Test   Chapter 5 Name ________________

I. Multiple Choice

_____ 1. The largest interval on which $f(x)=x^2+4x+2$ is increasing is

(A) $[0,\infty)$ (B) $[0,-\infty)$ (C) $(-\infty,2)$

(D) $(-2,\infty)$ (E) $(-\infty,+\infty)$

_____ 2. $f(x)=x^3+1$ has an absolute maximum on $[-1,1]$ of

(A) 6 (B) 0 (C) 11 (D) 2 (E) 4

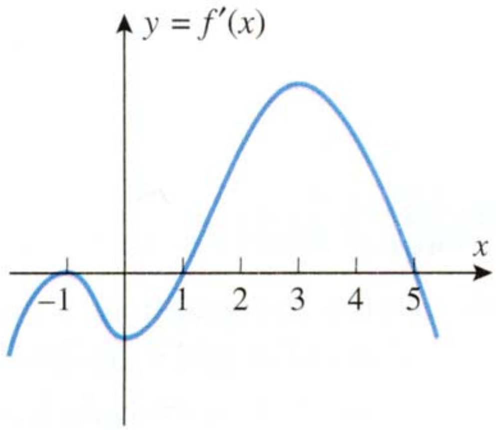
_____ 3. Determine the value of c that satisfies Rolle's Theorem for the function $f(x)=2x^2-8$ on $[-2,2]$.

(A) -1 (B) 0 (C) 1 (D) 0.5 (E) -0.5

_____ 4. Determine the value of c that satisfies the Mean Value Theorem for $f(x)=x^3$ on $[0,1]$.

(A) 0 (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{\sqrt{3}}{3}$ (D) $\frac{\sqrt{2}}{2}$ (E) $\frac{\sqrt{2}}{3}$

5-6. Use the graph of $f'(x)$ shown in the figure to answer the questions below.



_____ 5. Determine the x-coordinates where $f(x)$ has a relative minima.

(A) $x=0$ (B) $x=1$ (C) $x=-1$ and $x=0$ and $x=3$

(D) $x=-1$ (E) $x=3$

_____ 6. Determine the x-coordinates where $f(x)$ has a point of inflection.

(A) $x=0$ (B) $x=1$ (C) $x=\frac{-1}{2}$ and $x=\frac{3}{2}$

(D) $x=2$ (E) $x=-1$ and $x=0$ and $x=3$

_____ 7. $f(x)=3x^4-4x^3$ is concave down on

(A) $\left(0,\ \frac{2}{3}\right)$ (B) $\left(-\infty,\ \frac{2}{3}\right)$ (C) $\left(\frac{2}{3},\ +\infty\right)$ (D) nowhere

(E) $(-\infty,+\infty)$

_____ 8. $f(x)=x^2-8x+7$ has

(A) a relative maximum at x = -4

(B) a relative minimum at x = -4

(C) a relative maximum at x = 4

(D) a relative minimum at x = 4

(E) a relative minimum at x = 0

II. Free Response

9 - 10. Give the following information for the function:

$$y = x^4 + 4x^3$$

Derivative: ____

Increasing on (___ , ___) and (___ , ___)

Decreasing on (___ , ___)

Relative Minimum at (___ , ___)

Second Derivative: ________________________________

Concave Up on (___ , ___) and (___ , ___)

Concave Down on (___ , ___)

Points of Inflection at(___ , ___) and (___ , ___)

11. Sketch the function which is
 increasing on $(-\infty, 0)$ and $(2, +\infty)$,
 decreasing on $(0, 2)$,
 concave up on $(1, +\infty)$,
 concave down on $(-\infty, 1)$,
and has a
 relative maximum at $(0, 4)$,
 relative minimum at $(2, 0)$,
 point of inflection at $(1, 1)$.

12. Sketch a curve that satisfies the following conditions:

$\frac{dy}{dx} < 0$ on $(-\infty, 0)$ and $(2, +\infty)$ $\qquad$ $\frac{dy}{dx} > 0$ on $(0, 2)$

$\frac{d^2y}{dx^2} < 0$ on $(1, +\infty)$ $\qquad$ $\frac{d^2y}{dx^2} > 0$ on $(-\infty, 1)$

$f(0) = 0$ $\qquad$ $f(2) = 4$ $\qquad$ $f(1) = 1$

13. Sketch y = f(x), given that

$$f(1) = -3$$
$$f''(x) > 0 \text{ for } x < 1$$
$$f''(x) < 0 \text{ for } x > 1$$

14. Determine the constant k so that the function $f(x) = x^2 + \frac{k}{x}$ will have a point of inflection at x = 1.

15. The equation $y = x^2 - 2$ has one real root. Approximate it by Newton's method. Let $x_1 = 1$; then determine x_2 and x_3.

