

# 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.

$$F = kx$$

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

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

$$\int_0^{10} 48x \, dx \quad \text{1b-ft}$$

OR

$$\int_0^{10} 4x^{\frac{1}{2}} \, dx \quad \text{1b-in}$$

↑ ONLY 4 POINTS TOTAL

- [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.


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

$\frac{1}{2}$  POINT EACH

FINAL ANSWER  
IN 1b-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]

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

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

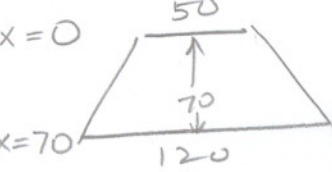
$$= 62.4 \pi (100 - x^2) \Delta x$$

$\frac{1}{2}$  POINT IF ONE CORRECT  
 $1\frac{1}{2}$  POINTS IF BOTH CORRECT

$$\int_0^{10} 62.4 \pi (100 - x^2) (x + 10) dx \quad \text{1b-ft} \quad \frac{1}{2}$$

- [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.

$x=0$   
 $x=70$



DEPTH =  $x$   
WIDTH =  $x + 50$

$$P = \delta h$$

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

$$F = PA$$

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

$$\int_0^{70} 62.4x(x + 50) dx \quad \text{1b}^{\frac{1}{2}}$$