1. Does the function $f(x)=|x|$ on $[-2,2]$ satisfy the conditions of the Mean Value Theorem? Why or why not?

2. Determine the vertical and horizontal asymptotes of $f(x)=\dfrac{2x^2+6x}{x^2-9}$

3. Evaluate $\lim\limits_{x\to 0}\dfrac{e^{-5x}-1+5x}{x^2}$

4. Evaluate $\lim\limits_{x\to \pi/2^-}\dfrac{3\sec x}{2+\tan x}$

5. Evaluate $\lim\limits_{x\to \pi/2^-}(1-\sin x)\tan x$

6. Evaluate $\lim\limits_{x\to 0}\left(\dfrac{1}{x^2}-\dfrac{1}{x^2\sec x}\right)$

7. Evaluate $\lim\limits_{x\to \infty}\left(1-\dfrac{4}{x}\right)^x$

8. Evaluate $\lim\limits_{x\to 0^+}(1+x)^{4/x}$

9. Find the local and absolute extreme values of the function $f(x)=x-\sqrt{x}$ on [0, 4].

10. Given $f'(x)=(x-1)(x+2)(x+4)$, determine the critical points of $f(x)$ and use the second derivative test to determine whether they correspond to local maxima, local minima, or the test is inconclusive.

11. For each function, $f(x)=\left(x^2-1\right)^3$ and $f(x)=x\sqrt{3-x}$
    a. Find the critical points.
    b. Find intervals of increase and decrease.
    c. Find local maximum and minimum values.
    d. Find intervals of concavity and inflection points.

12. For each of the following determine if the statement is True or False; explain your answer.
    a. If $f'(c)=0$ then f has a maximum or minimum at $x=c$.
    b. If f is differentiable for all x in its domain and has an absolute minimum at $x=c$, then $f'(c)=0$.
    c. If f is continuous on (a,b) then f attains an absolute maximum value $f(c)$ and an absolute minimum value $f(d)$ at some numbers c and d in (a,b).
    d. If $f''(2)=0$ then $(2,f(2))$ is an inflection point of the curve $y=f(x)$.
    e. There exists a function f such that $f(1)=-2$, $f(3)=0$ and $f'(x)>1$ for all x.

13. Sketch the graph of a function that satisfies all the conditions given below.

$$f(0)=0,\ \lim_{x\to\pm\infty}f(x)=2,\ \lim_{x\to 4}f(x)=+\infty$$
$$f'(x)<0 \text{ for } x<0 \text{ and } x>4 \text{ and } f'(x)>0 \text{ for } 0<x<4$$
$$f''(x)<0 \text{ for } x<-2 \text{ and } f''(x)>0 \text{ for } -2<x<4 \text{ and } x>4$$

14. A closed box with square base is to be built to house an ant colony. The bottom of the box and all four sides are to be made of material costing $\$1/\text{ft}^2$ and the top is to be constructed of glass costing $\$5/\text{ft}^2$. What are the dimensions of the box of greatest volume that can be constructed for \$72? Verify your answer yields a maximum.

15. Evaluate $\displaystyle\int\left(2x^3-4x^2+\frac{4}{x^2}+\frac{1}{x}\right)dx$

16. Evaluate $\int \frac{x^2 - x + \sqrt{x}}{\sqrt[3]{x}} dx$

17. Evaluate $\int (\sin 2x + \cos 3x) dx$

18. Evaluate $\int (\sec^2 \theta + \sec\theta \tan\theta) d\theta$

19. Evaluate $\int (e^{2x} + e^{-3x}) dx$

20. Evaluate $\int \frac{1}{16 + x^2} dx$

21. Evaluate $\int \frac{3}{\sqrt{1 - 4x^2}} dx$

22. Suppose $\frac{d^2y}{dx^2} = 7x^2 - 3x$, $y'(1) = 1$ and $y(1) = 2$, find y.

For additional problems, check out the review problems for Chapter 4. Note the questions above are simply a sample of questions possible for the exam; it is possible that other types of questions may appear on your exam.