Name: _____

Directions: Show all work. No credit for answers without work.

1. [**4 parts, 4 points each**] Solve the following for x <u>exactly</u>. Decimal approximations are worth partial credit.

   (a) Solve for x in $5^{4x} = 7$.

   (b) Solve for x in $3\ln(5 - 2x) = 7$.

   (c) Let $f(x) = (x - 2)^2$ and $g(x) = -3x + 1$. Find $f(g(-2))$.

   (d) Complete: If $f'(x) > 0$ for each x in $[a, b]$, then $f(x)$ is _____ on $[a, b]$.

2. [**4 points**] A table for $h(x)$ appears below. Using the average of the left-hand and right-hand estimates, give an approximation for $h'(2.4)$.

x	2.30	2.35	2.40	2.45
$h(x)$	35.94	29.64	31.45	34.39

3. A company rents compact cars for $25 a day plus $0.21 per mile driven and rents pickup trucks for $48 a day plus $0.16 per mile driven.

    (a) [**4 points**] Give a formula $C(x)$ for the cost (in dollars) of renting a car for 2 days when x miles are driven.

    (b) [**4 points**] Give a formula $T(x)$ for the cost (in dollars) of renting a truck for 2 days when x miles are driven.

    (c) [**8 points**] How many miles must be driven for the cost of a 2-day car rental and a 2-day truck rental to be the same?

    (d) [**2 points**] What is the marginal cost of driving a mile in the car?

    (e) [**2 points**] What are the fixed costs of a 2-day truck rental?

4. [**2 parts, 5 points each**] Doug needs to have $18,000 worth of savings in 12 years. Bank A offers an interest rate of 2% per year, compounded annually. Bank B offers an interest rate of 1.5% per year, compounded continuously.

 (a) If Doug uses Bank A, how much money should he deposit now?

  (b) If Doug uses Bank B, how much money should he deposit now?

5. [**2 parts, 5 points each**] A cancerous growth of 0.10 grams forms in a patient and grows exponentially. After 3 weeks, the growth has reached a mass of 0.14 grams. The growth is not detectable until it reaches a mass of 0.5 grams.

  (a) Give a formula $M(t)$ for the mass (in grams) of the growth after t weeks.

  (b) How much time will elapse before the growth is detectable?

6. [**6 parts, 3 points each**] In each part below, find the derivative of the given graph and write the corresponding number in the provided space. You may use a number more than once. You do not need to show your work.

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

(f) _____
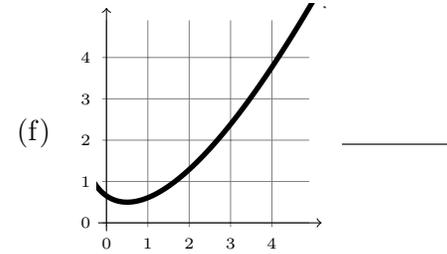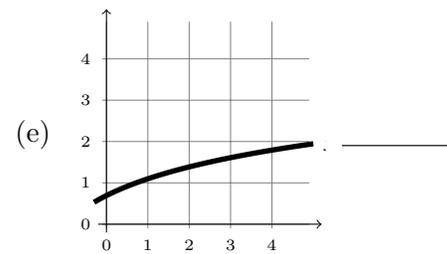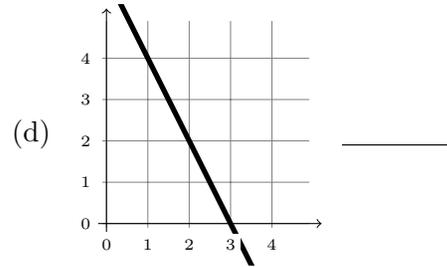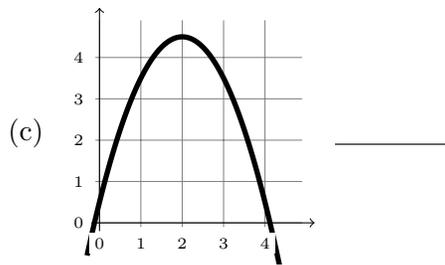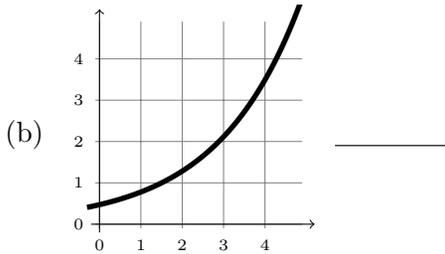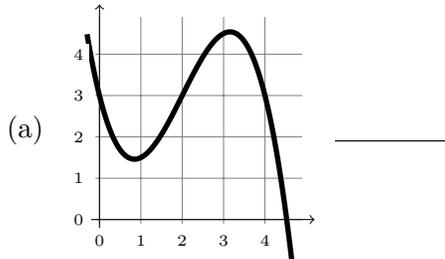
Derivative Library

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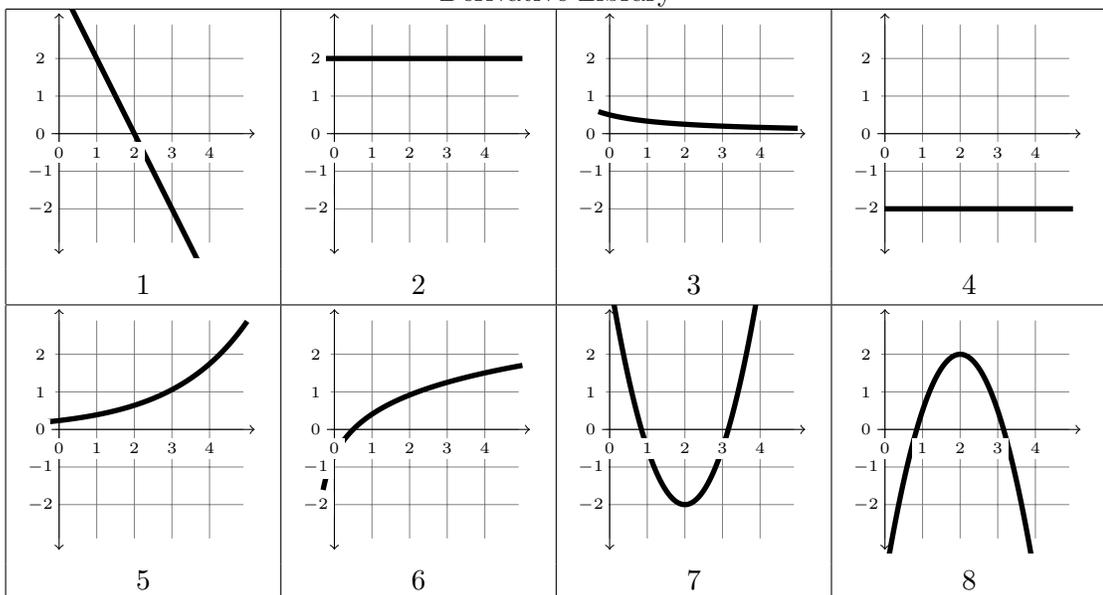
7. Let $f(x) = 5x^2$.

    (a) [**10 points**] Find the average rate of change of f over the interval $[2, 3]$.

    (b) [**10 points**] Find the average rate of change of f over the interval $[x, x + h]$.

    (c) [**2 points**] Using part (b), find $f'(x)$.