Let's say we have a parallel plate waveguide and radiation of a particular frequency. We want to set it up so that we'll have TEM modes, but not TM modes.
What can we do to work towards that?

A) Make the plate separation smaller 8

B) Make the plate separation larger 4

C) Stick a strong dielectric in between the plates 4

D) A and C 11

E) B and C 16

When we did plane waves in free space, we derived the intensity equation $I = \frac{1}{2}\varepsilon v E^2$. How can we tweak that to suit the parallel-plate waveguide context?

A) Change v to be the phase velocity 2

B) Change v to be the group velocity 7

C) Change ε to be a function of frequency, which ultimately comes from the dispersion relation 16

D) You can't tweak it. You have to throw it out and start over.

17

Here’s the E-field for the parallel-plate TM(n) mode in vacuum:

$$\vec{E} = \frac{c^2 k B_0}{\omega}\left[-\cos\left(\frac{n\pi y}{b}\right)\hat{\jmath} + \frac{in\lambda}{2b}\sin\left(\frac{n\pi y}{b}\right)\hat{k}\right] e^{i(kx-\omega t)}$$

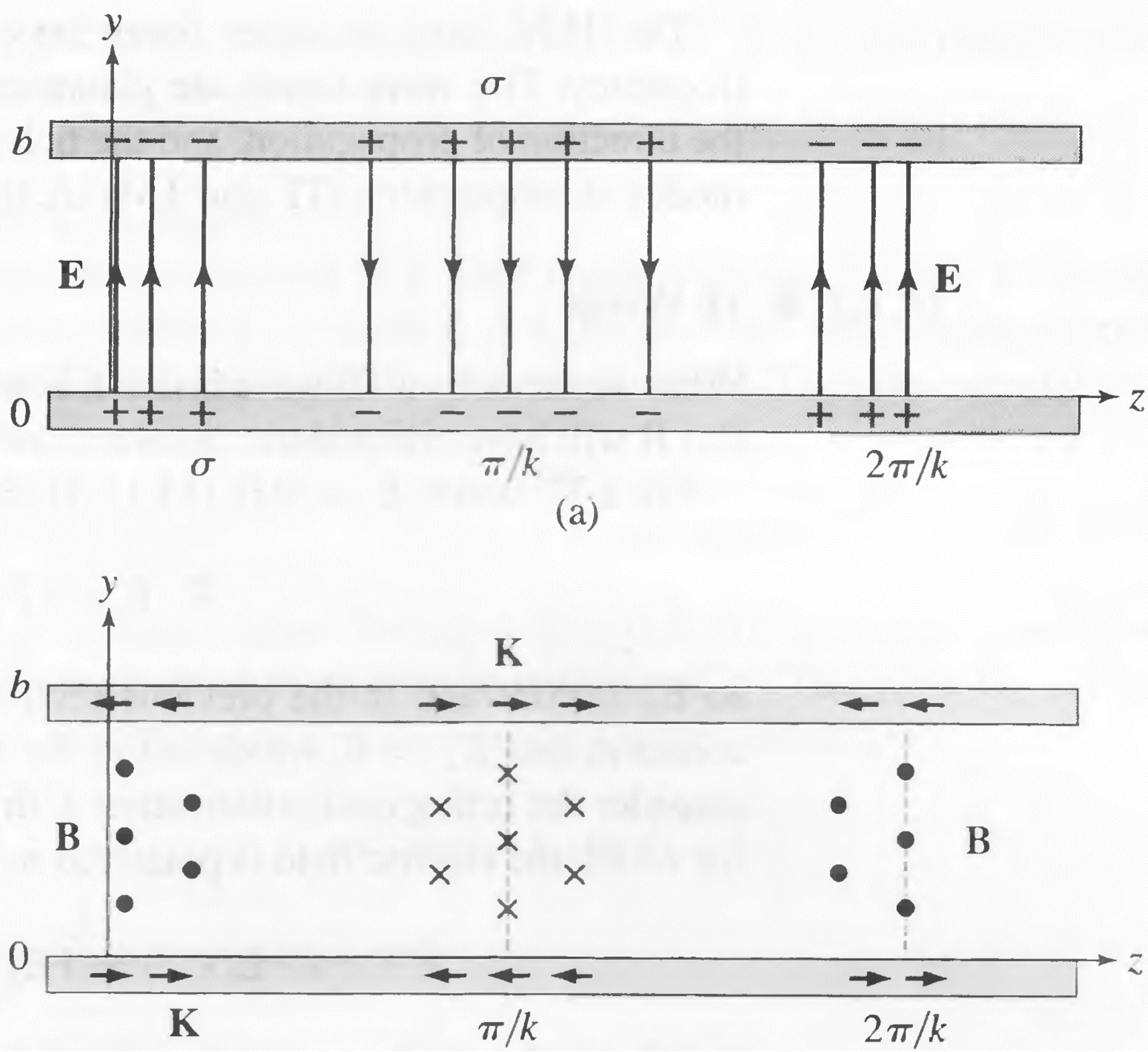
What does the c represent?

