HW 10/30

ep 28)

$$E = \$500\left(\frac{6}{38}\right) - \$100\left(\frac{32}{38}\right) = -\$5.26 \text{ for one game}$$

$$T = 100 \cdot E = 100(-5.26) = \boxed{-\$526} \text{ for 100 games}$$

ep 29)

$$E = 0(0.41) + 1(0.37) + 2(0.16) + 3(0.05) + 4(0.01) = \boxed{0.88 \text{ red cars}}$$

ep 30) a)

$$\bar{v} = \frac{1(10) + 0(20) + 1(25) + 10(30) + 20(35) + 15(40) + 1(45) + 1(50) + 1(60) + 1(70)}{1+0+1+10+20+15+1+1+1+1}$$

$$\boxed{\bar{v} = 36.47 \text{ mph}}$$

b)

$$\overline{v^2} = \frac{1(10)^2 + 1(25)^2 + 10(30)^2 + 20(35)^2 + 15(40)^2 + 1(45)^2 + 1(50)^2 + 1(60)^2 + 1(70)^2}{1+1+10+20+15+1+1+1+1}$$

$$\boxed{\overline{v^2} = 1397 \text{ mph}^2}$$

5.50) a)

$$U_{max} = KE_{max} = \tfrac{1}{2}kx^2 = \tfrac{1}{2}(120\,\text{N/m})(0.1\,\text{m})^2 = 0.6\,\text{J}$$

$$U_{max} = \left(n+\tfrac{1}{2}\right)\sqrt{\frac{k}{m}}\,\hbar$$

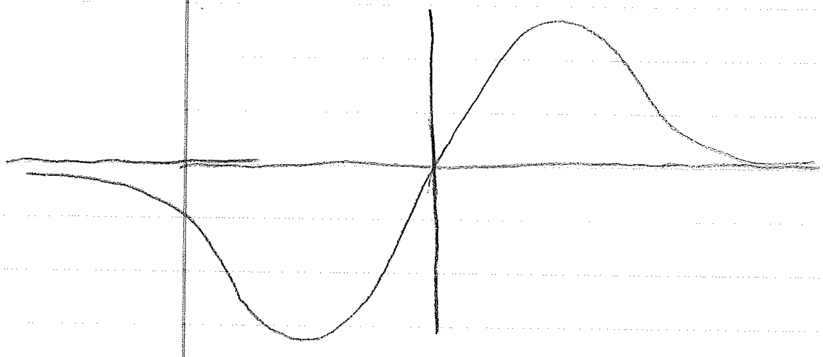
$$n = \frac{U_{max}}{\hbar}\sqrt{\frac{m}{k}} - \frac{1}{2} = \frac{0.6\,\text{J}}{1.055 \cdot 10^{-34}\,\text{Js}}\sqrt{\frac{2\,\text{kg}}{120\,\text{N/m}}} - \frac{1}{2}$$

$$\boxed{n = 7.34 \cdot 10^{32}}$$

b) Minimum ΔE is $\hbar\omega_0 = (1.055 \cdot 10^{-34}\,\text{Js})\sqrt{\frac{120\,\text{N/m}}{2\,\text{kg}}} = \boxed{8.2 \cdot 10^{-34}\,\text{J}}$

$$\frac{8.2 \cdot 10^{-34}\,\text{J}}{0.6\,\text{J}} = \boxed{1.4 \cdot 10^{-33}}$$

5.94) $\psi(x) = Axe^{-x^2/2b^2}$



The ground state usually had just one antinode. This has a node at $x=0$ and antinodes on either side, so it is not the ground state.
It is the first-excited $(n=1)$ state of a harmonic oscillator.

5.95) Probability is max where $\frac{d}{dx}\psi^2(x) = 0$

$$\frac{d}{dx}\psi^2(x) = 2\psi(x)\frac{d}{dx}\psi(x) = 0$$

$\psi(x) = 0$ at $x=0$

↳ clearly not a max of ψ

$$\frac{d}{dx}\psi(x) = 0$$

$$\frac{d}{dx}xe^{-x^2/2b^2} = 0$$

$$\left(1-\frac{x^2}{b^2}\right)e^{-x^2/2b^2} = 0$$

$$1-\frac{x^2}{b^2} = 0$$

$$\boxed{x = \pm b}$$