Name: _____

4-digit code: _____

- Write your name and the last 4 digits of your SSN in the space provided above.

- The test has five (5) pages, including this one.

- For multiple-choice questions, circle the answer you select. On the other problems, you should enter your answer in the box(es) provided.

- Show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.

- Credit for each problem is given at the right of each problem number.

- No books or notes may be used on this test. Calculators are allowed, provided they don't have a computer algebra system.

Page	Max	Points
2	30	
3	20	
4	20	
5	30	
Total	100	

Problem 1 (10 pts). The quantity of ozone in the upper atmosphere, Q, is decaying exponentially at a continuous rate of 0.2% per year. What is the half-life of ozone in the upper atmosphere?

Problem 2 (10 pts). If $g(t) = t^2$ and $f(t) = t + 2$, then $f\big(g(t)\big)$ is:
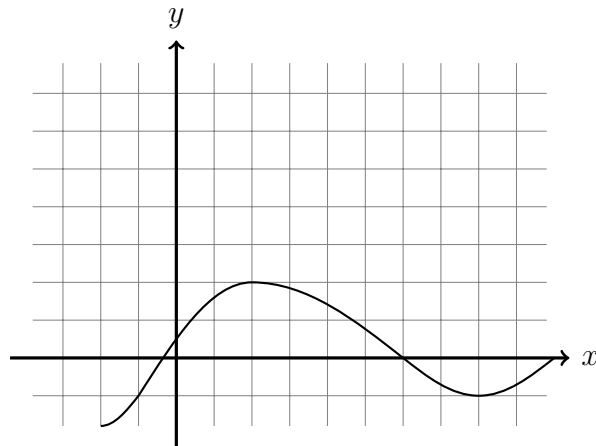
(a) $t^2 + 2$

(b) $t^2 + 4$

(c) $t^2 + 2t + 4$

     None of the above! The correct answer is

Problem 3 (10 pts). For the function f represented below, graph $2 + f(x)$ in the same coordinate axes.

Problem 4 (10 pts). Which of the following are power functions? For those which are, write the function in the form $y = kx^p$.

☐	$\dfrac{5}{x^3}$
☐	$5 \cdot 2^x$
☐	$\dfrac{3}{\sqrt{x}}$
☐	$(3x^2)^3$
☐	$e^{\ln x^2}$

Problem 5 (10 pts). The size S of a tumor (in cubic milimiters) is given by $S = 2^t$, where t is the number of months since the tumor was discovered.

(a) What is the total change in the size of the tumor during the first five months?

☐

(b) What is the average rate of change in the size of tumor during the first five months?

☐

(c) At what rate is the tumor growing at $t = 5$?

☐

(d) What is the corresponding relative rate of change at $t = 5$?

☐

Problem 6 (10 pts). The time L in hours that a drug stays in a person's system is a function of the quantity administered, q, in mg.
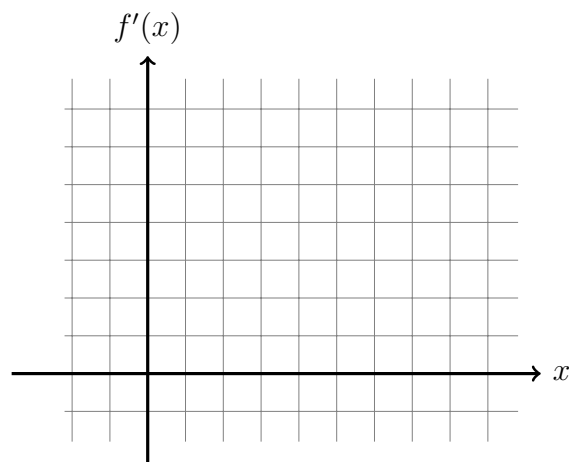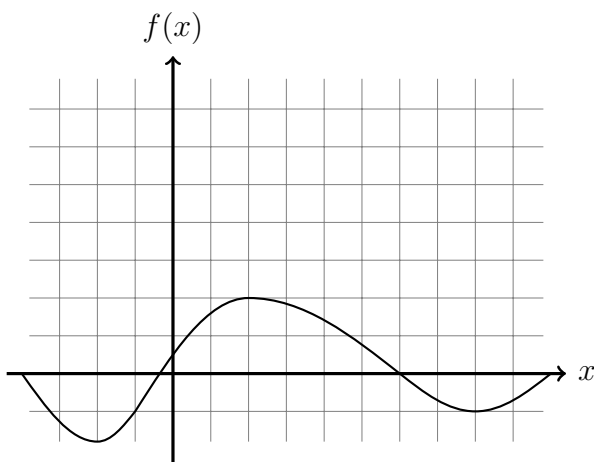
(a) Interpret the statement $f(10) = 6$. Make sure to give units for both 10 and 6.

(b) Write the derivative of the function $L = f(q)$ in Leibnitz notation.

(c) If $f'(10) = 0.5$, what are the units of the 0.5?

(d) Interpret the statement $f'(10) = 0.5$ in terms of dose and duration.

Problem 7 (10 pts). Sketch the graph of the derivative of the function $f(x)$ below.

$f(x)$

$f'(x)$

Problem 8 (10 pts). For the function in problem 7, we want to estimate the intervals on which the second derivative is negative. Mark all that apply.

(a) the interval $[-4, 0]$.

(b) the interval $[-2, 2]$.

(c) The interval $[0, 5]$.

(d) the interval $[2, 8]$.

(e) the interval $[5, 10]$.

Problem 9 (20 pts). Find the derivative of the following functions.

[2 pts] (a) $y = 3x^4 + 4x + 6x - 2, \quad y' =$

[2 pts] (b) $y = \sqrt{\dfrac{1}{x^4}}, \quad y' =$

[3 pts] (c) $y = \dfrac{4}{x} + \dfrac{3}{x^2}, \quad y' =$

[2 pts] (d) $y = e^{5x}, \quad y' =$

[3 pts] (e) $y = 5 \cdot 5^x + 6 \cdot 6^x, \quad y' =$

[4 pts] (f) $y = x^3 e^{2x}, \quad y' =$

[4 pts] (g) $y = \dfrac{3x^2}{x^5 + 1}, \quad y' =$