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 0.25% per year. What is the half-life of ozone in the upper atmosphere?

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

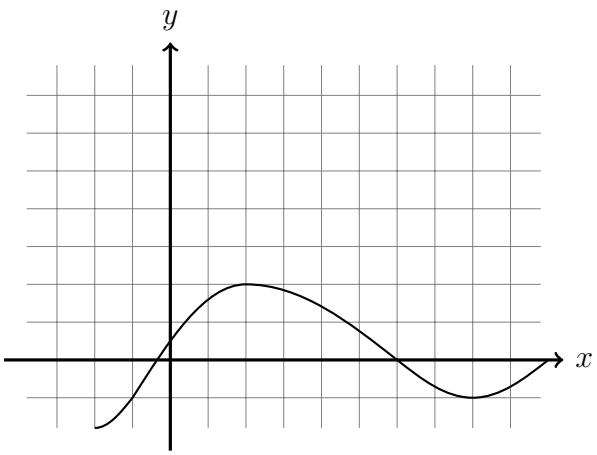
(a) $t^2 + 2$

(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 $f(x + 2)$ 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 $y = kx^p$.

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

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 six months?

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

(c) At what rate is the tumor growing at $t = 6$?

(d) What is the corresponding relative rate of change at $t = 6$?

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.

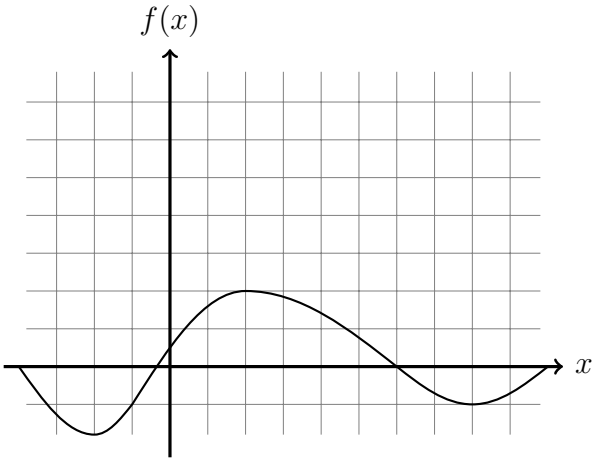
(a) Interpret the statement $f(10) = 6$. Make sure to give units for both 10 and 6.

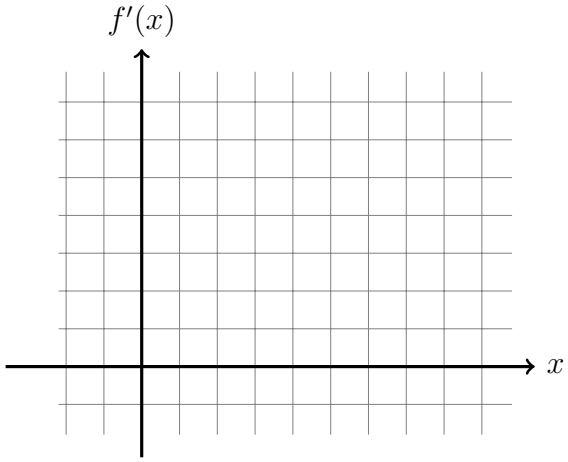
(b) Write the derivative of the function $L = f(q)$ in Leibnitz notation.

(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.





Problem 8 (10 pts)**.** For the function in problem 7, we want to estimate the intervals on which the second derivative is positive. 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) $y = \sqrt{\dfrac{1}{x^3}}, \qquad y' =$ ☐

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

[2 pts] (d) $y = e^{3x}, \qquad y' =$ ☐

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

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

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