AP Calculus – Multiple Choice — Post Exam Set #5

Integral Applications / Other

No Calculator – You will have just under 2 minutes per question.

1.) If $P(t)$ is the size of a population at time t, which of the following differential equations describes linear growth in the size of the population? [#23]

(A) $\frac{dP}{dt} = 200$	(B) $\frac{dP}{dt} = 200t$	(E) $\frac{dP}{dt} = 100P^2$
(C) $\frac{dP}{dt} = 100t^2$	(D) $\frac{dP}{dt} = 200P$	

2.) If $f(x) = \sqrt{x^2 - 4}$, and $g(x) = 3x - 2$ then the derivative of $f(g(x))$ at $x = 3$ is [#14]

a.) $\frac{7}{\sqrt{5}}$	b.) $\frac{14}{\sqrt{5}}$	c.) $\frac{18}{\sqrt{5}}$	d.) $\frac{15}{\sqrt{21}}$	e.) $\frac{30}{\sqrt{21}}$

3.) What is the area of the region in the first quadrant bounded by the graph of $y = e^{\frac{x}{2}}$ and the line $x = 2$? [#10]

(A) $2e - 2$	(B) $2e$	(C) $\frac{e}{2} - 1$	(D) $\frac{e-1}{2}$	(E) $e - 1$

4.) Which of the following is the solution to the differential equation $\frac{dy}{dx} = 2\sin x$ with the initial condition $y(\pi) = 1$? [#25]

(A) $y = 2\cos x + 3$	(B) $y = 2\cos x - 1$	(C) $y = -2\cos x + 3$
(D) $y = -2\cos x + 1$	(E) $y = -2\cos x - 1$	

t (hours)	4	7	12	15
$R(t)$ (liters/hour)	6.5	6.2	5.9	5.6

5.) A tank contains 50 liters of oil at time $t = 4$ hours. Oil is being pumped into the tank at a rate $R(t)$, where $R(t)$ is measured in liters per hour, and t is measured in hours. Selected values of $R(t)$ are given in the table. Using a right Riemann sum with three subintervals and data from the table, what is the approximation of the number of liters of oil that are in the tank at time $t = 15$ hours? [#8]

(A) 64.9	(B) 68.2	(C) 114.9	(D) 116.6	(E) 118.2

Calculator – You will have just under 3 minutes per question.

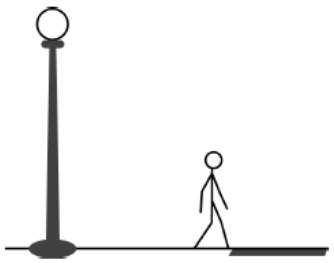
6.) Let R be the region in the first quadrant bounded below by the graph of $y = x^2$ and above by the graph of $y = x$. R is the base of a solid whose cross sections perpendicular to the x-axis are squares. What is the volume of the solid? [#92]

(A) 0.129	(B) 0.300	(C) 0.333	(D) 0.700	(E) 1.271

7.) Water is pumped into a tank at a rate of $r(t) = 30\ 1 - e^{-0.16t}$ gallons per minute, where t is the number of minutes since the pump was turned on. If the tank contained 800 gallons of water when the pump was turned on, how much water, to the nearest gallon, is in the tank after 20 minutes? [#81]

(A) 380 gal	(B) 420 gal	(C) 829 gal	(D) 1220 gal	(E) 1376 gal

8.) A person whose height is 6 feet is walking away from the base of a streetlight along a straight path at a rate of 4 feet per second. If the height of the streetlight is 15 feet, what is the rate at which the person's shadow is lengthening?