A) The phase velocity of the wave

B) The group velocity of the wave

C) The number given by $\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$

Thinking only about parallel plate waveguides, in what ways do TEM, TE, and TM modes differ from one another? List everything you can think of on a sheet of paper. Think about how TEM differs from TE/TM and also how TE and TM differ from one another.



y
σ
b
E
E
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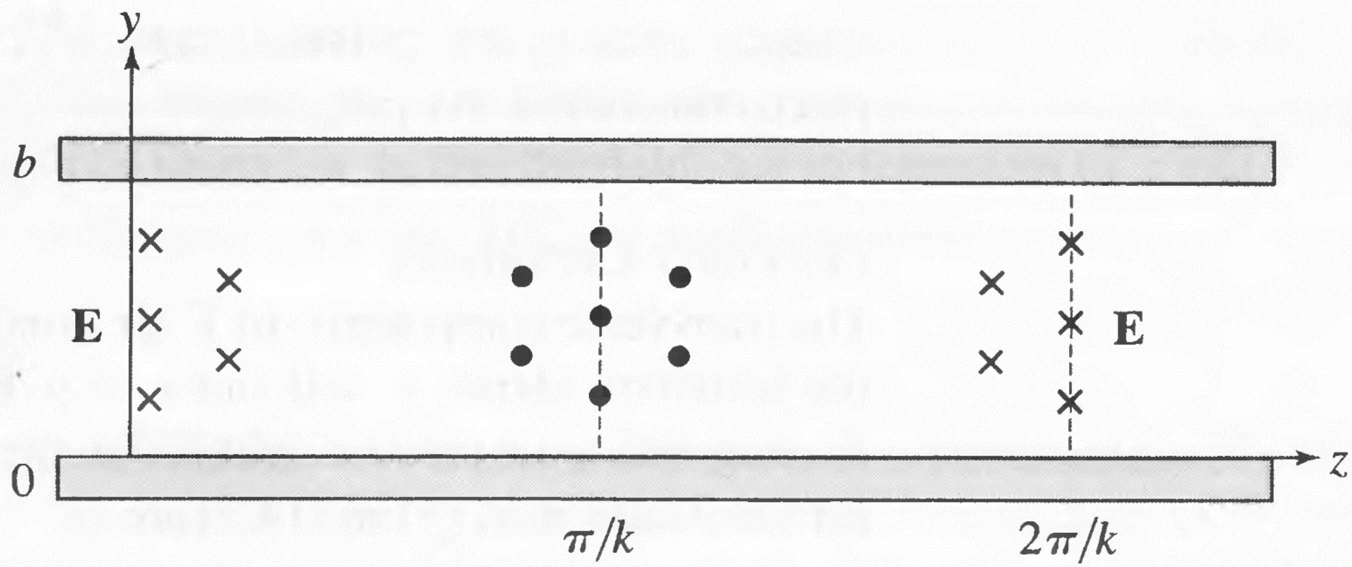
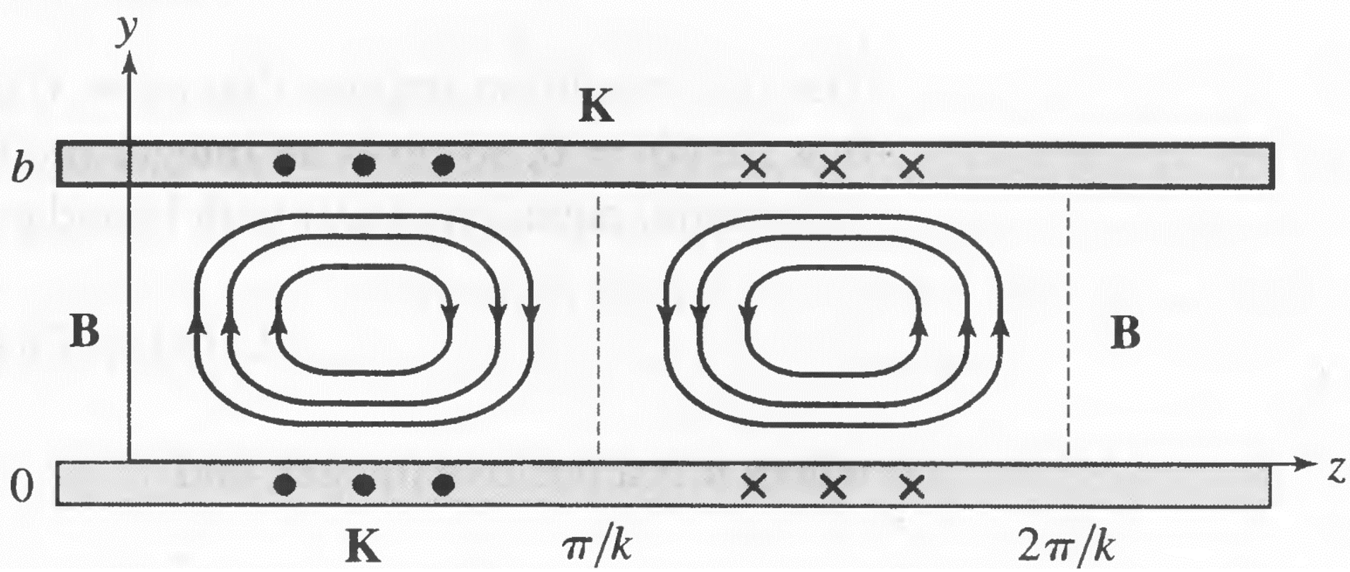
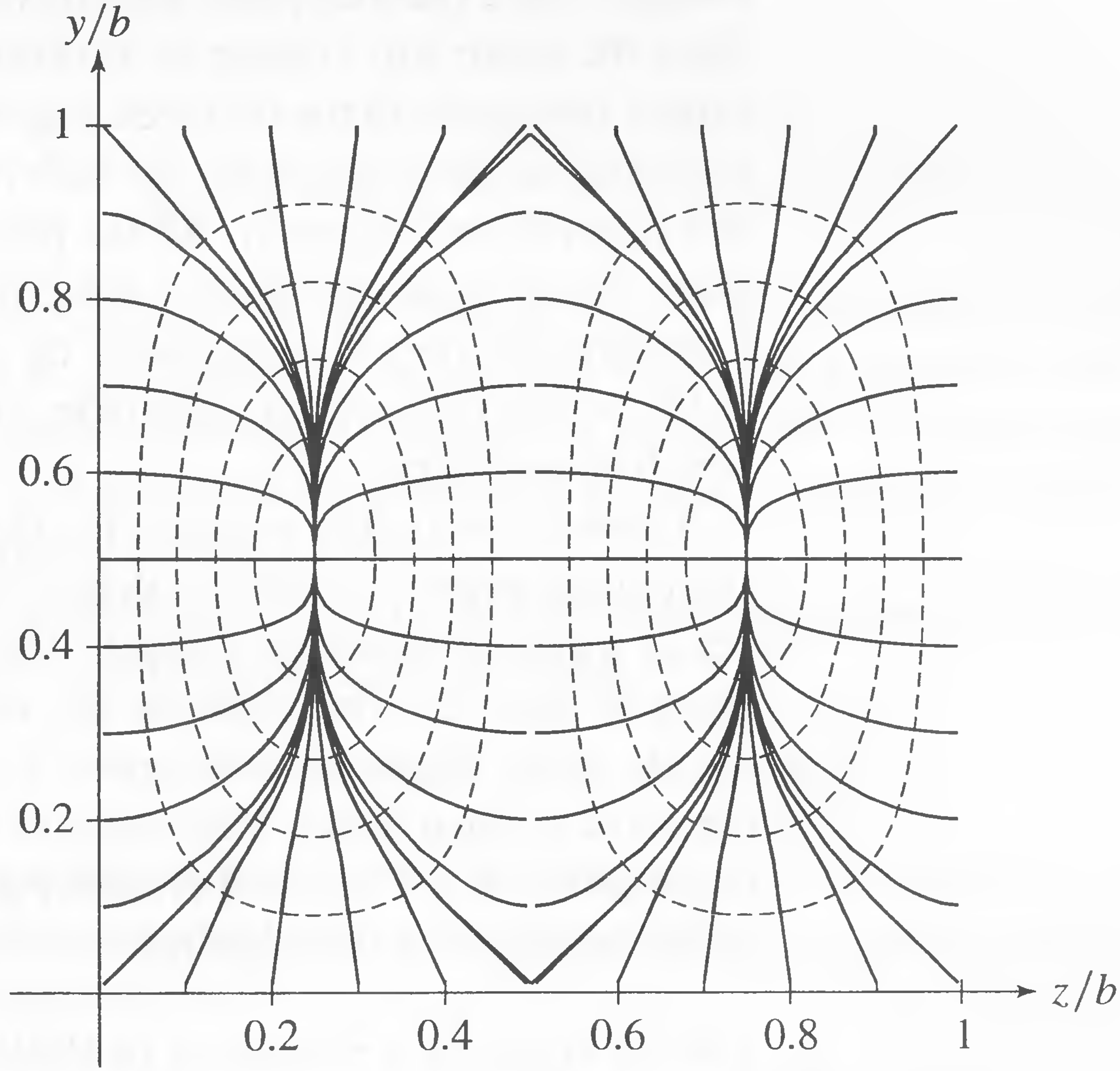
z
σ
π/k
2π/k
(a)
y
K
b
B
B
0
z
K
π/k
2π/k



