Problem 1 Time for one complete wave to pass by = period
Period $T = 5\,\text{sec}$. Wavelength $\lambda = 15\,\text{m}$.

Speed of waves relative to the boat: $v = f\lambda$

$$v = f\lambda = \left(\tfrac{1}{T}\right)\lambda = \frac{15\,\text{m}}{5\,\text{sec}} = \boxed{3\,\text{m/s} = v}$$

or by $\lambda = vT \Rightarrow v = \lambda/T$

Problem 3 $v = 3\times10^5\,\text{km/s} = 3\times10^8\,\text{m/s}$ ← remember to put your numbers in meters/s

$f = 100\,\text{MHz} = 100\times10^6\,\text{Hz} = 10^8\,\text{Hz} = 10^8\,\text{s}^{-1}$
($M = 10^6$)

$$v = \lambda f \Rightarrow \lambda = v/f = (3\times10^8\,\text{m/s})/(10^8\,\text{Hz}) = \boxed{3\,\text{m} = \lambda}$$

Problem 5 Middle C: $f = 256\,\text{Hz}$

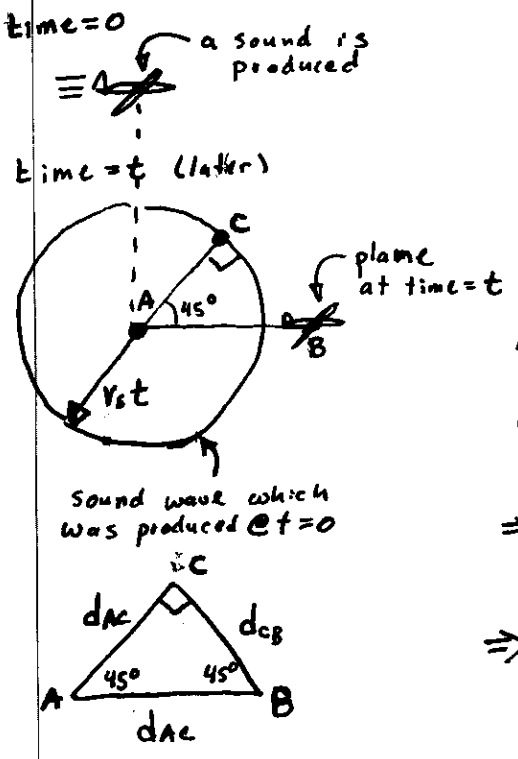
(a) Period $T = 1/f = \boxed{\frac{1}{256}\,\text{sec} = T}$

(b) $v = \lambda f \Rightarrow \lambda = v/f = (340\,\text{m/s})/(256\,\text{Hz}) = \boxed{1.33\,\text{m} = \lambda}$
($v = 340\,\text{m/s}$)

Problem 8

$v_s \equiv$ sound wave speed

$v_p \equiv$ speed of the plane $> v_s$



$$\left.\begin{aligned} d_{AB} &= v_p t \\ d_{AC} &= v_s t \end{aligned}\right\} \Rightarrow \frac{v_p}{v_s} = \frac{d_{AB}}{d_{AC}}$$

Now, $d_{AC} = d_{CB}$ and

$$d_{AB} = \sqrt{d_{AC}^2 + d_{CB}^2} = \sqrt{2 d_{AC}^2} = \sqrt{2}\, d_{AC}$$

$$\Rightarrow d_{AB}/d_{AC} = \sqrt{2}$$

$$\Rightarrow \boxed{v_p/v_s = \sqrt{2}}$$