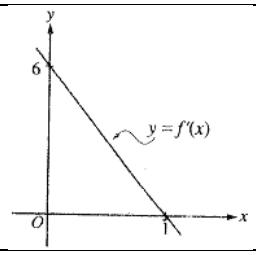
a.) 1.5 ft/sec	b.) 2.667 ft/sec	
c.) 3.75 ft/sec	d.) 6 ft/sec	d.) 10 ft/sec

[#88]

Practice Problems

1.) The graph of f', the derivative of f, is the line shown in the figure above. If $f(\quad) = 5$, then $f(1)$ = (2003-11)

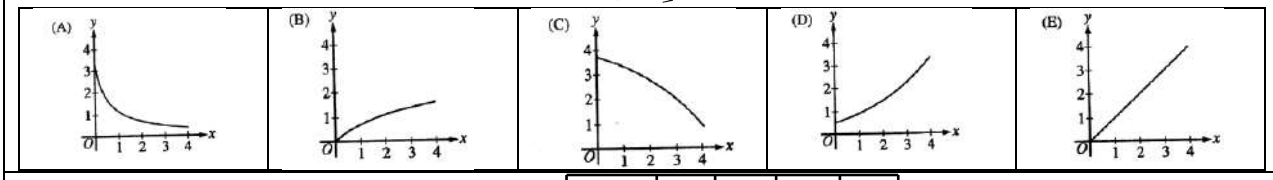
(A) 0 (B) 3 (C) 6 (D) 8 (E) 11



2.) A pizza, heated to a temperature of 350 degrees Fahrenheit (°F), is taken out of an oven and placed in a 75°F room at time $t = 0$ minutes. The temperature of the pizza is changing at a rate of $-110\,e^{-0.4t}$ degrees Fahrenheit per minute. To the nearest degree, what is the temperature of the pizza at time t = 5 minutes? (2003-84)

(A) 112°F (B) 119°F (C) 147°F
(D) 238°F (E) 335°F

3.) If a trapezoidal sum overapproximates $\int_0^4 f(x)\,dx$, and a right Riemann sum underapproximates $\int_0^4 f(x)\,dx$, which of the following could be the graph of $y = f(\quad)$? (2003 -87)



x	2	5	7	8
$f(x)$	10	30	40	20

4.) The function f is continuous on the closed interval $[2, 8]$ and has values that are given in the table above. Using the subintervals $[2, 5]$, $[5, 7]$, and $[7, 8]$, what is the trapezoidal approximation of $\int_2^8 f(x)\,dx$? (1998-85)

(A) 110 (B) 130 (C) 160 (D) 190 (E) 210

5.) The base of a solid is the region in the first quadrant bounded by the *y*-axis, the graph of $y = \tan^{-1} x$, the horizontal line $y = 3$, and the vertical line $x = 1$. For this solid, each cross section perpendicular to the *x*-axis is a square. What is the volume of the solid? (2003-83)

(A) 2.561 (B) 6.612 (C) 8.046 (D) 8.755 (E) 20.773

6.) The rate of change of the altitude of a hot-air balloon is given by $r(t) = t^3 - 4t^2 + 6$ for $0 \le t \le 8$. Which of the following expressions gives the change in altitude of the balloon during the time the altitude is decreasing?

(A) $\int_{1.572}^{3.514} r(t)\,dt$	(B) $\int_{0}^{8} r(t)\,dt$	(E) $\int_{0}^{2.667} r'(t)\,dt$
(C) $\int_{0}^{2.667} r(t)\,dt$	(D) $\int_{1.572}^{3.514} r'(t)\,dt$	

(2003-82)

7.) The radius of a circle is increasing at a constant rate of 0.2 meters per second. What is the rate of increase in the area of the circle at the instant when the circumference of the circle is 20π meters?

(A) 0.04π m^2/sec	(B) 0.4π m^2/sec
(C) 4π m^2/sec	(D) 20π m^2/sec
(E) 100π m^2/sec	

(2003-78)

8.) The rate of change of the volume, V, of water in a tank with respect to time, t, is directly proportional to the square root of the volume. Which of the following is a differential equation that describes this relationship?

(A) $V = k\sqrt{t}$	(B) $V = k\sqrt{V}$	(E) $\frac{dV}{dt} = k\sqrt{V}$
(C) $\frac{dV}{dt} = k\sqrt{t}$	(D) $\frac{dV}{dt} = \frac{k}{\sqrt{V}}$	

(2003-12)

9). Let f be the function defined by $f(x) = x^3 + x$. If $g(x) = f^{-1}(x)$ and $g(2) = 1$, what is the value of $g'(2)$?

(A) $\frac{1}{13}$	(B) $\frac{1}{4}$	(C) $\frac{7}{4}$	(D) 4	(E) 13

(2003-27)