(a)





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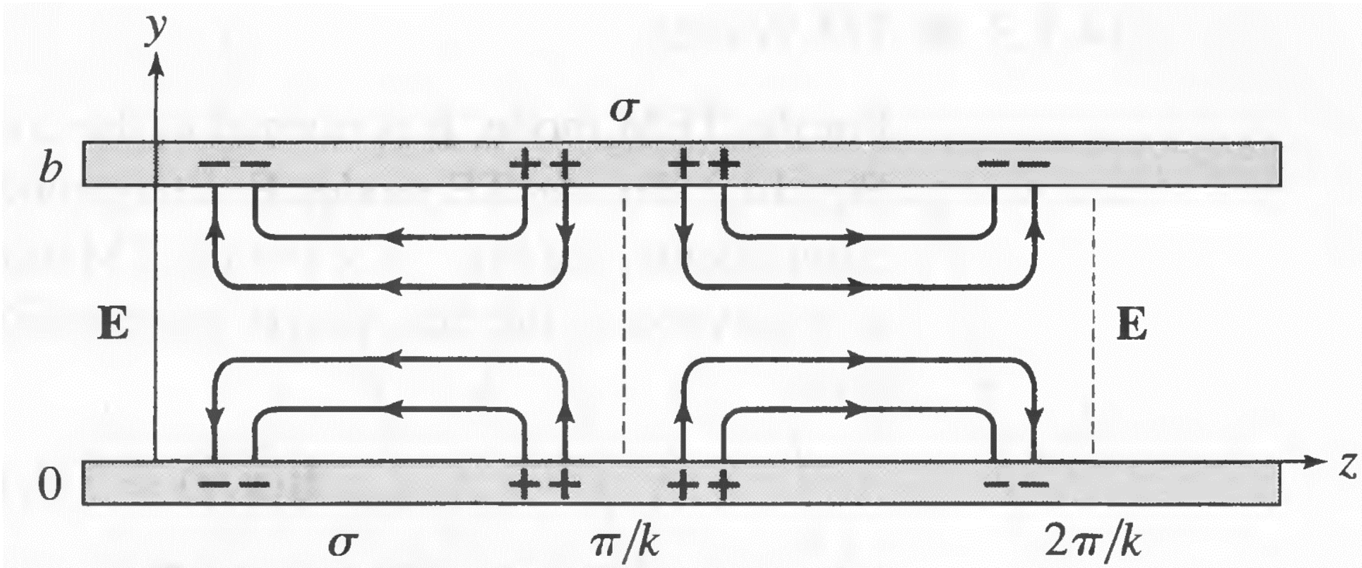
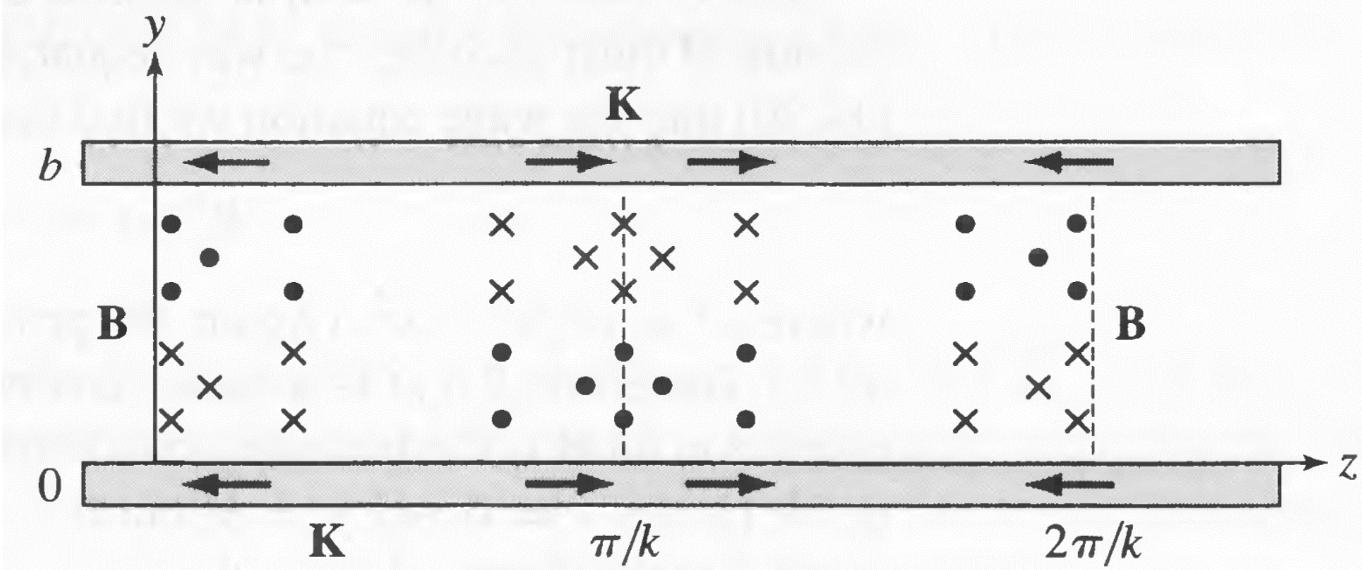
