Solutions to HW1 of PHYS 3038, Fall 2015

2.15 (a) $T = 0.20\ s$ (b) $f = 5Hz$ (c) $\lambda = 8\text{cm}$

2.22 $\psi(x,t) = (10^3 V/m)cos\,[9.5\times10^6 m^{-1}(x + 3\times10^8 (m/s)t)]$

2.23 $y(x,t) = C/[2 + (x + vt)^2]$

2.32 (a) It's a travelling wave in the +y direction, with speed $v = b/a$. $\psi(y,t) = \exp\,[-(ay - bt)^2]$

(b) Not a travelling wave.

(c) It's a travelling wave in the -x direction, with speed $v = a/b$.

(d) It's a travelling wave in the +x direction, with speed $v = 1$.

2.33 $\psi(x,t) = 5.0\exp\,[-a\left(x + \sqrt{b/a}t\right)^2]$. The propagation direction is negative x; $v = 0.6$ m/s.

2.40 The equation is satisfied whenever $\alpha^2 + \beta^2 + \gamma^2 = 1$.

3.4 The solution is trivial.

3.5 a) In the direction specified by vector $-2\hat{\imath} + \sqrt{5}\hat{\jmath}$.

b) $E_0 = 9\times10^4 V/m$.

c) The wave moves in the direction of $\vec{\text{k}} = \frac{1}{3}\left(\sqrt{5}\hat{x} + 2\hat{y}\right)\pi\times10^7 m^{-1}$.

d) $\lambda = 200\text{nm}$.

e) $\omega = 9.42\times10^{15}\text{rad/s}$, $f = 1.5\times10^{15} Hz$.

f) $v = 3.0\times10^8 m/s$.

3.7 a) $f = 5.45\times10^{14} Hz$.

b) $\omega = 3.43\times10^{15}\text{rad/s}$, $\text{k} = 1.14\times10^7 m^{-1}$.

c) $B_0 = 2\times10^{-6} T$.