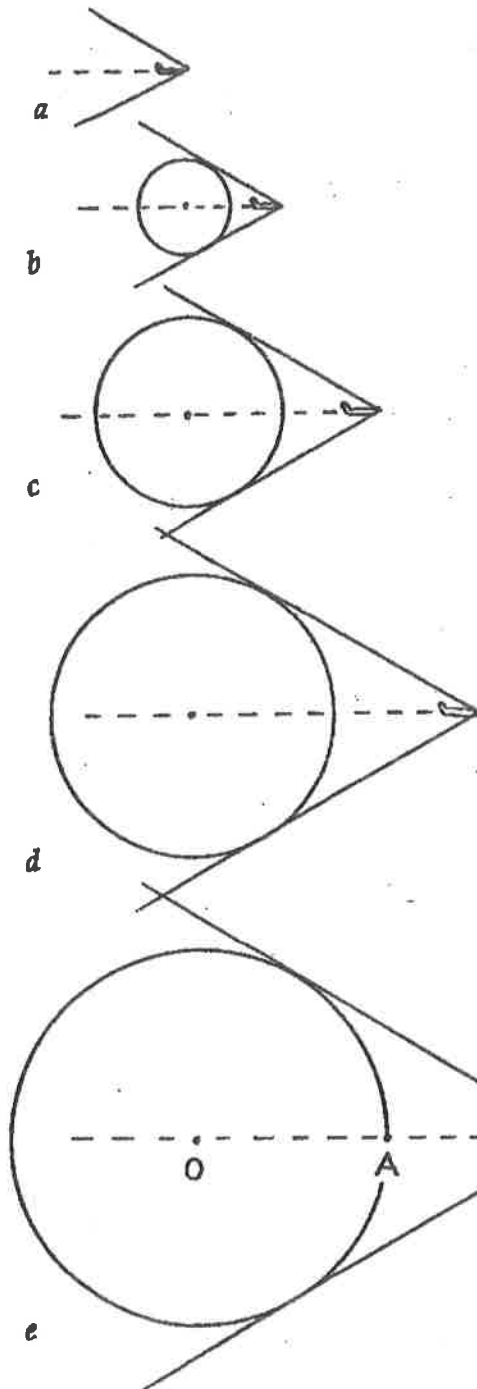


# Concept-Development Practice Page

# 25-2

## Shock Waves



The cone-shaped shock wave produced by a supersonic aircraft is actually the result of overlapping spherical waves of sound, as shown in Figure 25.22 in your text-book. Sketches *a*, *b*, *c*, *d*, and *e*, at the left show the "animated" growth of only one of the many spherical sound waves (shown as an expanding circle in the two-dimensional sketch). The circle originates when the aircraft is in the position shown in *a*. Sketch *b* shows both the growth of the circle and position of the aircraft at a later time. Still later times are shown in *c*, *d*, and *e*. Note that the circle grows and the aircraft moves farther to the right. Note also that the aircraft is moving farther than the sound wave. This is because the aircraft is moving faster than sound.

Careful examination will reveal how fast the aircraft is moving compared to the speed of sound. Sketch *e* shows that in the same time the sound travels from O to A, the aircraft has traveled from O to B — twice as far. You can check this with a ruler.

Circle the answer.

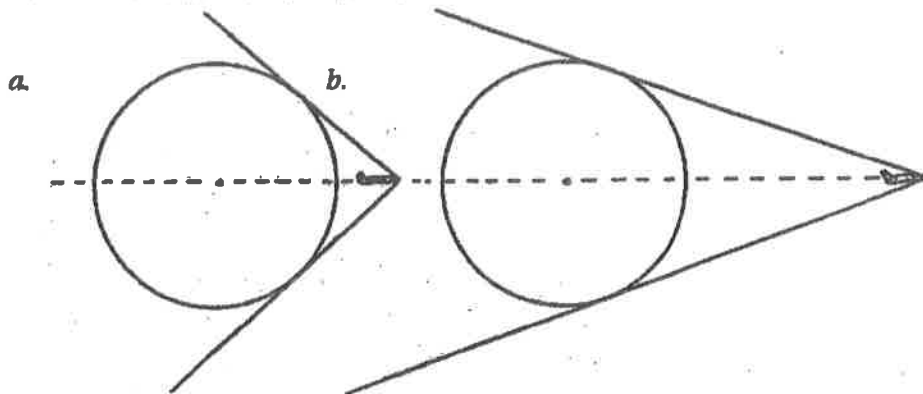
1. Inspect sketches *b* and *d*. Has the aircraft traveled twice as far as sound in the same time in these positions also?  
(yes) (no)
2. For greater speeds, the angle of the shock wave would be  
(wider) (the same) (narrower)

DURING THE TIME THAT SOUND TRAVELS FROM O TO A, THE PLANE TRAVELS TWICE AS FAR --- FROM O TO B.

SO IT'S FLYING AT TWICE THE SPEED OF SOUND!