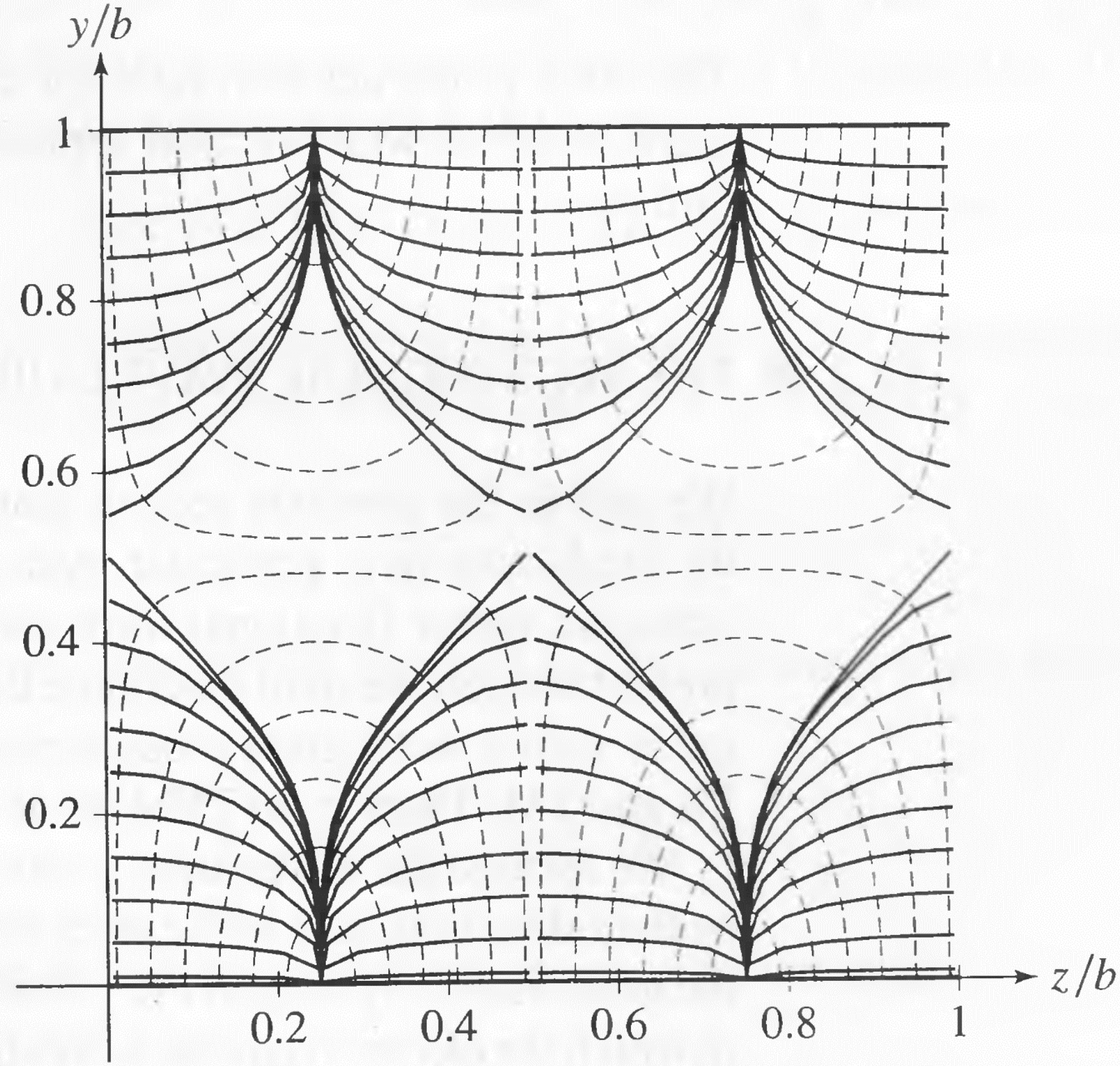
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1
z/b



