# REVIEW

MATH 1910 Recitation

§5.3 (Indefinite Integrals); §5.4, §5.5 (FTC)

September 6, 2016

(1) $F$ is called an **antiderivative** of $f$ if ______ (1) .

(2) Any two antiderivatives of $f$ on an interval $(a, b)$ differ by a constant.

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

______ (2)

(4) (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)

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

(6) The **area function** with lower limit $a$ is $A(x) =$ ______ (12) .

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

______ (13)

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

(9) 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)

# PRACTICE PROBLEMS

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(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: $\frac{d}{dx} \int_1^{x^3} \tan t \, dt$.