**Name:** _____

**Final Exam – Math 2311H – Fall 2020**

1. Supply the anti-derivatives. Here $k$ denotes a constant. [Don't forget +C.]

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

(b) $\int x^{-3} \, dx =$

(c) $\int 5x^{-\frac{4}{7}} \, dx =$

(d) $\int \cos(kx) \, dx =$

(e) $\int \frac{1}{1+x^2} \, dx =$

(f) $\int \frac{1}{x} \, dx =$

(g) $\int e^{kx} \, dx =$

(h) $\int \sec^2 x \, dx =$

(i) $\int \frac{1}{\sqrt{1-x^2}} \, dx =$

2. Find the derivative of the following functions.

(a) $\frac{d}{dx} e^{x^2} =$

(b) $\frac{d}{dx} \ln(\arctan x) =$

(c) $\frac{d}{dx} \frac{x^2+1}{x^3-1} =$

(d) $\frac{d}{dx} \sin^5(e^{2x}) =$

(e) $\frac{d}{dx}(x^2+1) \cdot \tan x =$

(f) $\frac{d}{dx}(e^x + x^\pi + e^\pi) =$

3. Compute $\int_{-3}^{3} \sqrt{9-x^2} \, dx$

4. Find the anti-derivative.

$$\int x \sec^2(x^2) \, dx$$

5. Find the anti-derivative.

$$\int \frac{\ln x}{x}\, dx$$

6. Find the anti-derivative.

$$\int \frac{e^x}{1+e^{2x}}\, dx$$

7. Find the anti-derivative.

$$\int \frac{x^3+x^5}{3x^4+2x^6+1}\, dx$$

8. Circle True or False.

   (a) True or False: $\ln(a^{n+m}) = n\ln a + m\ln a$, where $a > 0$ and $n, m$ are integers.

   (b) True or False: If the inverse function of $f$ exists, then the $y$-intercept of $f$ is an $x$-intercept of $f^{-1}$.

   (c) True or False: If $f(x) = g(x)e^x$, then the only zeros of $f$ are the zeros of $g$.

   (d) True or False: If $f'(x) = g(x)$, then $\int g(x)dx = f(x) + C$.

   (e) True or False: $\int_a^b f(x)g(x)dx = \left(\int_a^b f(x)dx\right)\left(\int_a^b g(x)dx\right)$.

   (f) True or False: The slope of the tangent line to the differentiable function at the point $(2, f(2))$ is

$$\frac{f(2+\Delta x) - f(2)}{\Delta x}$$

   (g) True or False: If a function is continuous at a point, then it is differentiable at that point.

   (h) True or False: If a function is differentiable at a point, then it is continuous at that point.

9. Suppose $f$ is a differentiable function. How do you find the relative extrema of $f$?

10. Suppose $f$ is continuous on the interval $[a, b]$? How do you find the absolute extrema of $f$?

11. Will you be taking MAC 2312 Honors Calculus 2 in the Spring (2021) with Dr. Welker?

12. What grade do you expect to earn in this class?