Phys273 - Homework 5

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1 Problem A

1.0.1 Function $(x > 0)$

$$\mu_1, T$$
$$\psi_i(x,t) = f(x - v_1 t)$$
$$v_1 = \sqrt{\frac{T}{\mu_1}}$$

1.0.2 Function $(x < 0)$

$$\mu_2, 2T$$
$$\psi_t(x,t) = a f(bx - c v_1 t)$$

1.0.3 Answer for μ_2

$$z = \frac{T}{v} = \sqrt{T\mu}$$
No reflection: $z_1 = z_2$

$$Z_1 = Z_2$$
$$\frac{T}{\sqrt{\frac{T}{\mu_1}}} = \frac{2T}{\sqrt{\frac{2T}{\mu_2}}}$$
$$T\sqrt{\frac{2T}{\mu_2}} = 2T\sqrt{\frac{T}{\mu_1}} \tag{1}$$
$$\frac{2T}{\mu_2} = 4\frac{T}{\mu_1}$$
$$2T\mu_1 = 4T\mu_2$$
$$\frac{1}{2}\mu_1 = \mu_2$$

2 Problem B

$$\psi_t(x,t) = a f(bx - c v_1 t) = \frac{2z_1}{z_1 + z_2}\psi_i(\frac{v_1}{v_2}x, t)$$
$$= \psi_i(\frac{v_1}{v_2}x, t) \tag{2}$$

$$Z_1 = Z_2$$
$$\frac{T}{v_1} = \frac{2T}{v_2}$$
$$Tv_2 = 2Tv_1 \tag{3}$$
$$v_2 = 2v_1$$

$$\psi_i(\frac{v_1}{v_2}x, t) = f(\frac{v_1}{2v_1}x - v_1 t)$$
$$= f(\frac{1}{2}x - v_1 t) = \psi_t(x, t) \tag{4}$$

$$a = 1 \tag{5}$$

$$b = \frac{1}{2} \tag{6}$$

$$c = 1 \tag{7}$$