

Name \_\_\_\_\_

**RULES FOR THIS TEST:**

- Do not borrow another student's calculator.
  - Circle each final answer.
  - A correct answer will only be given full credit if enough work is shown to justify that answer.
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1. (26 points) Complete each boxed equation with the appropriate formula for the derivative.

(a) If  $h(x) = 4e^x + (0.2)^x - 3 \ln x$ , then

$$h'(x) =$$

(b) If  $y = 10t^5 - 4t^3 + t - 7$ , then

$$\frac{dy}{dt} =$$

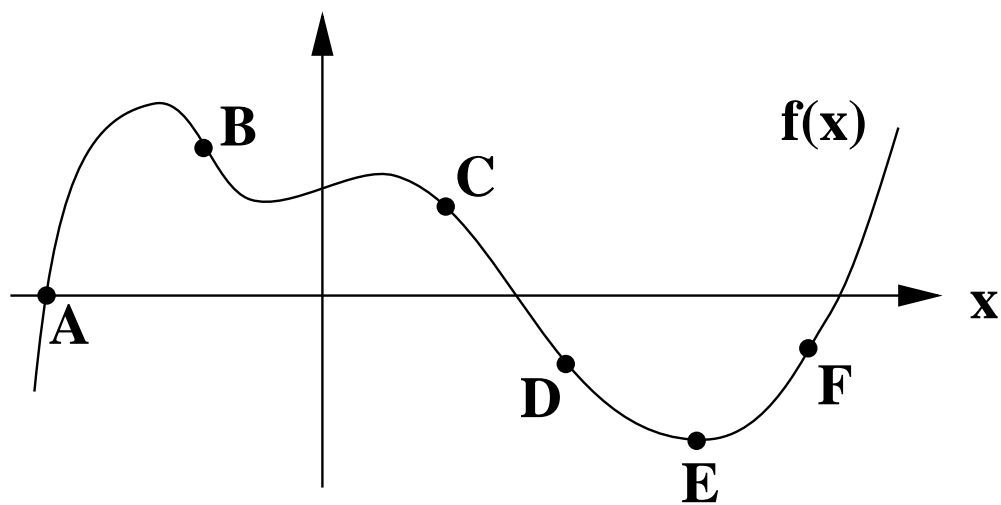
(c) If  $g(t) = \frac{1}{5t^2} - \sqrt[3]{t}$ , then

