Test Form A Name ____________ Date ________

Chapter 3 Class ____________ Section ________

1. Find all open intervals on which the function $f(x) = \dfrac{x^2}{x^2+4}$ is decreasing.

(a) $(0, \infty)$ (b) $(-2, 2)$ (c) $(-\infty, 0)$
(d) $(-\infty, \infty)$ (e) None of these

2. Find all critical numbers for the function $f(x) = \dfrac{x-1}{x+3}$.

(a) 1 (b) $1, -3$ (c) -3
(d) $1, -1$ (e) None of these

3. Find the values of x that give relative extrema for the function $f(x) = 3x^5 - 5x^3$.

(a) Relative maximum: $x = 0$; Relative minimum: $x = \sqrt{5/3}$
(b) Relative maximum: $x = -1$; Relative minimum: $x = 1$
(c) Relative maxima: $x = \pm 1$; Relative minimum: $x = 0$
(d) Relative maximum: $x = 0$; Relative minima: $x = \pm 1$
(e) None of these

4. Find all intervals on which the graph of the function is concave upward: $f(x) = \dfrac{x^2+1}{x^2}$.

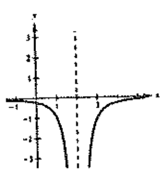
(a) $(-\infty, \infty)$ (b) $(-\infty, -1)$ and $(1, \infty)$ (c) $(-\infty, 0)$ and $(0, \infty)$
(d) $(1, \infty)$ (e) None of these

5. Let $f''(x) = 4x^3 - 2x$ and let $f(x)$ have critical numbers -1, 0, and 1. Use the Second Derivative Test to determine if any of the critical numbers gives a relative maximum.

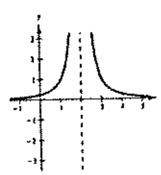
(a) -1 (b) 0 (c) 1
(d) -1 and 1 (e) None of these

8. Which of the following is the correct sketch of the graph of the function $f(x) = \dfrac{1}{(x-2)^2}$?

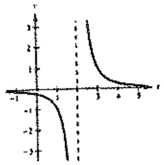
(a)



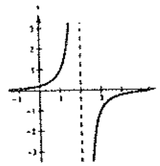
(b)



(c)



(d)



(e) None of these

9. Find all points of inflection: $f(x) = \frac{1}{12}x^4 - 2x^2 + 15$.

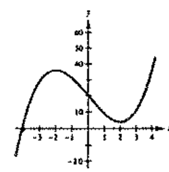
(a) $(2, 0)$ (b) $(2, 0), (-2, 0)$ (c) $(0, 15)$
(d) $\left(2, \frac{25}{3}\right), \left(-2, \frac{25}{3}\right)$ (e) None of these

10. The management of a large store wishes to add a fenced-in rectangular storage yard of 20,000 square feet, using the building as one side of the yard. Find the minimum amount of fencing that must be used to enclose the remaining 3 sides of the yard.

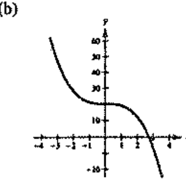
(a) 400 ft (b) 200 ft (c) 20,000 ft
(d) 500 ft (e) None of these

11. Which of the following is the correct sketch of the graph of the function $y = x^3 - 12x + 20$?

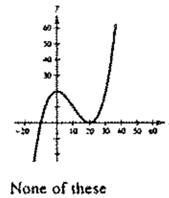
(a)



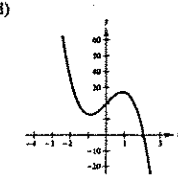
(b)



(c)



(d)



(e) None of these

12. State why Rolle's Theorem does not apply to the function $f(x) = \dfrac{2}{(x+1)^2}$ on the interval $[-2, 0]$.

(a) f is not continuous on $[-2, 0]$. (b) $f(-2) \neq f(0)$
(c) f is not differentiable at $x = -1$. (d) Both a and c.
(e) None of these

