

PHYS 2601 (Fall 2025): Problem Set 9

Due date: November 16, 9:00am. 50% penalty on late homework.

From Vibrations and Waves (King)

Problem 8.1 (5 pts)

Problem 8.4 (10 pts)

Problem 8.8 (5 pts)

Problem 8.9 (5 pts)

From Vibrations and Waves (French)

Problem 7-17 (5 pts)

7-17 The following two waves in a medium are superposed:

$$y_1 = A \sin(5x - 10t)$$

$$y_2 = A \sin(4x - 9t)$$

where x is in meters and t in seconds.

- (a) Write an equation for the combined disturbance.
- (b) What is its group velocity?
- (c) What is the distance between points of zero amplitude in the combined disturbance?

Problem 7-18 (10 pts)

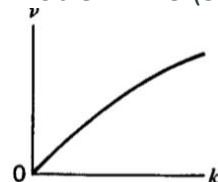
7-18 The motion of ripples of short wavelength ($\lesssim 1$ cm) on water is controlled by surface tension. The phase velocity of such ripples is given by

$$v_p = \left(\frac{2\pi S}{\rho \lambda} \right)^{1/2}$$

where S is the surface tension and ρ the density of water.

- (a) Show that the group velocity for a disturbance made up of wavelengths close to a given λ is equal to $3v_p/2$.
- (b) What does this imply about the observed motion of a group of ripples traveling over a water surface?
- (c) If the group consists of just two waves, of wavelengths 0.99 and 1.01 cm, what is the distance between crests of the group?

Problem 7-19 (5 pts)



7-19 The relation between frequency ν and wave number k for waves in a certain medium is as shown in the graph. Make a qualitative statement (and explain the basis for it) about the relative magnitudes of the group and phase velocities at any wavelength in the range represented.

In your solutions, please provide written comments (in addition to the math) that show your reasoning to receive full credit.

Please submit solutions electronically as a single merged pdf document to gradescope (handwritten or typeset) and tag all problems, otherwise a penalty will be applied.