UNIT 26: WORKSHEET

Some True-False Problems

1) ☐ T ☐ F   The fundamental theorem of calculus assures that $\int_a^b f'(x)\ dx = f(a) - f(b)$.

2) ☐ T ☐ F   If $\int_0^x f(t)\ dt$ is monotonically increasing in x for $0 \le x \le 1$, then $f(x) \ge 0$ on $0 \le x \le 1$.

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) $\int x\ln(x)\ dx$