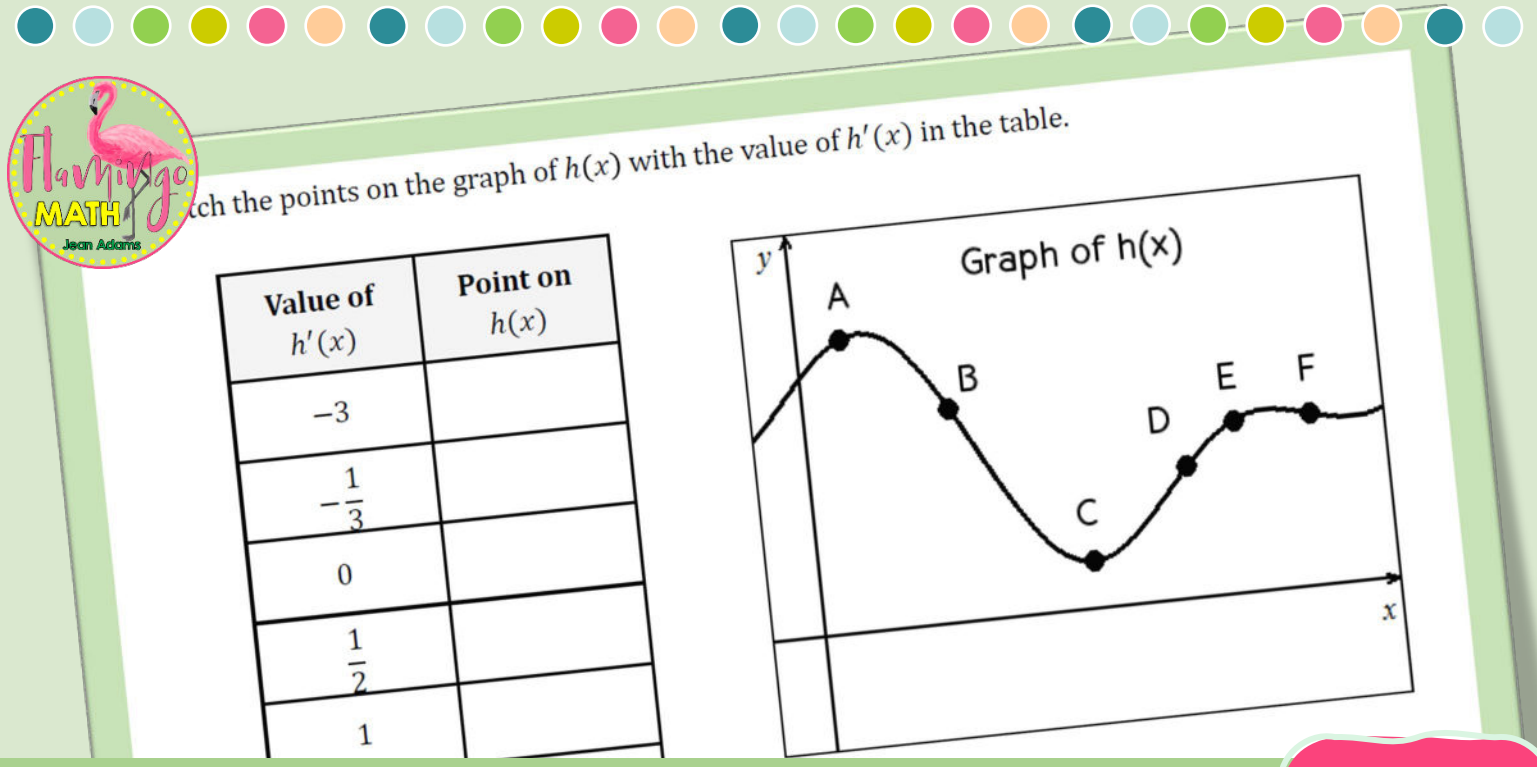
AP® Calculus

Differentiation

Basic Derivative Rules



Homework 2

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AP CALCULUS AB CURRICULUM

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AP CALCULUS BC CURRICULUM

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AP CALCULUS CURRICULUM

Scope and Sequence

Unit 2: Differentiation - Basic Derivative Rules

Lesson	Skills & Learning Objectives
[2.1] Rates of Change and the Tangent Line Problem	❑ Interpret rates of change over an interval or at a single point by graphical and numerical methods ❑ Write equations of tangent lines and normal lines
[2.2] Tangent Lines and the Derivative	❑ Use limit definition of the derivative, proper notation to find the general form of a derivative ❑ Analyze function behavior using the derivative
[2.3] Understanding the Derivative and Linear Approximations	❑ Explore the concept of local linearity ❑ Use the tangent line to investigate function behavior ❑ Estimate derivatives graphically and from tables
[2.4] Differentiability and Continuity	❑ Understand the relationship between differentiability and continuity
