Name____ Date______________________ Per__________

TEST: 4.1-4.3, Calculator Permitted

Part I: short answer: You know what to do (show all work and set-ups).

1. If $f'(x) = \dfrac{2}{x}$ and $f\left(\sqrt{e}\right) = 5$, then $f(e) =$

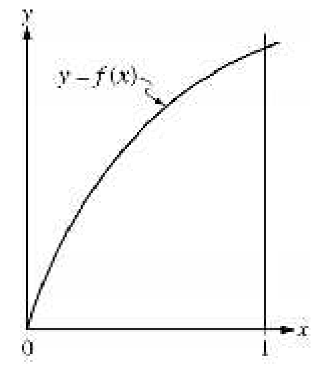
______ 2. $\int \left(x^3 + 1\right)^2 dx =$

______ 3. If $g(x) = x^2 - 3x + 4$ and $f(x) = g'(x)$, then $\int_1^3 f(x)dx =$

______ 4. If f is the function given by $f(x) = \int_4^{2x} \sqrt{t^2 - t}\,dt$, then $f'(2) =$

______ 5. If $\int_0^3 f(x)dx = 6$ and $\int_3^5 f(x)dx = 4$, then $\int_0^5 \left(3 + 2f(x)\right)dx =$

_____ 6. A left Rieman sum, a right Riemann sum, and a trapezoidal sum are used to approximate the value of $\int_0^1 f(x)dx$, each using the same number of subintervals. The graph of the function f is shown at right. Which of the sums give an underestimate of the value of $\int_0^1 f(x)dx$?



I. Left Sum **II. Right Sum** **III. Trapezoidal sum**

(List all that apply, and show graphical evidence.)

_____ 7. The rate at which water is sprayed on a field of vegetables if given by $R(t) = 2\sqrt{1+5t^3}$, where t is in minutes and $R(t)$ is in gallons per minute. During the time interval $0 \le t \le 4$, what is the average rate of water flow, in gallons per minute?

(A) 8.458 (B) 13.395 (C) 14.691 (D) 18.916 (E) 35.833

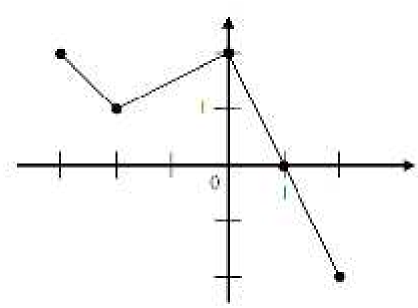
_____ 8. $\int \frac{1}{x^2} dx =$

(A) $\ln x^2 + C$ (B) $-\ln x^2 + C$ (C) $x^{-1} + C$ (D) $-x^{-1} + C$ (E) $-2x^3 + C$

_____ 9. The graph fo the piecewise linear function f is shown in the figure at right. If $g(x) = \int_{-2}^{x} f(t)dt$, which of the folliwng values is greatest?

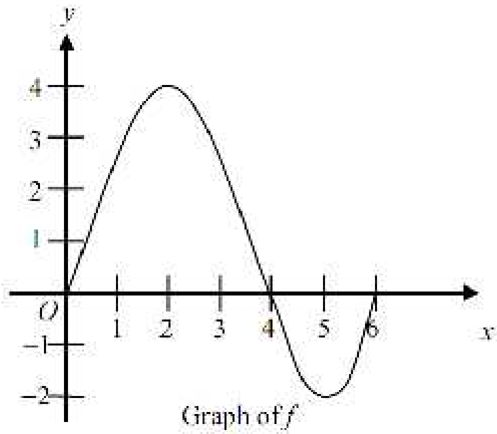
(A) $g(-3)$ (B) $g(-2)$ (C) $g(0)$

(D) $g(1)$ (E) $g(2)$



Graph of f

______ 10. The graph of the function f shown has horizontal tangents at $x=2$ and $x=5$. Let g be the funtion defined by $g(x)=\int_0^x f(t)dt$. For what values of x does the graph of g have a point of inflection?



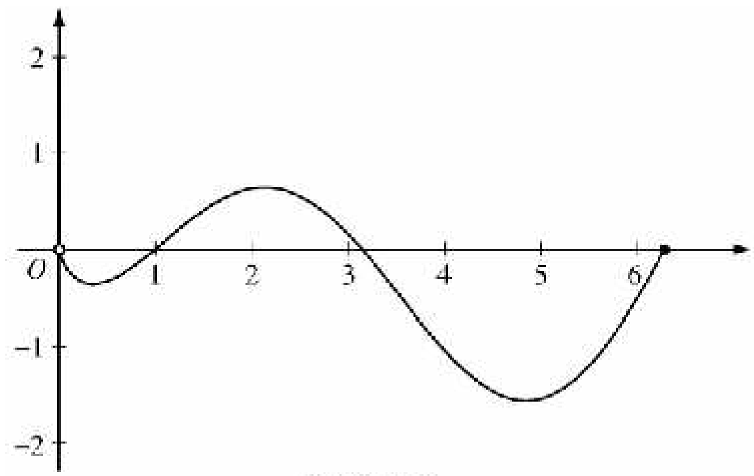
(A) 2 only (B) 4 only (C) 2 and 5 only
(D) 2, 4, and 5 (E) 0, 4, and 6

x	-4	-3	-2	-1
$f(x)$	0.75	-1.5	-2.25	-1.5
$f'(x)$	-3	-1.5	0	1.5

_______ 11. The table above gives values of a function f and its derivative at selected values of x. If f' is continuous on the interval $[-4,-1]$, what is the value of $\int_{-4}^{-1} f'(x)dx$?

(A) -4.5 (B) -2.25 (C) 0 (D) 2.25 (E) 4.5

Part II: Free Response: Respond Freely, bearing in mind 3 things: Notation, Notation, and (there was one more . . .)



Graph of f

12. Let f be the function given by $f(x) = (\ln x)(\sin x)$. The figure above shows the graph of f for $0 < x \le 2$®. The function g is defined by $g(x) = \int_1^x f(t)\,dt$ for $0 < x \le 2$®.

(a) Find $g(1)$ and $g'(1)$.

(b) On what intervals, if any, is g increasing? Justify your answer.

(c) For $0 < x \le 2$®, find the value of x at which g has an absolute minimum. Justify your answer.

(d) For $0 < x \le 2$®, is there a value of x at which the graph of g is tangent to the x-axis? Explain why or why not.