13. Find all extrema in the interval $[0, 2\pi]$ if $y = x + \sin x$.

(a) $\left(-1, -1 + \dfrac{3\pi}{2}\right), (0, 0)$ (b) $(2\pi, 2\pi), (0, 0)$
(c) $(2\pi, 2\pi)\ (\pi, \pi)$ (d) $(\pi, \pi)\ (0, 0)$
(e) None of these

Test Form A

1. c	2. e	3. b	4. c
5. a	[redacted]	[redacted]	8. b
9. d	10. a	11. a	12. d
13. b	[redacted]	[redacted]	

Test Form B Name ______________ Date ________

Chapter 3 Class ______________ Section ________

1. Find all open intervals on which the function $f(x) = \dfrac{x}{x^2 + x - 2}$ is decreasing.

(a) $(-\infty, \infty)$ (b) $(-\infty, 0)$ (c) $(-\infty, -2)$ and $(1, \infty)$

(d) $(-\infty, -2), (-2, 1)$ and $(1, \infty)$ (e) None of these

2. Find all critical numbers for the function $f(x) = (9 - x^2)^{3/5}$.

(a) 0 (b) 3 (c) $-3, 3$

(d) $-3, 0, 3$ (e) None of these

3. Find the values of x that give relative extrema for the function $f(x) = (x + 1)^2(x - 2)$.

(a) Relative maximum: $x = -1$; relative minimum: $x = 1$

(b) Relative maxima: $x = 1, x = 3$; Relative minimum: $x = -1$

(c) Relative minimum: $x = 2$

(d) Relative maximum: $x = -1$; Relative minimum: $x = 2$

(e) None of these

4. Find all intervals on which the graph of the function is concave upward: $f(x) = \dfrac{x - 1}{x + 3}$.

(a) $(-\infty, \infty)$ (b) $(-\infty, -3)$ (c) $(1, \infty)$

(d) $(-3, \infty)$ (e) None of these

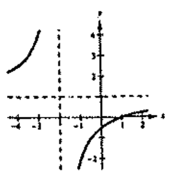
5. Let $f''(x) = 3x^2 - 4$ and let $f(x)$ have critical numbers -2, 0, and 2. Use the Second Derivative Test to determine which critical numbers, if any, gives a relative maximum.

(a) -2 (b) 2 (c) 0

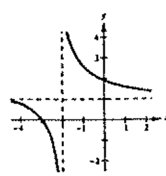
(d) -2 and 2 (e) None of these

8. Which of the following is the correct sketch of the graph of the function $f(x) = \dfrac{x - 1}{x + 2}$?

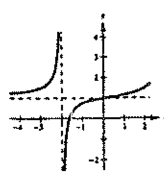
(a)



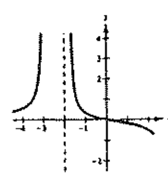
(b)



(c)



(d)



(e) None of these

9. Find all points of inflection: $f(x) = x^3 - 12x$.

(a) $(0, 0), (\pm\sqrt{12}, 0)$ (b) $(0, 0)$ (c) $(2, 0), (-2, 0)$

(d) $(2, -16), (-2, 16)$ (e) None of these

10. A farmer has 160 feet of fencing to enclose 2 adjacent rectangular pig pens. What dimensions should be used so that the enclosed area will be a maximum?

(a) $4\sqrt{15}$ ft by $\frac{8}{3}\sqrt{15}$ ft (b) 40 ft by $\frac{80}{3}$ ft (c) 20 ft by $\frac{80}{3}$ ft

(d) 40 ft by 40 ft (e) None of these

11. State why the Mean Value Theorem does not apply to the function $f(x) = \dfrac{2}{(x + 1)^2}$ on the interval $[-3, 0]$.

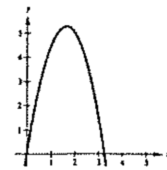
(a) $f(-3) \neq f(0)$ (b) f is not continuous at $x = -1$.