[2.5] Basic Differentiation Rules	❑ Find derivatives using basic rules of differentiation for polynomial, power, sine, cosine, tangent, exponential and logarithmic functions
[2.6] Product and Quotient Rules	❑ Apply the product and quotient rules algebraically for polynomial, power, sine, cosine, tangent, exponential and logarithmic functions
[2.7] Velocity and Other Rates of Change	❑ Solve basic rectilinear motion problems involving position, speed, velocity and acceleration ❑ Interpret the effect of a one-unit change

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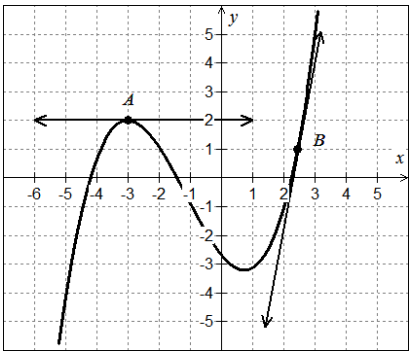
2.1 Rates of Change and the Tangent Line Homework

Name _____

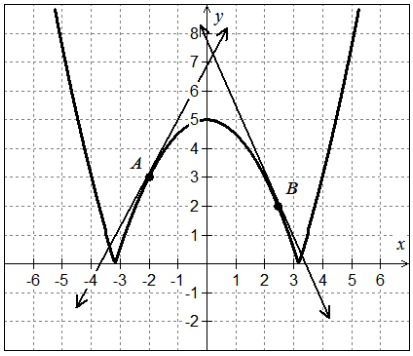
Date _____ Period _____

Problems 1–2, estimate the slope of the graph at the points *A* and *B*.

1.

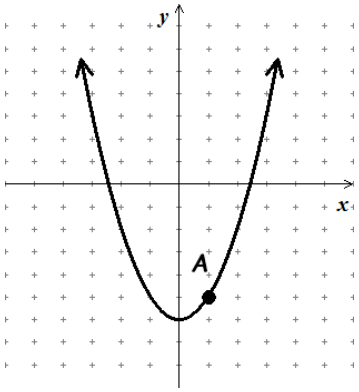


2.

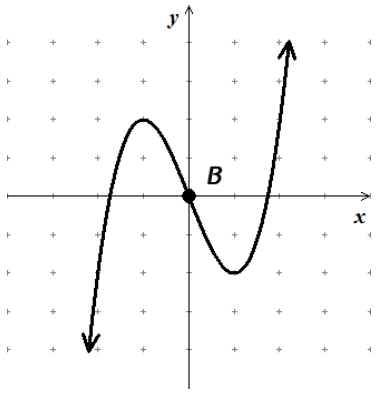


Problems 3–6, sketch tangent lines to the given functions at each of the labeled points. Use a straightedge, be precise. Extend each tangent line well beyond the point of tangency in each direction. Estimate the slope of the tangent line. Show your analysis algebraically.

