experience shows that there are long queues around deadline, you are adviced to turn in your paper early. Remember to put your name and the number of your group on your paper! If you due to illness or other circumstances have a need to extend the deadline, you must apply for an extension to Heidi Raude (room B 718, NHA, e-mail: heidimr@math.uio.no, phone 22 85 59 01). Remember that illness has to be documented by a medical doctor. For more information about exams and compulsory assignments in MAT 1100, see http://www.math.uio.no/ lindstro/Eksamen.htm.*

<u>Instructions</u>: *The assignment is compulsory, and students who do not get their paper accepted, will not get access to the final exam. To get the paper accepted, you must have a score of at least 50%. All questions (1a, 1b etc.) have equal weight except 3c which counts double. As you may get partial credit for a problem even without having reached a final answer, it is important that you turn in all your work. Students who do not get their original paper accepted, will get* one *opportunity to turn in an improved version. In the evaluation, credit will be given for a clear and well organized presentation.*

In solving the problems you may collaborate with others and use all tools available. However, the paper you turn in must be written by you personally (by hand or computer) and it should reflect your *understanding of the material. If we are not certain that you understand your own paper, we may ask you to give an oral presentation.*

The assignment consists of 5 problems.

Problem 1: Calculate:

a) $\int_2^3 x e^{x^2}\, dx$

b) $\int x \cos x\, dx$

c) $\int_1^\infty \frac{1}{\sqrt{x}(x+1)}\, dx$

Problem 2: A is the region in the first quadrant bounded by the x-axis, the y-axis, the line $x = 1$ and the graph of the function $f(x) = \arcsin x$. Find the volume of the body obtained by rotating A around the y-axis.

Problem 3:

a) Use polynomial division to divide $P(x) = x^4 + 4x^3 + 12x^2 + 17x + 14$ by $Q(x) = x^3 + 3x^2 + 6x + 4$.

b) Show that -1 is a root of the polynomial $Q(x)$. Find the real and complex factorization of $Q(x)$.

c) (counts as two ordinary questions) Solve the integral

$$\int \frac{x^4 + 4x^3 + 12x^2 + 17x + 14}{x^3 + 3x^2 + 6x + 4}\, dx$$

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Problem 4: (Before you start this problem, you should read the subsection "**2. Integraler av typen** $\int \sin^n x \cos^m x \, dx$ **der** n **og** m **er hele tall**" on page 411 of *Kalkulus*. If you prefer an English text, you may try the section on "Trigonometric Integrals" in Adams: *Calculus*.) Compute the integrals:

a) $\int \sin^3 x \cos^2 x \, dx$

b) $\int \cos^4 x \, dx$

Oppgave 5: The figure shows the positions and velocities of two ships, A and B, seen from above. Ship A is approaching the point C of intersection with a speed of 10 (nautical) miles per hour, while B is sailing away from C with a speed of 11 miles per hour. The distance from A to C is 5 miles, while the distance from C to B is 3 miles. The angle between the two directions is $60°$.
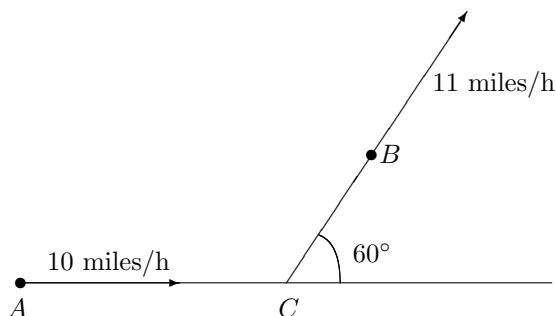
a) Find the distance between the ships.
b) How fast is the distance between the ships changing? Is it increasing or decreasing?

GOOD LUCK!