(c) f is not defined at $x = -3$ and $x = 0$. (d) Both a and b

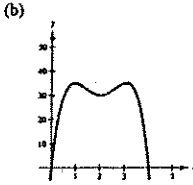
(e) None of these

12. Which of the following is the correct sketch of the graph of the function $y = 8x^3 - 2x^4$?

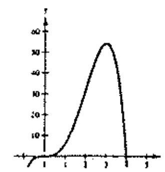
(a)



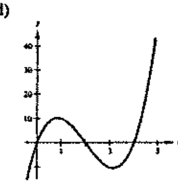
(b)



(c)



(d)



(e) None of these

13. Find all extrema in the interval $[0, 2\pi]$ for $y = x - \cos x$.

(a) $\left(\frac{3\pi}{2}, \frac{3\pi}{2}\right), (2\pi, 2\pi - 1)$ (b) $(\pi, \pi + 1), (0, 0)$ (c) $(2\pi, 2\pi - 1), (0, 0)$

(d) $(2\pi, 2\pi - 1), (\pi, \pi + 1)$ (e) None of these

Test Form B

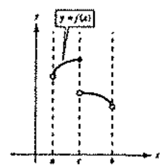
1. d	2. d	3. a	4. b
5. c	[redacted]	[redacted]	8. a
9. b	10. c	11. b	12. c
13. e	[redacted]	[redacted]	

Test Form C
Chapter 3

Name ______ Date ______
Class ______ Section ______

A graphing calculator/utility is recommended for this test.

1. Determine from the graph whether f possesses extrema on the inverval (a, b).

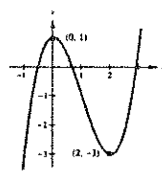


(a) Maximum at $x = c$, minimum at $x = b$
(b) Maximum at $x = c$, no minimum
(c) No maximum, minimum at $x = b$
(d) No extrema
(e) None of these

2. Use a graphing utility to graph $f(x) = x^{2/3}$. State why Rolle's Theorem does not apply to f on the interval $[-1, 1]$.

(a) f is not continuous on $[-1, 1]$.
(b) f is not defined on the entire interval.
(c) f is not differentiable at $x = 0$.
(d) The interval $[-1, 1]$ is not closed.
(e) None of these

3. Use the graph to identify the open intervals where the function is increasing or decreasing.



(a) Increasing $(-\infty, 1)$ and $(-3, \infty)$; decreasing $(1, -3)$
(b) Increasing $(0, 2)$; decreasing $(-\infty, 0)$ and $(2, \infty)$
(c) Increasing $(-\infty, \infty)$
(d) Increasing $(-\infty, 0)$ and $(2, \infty)$; decreasing $(0, 2)$
(e) None of these

4. Let $f(x) = (x + 2)^3 - 4$. The point $(-2, -4)$ is ______.

(a) An absolute maximum
(b) An absolute minimum
(c) A critical point but not an extremum
(d) Not a critical point
(e) None of these

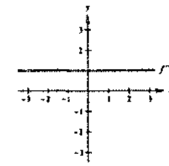
5. Given that $f(x) = -x^2 + 12x - 28$ has a relative maximum at $x = 6$, choose the correct statement.

(a) f' is negative on the interval $(-\infty, 6)$
(b) f' is positive on the interval $(-\infty, \infty)$
(c) f' is negative on the interval $(6, \infty)$
(d) f' is positive on the interval $(6, \infty)$
(e) None of these

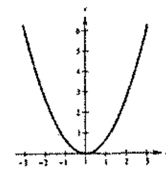
6. Use a graphing utility to graph $f(x) = -\frac{1}{(x + 1)^2}$. Use the graph to determine the open intervals where the graph of the function is concave upward or concave downward.

(a) Concave downward: $(-\infty, \infty)$
(b) Concave downward: $(-\infty, -1)$; concave upward: $(-1, \infty)$
(c) Concave downward: $(-\infty, -1)$ and $(-1, \infty)$
(d) Concave upward: $(-\infty, -1)$ and $(-1, \infty)$
(e) None of these

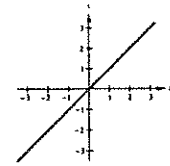
7. The figure given in the graph is the second derivative of a polynomial function, f. Choose a graph of f.