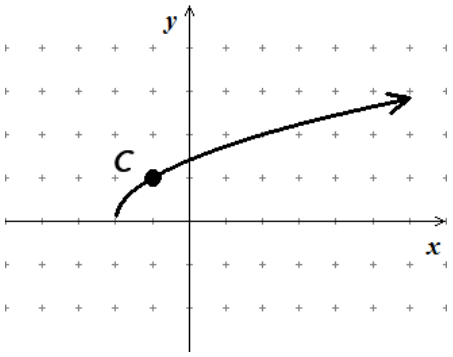
3. $f(x) = x^2 - 6$ at $(1, -5)$



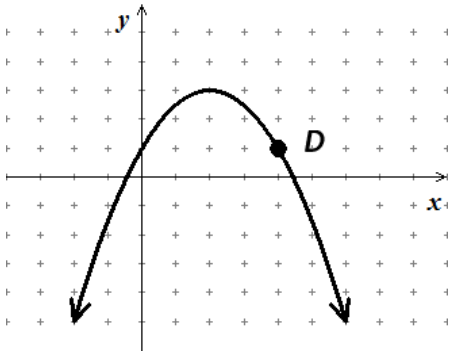
4. $f(x) = x^3 - 3x$ at $(0, 0)$



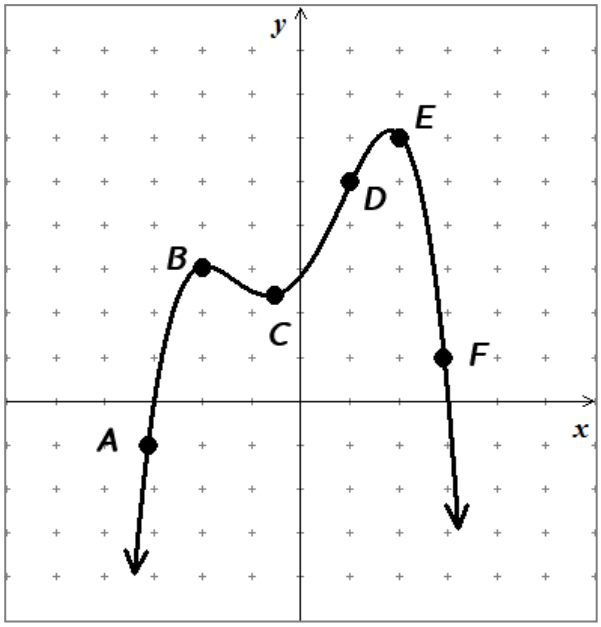
5. $f(x) = \sqrt{x+2}$ at $(-1,\ 1)$



6. $f(x) = -0.5(x-2)^2 + 3$ at $(4, 1)$



13. Complete the table below. Estimate the value of $f'(x)$ at the indicated x-values by drawing a tangent line and estimating its slope. Describe the behavior at the given point. Write the equation of the tangent line.



Point of tangency	Behavior at this point? increasing, decreasing, relative maximum or relative minimum	Estimated Slope of Tangent Line	Equation of the tangent line at given point:
A			
B			
C			
D			
E			
F			

2.3 Understanding the Derivative Homework

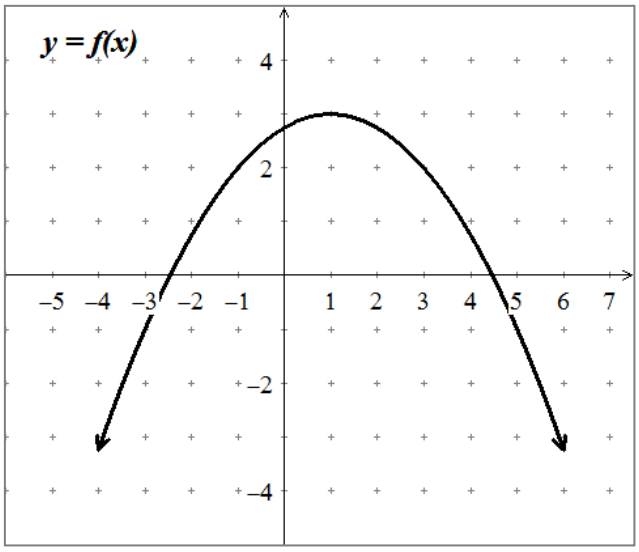
Name _____

Date _____ Period _____

Problems 1–2, estimate the slope of the curve at the indicated *x*-coordinate.

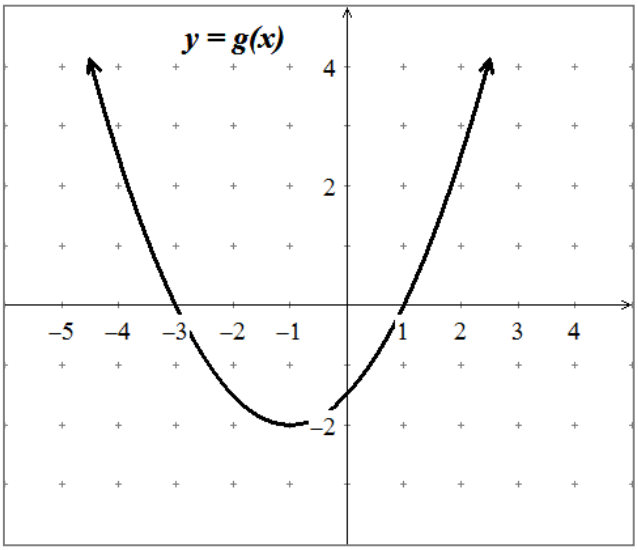
1.

