Huygen's Wavlet Lab

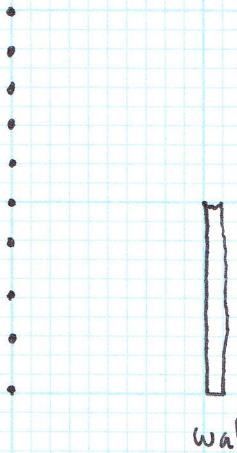
- Velocity of waves is reckoned as $\frac{\text{number of grids}}{\text{second}}$.
- Practice on spare graph paper.

1. Use Huygen's Wavelets to propagate the wave crest 2 seconds to the right. Assume velocity = 10 $\frac{\text{grids}}{\text{sec}}$. Draw the new wavefront and raypaths.

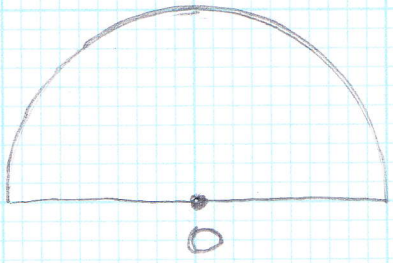
t=0

2. Propagate the wave twice, once to the wall and then another two seconds beyond the wall $v = 10$ grids/s.

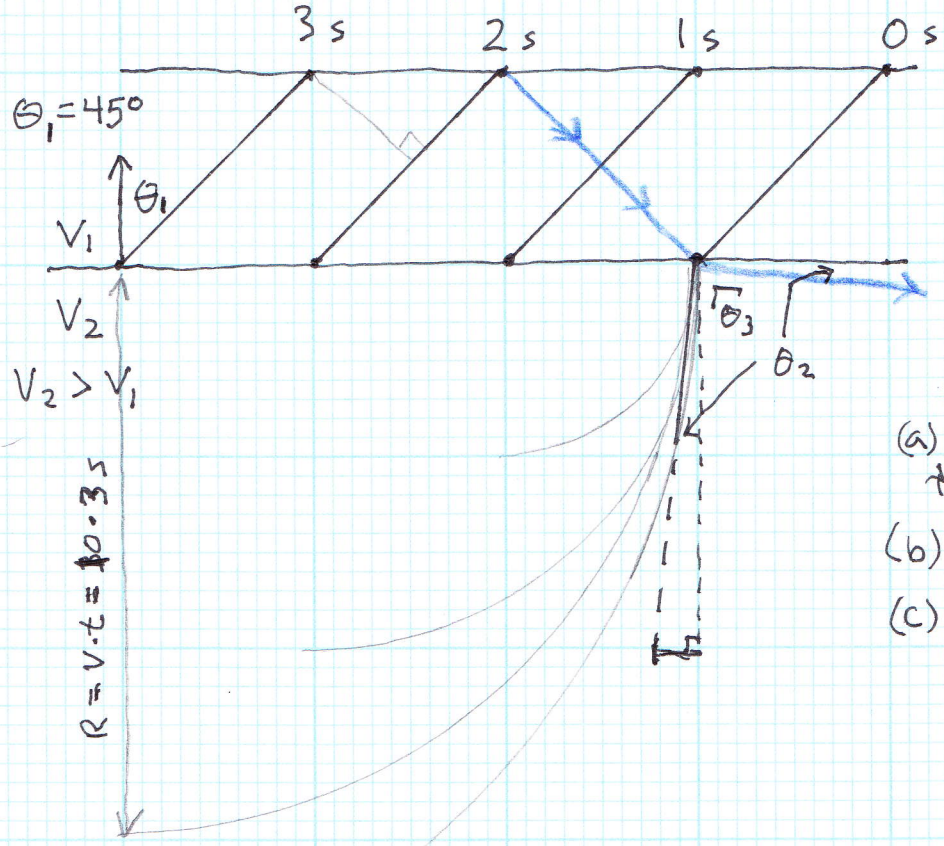
Question: Why does the wave propagate into the "Shadow Zone"?



3. Propagate the spherical wave 1 second at $v = 10$ grids/sec. Draw new wavefront and raypaths.



4. A plane-wave is at four positions at times $t = 0, 1, 2, 3$ seconds. What is the velocity of the wave in layer one? [Use trig: Answer = 7 $\frac{\text{grids}}{\text{sec}}$]



- Propagte the wave into second layer at $V_2 = 10$ grids/s.
- Make sure your propagational time is with respect to current wavefront at $t = 0$ seconds

(a) Calculate θ_2 using tangent function.

(b) Calculate θ_3.

