Group assignment
Dusty Wilson
Math 125

Name: key

If only I had the theorems!
Then I should find the proofs easily enough.

Georg Friedrich Bernhard Riemann (1826 - 1866)
German mathematician

No work = no credit

Warm-ups $1+1=$ 2 $-3^2=$ -9 $\int_0^\pi \sin(x)\,dx=$ 2

1.) According to the quote (see above), what did Riemann find more easily – theorems or proofs? Answer using complete sentences.

Finding proofs is easy ... the challenge is in determining the theorems or starting point.

2.) State the Fundamental Theorem of Calculus, Part 1. Make sure to include all of the conditions and the full conclusion.

If f is cont. on $[a,b]$, then $g(x)=\int_a^x f(t)\,dt$ on $[a,b]$ is cont on $[a,b]$, diff. on (a,b), and $g'(x)=f(x)$.

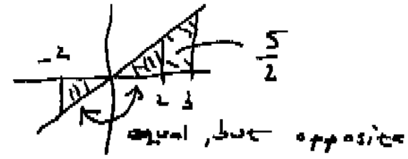
3.) Use Part 1 of the Fundamental Theorem of Calculus to find $\frac{d}{dx}\int_{2-5x}^{1}\frac{u^3}{1+u^2}\,du$. (You do not need to simplify).

$$\frac{d}{dx}\int_{2-5x}^{1}\frac{u^3}{1+u^2}\,du = -\frac{d}{dx}\int_{1}^{2-5x}\frac{u^3}{1+u^2}\,du$$

$$= -\frac{(2-5x)^3}{1+(2-5x)^2}\cdot(-5)$$

Solution: ____________________

or geometric means.



4.) Use the <u>definition of the definite integral</u> to evaluate $\int_{-2}^{3}\left(x^2-7x+2\right)dx$.

$\Delta x = \frac{5}{n}$

$x_i = -2 + \frac{5i}{n}$

$x_i^2 = 4 - 2(+2)\left(\frac{5i}{n}\right) + \frac{25i^2}{n^2}$

$= 4 + \frac{-20i}{n} + \frac{25i^2}{n^2}$

$x_i^2 \Delta x = \frac{20}{n} - \frac{100i}{n^2} + \frac{125i^2}{n^3}$

$\Rightarrow \int_{-2}^{3} x^2 dx = \lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{20}{n} - \frac{100i}{n^2} + \frac{125i^2}{n^3}\right)$

$= \lim_{n\to\infty}\left(\frac{20}{n}\cdot n - \frac{100}{n^2}\cdot\frac{n(n+1)}{2} + \frac{125}{n^3}\frac{(n)(n+1)(2n+1)}{6}\right)$

$= 20 + {}^{-}50 + \frac{125}{3}$

$= -\frac{90}{3} + \frac{125}{3} = \frac{35}{3}$

Solution: ______________________

$= \underbrace{\int_{-2}^{3} x^2 dx}_{\frac{35}{3}} - 7\underbrace{\int_{-2}^{3} x\, dx}_{\left(\frac{5}{2}\right)} + \underbrace{\int_{-2}^{3} 2\, dx}_{10}$

$= \frac{35}{3} - 7\left(\frac{5}{2}\right) + 10$

$= \frac{70 - 105 + 60}{6}$

$= \frac{25}{6}$

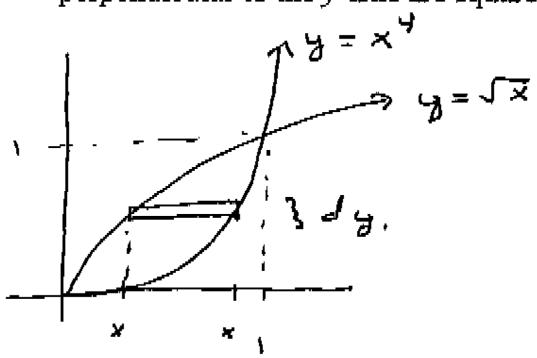
check

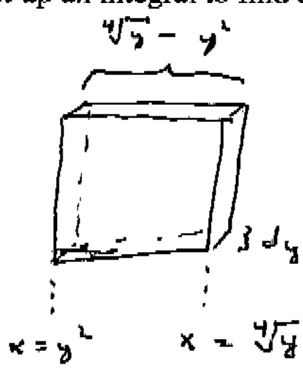
$\int_{-2}^{3}(x^2 - 7x + 2)dx$

$= \frac{x^3}{3} - \frac{7x^2}{2} + 2x \Big|_{-2}^{3}$

$= \left(9 - \frac{63}{2} + 6\right) - \left(-\frac{8}{3} - \frac{28}{2} - 4\right) = \frac{25}{6}$

5.) The base of the solid S is the region bounded between $y = x^4$ and $y = \sqrt{x}$. Cross-sections perpendicular to the y-axis are squares. Set up an integral to find determine the volume of S.





Brazil nut shape

Solution: $V = \int_0^1 \left(\sqrt[4]{y} - y^2\right)^2 dy.$