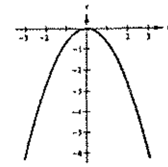
(a)



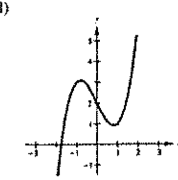
(b)



(c)



(d)



(e) None of these

8. Let $f(x)$ be a polynomial function such that $f(-2) = 5$, $f'(-2) = 0$, and $f''(-2) = 3$. The point $(-2, 5)$ is a ______ the graph of f.

(a) Relative minimum
(b) Relative minimum
(c) Intercept
(d) Point of inflection
(e) None of these

10. Find the limit: $\lim_{x \to \infty} \frac{a - bx^4}{cx^4 + x^2}$.

(a) 0
(b) ∞
(c) $-\frac{b}{c}$
(d) $\frac{a}{c}$
(e) None of these

12. Determine the function whose graph has vertical asymptotes at $x = \pm 2$ and a horizontal asymptote at $y = 0$.

(a) $f(x) = \frac{x}{(x - 2)^2}$
(b) $f(x) = \frac{x}{x^2 + 4}$
(c) $f(x) = \frac{3x}{x^2 - 4}$
(d) $f(x) = x(x - 2)(x + 2)$
(e) None of these

Test Form C

1. b	2. c	3. d	4. c
5. c	6. c	7. a	8. b
[redacted]	10. c	[redacted]	12. c

[redacted]

Test Form D | **Name** ____________ **Date** ________

Chapter 3 | **Class** ____________ **Section** ________

1. Investigate for intervals where $f(x) = \frac{1}{x^2}$ is increasing or decreasing.

2. Find all critical numbers: $f(x) = x\sqrt{2x + 1}$.

3. Find extrema: $y = \frac{2x}{(x + 4)^3}$.

4. Find all extrema in the interval $[0, 2\pi]$ if $y = \sin x + \cos x$.

5. Find all intervals for which the graph of the function $y = 8x^3 - 2x^4$ is concave downward.

6. Let $f(x) = x^3 - x^2 + 3$. Use the Second Derivative Test to determine which critical numbers, if any, give relative extrema.

[redacted]

8. Use the techniques learned in this chapter to sketch the graph of $y = \frac{3}{(1 - x)^2}$.

9. Use the techniques learned in this chapter to sketch the graph of $y = x^3 - 3x + 1$.

10. Find all points of inflection for the graph of the function $f(x) = 2x(x - 4)^3$.

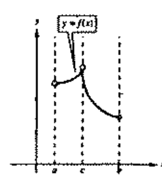
11. The management of a large store has 1600 feet of fencing to fence in rectangular storage yard using the building as one side of the yard. If the fencing is used for the remaining 3 sides, find the area of the largest possible yard.

Test Form E | **Name** ____________ **Date** ________

Chapter 3 | **Class** ____________ **Section** ________

A graphing calculator/utility is recommended for this test.

1. Determine from the graph whether f possesses extrema on the interval $(a, b]$.



2. Consider $f(x) = \frac{1}{(x - 3)^2}$.
   a. Sketch the graph of $f(x)$.
   b. Calculate $f(2)$ and $f(4)$.
   c. State why Rolle's Theorem does not apply to f on the interval $[2, 4]$.

3. Consider $f(x) = \sqrt{x}$. Find all values, c, in the interval $[0, 1]$ such that the slope of the tangent line to the graph of f at c is parallel to the secant line through the points $(0, f(0))$ and $(1, f(1))$. Mean Value

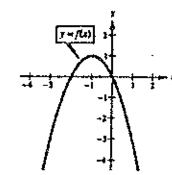
4. Use a graphing utility to graph the function $f(x) = 9x^4 + 4x^3 - 36x^2 - 24x$.
   a. Adjust the viewing window and use the zoom and trace features to estimate the x-values of the relative extrema to one decimal place.
   b. Use calculus to find the actual x-values of the relative extrema.

