§5.3: INDEFINITE INTEGRALS
§5.4, §5.5: FUNDAMENTAL THEOREM

NAME: ____________

Math 1910

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ONE-PAGE REVIEW

(1) F is called an **antiderivative** of f if [ ] (1). Any two antiderivatives of f on an interval (a, b) differ by a constant.

(2) **Fundamental Theorem of Calculus, Part I (FTC I):** if $F(x)$ is an antiderivative for $f(x)$, then

[ ] (2)

(3) (a) $\int 0\,dx =$ [ ] (3)

(b) $\int k\,dx =$ [ ] (4)

(c) $\int cf(x)\,dx =$ [ ] (5)

(d) $\int (f(x) + g(x))\,dx =$ [ ] (6) $+$ [ ] (7)

(e) $\int x^n\,dx =$ [ ] (8)

(f) $\int \sin x\,dx =$ [ ] (9)

(g) $\int \sec^2 x\,dx =$ [ ] (10)

(h) $\int \sec x \tan x\,dx =$ [ ] (11)

(4) To solve an initial value problem $\frac{dy}{dx} = f(x)$, $y(x_0) = y_0$, first find the general antiderivative $y = F(x) + C$. Then determine C using the initial condition $F(x_0) + C = y_0$.

(5) The **area function** with lower limit a is $A(x) =$ [ ] (12) .

(6) **Fundamental Theorem of Calculus, Part II (FTC II):**

[ ] (13)

(7) A consequence of FTC II is that *every* continuous function has an antiderivative.

(8) Let $G(x) = \int_a^{g(x)} f(t)\,dt$. Let $A(x) = \int_a^x f(t)\,dt$. Then

$$\frac{d}{dx}G(x) = \frac{d}{dx}\int_a^{g(x)} f(t)\,dt =$$ [ ] (14)

PROBLEMS

(1) Evaluate the integral:

(a) $\int \cos x \, dx$

(b) $\int \csc x \cot x \, dx$

(c) $\int \frac{3}{x^{3/2}} \, dx$

(d) $\int_{-2}^{2} (10x^9 + 3x^5) \, dx$

(e) $\int_0^4 \sqrt{x} \, dx$

(f) $\int_{\pi/4}^{3\pi/4} \sin\theta \, d\theta$

(g) $\int_0^5 |x^2 - 4x + 3| \, dx$

(h) $\int_4^9 \frac{16+t}{t^2} \, dt$

(2) Solve the differential equation $\frac{dy}{dx} = 8x^3 + 3x^2 - 3$ with initial condition $y(1) = 1$.

(3) Given that $f''(x) = x^3 - 2x + 1$, $f'(0) = 1$, and $f(0) = 0$, find f' and then find f.

(4) If $G(x) = \int_1^x \tan t \, dt$, find $G(1)$ and $G'(\pi/4)$.

(5) Find a formula for the function represented by the integral: $\int_2^x (t^2 - t) \, dt$.

(6) Express the antiderivative $F(x)$ of $f(x)$ as an integral, given that $f(x) = \sqrt{x^4 + 1}$ and $F(3) = 0$.

(7) Calculate the derivative: $\frac{d}{dx} \int_1^{x^3} \tan t \, dt$.