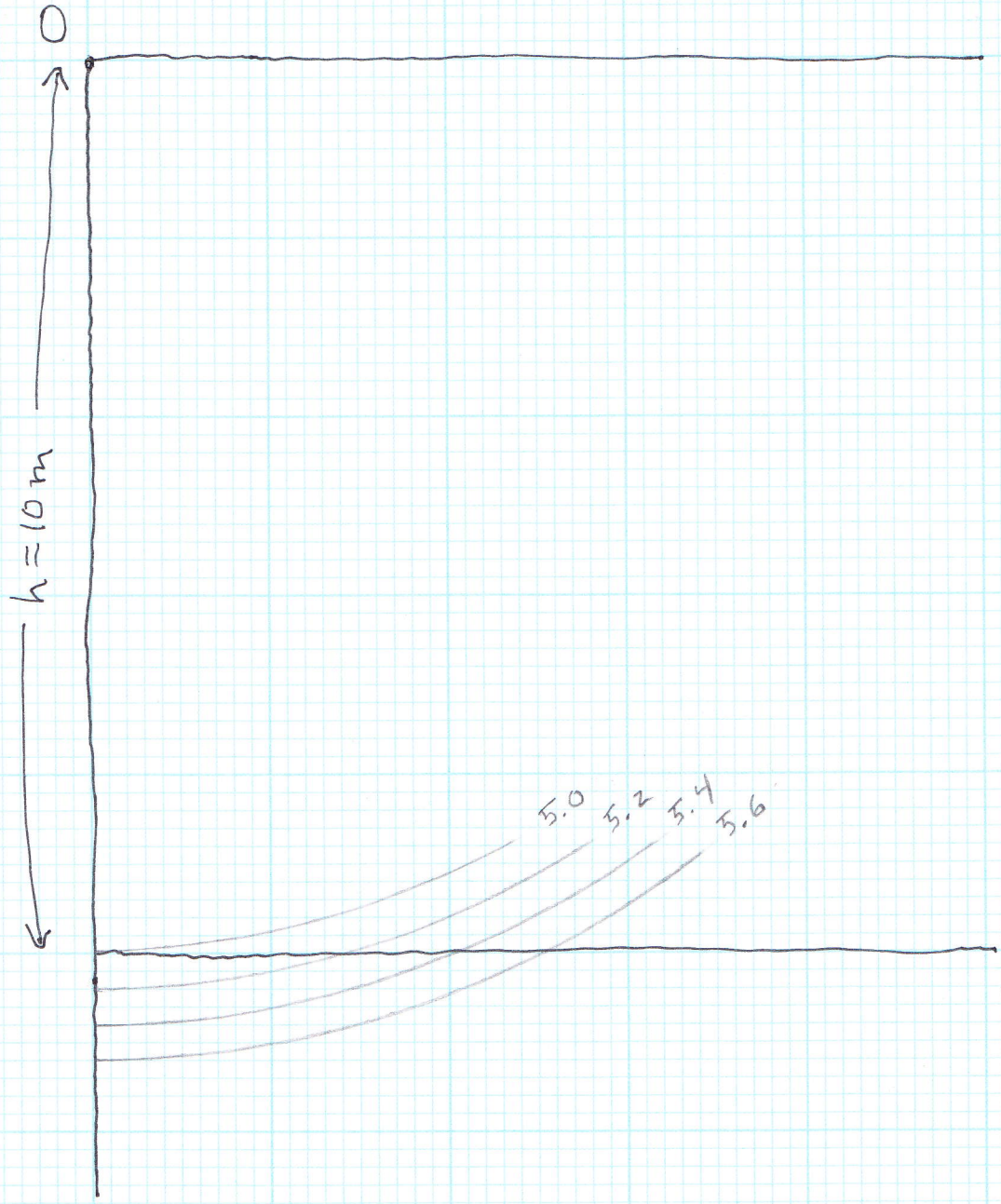
(c) Confirm Snell's Law is true.

$$\frac{\sin\theta_1}{V_1} = \frac{\sin\theta_3}{V_2}$$

5. Assume a layer 10 meters thick ($h = 10$ m) and a wave speed of $v = 10$ grids/sec. Use Compass to propagate wave to time = 5.0, 5.2, 5.4, 5.6 sec.

(a) Calculate the four take-off angles using trig.

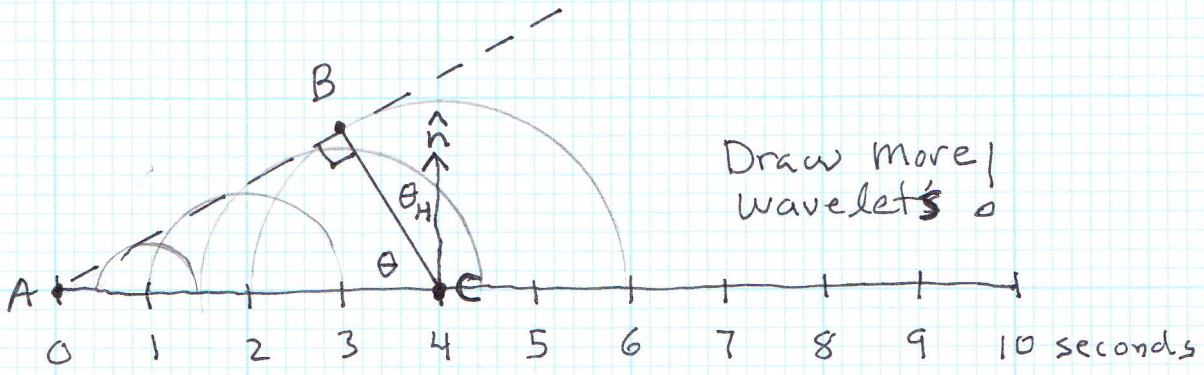
(b) Calculate the travel times for the four rays.



6. The graph shows the position of the head wave at marked times in seconds. Construct the upward traveling head wave with compass. Assume ~~at~~ velocity in upper layer of 2.5 grids/sec.

(a) Draw (3) raypaths for the head wave with arrow to label direction of Energy transport.

(b) Using trigonometry on a chosen right triangle, derive the Equation that proves the head wave upgoing angle w.r.t. interface normal (θ_H) equals the refraction critical angle (θ_c).



Hint: for (b) question

- $\theta + \theta_H = 90°$
- $\cos(\theta) = \frac{BC}{AC}$
- $\cos(90° - \theta) = \sin(\theta)$
- BC = velocity * time
- AB = ?