

Name: _____

Notesheet. Section 6.1: Antiderivatives a.k.a. Integration

Math 1210

Definition 1. An antiderivative of a function f is some other function F such that

Challenge 2. If $f(x) = x^2 - \frac{1}{5}x + 1$, show that $F(x) = \frac{1}{3}x^3 - \frac{1}{10}x^2 + x$ is an antiderivative of f . If $g(x) = x^3 - x + 4$, find an antiderivative G of g .

Theorem 3. If G is an antiderivative of f , then every antiderivative F of f is of the form

Definition 4. What are antidifferentiation, integration, integral sign, indefinite integral, integrand, and the constant of integration?

Theorem 5.

$$(1) \int k \, dx =$$

$$(2) \int x^n \, dx =$$

$$(3) \int kf(x) \, dx =$$

$$(4) \quad \bullet \int [f(x) + g(x)] \, dx =$$

$$\bullet \int [f(x) - g(x)] \, dx =$$

$$(5) \int e^x \, dx =$$

$$(6) \int x^{-1} \, dx =$$

Challenge 6. Find the indefinite integral of

$$\bullet f(x) = x^4 + x^{-3} + x^2 + x + 1$$

$$\bullet g(x) = 5e^x + 2\frac{1}{x} + 7e^{-x}$$

Challenge 7. The velocity of a train at time t is $v(t) = 9t$. What is the velocity at time 0? What is the acceleration of the train as a function of time? What is the position of the train as a function of time, given that the position at time 0 is 0? (The final question is an “initial value problem”.)