$$g'(t) =$$

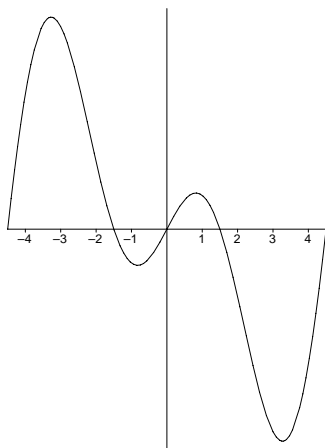
(d) If  $f(x) = x^2(x^3 + 4)$ , then

$$f'(x) =$$

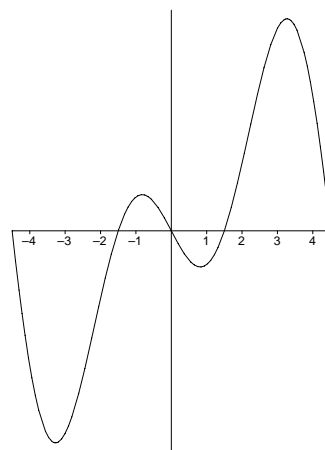
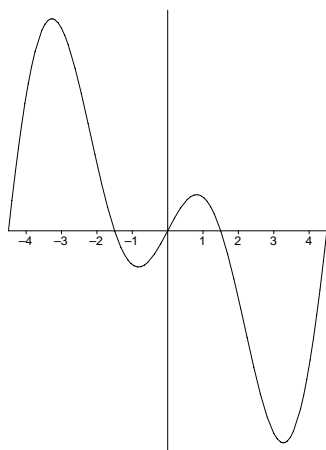
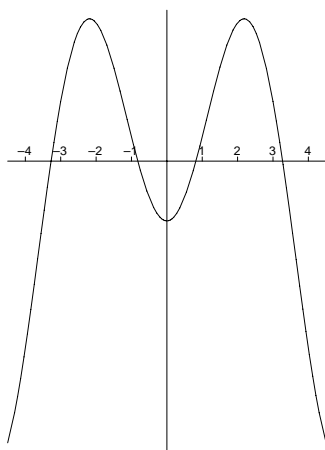
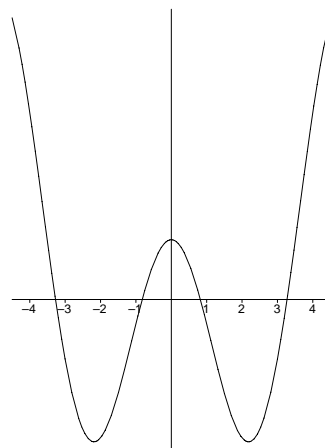
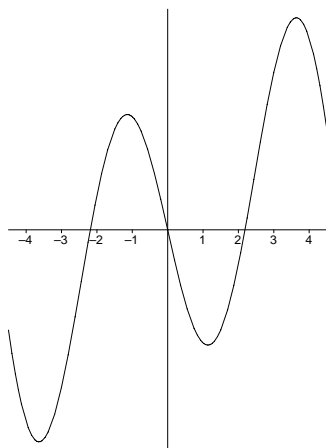
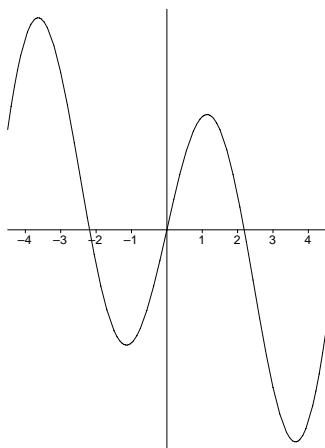
2. (18 points) State whether the derivative of the function graphed below is positive, negative, or zero at each of the labeled points.



3. (10 points) The graph of  $f(x)$  is shown below.



Circle the graph of  $f'(x)$ , given that it is one of the 6 choices below.



4. (14 points) A student carrying a flu virus returns to an isolated college campus. The virus spreads and the total number of infected students  $t$  days after the return of this student is approximated by  $f(t)$ .

(a) Suppose that  $f(8) \approx 160$  and  $f'(8) \approx 12$ . Write one or two sentences to explain what this means in practical terms to this college?

(b) Approximately how many students do you expect to be infected 10 days after this student returned to campus?

5. (14 points) DataSource, a database management company, first went online on January 1, 1996. Their yearly profits are recorded in the table below.

year	1996	1997	1998	1999	2000	2001
profit (in millions of dollars)	1.6	4.6	8.4	13.2	19.2	26.8

- (a) On average, how quickly were profits increasing between 1996 and 2001? Do not round off your answer – show all decimal places.

- (b) Estimate how quickly profits were increasing in the year 2000?

6. (18 points) An engineer tests the strength of a material as its temperature changes over an 40-minute period from below freezing to slightly above the temperature of a typical oven. During her test, the material's temperature, in degrees Fahrenheit ( $^{\circ}F$ ), is approximated by the function  $f(t) = 10t + 250te^{-0.17t}$  where  $t$  represents the number of minutes since she began testing.

(a) **Carefully** sketch a graph of the temperature of the material during her 40-minute test. From your graph, I should easily be able to see the value of any intercepts, as well as any high or low points on the graph. A well-drawn graph should also include proper labels with units for both axes.

(b) During the test, when did the material reach its highest temperature? What was that temperature? Your answers should be rounded off to one place after the decimal point.

(c) What was the temperature of the material 14 minutes after the start of her test? How quickly was the temperature increasing (or decreasing) at that time? Your answers should be rounded off to one place after the decimal point.