AP Calculus BC '17-18 Name_____
Integral Test

Score_____

NO CALCULATOR ALLOWED

1. $\int_0^{\pi/4} \cos(2x)\sin^3(2x)\,dx$ is equivalent to

a) $\int_0^{\pi/4} \cos u \sin^3 u\,du$ b) $\int_0^{\pi/4} u^3\,du$ c) $\frac{1}{2}\int_0^{\pi/4} u^3\,du$ d) $\frac{1}{2}\int_0^{1} u^3\,du$ e) $\int_0^{1} u^3\,du$

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2. $\int_0^3 |x-1|\,dx$

a) 1 b) $\frac{3}{2}$ c) 2 d) $\frac{5}{2}$ e) 3

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3. $\int_0^{1/2} \frac{dt}{\sqrt{1-t^2}}$

a) $\frac{\pi}{6}$ b) 0 c) $\ln\sqrt{3/4}$ d) $\sqrt{3}$ e) dne

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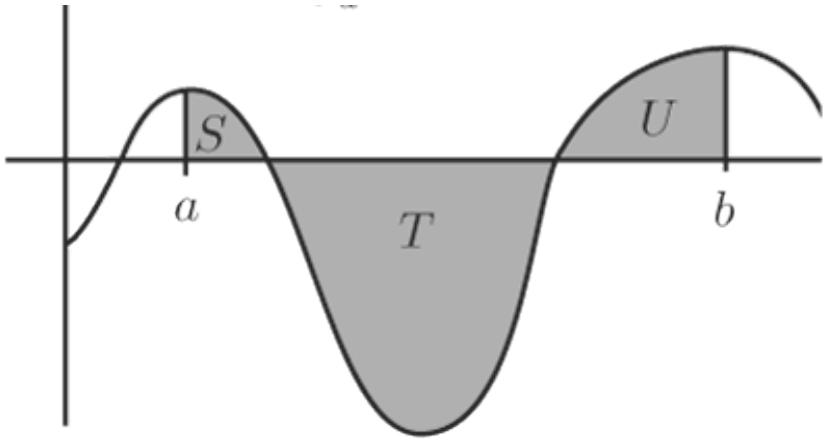
4. If he average value of x^3 is 9 on $x \in [0, k]$, then $k =$

a) $\sqrt[3]{36}$ b) $\sqrt[4]{36}$ c) 6 d) $\sqrt[3]{18}$ e) 3

5.



The function g(x) is graphed above. S, T, and U are positive numbers which represent the areas of each region. What is the ***difference*** between the total area under g(x) from a to b and the definite integral of g(x) from a to b?

a) 0 b) T c) S+U

d) 2T e) S-T+U

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6. Let $R(t)$ represent the rate in gal/hr at which water is leaking out of a tank, where is measured in hours. Which of the following expressions represents the average rate of change of gallons of water per hour that leaks out in the first three hours?

a) $\int_0^3 R(t)\,dt$ b) $\frac{1}{3}\int_0^3 R(t)\,dt$ c) $\int_0^3 R'(t)\,dt$

d) $R(3)-R(0)$ e) $\frac{R(3)-R(0)}{3-0}$

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7. The following Table lists known values of a function $f(x)$.

t	0	1	2	3	4
$H(t)$	0	1.3	1.5	2.1	2.6

A small plant is purchased from a nursery and the change in height of the plant is measured at the end of each day for four days. The data, where $H(t)$ is measured in inches per day and t is measured in days, are listed above. Using the trapezoidal rule, which of the following represents an estimate of of the average rate of growth of the plant over the four day period?

a) $\frac{1}{4}(0+1.3+1.5+2.1+2.6)$

b) $\frac{1}{4}\left[\frac{1}{2}(0+1.3+1.5+2.1+2.6)\right]$

c) $\frac{1}{4}\left[\frac{1}{2}(0+2(1.3)+2(1.5)+2(2.1)+2.6)\right]$

d) $\frac{1}{4}\left[\frac{1}{2}(0+2(1.3)+2(1.5)+2(2.1)+2(2.6))\right]$

e) $\frac{1}{4}\left[\frac{1}{4}(0+2(1.3)+2(1.5)+2(2.1)+2.6)\right]$

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CALCULATOR ALLOWED
Directions: Show all work.
Do not use math 9.

1. $\int_0^{\pi/4} \left(\sin^2 x + \cos 2x\right) dx$

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2. Find the average value of $y = \tan x \ln^2(\cos x)$ on $x \in \left[0, \frac{\pi}{4}\right]$.

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3. Find the area between $y = x\sqrt{9 - x^2}$ and the x-axis on $x \in [-2, 1]$.

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4. Find the area on $x \in [0, 2]$ under $f(x) = \frac{1}{x^2 + 4} + e^{3x}$. Show the anti-derivative.

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5. The tide removes sand from the beach at a rate modeled by the function

$$R(t) = 2 + 5\sin\left(\frac{4\pi t}{25}\right)$$

A pumping station add sand to the beach at a rate modeled by the function

$$S(t) = \frac{15t}{1+3t}.$$

Both $S(t)$ and $R(t)$ have units of cubic yards per hour and t is measured in hours for $0 \le t \le 6$. At $t = 0$, the beach contains 2500 cubic yards of sand.

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a) How much sand will be removed from the beach during the six-hour period? Indicate units of measure.

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b) Write and expression for $Y(t)$, the total number of cubic yards of sand on the beach at time t.

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c) Find the rate at which the total amount of sand on the beach is changing at time $t = 4$.

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d) For $0 \le t \le 6$, at what time is the amount of sand on the beach a minimum? What is the minimum value? Justify your answers.

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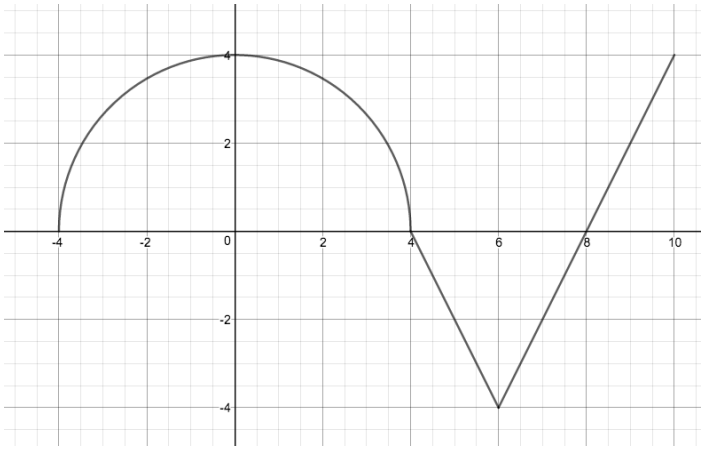
12. The graph of $g(x)$, defined on $x \in [-4, 10]$, is shown below. $g(x)$ consists of a semi-circle and line segments. Let $f(x) = \int_6^x g(t)\,dt$.



graph of g

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a) Find $f(0)$ and $f(10)$.

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b) Write the equation of the line tangent to $f(x)$ at $x = 6$.

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c) On what interval(s), if any, is the graph of $f(x)$ both decreasing and concave up? Justify your answer.

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d) Find the absolute minimum value of $f(x)$ on $x \in [-4, 10]$. Justify your answer.
