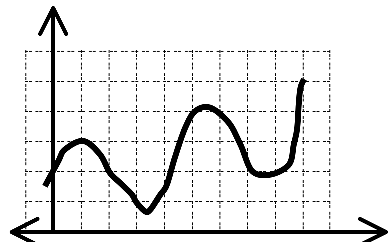
Question #1
Calculus Bowl 2004

The graph of function *f* is shown in the figure such that

$f(1)=3$, $f(3)=1$, $f(5)=4$, $f(7)=2$ and $f(9)=5$. Three approximations for $\int_1^9 f(x)\,dx$ are obtained using $n=4$ where n is the number of equal subdivisions of [1, 9].

L = the left endpoint Riemann sum approximation
R = the right endpoint Riemann sum approximation
T = the trapezoid rule approximation

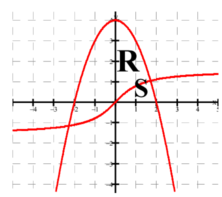
Find L + R + T.



Note: The scale on both axes is 1.

Question #2
Calculus Bowl 2004

$f(x)=\arctan(x)$ and $g(x)=4-x^2$
Regions R and S are as follows: (Also see diagram)
R = the area of the region bounded by the y-axis and *f* and *g* in quadrant I
S = the area of the region bounded by the graphs of f and g above and below by the *x*-axis in quadrant I.



Find R – S to the nearest thousandth.

Question #3
Calculus Bowl 2004

If $f(x)=ax^2+bx+c$ has an *x*-intercept of 3, a *y*-intercept of 2 and a tangent line with slope 2 at the *x*-intercept, find $a+b+c$.

Question #4
Calculus Bowl 2004

A particle is moving along the curve $\dfrac{x^2 f^3(x)}{2-f^2(x)}=-4$. If the *x*-coordinate is increasing at a constant rate of 2 units per second, find the rate at which the *y*-coordinate is changing in units per second when the particle is at $(-1,2)$.

Question #5
Calculus Bowl 2004

The velocity of an object moving on a line is given by $v(t) = \ln(t+2) + 2\sin(2t) - 0.5$ on [0, 2]. The object is located at 2 on the number line when $t = 0$. Find the sum of the values of the statements listed that are correct to the nearest thousandth. Values of the statements are listed in parenthesis to the left.

(-3) Speed is increasing at $t = 1.9$.
(5) Total distance traveled is 2.955
(-8) The object ends up at 4.813 on the number line.
(7) Acceleration is increasing at $t = 1.9$.
(4) The object changes direction once.
(-7) The average velocity is 1.406.

Question #6
Calculus Bowl 2004

If $f(x) = e^{\sin(x)}$, find A, B, C, and D to the nearest thousandth.
A = the linear approximation of $f(.1)$ using a tangent line at $x = 0$.
B = the area of the region bounded by the axes, $f(x)$ and $x = 1$.
C = the volume of the solid formed when revolving the region described in B about the x-axis.
D = the least value of c guaranteed by the Mean Value Theorem for Derivatives on the interval [0, 1].
Find A + B + C + D.

Question #7
Calculus Bowl 2004

A = the rate of change in cm^2/min of the area of an equilateral triangle when the side is 6 cm in length if the perimeter is increasing at a constant rate of $9\ \text{cm}/\text{min}$.
B = the x-coordinate of the point on the graph of $y = 3\ln(x+2)$ that is closest to the origin.
Find A + B and round the answer to the nearest thousandth.

Question #8
Calculus Bowl 2004

Let A = the exact distance between the critical points on the graph of $y = x^3 - 2x^2 + x - 1$.
Let B = the x-coordinate of the inflection point on the graph of $y = x^3 - 2x^2 + x - 1$.
Find $\dfrac{A}{B}$.

Question #9
Calculus Bowl 2004

Let $f(x)=2x^2-3+g(x)$, $f'(x)=8x-12$, and $g(0)=1$. Find $g(2)$.

Question #10
Calculus Bowl 2004

Find the volume of the solid formed when the region enclosed by $y=e^{-x}$, $y=\ln(x+1)$, and the y-axis is rotated about $y=-2$. Round to the nearest thousandth.

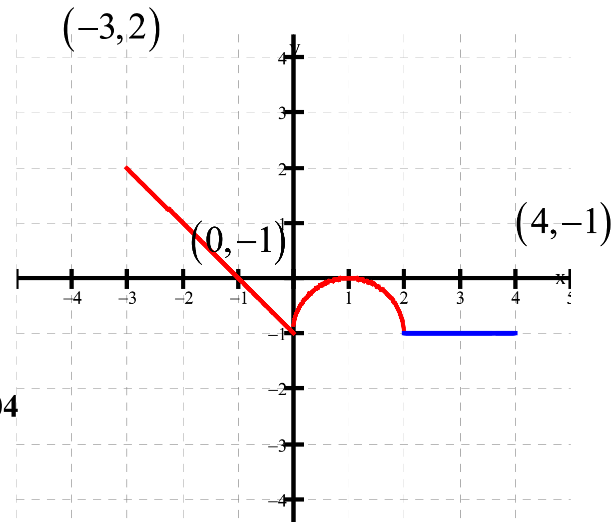
Question #11
Calculus Bowl 2004

The graph shown is made up of a semicircle and 2 line segments. It is f', the derivative of function f. Function f is defined on $[-3, 4]$ and $f(0) = 2$.

A = the maximum value of f on $\left[-3,4\right]$.

B = the minimum value of f on $\left[-3,4\right]$.

C = the volume of the solid formed by rotating the region between f' and the x-axis on $[2, 4]$ around the x-axis.



Evaluate $\dfrac{C}{B+2}+2A$

Question #12
Calculus Bowl 2004

If $\dfrac{dy}{dx}=2y(2x^2-2)$ and $y(0)=3$, find $y(2)$.

Question #13
Calculus Bowl 2004

Find the sum of the y-intercepts of the lines which are tangent to the graph of $xy=4$ and contain the point (3, 1).

Question #14
Calculus Bowl 2004

If $\dfrac{dy}{dx}=\left[2x+1\right]$, find the average rate of change of y with respect to x on the interval [0, 4].

Question #15
Calculus Bowl 2004

The region bounded by the x-axis and the part of the graph of $y=x^2$ between 0 and 4 is separated into two regions by the line $x=p$. If the area of the region on $[0, p]$ is 1 square unit less than the area of the region on $[p, 4]$, find the value of p.