AP Calculus
Review for Application of Integration Test

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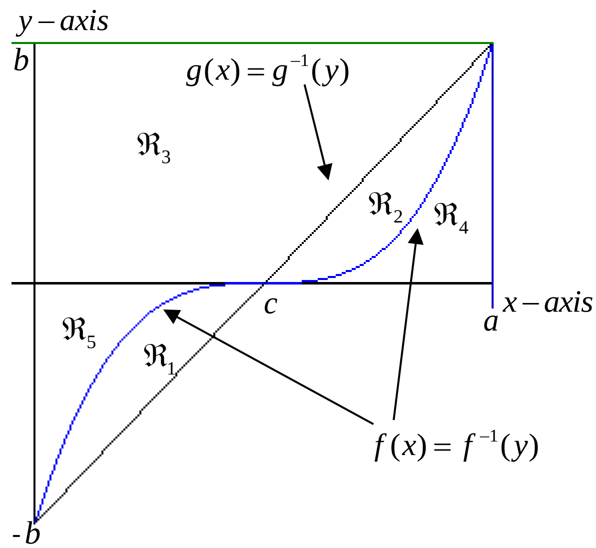
Use the figure at the right to write an integral expression that represents the given. **Do not evaluate**.



1. The area of $\Re_1$

2. The area of $\Re_2$

3. The area of $\Re_3$

4. The area of $\Re_4$

5. The volume of $\Re_2$ revolved about the x-axis.

6. The volume of $\Re_3$ revolved about the y-axis.

7. The volume of $\Re_1$ revolved about the $x = a$.

8. The volume of $\Re_2$ revolved about the $y = -1$.

9. The volume of $\Re_4$ revolved about the x-axis.

10. The volume of $\Re_5$ revolved about the $y = 1$.

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11. Compute the area of the region bounded by the functions $x = y + 4$ and $x = y^2 - 2$.
No Calculator

12. Compute the area of the region bounded by $y = x^2$ and $y = \sqrt{x}$
No Calculator

13. Find the volume of the solid generated by revolving the region bounded by the graphs of the equations about the indicated lines. $y = \sqrt{x}$, $y = 0$, and $x = 4$
Set up each. **DO NOT INTEGRATE!!**

A. The $x - axis$

B. The $y - axis$

C. The line $x = 4$

D. The line $x = 6$

E. The line $y = -3$

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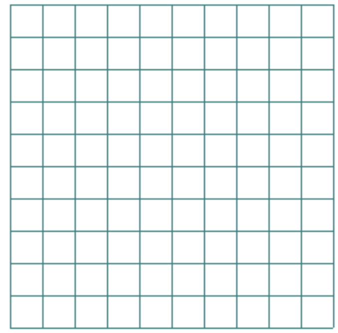
14. Find the volume of the solid generated by the solid with base region bounded by the graphs of the equations about the indicated lines. $y=\sqrt{x}$, $y=0$, and $x=4$

Set up each. **DO NOT INTEGRATE!!**



A. Cross sections perpendicular to x-axis are squares.

B. Cross sections perpendicular to the x-axis are semi-circles.

C. Cross sections perpendicular to the x-axis are rectangles with width being on the base and length is 3 times the width.

D. Find the region $\Re$ is the base of a solid, at each x the cross section perpendicular to the $x-axis$ has area $A(x)=\sin\left(\frac{\pi}{4}x\right)+1$. Find the volume of the solid.

E. Cross sections perpendicular to y-axis are equilateral triangles.

F. Cross sections perpendicular to y-axis are isosceles triangles with leg on the base.

15. The base of a solid is the region in the first quadrant enclosed by the parabola $y=3x^2$, the line x = 1 and the x-axis. Each cross section of the solid perpendicular to the x-axis is a square. The volume of the solid is:

A. π B. $\frac{9}{5}$ C. $\frac{9\pi}{5}$ D. $\frac{16}{5}$ E. 1

16. The base of a solid is the region enclosed by the parabola $y=x^2-2x+4$ and $y = 1+ 2x$. If each cross section of the solid perpendicular to the **x-axis** is a rectangle with a height that is 3 times the width, what is the volume of the solid?