5. Use a graphing utility to graph the function $f(x) = x^3 + 3x^2 - 9x - 10$. Then use the graph to determine open intervals of increasing or decreasing.

6. A differentiable function f has only one critical number: $x = -3$. Identify the relative extrema of f at $(-3, f(-3))$ if $f'(-4) = \frac{1}{2}$ and $f'(-2) = -1$.

7. Use a graphing utility to graph $f(x) = \frac{1}{x - 2} + 1$. Use the graph to determine the open intervals where the graph of the function is concave upward or concave downward.

8. The graph of a polynomial function, f, is given. On the same coordinate axes sketch f' and f''.



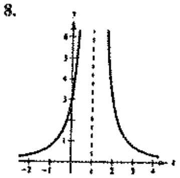
10. Consider $f(x) = \frac{x^2 - 4x + 1}{x^2 + 1}$.
   a. Find all asymptotes.
   b. Use a graphing utility to graph f.
   c. Use the graph to find the point on the graph where the curve crosses the asymptote.

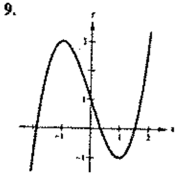
11. Create a function whose graph has a vertical asymptote at $x = 0$ and a slant asymptote at $y = x - 1$.

12. An open box is to be made from a rectangular piece of cardboard, 7 inches by 3 inches, by cutting equal squares from each corner and turning up the sides.
   a. Write the volume, V, as a function of the edge of the square, x, cut from each corner.
   b. Use a graphing utility to graph the function, V. Then use the graph of the function to estimate the size of the square that should be cut from each corner and the volume of the largest such box.

Test Form D

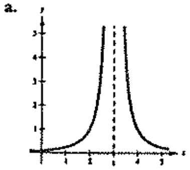
1. Increasing $(-\infty, 0)$; Decreasing $(0, \infty)$
2. $-\frac{1}{3}, -\frac{1}{2}$ 3. $\left(2, \frac{1}{54}\right)$, relative maximum
4. Relative maximum: $\left(\frac{\pi}{4}, \sqrt{2}\right)$

   Relative minimum: $\left(\frac{5\pi}{4}, -\sqrt{2}\right)$
5. $(-\infty, 0)$ and $(2, \infty)$
6. $x = 0$, relative maximum; $x = \frac{2}{3}$, relative minimum
7. 2
8. 

9. 

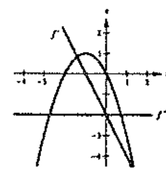
10. $(4, 0), (2, -32)$ 11. 320,000 sq ft

Test Form E

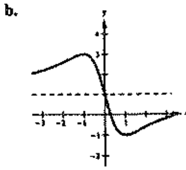
1. Minimum at $x = b$
2. a. 

   b. $f(2) = f(4) = 1$

   c. f is not continuous on $[2, 4]$.
3. $\frac{1}{4}$
4. a. Relative minimum at $x = \pm 1.4$
   Relative maximum at $x = -0.3$

   b. Relative minimum at $x = \pm\sqrt{2}$
   Relative maximum at $x = -\frac{1}{3}$
5. Increasing $(-\infty, -3)$ and $(1, \infty)$
   Decreasing $(-3, 1)$
6. Relative maximum
7. Concave downward: $(-\infty, 2)$
   Concave upward: $(2, \infty)$
8. 

10. a. $y = 1$

    b. 

    c. $(0, 1)$
11. $f(x) = \dfrac{x^2 - x + 5}{x}$ (The answer is not unique.)

12. a. $V = x(7 - 2x)(3 - 2x)$

    b. 0.65 in. by 0.65 in.; $V = 6.3$ cubic inches

Text

pg. 235 / 3, 4, 6-8, 13-16, 19, 20, 25, 26, 33, 34, 36-38, 41-46