**I a. NO CALCULATOR !!**

1. If  is a continuous function  then

  is

 (A) 0 (B)  (C)  (D)  (E) 

2.  is

 (A) 0 (B) 1 (C) 3 (D)  (E) nonexistent

3. *y*



 *x*

 If *f* is a continuous, strictly increasing function on the interval  as shown above, which of the following must be true ?

 I. 

 II. 

 III.  for some *c* such that 

(A) I only (B) II only (C) III only (D) I and III only

(E) I , II , and III

4. An antiderivative of  is

 (A)  (B)  (C) 

 (D)  (E) 

5. If  then 

 (A)  (B)  (C) 

 (D)  (E) 

6. The average value of  on the closed interval  is

 (A)  (B)  (C)  (D)  (E) 

7. If  , then 

 (A)  (B)  (C) 

 (D)  (E) 

8. If *f*  is a function such that  exists  and  which of the following is NOT necessarily true ?

 (A)  (B) 

 (C)  (D) 

 (E) 

9. If  and  which of the following must be true?

 I.  for 

 II. 

 III. 

 (A) I only (B) II only (C) III only (D) II and III only

 (E) I , II , and III

10. Which of the following is equal to  ?

 (A)  (B)  (C) 

 (D)  (E) 

11. If  then the average rate of change of *y*  with respect to *x*  on  is

 (A)  (B)  (C)  (D)  (E) 2

12. Let  At what value of *x*  is  a minimum ?

 (A) no value of *x* (B)  (C)  (D) 2 (E) 3

13. If *f*  is continuous on the closed interval , then  such that  and 

 (A)  (B)  (C) 

 (D)  (E) 

14.  is

 (A) 0 (B)  (C)  (D) 

 (E) 

15. 

 (A)  (B) 30 (C) 90 (D) 112 (E) 

16. Use the Trapezoidal Rule with  to approximate the area between the curve  and the *x –* axis for  ( Remember no calculator )

 (A) 14 (B) 21 (C) 21.5 (D) 29 (E) 30

17. Let  Let 

 Which of the following functions are continuous at  ?

 I.  II.  III. 

 (A) I only (B) II only (C) III only (D) I and II

 (E) I and III

**I b. Calculator permitted.**

18. The average value of the function  on the closed interval  is

 (A) 0.70 (B) 0.75 (C) 0.80 (D) 0.85 (E) 0.90

19. The graphs of five functions are shown below. Which function has a nonzero average value over the closed interval 

20. Let *g*  be the function given by 

 Which of the following statements about *g*  must be true ?

 I. *g*  is increasing on 

 II. *g*  is increasing on 

 III. 

(A) I only (B) II only (C) III only (D) II and III only

 (E) I , II , and III

21. 

 (A) 0.000 (B) 14.946 (C) 34.415 (D) 46.000

 (E) 136.364

22. If the definite integral  is first approximated by using two inscribed rectangles of equal width and then approximated by using the Trapezoidal Rule with  the difference between the two approximations is

 (A) 53.60 (B) 30.51 (C) 27.80 (D) 26.80 (E) 12.78

24. Find the average value of  on 

 (A) 8 (B) 12 (C) 24 (D) 32 (E) 48

25. Suppose *f*  and *g*  are even functions that are continuous  and let *a*  be a real number. Which of the following expressions must have the same value ?

 I. 

 II. 

 III. 

 (A) I and II only (B) I and III only (C) II and III only

 (D) I , II , and III (E) none of the above

**Free – Response section: Show work and write the language of calculus properly !!**

26. Suppose that  and 

a. Find 

b. Find 

c. Find 

27. Using your knowledge of area, evaluate the following integrals

a.  c. 

b.  d. 

28. Express each as a definite integral.

a.  where *P*  is any partition of 

b.  on the interval 

29. Let the region *R*  be in the **first quadrant** enclosed by the *x –* axis and the graph of the function 

a. Sketch *R*  and partition it into four subregions, each with a base of length 

b. Sketch the recrangles and compute ( by hand ) the area for  approximation.

c. Sketch the rectangles and compute ( by hand ) the area for  approximation.

d. Sketch the rectangles and compute ( by hand ) the area for the  approximation.

e. Sketch the trapezoids and compute ( by hand ) the area for the  approximation.

f. Find the exact area of *R*  by using the Fundamental Theorem of Calculus.

30. Find the total area of the region between the curve  and the *x –* axis on the closed interval 

31. A town wants to drain and fill the small polluted swamp shown below. The swamp averages 5 ft deep. About how many cubic yards of fill dirt will it take to fill the swamp after it is drained ?

32. Find the area under the curve  on  by using the FTC ! Check your work by using fnInt .

33. A particle moves along a coordinate axis. Its position at time *t*  (sec) is

  cm,



 where *f*  is the function whose graph is shown.

a. What is the particle's position at 

b. What is the particles's position at 

c. What is the particle's velocity at 

d. Approximately when is the acceleration zero ?

e. At what time during the first 7 seconds does *s*  have its largest value ?