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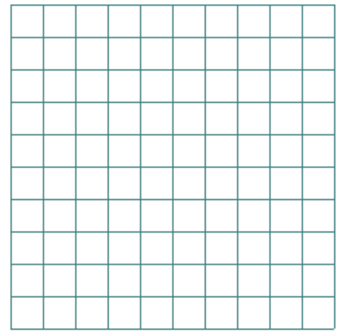
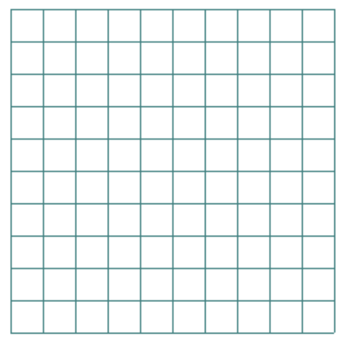
Calculators may be used on this portion of the test.

Answer the following.

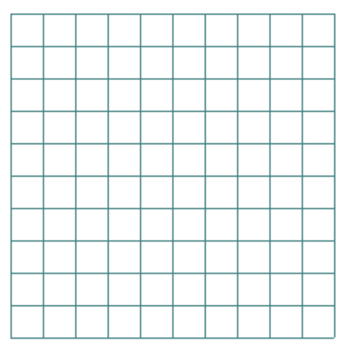
17. Find the area bounded by the curves -x + $y = 2$ and $y = -x^2 + 4x + 2$.



18. Find the area bounded by the curves $y = 2\sin x$ and $y = \tan x$, $-\frac{\pi}{3} \le x \le \frac{\pi}{3}$



19. A region is bounded by the curve $y = x^2 + 2$, $y = 6$, and x=0. Find the volume generated by revolving the region about the *y*-axis.



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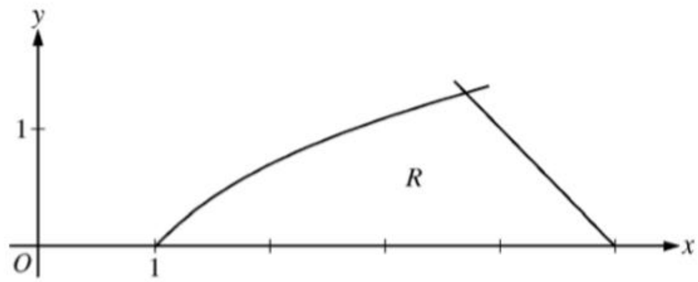
20. Let R be the region in the first quadrant
bounded by the x-axis and the graphs of
$y = \ln x$ and $y = 5 - x$, as shown in the
figure to the right.



a.) Find the area of R.

b.) Region R is the base of a solid. For the solid, each cross section perpendicular to the x-axis is a square. Write, but do not evaluate, an integral expression involving one or more integrals that gives the volume of the solid.

c.) The horizontal line $y = k$ divides R into two regions of equal area. Write, but do not solve, an equation involving one or more integrals whose solution gives the value of k.

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Solve using separation of variables.

21. $y' = xy^2$

22. $y' = 0.5xy$

23. $y' = 9y$

24. $y' = 2(4 - y)$

25. $\frac{dy}{dx} = 2\sqrt{y}$

26. $y' = y^2(1 - x^2)$

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Find the particular solution using the given point.

27. $y' = 2y - 4$ (1, 4)

28. $y^2 \frac{dy}{dx} = x^{-3}$ (2, 0)

Find the average value of the function on the given interval. (Integrate by hand)

29. $f(x) = x^2$; [-1, 1]

30. $g(x) = \cos x$, $[0, \frac{\pi}{2}]$

31. $f(t) = t\sqrt{1+t^2}$, [0, 5]

32. $g(x) = x^2\sqrt{1+x^3}$, [0, 2]

