Math 1B
Quiz 6
Fri Feb 22, 2008

Code: _____
I forgot my code, so please charge me two points: (Name) _____

THIS IS A NO CALCULATOR QUIZ

WRITE BUT DO NOT EVALUATE INTEGRALS FOR THE FOLLOWING PROBLEMS

[5 POINTS] A force of 20 pounds stretches a spring 5 inches. Write an integral **(including units)** for the work done in stretching the spring 10 inches beyond its natural length.

$F = kx$

$20 \text{ pounds} = k\left(\frac{5}{12} \text{ ft}\right)$

$k = 48 \frac{\text{lb}}{\text{ft}}$

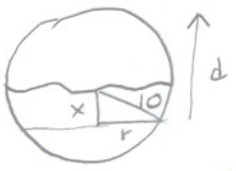
$$\int_0^{\frac{10}{12}} 48x\,dx \text{ lb-ft}$$

[3 POINTS] A rocket full of fuel weighs 20,000 pounds at launch. After launch, the rocket gains altitude and loses weight as the fuel burns. If the rocket loses 2 pounds of fuel for each 25 feet of altitude gained, write an integral **(including units)** for the work done raising the rocket to an altitude of 40,000 feet.

$$\int_0^{40{,}000} \left(20{,}000 \text{ lb} - \frac{2 \text{ lb}}{25 \text{ ft}} x\right) dx$$

FINAL ANSWER IN lb-ft

[7 POINTS] A spherical tank of radius 10 feet is filled **halfway up** with water. Write an integral **(including units)** for the work done in pumping the water out through the top of the tank.



$x = 0$

$x = 10$

$d = x + 10$ [ON A SLICE]

$r = \sqrt{100 - x^2}$

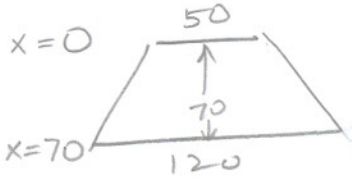
$F = w = \delta A \Delta x$

$= \left(62.4 \frac{\text{lb}}{\text{ft}^3}\right) \pi \left(\sqrt{100 - x^2}\right)^2 \Delta x$

$= 62.4\pi (100 - x^2) \Delta x$

$$\int_0^{10} 62.4\pi (100 - x^2)(x + 10)\,dx \text{ lb-ft}$$

[5 POINTS] A dam is in the shape of a trapezoid with height 70 feet. The width at the top is 50 feet and the width at the bottom is 120 feet. Write an integral **(including units)** for the maximum hydrostatic force the wall would need to withstand.



DEPTH = x

WIDTH = $x + 50$

$P = \delta h$

$= \left(62.4 \frac{\text{lb}}{\text{ft}^3}\right) x = 62.4x$

$F = PA$

$= (62.4x)(x + 50) \Delta x$

$$\int_0^{70} 62.4x(x + 50)\,dx \text{ lb}$$