Name _____ **Integration after Extension of FTC (& abs)**

Part I: Calculator

1. A particle moves along a line with acceleration a(t)=2+6t. When t=0, its velocity equals 3 and it is at position s=2. When t=1, it is at position s=
a) 2 b) 7 c) 6 d) 5 e) 8

2. $\frac{d}{dt}\int_0^t \sqrt{x^3+1}\,dx$

A) $\frac{\sqrt{t^3+1}}{3t^2}$ B) $3x^2\sqrt{x^3+1}$ C) $\frac{2}{3}(t^3+1)(\sqrt{t^3+1}-1$

D) $\sqrt{t^3+1}$ E) none of these

3. $\frac{d}{dt}\int_\pi^{x^2} \sqrt{\sin t}\,dt$

A) $2x\sqrt{\sin x^2}$ B) $2x\sqrt{\sin x^2}-1$ C) $\frac{2}{3}\left(\sin^{\frac{2}{3}} x^2-1\right)$ D) $\sqrt{\sin x^2}-1$ E) $\sqrt{\sin t^2}$

4. Air is escaping from a balloon at a rate of R(t)= $\frac{60}{1+t^2}$ ft^3/min, where t is measured in minutes. How much (in ft^3) escapes during the first minute?
A) 15 B) 30 C) 47.123 D) 94.248 E) 20.794

5. Using Riemann Sums with left hand sums of 4 subdivision, estimate
$\int_0^8 \left(x^2-4x+4\right)dx$
A) 48 B) 24 C) 112 D) 120 E) none of these

6. If f is the antiderivative of $\frac{x^2}{1+x^5}$ such that $f(1)=0$, then $f(4)=$

(A) -0.012 (B) 0 (C) 0.016 (D) 0.376 (E) 0.629

7. The table shows the speed of an object in feet per second during a 3 second period. Estimate the distance the object travels using the trapezoid method:

Time(sec)	0	1	2	3
Speed (ft/sec)	30	22	12	0

A) 34 ft B) 45 ft C) 49 ft D) 48 ft E) 64 ft.

Part 2: Non-Calculator

1. $\int(3x^2 - 2x + 3)dx$

A) $x^3 - x^2 + 3x + C$ B) $3x^3 - x^2 + 3x + C$ C) $x^3 - x^2 + C$ D) $\frac{1}{2}(3x^3 - 2x + 3)^2 + C$ E) none

2. $\int\sqrt{x}(\sqrt{x} - 1)dx =$

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

3. $\int_{-1}^{1}(x^2 - x - 1)dx$

A) $\frac{2}{3}$ B) $\frac{-4}{3}$ C) 0 D) -2 E) -1

4. The number of inflection points of $f(x)=3x^5 - 10x^3$ is

A) 4 B) 3 C) 2 D) 1 E) 0

Part 3: Free response noncalculator

1. An object moves along the x-axis with initial position $x(0) = 2$. The velocity of the object at time $t \geq 0$ is given by $v(t) = \sin\left(\frac{\pi}{3}t\right)$.

(a) What is the acceleration of the object at time $t = 4$?

(b) Consider the following two statements?

Statement I: For $3 < t < 4.5$, the velocity of the object is decreasing.
Statement II: For $3 < t < 4.5$, the speed of the object is increasing.

Are either or both of these statements correct? For each statement provide a reason why it is correct or not correct.

(c) What is the total distance traveled by the object over the time interval $0 \leq t \leq 4$?

(d) What is the position of the object at time $t = 4$?

Part 4: Free response with a calculator

2. Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function F defined by

$$F(t) = 82 + 4\sin\left(\frac{t}{2}\right) \text{ for } 0 \leq t \leq 30,$$

where $F(t)$ is measured in cars per minute and t is measured in minutes.

(a) To the nearest whole number, how many cars pass through the intersection over the 30-minute period?

(b) Is the traffic flow increasing or decreasing at $t = 7$? Give a reason for your answer.

(c) What is the average value of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.