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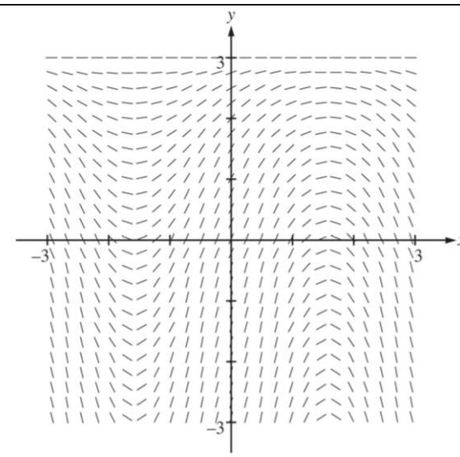
33. Consider the differential equation $\frac{dy}{dx} = (3 - y)\cos x$. Let $y = f(x)$ be the particular solution to the differential equation with the initial condition $f(0) = 1$. The function f is defined for all real numbers.

a.) A portion of the slope field of the differential equation is given to the right. Sketch the solution curve through the point $(0,1)$



b.) Write an equation for the line tangent to the solution curve in part (a) at the point $(0,1)$. Use the equation to approximate $f(0.2)$.

c.) Find $y = f(x)$, the particular solution to the differential equation with the initial condition $f(0) = 1$.

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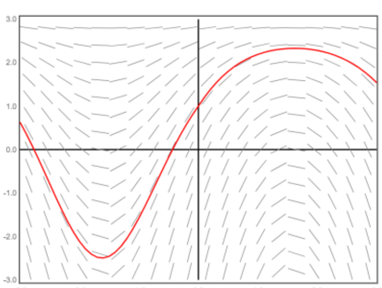
Answers:

1. $\int_0^c f(x)-g(x)dx$
2. $\int_c^a g(x)-f(x)dx$
3. $\int_0^b g^{-1}(y)dy$
4. $\int_0^b a-f^{-1}(y)dy$
5. $\pi\int_c^a [g(x)]^2-[f(x)]^2 dx$
6. $\pi\int_0^b [g^{-1}(y)]^2 dy$
7. $\pi\int_{-b}^0 [a-f^{-1}(y)]^2-[a-g^{-1}(y)]^2 dy$
8. $\pi\int_c^a [g(x)+1]^2-[f(x)+1]^2 dx$
9. $\pi\int_c^a [f(x)]^2 dx$
10. $\pi\int_0^c [1-f(x)]^2-1\,dx$
11. $\frac{125}{6}$
12. $\frac{1}{3}$
13. a) $\pi\int_0^4 xdx$ b) $\pi\int_0^2 16-y^4\,dy$ c) $\pi\int_0^2 (4-y^2)^2 dy$ d) $\pi\int_0^2 (6-y^2)^2-4dy$ e) $\pi\int_0^4 (\sqrt{x}+3)^2-9dx$
14. a) $\int_0^4 xdx$ b) $\frac{\pi}{8}\int_0^4 xdx$ c) $3\int_0^4 xdx$ d) $\int_0^4 A(x)dx$ e) $\frac{\sqrt{3}}{4}\int_0^2 (4-y^2)^2 dy$ f) $\frac{1}{2}\int_0^2 (4-y^2)^2 dy$
15. B
16. 3.2
17. 4.5
18. .614
19. 25.132
20. a) 2.985 b) $\int_1^{3.6934}(\ln(x))^2 dx+\int_{3.6934}^5 (5-x)^2 dx$ c) $1.493=\int_0^k 5-y-e^y\,dy$
21. $y=\frac{-1}{\frac{1}{2}x^2+C}$
22. $y=Ce^{\frac{1}{4}x^2}$
23. $y=Ce^{9x}$
24. $y=\frac{1}{Ce^{2x}}+4$
25. $y=(x+c)^2$
26. $y=\frac{-1}{x-\frac{1}{3}x^3+C}$
27. $y=2e^{2x-2}+2$
28. $y=\sqrt[3]{\frac{-3}{2x^2}+\frac{3}{8}}$
29. $\frac{1}{3}$
30. $\frac{2}{\pi}$
31. $\frac{1}{5}\left(\left(\sqrt{26}\right)^3-1\right)$
32. $\frac{26}{9}$
33. a)



b) 1.4

$y=3-2e^{-\sin x}$