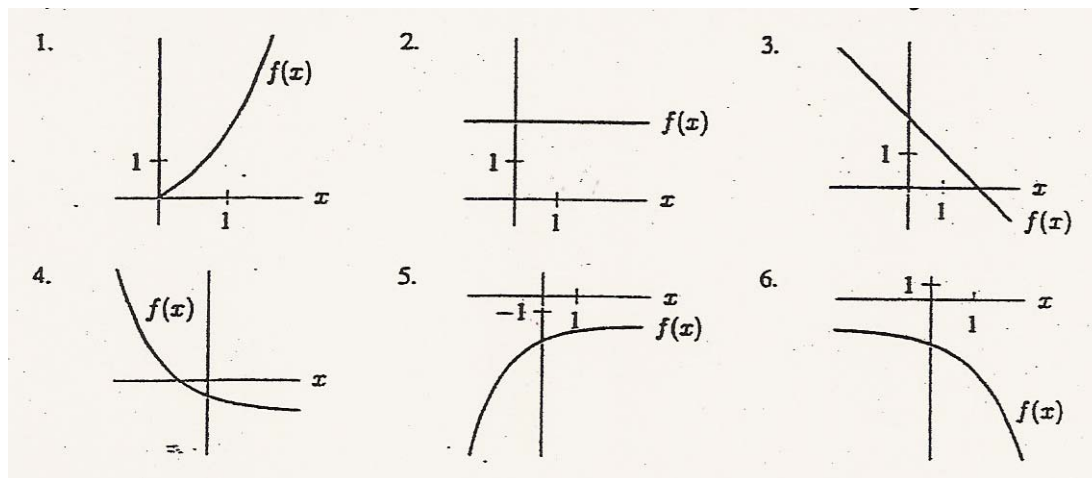


CALCULUS  
WORKSHEET ON  $f$ ,  $f'$ ,  $f''$

For problems 1 – 6, give the signs of the first and second derivatives for each of the following functions.



7. Let  $P(t)$  represent the price of a share of stock of a corporation at time  $t$ . What does each of the following statements tell us about the signs of the first and second derivatives of  $P(t)$ ?

(a) “The price of the stock is rising faster and faster.”

(b) “The price of the stock is close to bottoming out.”

8. Given the following data:

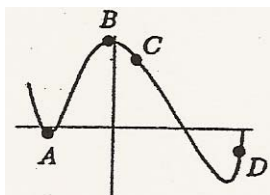
$x$	0	0.2	0.4	0.6	0.8	1.0
$f(x)$	3.7	3.5	3.5	3.9	4.0	3.9

(a) Estimate  $f'(0.6)$  and  $f'(0.5)$ .

(b) Estimate  $f''(0.6)$ .

(c) Where do you think the maximum and minimum values of  $f$  occur in the interval  $0 \leq x \leq 1$ ?

9. The graph of a function  $f(x)$  is shown in the figure below. On the table, indicate whether  $f$ ,  $f'$ ,  $f''$  at each of the marked points is positive, negative, or zero.



Point	$f$	$f'$	$f''$
A			
B			
C			
D			

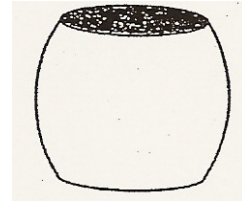
10. Do the values for the function  $y = k(x)$  in the table below suggest that the graph of  $k(x)$  is concave up or concave down for  $1 \leq x \leq 3.3$ ? Write a sentence in support of your conclusion.

$x$	1.0	1.2	1.5	1.9	2.5	3.3
$k(x)$	4.0	3.8	3.6	3.4	3.2	3.0

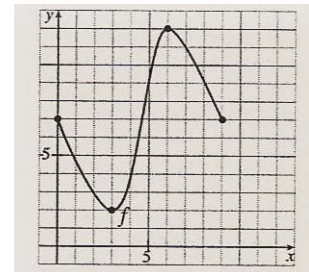
- 
11. (a) Water is flowing at a constant rate into a cylindrical container standing vertically. Sketch a graph showing the depth of water against time.

- (b) Water is flowing at a constant rate into a cone-shaped container standing in its vertex. Sketch a graph showing the depth of the water against time.

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12. If water is flowing at a constant rate into the Grecian urn in the figure on the right, sketch a graph of the depth of the water against time. Mark on the graph the time at which the water reaches the widest point of the urn.



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13. Let  $f$  be defined as shown in the figure on the right. Use the graph of  $f$  to estimate the values of  $c$  that satisfy the conclusion of Rolle's Theorem on  $[0, 9]$ . What theorem would apply for the interval  $[0, 5]$ ?



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14. At what value of  $x$  does the graph of  $y = \frac{1}{x^2} - \frac{1}{x^3}$  have a point of inflection?  
 (A) 0            (B) 1            (C) 2            (D) 3            (E) At no value of  $x$

- 
15. The absolute maximum value of  $f(x) = x^3 - 3x^2 + 12$  on the closed interval  $[-2, 4]$  occurs at  $x =$   
 (A) 4            (B) 2            (C) 1            (D) 0            (E) -2

- 
16. Let  $f$  be a polynomial function with degree greater than 2. If  $a \neq b$  and  $f(a) = f(b) = 1$ , which of the following must be true for a least one value of  $x$  between  $a$  and  $b$ ?

- I.  $f(x) = 0$   
 II.  $f'(x) = 0$   
 III.  $f''(x) = 0$
- (A) None            (B) I only            (C) II only            (D) I and II only            (E) I, II, and III