Name Solutions Date

Math 2 — Quiz 1

1. Compute the derivative of $f(x) = e^{5x}\sin(3x)$. (3 pts.)

(Product Rule)

$$\frac{d}{dx}\left(e^{5x}\sin(3x)\right) = e^{5x}\cdot\frac{d}{dx}\left(\sin(3x)\right) + \frac{d}{dx}\left(e^{5x}\right)\cdot\sin(3x)$$

(Chain Rule)

$$= e^{5x}\cdot\cos(3x)\cdot\frac{d}{dx}(3x) + e^{5x}\cdot\frac{d}{dx}(5x)\cdot\sin(3x)$$

$$= e^{5x}\cos(3x)\cdot 3 + e^{5x}\cdot 5\cdot\sin(3x)$$

$$= \boxed{e^{5x}\left(3\cos(3x) + 5\sin(3x)\right)}$$

2. Let $F(x)$ be the antiderivative of $f(x) = 4x^2 - 8x^{-4} + 2$ with $F(1) = 3$. Find $F(x)$. (4 pts.)

$$F(x) = \frac{4}{3}x^3 - \frac{8}{-3}x^{-3} + 2x + C$$

$$= \frac{4}{3}x^3 + \frac{8}{3}x^{-3} + 2x + C$$

$$3 = F(1) = \frac{4}{3}(1)^3 + \frac{8}{3}(1)^{-3} + 2(1) + C$$

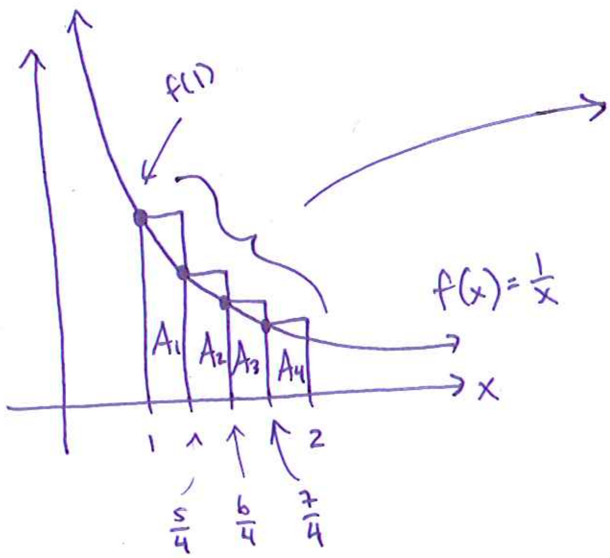
$$= \frac{4}{3} + \frac{8}{3} + 2 + C$$

$$= \frac{12}{3} + 2 + C$$

$$= 6 + C \Rightarrow \boxed{C = -3} \Rightarrow \boxed{F(x) = \frac{4}{3}x^3 + \frac{8}{3}x^{-3} + 2x - 3}$$

3. (a) Estimate the area under the curve of the function $f(x) = \frac{1}{x}$ on the interval $[1, 2]$ using the left endpoint method with 4 rectangles. (4 pts.)
(b) Is this an underestimate or an overestimate? (1 pt.)

b)



This is an overestimate.

$$\text{Estimate} = A_1 + A_2 + A_3 + A_4$$

$$= \frac{1}{4} \cdot f(1) + \frac{1}{4} f\left(\frac{5}{4}\right) + \frac{1}{4} f\left(\frac{6}{4}\right) + \frac{1}{4} f\left(\frac{7}{4}\right)$$

$$= \frac{1}{4} \cdot \frac{1}{1} + \frac{1}{4} \cdot \frac{4}{5} + \frac{1}{4} \cdot \frac{6}{4} + \frac{1}{4} \cdot \frac{7}{4}$$

a) $= \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}$