16. The height of an object at a given time t is given by the formula $s = s_0 + v_0 t - \frac{1}{2} g t^2$ where s_0 is the initial position, v_0 is the initial velocity, and g is the acceleration due to gravity (use 32 ft/sec^2 for the value of g).

If an object is launched vertically upward from an initial height of 10 feet with an initial speed of 64 ft/sec, use calculus to determine how high the object will rise.

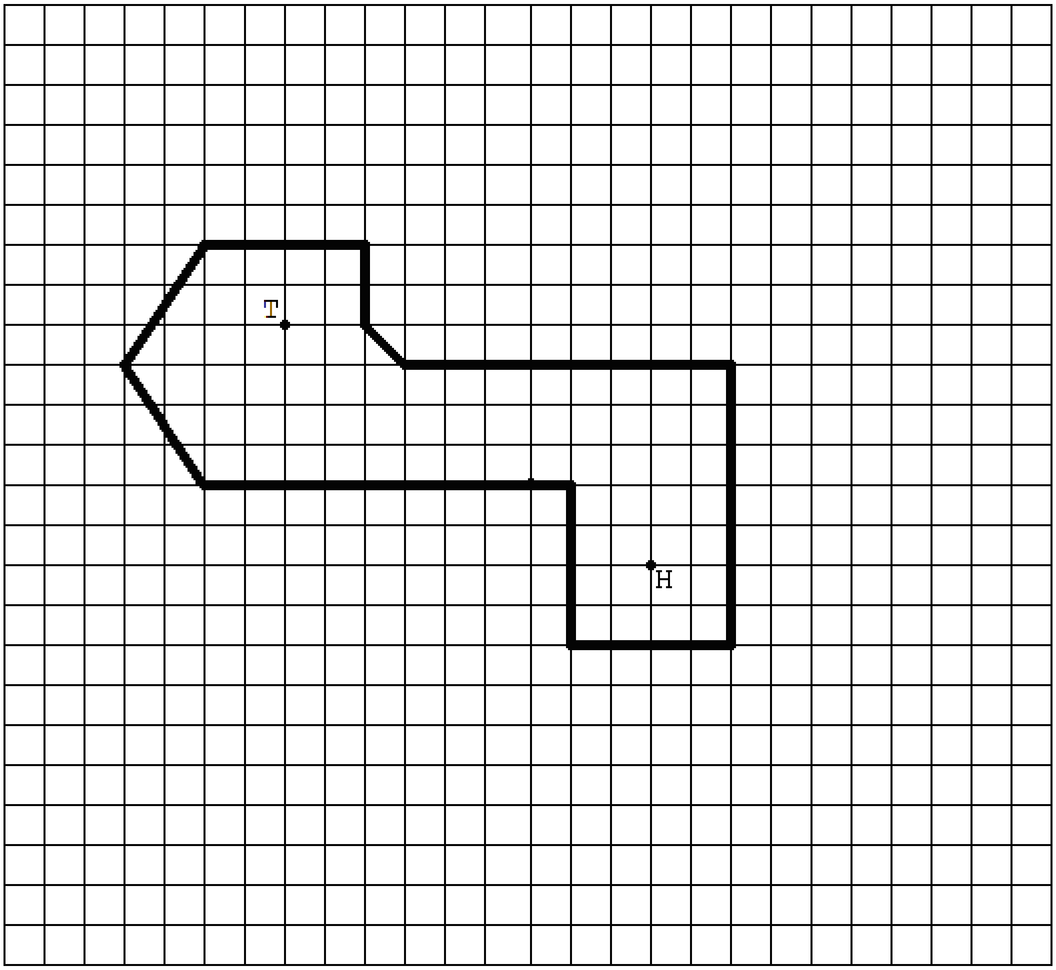
17 - 19. Set up each of the following, but do not solve them. You may stop when you have expressed the quantity you are trying to maximize or minimize in terms of only one variable. When you have finished setting up all three problems, go back and **completely solve *one* of them**.

17. Determine the volume of the largest right circular cylinder that can be inscribed in a right circular cone whose radius is 3 feet and altitude is 6 feet.

18. A tank with a rectangular base and rectangular sides is to be open at the top. It is to be constructed so that its width is 4 meters and its volume is 36 cubic meters. If building the tank costs $10 per square meter for the base and $5 per square meter for the sides, what is the cost of the least expensive tank?

19. A cylindrical can is to hold 20π cubic meters. The material for the top and bottom costs \$10 per square meter and material for the side costs \$8 per square meter. Find the radius and height of the most economical can.

20. In the diagram below, show how you would hit the golf ball from T so that it would go into the hole at H.


T
H