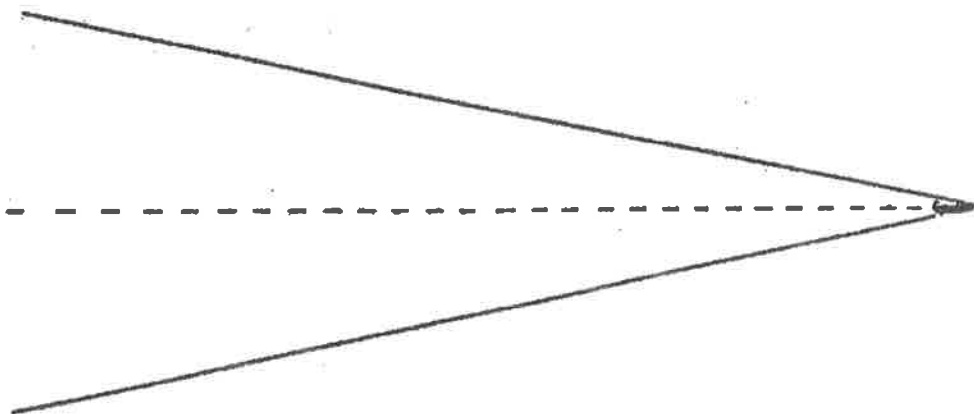
3. Use a ruler to estimate the speeds of the aircraft that produce the shock waves in the two sketches below.



Aircraft *a* is traveling about \_\_\_\_\_ times the speed of sound.

Aircraft *b* is traveling about \_\_\_\_\_ times the speed of sound.

4. Draw your own circle (anywhere) and estimate the speed of the aircraft to produce the shock wave shown below.



The speed is about \_\_\_\_\_ times the speed of sound.

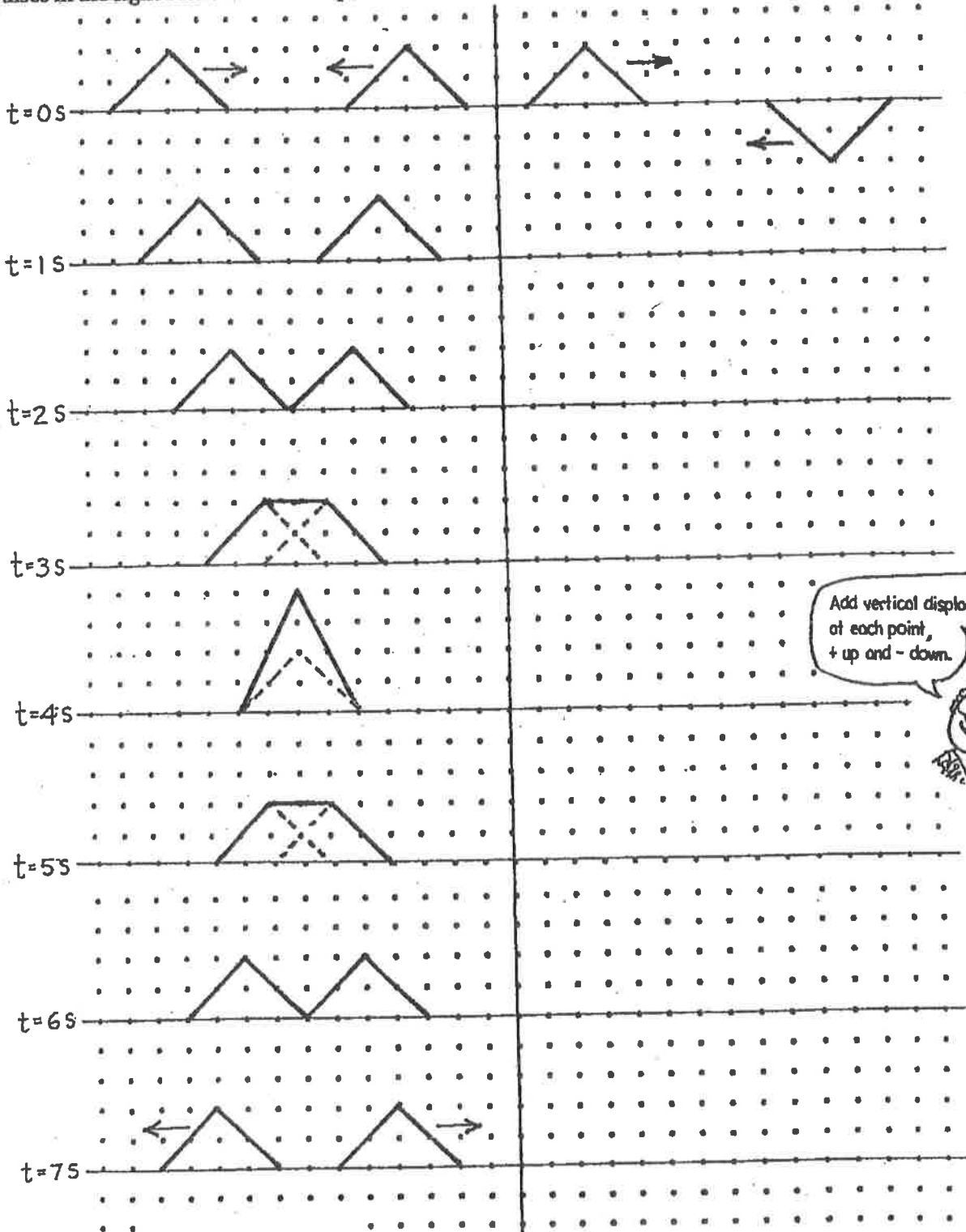
5. In the space below, draw the shock wave made by a supersonic missile that travels at four times the speed of sound.

**Concept-Development  
Practice Page**

**25-3**

**Wave Superposition**

A pair of pulses travel toward each at equal speeds. The composite waveforms as they pass through each other and interfere are shown at 1-second intervals. In the left column note how the pulses interfere to produce the composite waveform (solid line). Make a similar construction for the two wave pulses in the right column. Like the pulses in the first column, they each travel at 1 space per second.



Add vertical displacements of each point, + up and - down.

Construct the composite waveforms at 1-second intervals for the two waves traveling toward each other at equal speed.

