

NAME: _____

YOUR GRADE IS BASED ON THE PROCESS AS WELL AS THE FINAL RESULT. SHOW ALL YOUR STEPS CLEARLY SO YOU WILL BE ELIGIBLE FOR THE MOST PARTIAL CREDIT. YOU MAY USE A CALCULATOR, BUT NO NOTES, BOOKS, OR OTHER STUDENTS. GOOD LUCK!

1.) (10 pts.) For $f(x) = 2x^2 - 3$, compute $f'(x)$ using *the limit definition of the derivative*.

2.) (15 pts.) Two people start biking from the same point. One bikes east at 15 mph, the other south at 18 mph. How fast is the distance between the two people changing after 20 minutes? (Give your answer in exact terms.)

3.) (15 pts.) Given the integral $\int_1^4 \frac{5}{x} dx$,

a.) (4 pts.) compute the exact integral using the Fundamental Theorem of Calculus;

b.) (4 pts.) approximate the integral using a trapezoidal sum with 3 subintervals (include a picture);

c.) (4 pts.) approximate the integral using a right-endpoint sum with 3 subintervals (include a picture);

d.) (3 pts.) write your answer to part (c.) in Σ -notation.

4.) (15 pts.) Let $f(x) = |x - 3|$.

a.) (4 pts.) Does f satisfy all hypotheses of the EVT on $[2, 5]$? (In answering this, be sure to state what those hypotheses are.)

b.) (4 pts.) What is the conclusion of the EVT? If you thought the answer in part (a.) was “yes”, also compute all points, specific to f , that are guaranteed by the EVT.

c.) (4 pts.) Does f satisfy all hypotheses of the MVT on $[2, 5]$? (In answering this, be sure to state what those hypotheses are.)

d.) (3 pts.) What is the conclusion of the MVT? If you thought the answer in part (c.) was “yes”, also compute all points, specific to f , that are guaranteed by the MVT.

5.) (15 pts.) Let $f(x) = \frac{2x + 3}{5x - 4}$.

a.) (5 pts.) Compute $f'(x)$ using the Quotient Rule.

b.) (5 pts.) Compute $f'(x)$ by first re-writing $f(x) = (2x + 3)(5x - 4)^{-1}$ and then using the Product Rule.

c.) (5 pts.) Do any necessary algebra to answer this question: are your answers equal to each other? (Should they be?)

6.) (15 pts.)

a.) (5 pts.) Compute $h'(x)$ if $h(x) = \log_2 x + e^\pi - \sin(\cos x)$.

b.) (5 pts.) Solve the IVP $y' = 3^x \ln 3 - 4$, $y(1) = 5$.

c.) (5 pts.) Compute the limit $\lim_{x \rightarrow 0} \frac{e^x - x - 1}{3x}$. Be sure to show all necessary steps.

7.) (15 pts.) Given the graph of $f(x)$ below, graph an antiderivative $F(x)$ on the bottom left set of axes, and graph $f'(x)$ on the bottom right set of axes. For the $F(x)$ graph, let $F(0) = -3$.

