

Name: \_\_\_\_\_

Student ID number: \_\_\_\_\_

1. (30 pts; 2 pts for each problem; **No partial credit**) Find the general antiderivative of the given function ( $f(x) = F'(x)$ ).

(a)  $f(x) = 1$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(b)  $f(x) = x^2$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(c) For  $x \geq 0$ ,  $f(x) = \sqrt{x}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(d)  $f(x) = x^{1/3}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(e)  $f(x) = e^x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(f)  $f(x) = e^{4x}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(g)  $f(x) = 2^x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(h) For  $x \neq 0$ ,  $f(x) = \frac{1}{x}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(i) For  $x \neq 0$ ,  $f(x) = \frac{1}{2x}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(j)  $f(x) = \sin x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(k)  $f(x) = \cos x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(l)  $f(x) = \sec^2 x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(m)  $f(x) = \sec x \tan x$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(n)  $f(x) = \frac{1}{1+x^2}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

(o) For  $x \neq 0$ ,  $f(x) = \frac{x^2+1}{x}$ ,  $F(x) =$  \_\_\_\_\_  $+C$

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2. (5 pts) Given that  $f'(x) = 1 - 6x$  and  $f(0) = 8$ , find  $f(x)$ .

3. (5 pts) Express the limit as a definite integral on the given interval.

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n 2x_i \ln(1 + x_i^2) \Delta x, \quad [2, 6], \quad (x_i = 2 + i\Delta x, \Delta x = (6 - 2)/n)$$

4. (10 pts) Find the derivative of

- $\int_0^x \sqrt{t} \sin t \, dt, x \geq 0,$

- $\int_{x^2}^{x^4} \sqrt{t} \sin t \, dt, x \geq 0.$

5. (10 pts) Evaluate the definite integral  $\int_0^1 x e^{x^2} \, dx$

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6. (10 pts) Evaluate the definite integral  $\int_{-1}^2 x - 2|x| dx$

7. (10 pts) Evaluate  $\int \ln x dx$

8. (10 pts) Evaluate  $\int \sin^4 x \cos^3 x dx$

9. (10 pts) Evaluate  $\int \frac{1}{\sqrt{1+x^2}} dx$ . (Hint:  $\int \sec \theta d\theta = \ln |\sec \theta + \tan \theta| + C$ )