

Name: _____

Please show all work. Supply brief narration with your solutions and draw conclusions.

1. Katie Perry starts a bacterial culture in a petri dish. A day later the colony is 30 million strong. The next day it reaches 45 million. Assuming the growth is exponential, what will be the size of the colony one week after the start of the experiment?
2. Suppose Tucker Carlson's credibility rating (in points) is given by $1000/t^2$, where t is his age in years.
 - (a) Use the definition of derivative to find the instantaneous rate of change of Carlson's credibility on his 21st birthday.
 - (b) What is the average rate of change between his 21st birthday and 25th birthday?
3. Assume a and b are positive constants. Find derivatives with respect to t of

$$(a) t^4 a^{b^t} \quad (b) \frac{\ln t}{t}$$

4. Let $f(x) = 2x^2 - x^4$.
 - (a) Find all critical points of f and classify each as a local maximum or minimum.
 - (b) Find all inflection points of f and describe the concavity of f .
5. Justin Bieber receives an injection of a drug. Suppose the blood concentration t hours after the injection is given by $3te^{-0.2t}$ (mg/cc).
 - (a) How fast does the concentration increase initially?
 - (b) What is the maximum concentration and how soon will it be reached?
 - (c) If the effective level of the drug is 2 mg/cc, when will Justin's injection cease being effective?

Hint: In part (c) use your calculator to solve the equation numerically.

1	2	3	4	5	total (50)