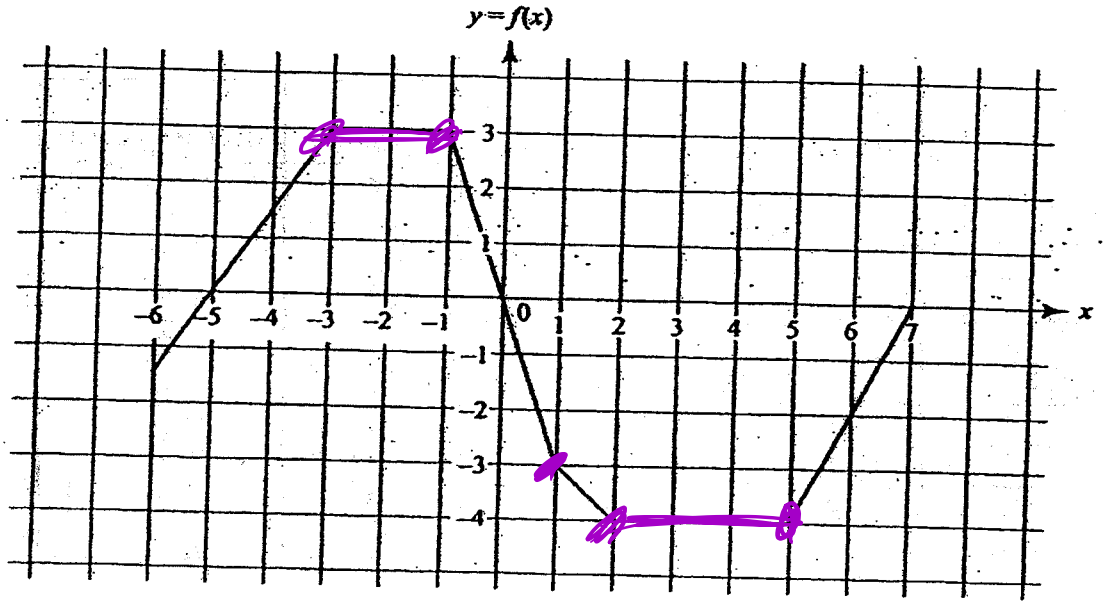
Questions are based on the following graph of $f(x)$, sketched on $-6 \leq x \leq 7$. Assume the horizontal and vertical grid lines are equally spaced at unit intervals.



On the interval $1 < x < 2$, $f(x)$ equals

(A) $-x-2$ (B) $-x-3$ (C) $-x-4$ (D) $-x+2$ (E) $x-2$

Over which of the following intervals does $f'(x)$ equal zero?

I. $(-6,-3)$ II. $(-3,-1)$ III. $(2,5)$

(A) I only (B) II only (C) I and II only
(D) I and III only (E) II and III only

How many points of discontinuity does $f'(x)$ have on the interval $-6 < x < 7$?

(A) none (B) 2 (C) 3 (D) 4 (E) 5

For $-6 < x < -3$, $f'(x)$ equals

(A) $-\frac{3}{2}$ (B) -1 (C) 1 (D) $\frac{3}{2}$ (E) 2

Which of the following statements about the graph of $f'(x)$ is false?

(A) It consists of six horizontal segments.
(B) It has four jump discontinuities.
(C) $f'(x)$ is discontinuous at each x in the set $\{-3,-1,1,2,5\}$.
(D) $f'(x)$ ranges from -3 to 2.
(E) On the interval $-1 < x < 1$, $f'(x) = -3$.

The previous two examples show how to compute the derivatives of power functions of the form $f(x) = x^n$, when n is 2 or 3. We can use the Binomial Theorem to show the *power rule* for a positive integer n:

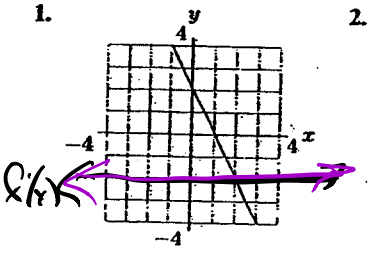
> If $f(x) = x^n$ then $f'(x) = nx^{n-1}$.

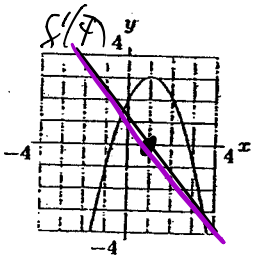
This result is in fact valid for any real value of n.

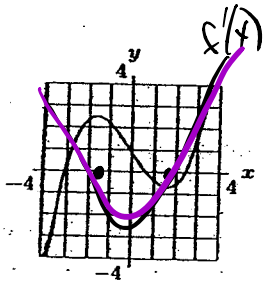
Exercises and Problems for Section 2.4

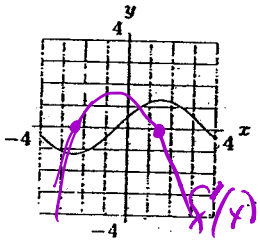
Exercises

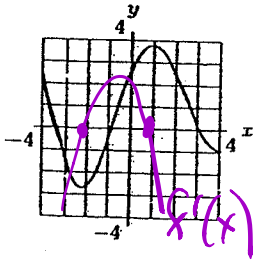
For Exercises 1–9, sketch a graph of the derivative function of each of the given functions.

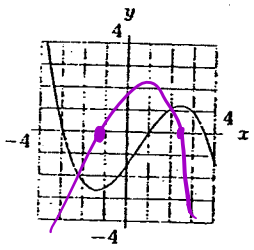
1. 

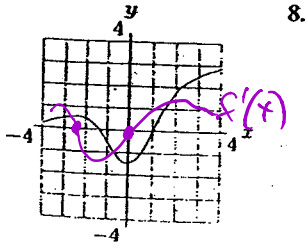
2. 

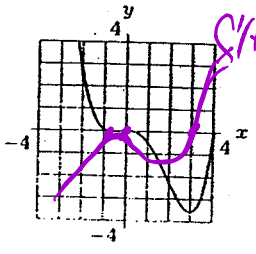
3. 

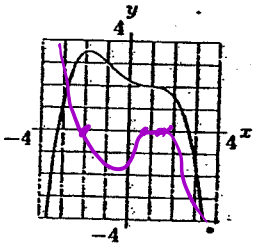
4. 

5. 

6. 

7. 

8. 

9. 

10. For $f(x) = \ln x$, construct tables, rounded to four decimals, near $x = 1$, $x = 2$, $x = 5$, and $x = 10$. Use the tables to estimate $f'(1)$, $f'(2)$, $f'(5)$, and $f'(10)$. Then guess a general formula for $f'(x)$.

11. (a) Estimate $f'(2)$ using the values of f in the table.
    (b) For what values of x does $f'(x)$ appear to be positive? Negative?

x	0	2	4	6	8	10	12
$f(x)$	10	18	24	21	20	18	15

12. Find approximate values for $f'(x)$ at each of the x-values given in the following table.

x	0	5	10	15	20
$f(x)$	100	70	55	46	40

In Exercises 13–14, find a formula for the derivative using the power rule. Confirm it using difference quotients.

13. $k(x) = 1/x$

14. $l(x) = 1/x^2$

Find a formula for the derivatives of the functions in Exercises 15–16 using difference quotients.

15. $g(x) = 2x^2 - 3$

16. $m(x) = 1/(x+1)$

For Exercises 17–20, sketch the graph of $f(x)$, and use this graph to sketch the graph of $f'(x)$.

17. $f(x) = x^2$

18. $f(x) = x(x-1)$

19. $f(x) = \cos x$

20. $f(x) = \log x$