Name_____ Date_____ Shadow Puppet_____

AP Calculus TEST: 4.1—4.4 **No Calculator**

PART I: Multiple Choice. SHOW ALL WORK AND/OR INTEGRAL SET-UPS. NO WORK, NO CREDIT. Put the Capital Letter of the correct answer choice in the space to the left of each problem number.

_____ 1. $\int x\sqrt{5x^2-4}\,dx =$

(A) $\frac{1}{10}\left(5x^2-4\right)^{3/2}+C$ (B) $\frac{1}{15}\left(5x^2-4\right)^{3/2}+C$ (C) $-\frac{1}{5}\left(5x^2-4\right)^{1/2}+C$

(D) $\frac{20}{3}\left(5x^2-4\right)^{3/2}+C$ (E) $\frac{3}{20}\left(5x^2-4\right)^{3/2}+C$

_____ 2. The average value of the function $f\left(x\right)=\left(x-1\right)^2$ on the interval from $x=1$ to $x=5$ is

(A) $\frac{5}{3}$ (B) $\frac{16}{3}$ (C) $\frac{64}{3}$ (D) $\frac{66}{3}$ (E) $\frac{256}{3}$

_____ 3. $\int \frac{dx}{9+x^2} =$

(A) $3\tan^{-1}\left(\frac{x}{3}\right)+C$ (B) $\frac{1}{3}\tan^{-1}\left(\frac{x}{3}\right)+C$ (C) $\frac{1}{9}\tan^{-1}\left(\frac{x}{3}\right)+C$ (D) $\frac{1}{3}\tan^{-1}\left(x\right)+C$ (E) $\frac{1}{9}\tan^{-1}\left(x\right)+C$

_____ 4. $\int x\sqrt{x+3}\,dx =$

(A) $\frac{2}{3}x^{3/2}+6x^{1/2}+C$ (B) $\frac{2(x+3)^{3/2}}{3}+C$ (C) $\frac{2}{5}(x+3)^{5/2}-2(x+3)^{3/2}+C$

(D) $\frac{2}{3}(x+3)^{3/2}+6(x+3)^{1/2}+C$ (E) $\frac{3(x+3)^{3/2}}{2}+C$

_____ 5. $\int \frac{3}{x^2+4x+8}\,dx =$

(A) $\frac{3}{2}\arctan\left(\frac{x+2}{2}\right)+C$ (B) $3\arcsin\left(\frac{x+2}{2}\right)+C$ (C) $3\ln\left|x^2+4x+8\right|+C$

(D) $\frac{3}{x+2}+C$ (E) $\frac{3}{2}\left(x^2+4x+8\right)^2+C$

_____ 6. $\int \frac{2x^2+x+18}{x^2+9}\,dx =$

(A) $\frac{1}{4}\ln\left|2x^2+x+18\right|+C$ (B) $\frac{1}{3}\arctan\left(x^2+9\right)+C$ (C) $\frac{1}{8}\left(2x^2+x+18\right)^2+C$

(D) $2x-\frac{1}{2}\ln\left|x^2+9\right|+C$ (E) $2x+\frac{1}{2}\ln\left|x^2+9\right|+C$

_____ 7. If $F(x)=\int_{\pi}^{x^2}\sqrt{1+t^3}\,dt$, then $F'(x)=$

(A) $\sqrt{1+x^3}$ (B) $2x\sqrt{1+x^3}$ (C) $\sqrt{1+x^6}$ (D) $2x\sqrt{1+x^6}$ (E) $2x\sqrt{1+x^5}$

_____ 8. $\int \tan^6 x\cdot\sec^2 x\,dx=$

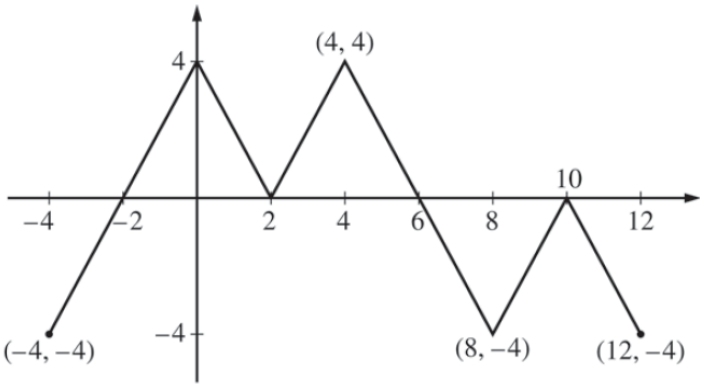
(A) $\frac{\tan^7 x}{7}+C$ (B) $\frac{\tan^7 x}{7}+\frac{\sec^3 x}{3}+C$ (C) $\frac{\tan^7 x\cdot\sec^3 x}{21}+C$ (D) $\tan^7 x+C$ (E) $\frac{2}{7}\tan^7 x\cdot\sec x+C$

_____ 9. $\int_0^1 \tan x\,dx=$

(A) 0 (B) $\frac{\tan^2 1}{2}$ (C) $\ln(\cos(1))$ (D) $\ln(\sec(1))$ (E) $\ln(\sec(1))-1$

PART II: Free Response. SHOW ALL WORK AND/OR INTEGRAL SET-UPS in the space provided. Focus on notation, notation, notation. Communicate, clearly, your result.

10.



Graph of f

The figure above shows the graph of the piecewise-linear function f. For $-4 \le x \le 12$, the function $F(x) = \int_2^x f(t)\,dt$.

(a) Evaluate $F(2)$, $F(8)$, and $F(-4)$. Show the work that leads to your answer.
(b) Find $F'(x)$ and $F'(0)$.
(c) Find the x-coordinate of any local minimum of $F(x)$. Justify.
(d) Does the graph of $F(x)$ have and inflection point at $x = 4$? Justify.