

Math 134: Homework 9  
Due December November 3

- (1) By the Fundamental Theorem of Calculus, if  $f$  has a continuous first derivative on the interval  $[a, b]$  then

$$f(b) = f(a) + \int_a^b f'(x) dx .$$

- (a) Assume that  $f$  has a continuous second derivative on  $[a, b]$ , and apply integration by parts to the integral above to derive the identity

$$f(b) = f(a) + f'(a)(b - a) - \int_a^b f''(x)(x - b) dx .$$

- (b) Finally assume that  $f$  has a continuous third derivative on  $[a, b]$  and apply integration by parts once more to derive the identity

$$f(b) = f(a) + f'(a)(b - a) + \frac{f''(a)}{2}(b - a)^2 + \frac{1}{2} \int_a^b f'''(x)(x - b)^2 dx .$$

- (2) Evaluate the integral  $\int \frac{x^2}{(x^2 + 4x + 5)^{3/2}} dx$ .

- (3) Evaluate the integral  $\int \frac{4 \arctan x}{(x + 1)^3} dx$ .