

Exercise 222

Using $\mu = 2 \sin^{-1} \left(\frac{1}{M} \right)$, find the Mach number M for the following angles.

a. $\mu = \frac{\pi}{6}$

b. $\mu = \frac{2\pi}{7}$

c. $\mu = \frac{3\pi}{8}$

Solution

Since the question is asking for M , solve the given formula for M .

$$\mu = 2 \sin^{-1} \left(\frac{1}{M} \right)$$

$$\frac{\mu}{2} = \sin^{-1} \left(\frac{1}{M} \right)$$

$$\sin \left(\frac{\mu}{2} \right) = \frac{1}{M}$$

$$M = \frac{1}{\sin \left(\frac{\mu}{2} \right)}$$

Plug the given numbers into the formula for M . If $\mu = \frac{\pi}{6}$, then

$$M = \frac{1}{\sin \left(\frac{\pi}{12} \right)} \approx 3.86.$$

If $\mu = \frac{2\pi}{7}$, then

$$M = \frac{1}{\sin \left(\frac{2\pi}{14} \right)} \approx 2.30.$$

If $\mu = \frac{3\pi}{8}$, then

$$M = \frac{1}{\sin \left(\frac{3\pi}{16} \right)} \approx 1.80.$$