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6)

a)

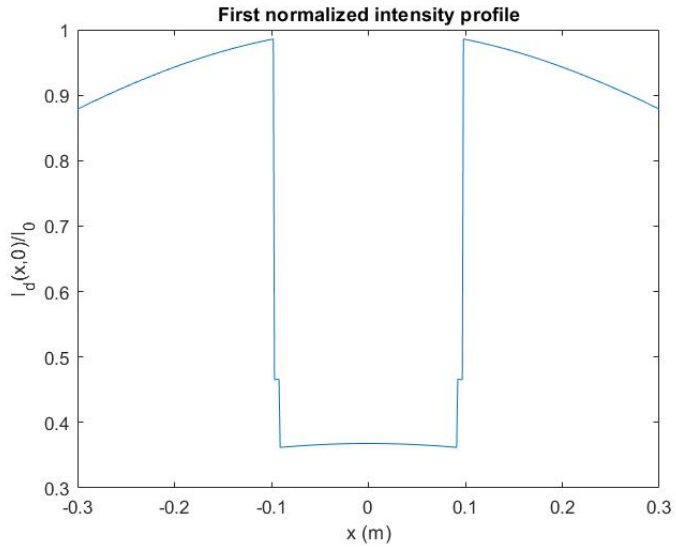

Figure 1.1

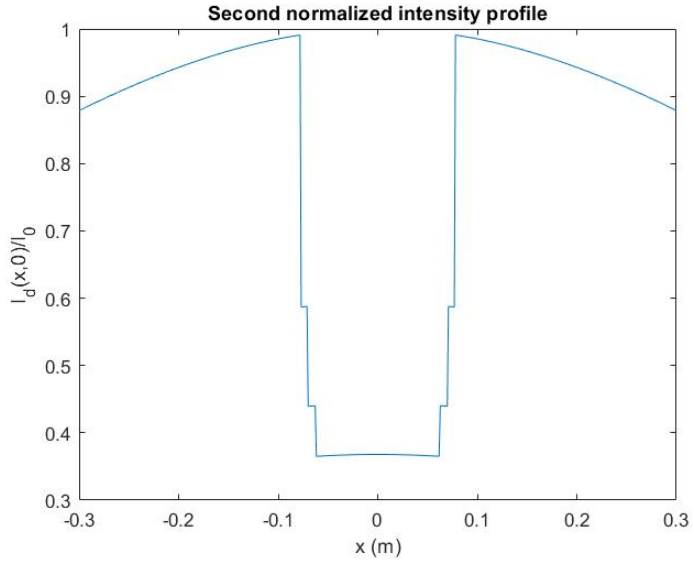

Figure 1.2

b) Geometrically speaking, in the first profile, light beam must travel with a larger angle compared to the second profile for no collision with the object. This can also be verified from the plots, since in the second profile, normalized intensity approaches to 1 before the first profile. Other than the middle part, the plots are essentially the same, since after a certain point there is no collision in both profiles.

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APPENDIX

MATLAB code for Q6:

```
%% HW 2
x_val = linspace(-0.3,0.3,512);

%% empty intensities
intensity_1 = [];
intensity_2 = [];

%% generate intensities
% by the way, code runs poorly because i had some problems
while
% vectorizing it, so instead of debugging it i just used
two for loops, it
% takes max 1 mins to compile.
for i = 1:size(x_val,2)

    fun1 = @(z) rectangularPulse((z-
0.55)/0.1)*rectangularPulse(z*x_val(i)/((2*z/sqrt(3))-
(1/sqrt(3))));
    fun2 = @(z) rectangularPulse((z-
0.85)/0.1)*rectangularPulse(z*x_val(i)/((2*z/sqrt(3))-
(16/(10*sqrt(3)))));

    intensity_1(end+1) =
((1/(1+(x_val(i))^2))^(3/2)).*exp((-
10/((1/(1+(x_val(i))^2))^(1/2)))*integral(fun1,0,1));
    intensity_2(end+1) =
((1/(1+(x_val(i))^2))^(3/2)).*exp((-
10/((1/(1+(x_val(i))^2))^(1/2)))*integral(fun2,0,1));

end

%% figures
figure;
plot(x_val, intensity_1);
xlabel("x (m)");
ylabel("I_d(x,0)/I_0");
title("First normalized intensity profile");

figure;
plot(x_val, intensity_2);
xlabel("x (m)");
ylabel("I_d(x,0)/I_0");
title("Second normalized intensity profile");
```