Q1. Calculate the crossover distance from the below figure?

a- The crossover distance (Xcr) can be computed from the following equation:

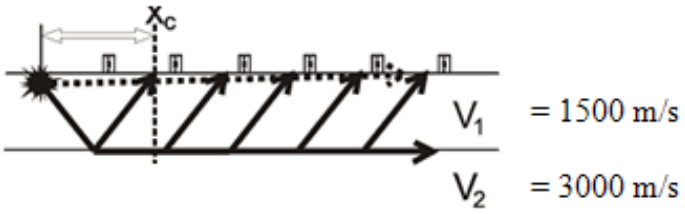
$$X_{cr} = 2h\sqrt{\frac{V_2 + V_1}{V_2 - V_1}}$$

where:

h= 100 m

V_1= 1500 m/s

V_2= 3000 m/s



$$X_{cr} = 2(100)\sqrt{\frac{3000 + 1500}{3000 - 1500}}$$

$$X_{cr} = 200\sqrt{\frac{4500}{1500}}$$

therefore: **Xcr= 346.410 meters**

Q2. Using Snell's law, calculate the reflected angle if V_1= 4 km/s, V_2= 6 km/s, and i= 30º?

$$\frac{V_i}{\sin i} = \frac{V_r}{\sin r}$$

$$\frac{4}{\sin 30^0} = \frac{6}{\sin r}$$

$$r = \sin^{-1}\left\langle \frac{\sin 30^0 (6)}{4} \right\rangle$$

$$r \approx 49^0$$

Q3. An incident P-wave strikes an interface between two different rock types. The upper layer has a P-wave velocity of 1500 m/s, and the lower layer has a P-wave velocity of 3900 m/s. The incident angle is 19 degrees:
a. Calculate the angles of refraction for P-wave.
b. Calculate the angles of refraction for S-wave

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a. The angle of refraction for P-wave can be calculated from Snell's law:

$$\sin \theta_i / Vp_1 = \sin \theta_{rfrct} / Vp_2$$

Where:

Vp_1= 1500 m/s, Vp_2= 3900 m/s, and θ_i=19°

$\sin (19)/1500 = \sin \theta_{rfrct}/3900$
$0.325/1500 = \sin \theta_{rfrct}/3900$
$\theta_{rfrct} = \sin^{-1} (0.325)(3900)/1500$
$\theta_{rfrct} = 57.67°$

b. The angle of refraction for S-wave can be calculated from Snell's law:

$$\sin \theta_i / Vp_1 = \sin \theta_{rfrct} / Vs_2$$

Where:

Vp_1= 1500 m/s
$Vs_2= Vp_2/(1.732)= (3900)/(1.732) = 2251.73$ m/s, and θi=19°

$\sin (19)/1500 = \sin \theta_{rfrct}/2251.73$
$0.325/1500 = \sin \theta_{rfrct}/2251.73$
$\theta_{rfrct} = \sin^{-1} (0.325)(2251.73)/1500$
$\theta_{rfrct} = 29.20°$