MATH 110	NAME ____________________
EXAMINATION II	STUDENT NUMBER ____________________
MARCH 28, 2005	INSTRUCTOR ____________________
TEST FORM A	SECTION NUMBER ____________________

This examination will be machine processed by University Testing Services. Use only a number 2 pencil on your answer sheet. On your answer sheet identify your name, this course (MATH 110) and the date. Code and blacken the corresponding circles on your answer sheet for your student I.D. number and class section number. Code in your test form.

There are **20** multiple choice questions. For each problem **four** possible answers are given, only one of which is correct. You should solve the problem, note the letter of the answer that you wish to give and **blacken** the corresponding space on the **answer sheet**. Mark only one choice; darken the circle completely (you should not be able to see the letter after you have darkened the circle). Check frequently to be sure the problem number on the test sheet is the same as the problem number of the answer sheet.

THE USE OF CALCULATORS AND OTHER PORTABLE ELECTRONIC DEVICES IS NOT PERMITTED DURING THIS EXAMINATION.

THE USE OF NOTES OF ANY KIND IS NOT PERMITTED DURING THIS EXAMINATION.

1. Let $h(x) = \dfrac{x}{x^2+1}$. Find the relative maxima and minima of h.

   a) Relative maximum at $x = 1$; relative minimum at $x = -1$.

   b) No relative maxima or minima.

   c) Relative minimum at $x = -1$; no relative maximum.

   d) Relative maximum at $x = -1$; no relative minimum.

2. Let $f(x) = x^3 - 12x + 3$. Find the intervals where f is increasing and where f is decreasing.

   a) Increasing on $(-\infty, -2)$, decreasing elsewhere.

   b) Increasing on $(-2, 2)$, decreasing elsewhere.

   c) Increasing on $(2, \infty)$, decreasing elsewhere.

   d) Increasing on $(-\infty, -2)$, and $(2, \infty)$, decreasing elsewhere.

3. Find the relative extrema (if any) of the function $f(x) = x^2 - \frac{2}{x}$.

a) there are no relative extrema

b) a relative maximum at $x = 0$

c) a relative maximum at $x = -1$

d) a relative minimum at $x = -1$

4. Let $f(x) = \frac{x+2}{x-2}$. Determine the intervals of concavity of f.

a) f is concave upward on $(-\infty, 2) \cup (2, \infty)$.

b) f is concave down on $(-\infty, 2)$ and upward on $(2, \infty)$.

c) f is concave down on $(-\infty, -2)$ and upward on $(-2, \infty)$.

d) f is concave down on $(-\infty, -2) \cup (-2, \infty)$.

5. A company's cost (in dollars) for producing x units of their product is

$$C(x) = 7 + \frac{1000}{x^2+1} + \frac{3000}{x+1}$$

What is the limiting value of the cost for large number of units? (That is, what is the cost when the number of units grows infinitely large?)

a) 7

b) 4007

c) 0

d) ∞

6. Determine all vertical and horizontal asymptotes of the function $f(x) = \dfrac{x^2-5x+6}{x^2-8x+15}$.

a) vertical asymptote $x = 5$; horizontal asymptote $y = 1$

b) vertical asymptotes $x = 5$ and $x = 3$; horizontal asymptote $y = 0$

c) vertical asymptotes $x = 5$ and $x = 3$; horizontal asymptote $y = 1$

d) vertical asymptotes $x = 2$ and $x = 3$; no horizontal asymptote

7. The daily profit function (in dollars) for producing x units of a certain product is

$$P(x) = -2x^3 + 6x + 400.$$

What is the largest possible daily profit?

a) $400

b) $404

c) $410

d) $398

8. Find the absolute maxima and absolute minima, if any, of the function $f(x) = x^2 - 4x + 8$ on $[0, 3]$.

a) absolute maximum is 8, absolute minimum is 4

b) absolute maximum is 5, absolute minimum is -4

c) absolute maximum is 9, absolute minimum is 0

d) absolute maximum is 3, absolute minimum is 0

9. Find the x-coordinates of all inflection points of the graph of the function

$$f(x) = x^4 - 6x^3 + 2x + 8.$$

a) $x = -1$, $x = 2$

b) $x = -1$, $x = 3$

c) $x = 0$, $x = 2$

d) $x = 0$, $x = 3$

10. If $xy = 1$ and x is guaranteed to be positive, what is the minimal possible value of $x + y$?

a) $\frac{1}{2}$

b) 1

c) $\frac{3}{2}$

d) 2

11. Determine the critical numbers for the function $f(x) = x\sqrt{x+1}$.

a) $x = \frac{-2}{3}$

b) $x = -1$ and $x = 2$

c) $x = -1$ and $x = \frac{-2}{3}$

d) There are no critical numbers.

12. The graph of the function is shown. Which set of conditions does the function satisfy?

a) $f'(x) > 0$ on $(-\infty, a)$ and $f''(x) > 0$ on $(-\infty, b)$

b) $f'(x) > 0$ on (a, c) and $f''(x) > 0$ on $(-\infty, b)$

c) $f'(x) > 0$ on $(-\infty, c)$ and $f''(x) > 0$ on $(-\infty, c)$

d) $f'(x) > 0$ on (a, c) and $f''(x) > 0$ on (b, ∞)

13. With 600 feet of fencing, what largest possible rectangular area (in square feet) can be enclosed with an extra interior subdivision wall parallel to two of the sides?

a) 10000

b) 15000

c) 20000

d) 25000

14. Squares of dimension $x \times x$ are cut out of the rectangular 8×10 sheet of paper, and the sides are folded up to form a box (without a top). The volume of the resulting box is

a) $80x$

b) $(8-x)(10-x)x$

c) $(8-2x)(10-2x)x$

d) $(8-x)(10-x)2x$

15. Let $f(x) = \dfrac{x}{x^2+1}$. Which sketch best represents the graph of f?

a)

b)

c)

d)

16. Given that $f'(x) > 0$ on $(0,2)$ and $f''(x) > 0$ on $(0,1)$ and $f''(x) < 0$ on $(1,2)$. The global maximum of f on the interval $[0,2]$ is achieved at

a) $x = 0$.

b) $x = 1$.

c) $x = 2$.

d) There is no global maximum.

17. Find the maximal possible area of the rectangle two of whose sides lie on the coordinate axes and one of whose vertices lies on the parabola $y = -\frac{1}{3}x^2 + 25$. (See the given sketch.)

a) $\frac{250}{3}$

b) $\frac{350}{3}$

c) $\frac{460}{3}$

d) $\frac{550}{3}$

18. The height of a cannonball at time t is given by $h(t) = 40t - 20t^2 + 7$. To what maximal height will the ball rise?

a) 20

b) 1

c) 27

d) 37

19. Which function best fits the given graph?

a) $\dfrac{3x^4}{(x+2)^2(x-2)^2}$

b) $\dfrac{4x^3}{(x+2)^2(x-2)^2}$

c) $\dfrac{3x^3}{(x+2)(x-2)^2}$

d) $\dfrac{3x^4}{(x+2)^2(x-2)}$

20. The global maximum of the function $f(x) = x^2 + (2-x)^2$ on $[0, 3]$ is achieved at

a) 0

b) 1

c) 2

d) 3