FACULTY ECONOMICS AND BUSINESS
Mathematics Entrance test. Time: 2 h. 30 min. June 2010
( ln means: the natural logarithm, so with base $e \approx 2.72$ )

1. Simplify: ($a,\ b,\ c,\ x,\ y,\ z$ and $n$ are positive constants)

a. $\dfrac{a-1}{2a} - \dfrac{2b+1}{5b} + \dfrac{2a+5b}{10ab}$ b. $\dfrac{x^6\sqrt{yz^2}}{x^2\sqrt{y^3}}$ c. $n - \dfrac{n}{1-\dfrac{1}{n}}$

2. Factorize completely:

a. $x^4 - x^3 - 2x^2$ b. $x^{a-1}(px+q)^2 + x^a(px+q)$

3. Solve:

a. $x^2 + 1{,}17x = 0$ b. $\ln(x+1) - \ln x = 1$ c. $x^2 + 2x - 7 = 0$

4. Solve the next inequalities:

a. $\dfrac{x^2+1}{x-3} \le 1$ b. $e^{4x-10} > 0$ c. $(e^x - 2)(1-x) > 0$

5. Find the derivative of the next functions and simplify and factorize the result:

a. $f(x) = \dfrac{x}{(1+x^2)^2}$ b. $g(t) = e^t(2t-3)^5$

6. Let $f(x) = \dfrac{x^2-2}{\sqrt{x}}$ Find the equation of the tangent at the graph of the function where $x$ = 4.

7. Let: $f(x) = 6x^4 - 8x^3 + 1$
a. Find the stationary points of $f$ ( so: $f'(x) = 0$ )
b. Classify the stationary points (maximum or minimum).

Answers:

1.a. $\frac{1}{10}$ 1.b. $x^4y^{-1}z$ 1.c. $\dfrac{n}{1-n}$

2.a. $x^2(x-2)(x+1)$ 2.b. $x^{a-1}(px+q)[(p+1)x+q]$

3.a. 0 and – 1.17 3.b. $\dfrac{1}{e-1}$ 3.c. $-1 \pm 2\sqrt{2}$

4.a. $x < 3$ 4.b. all $x$ 4.c. $\ln 2 < x < 1$

5.a. $\dfrac{1-3x^2}{(1+x^2)^3}$ 5.b. $e^t(2t-3)^4(2t+7)$

6. $y - 7 = \frac{25}{8}(x-4)$ or: $y = \frac{25}{8}x - \frac{11}{2}$

7.a. $x = 0$ or $x = 1$ 7.b. $f(0) = -1$ is an inflection point.
$f(1) = -1$ is a minimum.