

Name: _____

1. (10 pts) What continuous growth rate would make the world population grow from 6 billion in the year 2000 to 12 billion in the year 2100? (You may leave an unevaluated natural logarithm in the answer.) What is the formula for population as a function of t , the number of years since 2000?

2. (10 pts) Consider a function $f(x)$ given by the following table:

x	5	10	15	20	25	30
f(x)	15	95	225	405	635	915

- (a) Estimate $f'(10)$ and $f'(15)$.
(b) Estimate $f''(10)$.

3. (10 pts) A car makes a one hour journey in such a way that in t hours it travels $30t^2$ miles. What is its speed (in miles per hour) after 30 minutes? What is its acceleration (in miles per hour per hour) at the beginning of the trip? (Be careful of units.)

4. (20 pts) Compute $\frac{dy}{dx}$:

(a) $(x^2 + 1)^5$

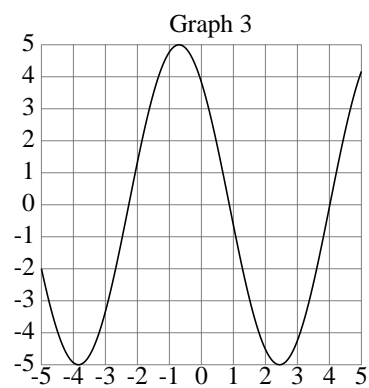
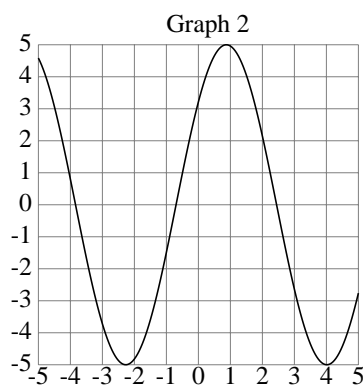
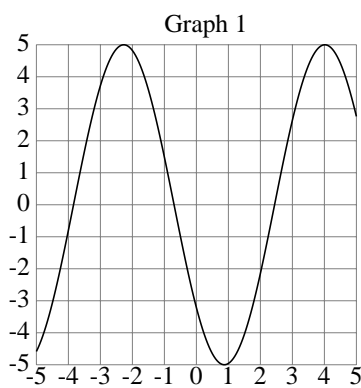
(b) $\ln \frac{x}{x-1}$

(c) $\frac{1}{\sqrt{2x+1}}$

(d) $2^x \sin x$

5. (10 pts) Suppose that $f(x)$ is a function with $f(10) = 5$ and $f'(10) = -1$. Estimate $f(9)$.

6. (10 pts) The following diagram shows the graphs of $y = f(x)$, $y = f'(x)$, and $y = f''(x)$ for some function $f(x)$. Which is which?



7. (10 pts) The quantity of a drug in a patient's body t hours after it is administered is $100e^{-t}$ milligrams. What is the rate at which the drug level is changing after one hour? Remember to include units in your answer.

8. (10 pts) Find the equation of the tangent line to $y = \ln(2x - 1)$ at $(1, 0)$.

9. (10 pts) The cost function for a certain manufacturer is $C(q) = 20000 + 1000 \ln(q + 1)$. What is the marginal cost at a production level of $q = 49$?