MATH 2 SOLUTIONS TO PROBLEM SET #12

SECTION 6.4 : WORK

(1.) $W = F \cdot d$

$F = m \cdot a = 40\ kg \cdot 9.8\ m/sec^2 = 392\ N$

$d = 1.5\ m$

THUS $W = 392\ N \cdot 1.5\ m = \boxed{588\ J}$.

(7.) BY HOOKE'S LAW, $f(x) = kx$.

$f(\frac{1}{3}\ ft) = k(\frac{1}{3}\ ft) = 10\ lb$, so $k = 30\ lb/ft$

THUS $W = \int_0^{1/2} 30x\,dx = [15x^2]_0^{1/2} = \boxed{\frac{15}{4}\ ft\text{-}lb}$.

(8.) BY HOOKE'S LAW, $f(x) = kx$.

$f(\frac{1}{10}\ METER) = k(\frac{1}{10}\ METER) = 25\ N$, so $k = 250\ N/m$

THUS $W = \int_0^{1/20} 250x\,dx = [125x^2]_0^{1/20}$

$= 125(\frac{1}{400} - 0) = \boxed{\frac{5}{16}\ J}$.

(16.) $W = \int_0^{80} 44 - \frac{1}{10}x\,dx = \left[44x - \frac{1}{20}x^2\right]_0^{80}$

$= 44(80) - \frac{6400}{20} = 3520 - 320 = \boxed{3200\ ft\text{-}lb}$.

(29.) $$W = \int_a^b \frac{Gm_1m_2}{r^2}\,dr = Gm_1m_2\int_a^b r^{-2}\,dr$$

$$= Gm_1m_2\left[-\frac{1}{r}\right]_a^b = \boxed{Gm_1m_2\left(\frac{1}{a}-\frac{1}{b}\right)}.$$

(27.) $$W = \int_{x_1}^{x_2} \pi r^2 P(\pi r^2 x)\,dx = \int_{\pi r^2 x_1}^{\pi r^2 x_2} P(V)\,dV$$

$$\boxed{\begin{aligned} V &= \pi r^2 x \\ dV &= \pi r^2\,dx \end{aligned}} \qquad = \int_{V_1}^{V_2} P(V)\,dV.$$