

Name:

Math 115 Practice Exam 2

1) Compute the derivatives of the following functions.

a) (6 points) $f(x) = x^3 \tan(x)$.

b) (8 points) $g(x) = \sec^5(x)$.

c) (8 points) $h(x) = \frac{x^2 + 1}{x - 7}$

2) The position of a lepton in Fermilab's Tevatron is given in meters by $s(t) = 3t^4 - 44t^3 + 144t^2$ where $t \geq 0$ is in seconds.

a) (9 points) Locate all critical points of $s(t)$.

b) (6 points) Find the intervals where the lepton is moving forward (increasing) or moving backward (decreasing).

c) (4 points) Determine the local maxima and minima (if any exist) of $s(t)$.

3) Evaluate the following limits.

a) (11 points) $\lim_{x \rightarrow 4} \frac{\sqrt[3]{x^4 - 40} - 6}{3x - 12}$

b) (11 points) $\lim_{\theta \rightarrow 0} \frac{\sin^2(3\theta)}{8\theta^2}$

4) Achilles is running a 100 meter dash against Ted the tortoise. Achilles can sprint at the blistering rate of 10 meters per second, while Ted (who is fast for a tortoise) goes a more pedestrian 1 meter per second. In order for the race to be fair, Ted will get a one minute head start. Ted and Achilles are spaced 4 meters apart from each other and both run in a straight line.

a) (4 points) Who is in the lead a minute and 7 seconds after Ted begins the race?

b) (8 points) Draw a picture representing the above scenario, labeling your variables.

c) (12 points) How fast is the distance between Achilles and Ted changing a minute and 7 seconds after Ted begins the race?