(a)





y/b
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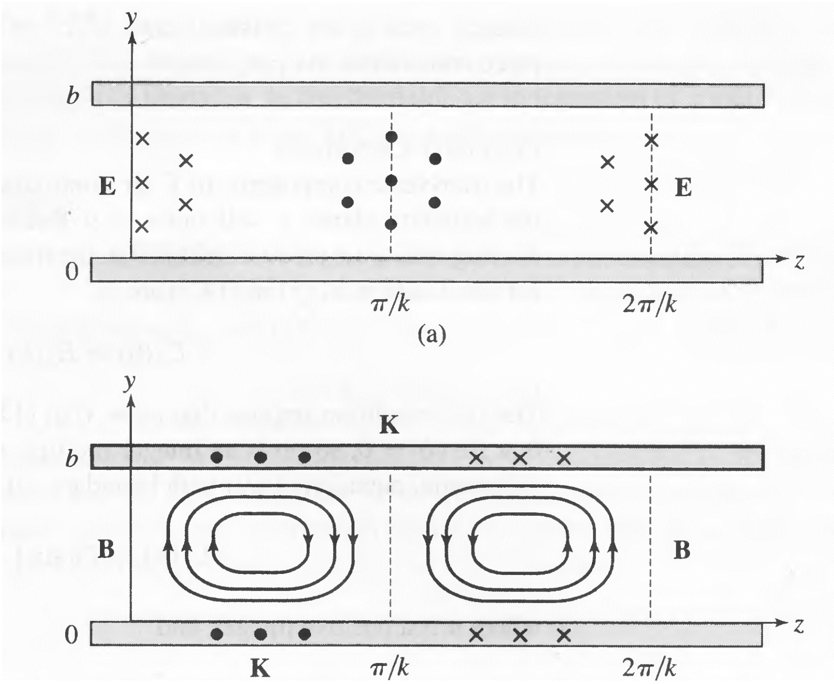
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1
z/b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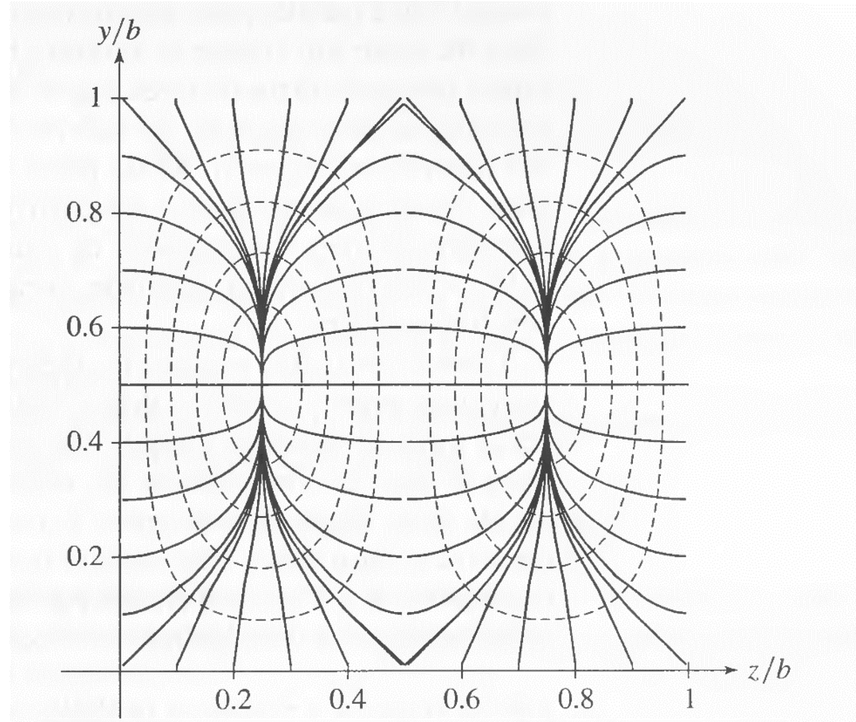
b
E
E
0
z
π/k
2π/k
(a)
y
K
b
B
B
0
z
K
π/k
