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 ME 2080-Dynamics

**Problem:** The diagram shows the experimentally determined relationship between the pull  $F$  and draw  $x$  of a bow. Find the speed at which a 0.085-kg arrow leaves the bow, assuming that the draw was 0.5 m. (HINT: Since there are an odd number of  $\Delta A$ 's, use the Simpson's rule to calculate the area of the first four and the trapezoidal rule for the last one.)

*Trapezoidal Rule:*

*Simpson's Rule:*

**Information Given:**       $m = 0.09 \text{ kg}$   
                                   $\Delta X = 0.1$

X (m)	F (N)
0	0
0.1	107
0.2	187
0.3	240
0.4	285
0.5	312

Calculated Simpson's Rule:      68.23 N/m  
 Calculated Trapezoidal Rule:    29.85 N/m  
 Total Area Under the Curve=      98.08N/m

$(1/2)mv^2 = (1/2)kx^2$       where  $x$  is equal to 0.5 m.

$k = 784.67 \text{ N/m}$

$x = 0.5 \text{ m}$

$m = 0.09 \text{ kg}$

$(1/2)mv^2 = (1/2)kx^2 \quad \rightarrow \quad mv^2 = kx^2 \quad \rightarrow \quad v^2 = (kx^2)/m \quad \rightarrow \quad v = \sqrt{(kx^2)/m}$

$v = 48.04 \text{ m/s}$