A.) $x = -1$ **B.)** $x = 1$ **C.)** $x = 4$

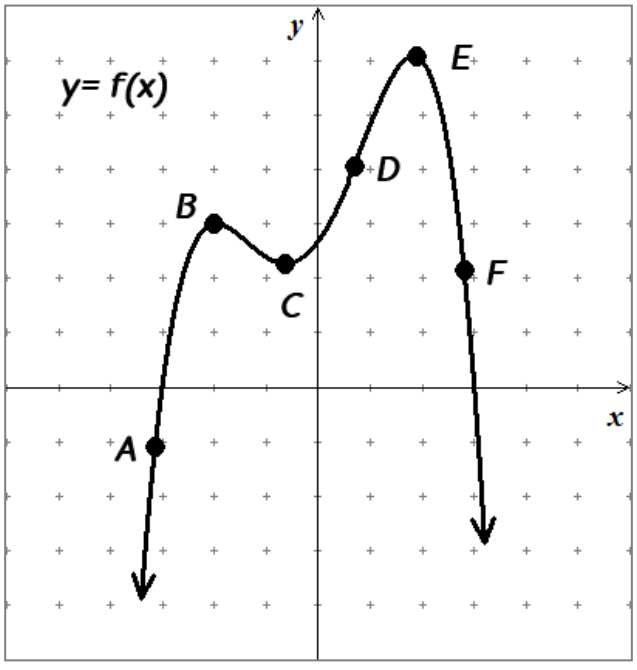


2.

A.) $x = 0$ **B.)** $x = -2$ **C.)** $x = 1$



Problems 3–7, use the graph of *f* shown below.



3. At which labeled point(s) is the slope of the curve

A. positive

B. negative

C. zero

4. Where is f increasing?

5. Where is f decreasing?

6. Which labeled point has the greatest slope?

7. Which labeled point has the least slope?

Problems 23 – 26, Let $f(x)$ and $g(x)$ be differentiable functions with the following values:

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
-1	-4	1	2	-1
0	1	-2	1	3
2	-3	-1	-1	1

23. If $h(x) = 3\,f(x)\,g(x)$, find $h'(-1)$.

24. Find the slope of the tangent line to $k(x) = g(x) \cdot \cos(x)$ when $x = 0$.

25. If $s(x) = \frac{-2 \cdot g(x)}{f(x)}$, find $s'(-1)$. Write the equation of the tangent line at $x = -1$.

26. If $k(x) = [g(x) - 1][2f(x) + 3]$, find $k'(2)$. Write the equation of the tangent line at $x = 2$.

2.7 Velocity and Other Rates Of Change Homework

Name _____

Date _____ Period _____

Problems 1 – 2, Interpret each scenario.

1. The temperature T, in degrees Fahrenheit, of your holiday turkey placed into a hot oven is modeled by $T = f(t)$, where t is the time in minutes since the turkey was put in the oven.

A. What is the sign of $f'(t)$? Explain how you know.

B. What are the units of $f'(35)$?

C. Explain the meaning of the statement $f(35) = 106$ in the context of the problem.

D. What is the meaning of the statement $f'(35) = 3$?

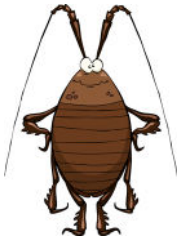
2. A skateboard manufacturer wants to understand how the price of their longboard affects the overall sales. Suppose that at a price of p dollars, the quantity, Q, of longboards sold is a function of the longboards price, that is $Q = f(p)$.

A. Explain the meaning of $f(175) = 80{,}000$ in a complete sentence.

B. Using the correct units, explain the meaning of $f'(175) = -45$

C. If the rate from part (B) holds true for $150 \leq p \leq 190$, how many longboard are predicted to sell when the price of a longboard is \$190 ? Show the work leading to your answer.

6. Randy the Roach is moving in a smooth and continuous manner along a line. His location has been tracked and his position at any given time, $0 \leq t \leq 5$, is given in the table below. [*Note, this prompt has no units.*]



t	0	0.5	1	1.8	2	2.4	3	3.5	4	5
$s(t)$	25	28.2	31	37	43	39	34	21	17	2

A. Find the displacement of Randy Roach during the given interval $[0, 5]$. Show work that leads to your answer.

B. What is the minimum number of times Randy changes direction? Explain your answer.

C. What is Randy's average velocity for $[0, 2]$? Show work that leads to your answer.

D. Estimate Randy's velocity at $t = 2.4$. Use proper notation and show work.

E. Is it possible to determine the time and position when Randy is farthest away from the origin? Why or why not?

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7. An object moves along a horizontal line according to $s(t) = t^3 - 9t^2 + 24t$.



A. When is s increasing, and when is it decreasing? Show work that supports your answer.

B. Find the total distance traveled in the first 5 seconds of motion. Show work.