

INTRODUCTION TO CALCULUS

MATH 1A

UNIT 26: WORKSHEET

Some True-False Problems

- 1) T F The fundamental theorem of calculus assures that $\int_a^b f'(x) dx = f(b) - f(a)$.
- 2) T F If $\int_0^x f(t) dt$ is monotonically increasing in x for $0 \leq x \leq 1$, then $f(x) \geq 0$ on $0 \leq x \leq 1$.
- 3) T F For any continuous function f , the integral $\int_a^b f(x) dx$ is the area under a curve and therefore always positive or zero.
- 4) T F If $f_c(x)$ has a minimum x_c which is present for $c < 0$ and disappears for $c > 0$, then $c = 0$ is a catastrophe.

A Catastrophe problem

Problem) Catastrophes (10 points)

Consider the family of functions $f(x) = x^3 + cx$ on the real line.

- a) (5 points) Find all critical points of f , depending on c .
- b) (2 points) Using the second derivative test, determine which are minima and which are maxima.
- b) (3 points) For which value of c does a catastrophe occur?

Problem) Integrals (10 points)

Two of the following 6 integrals can be solved (with the methods we know) two more are harder to guess at this stage. Two can not be solved.

- a) $\int \ln(x) dx$
- b) $\int 1/\ln(x) dx$
- c) $\int \ln(x)/x dx$
- d) $\int 1/(\ln(x)x) dx$
- e) $\int x/\ln(x) dx$
- f) $\int x \ln(x) dx$