2π/k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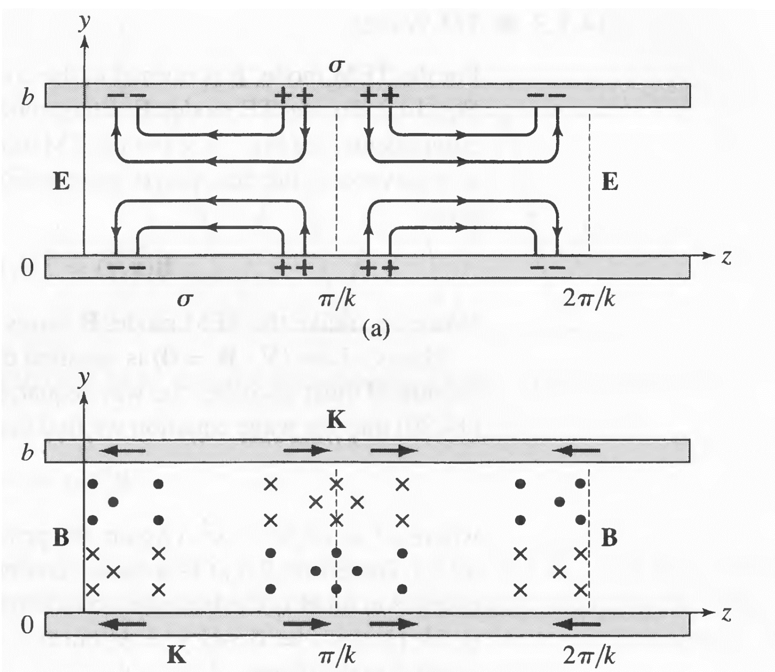
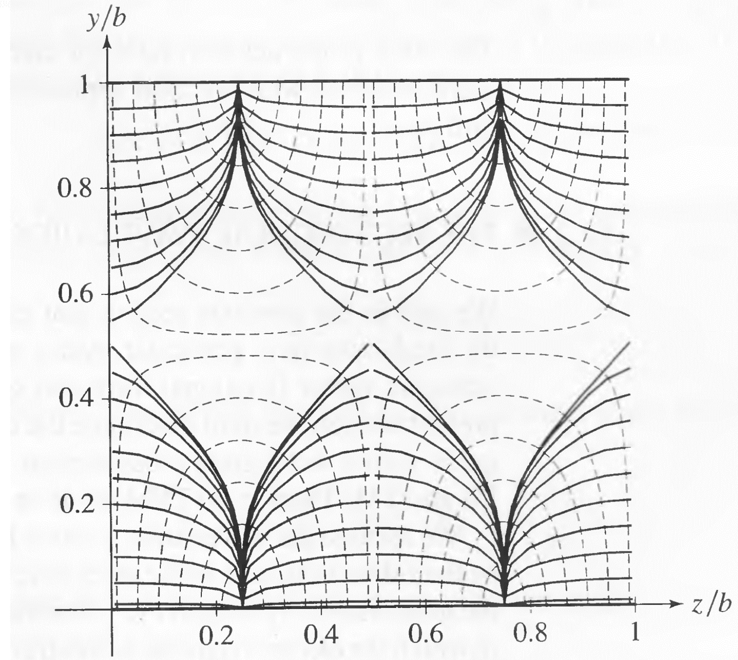
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1
z/b


y
σ
b
E
E
0
z
σ
π/k
2π/k
(a)
y
K
b
B
B
0
z
K
π/k
2π/k


y/b
1
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1
z/b