Using the Psychrometric Chart

Problem Statement

The air in a room has a dry-bulb temperature of 80°F and a wet-bulb temperature of 65°F. Assuming a pressure of 14.7 psia, use the psychrometric chart to determine:

1. The specific humidity.
2. The relative humidity.
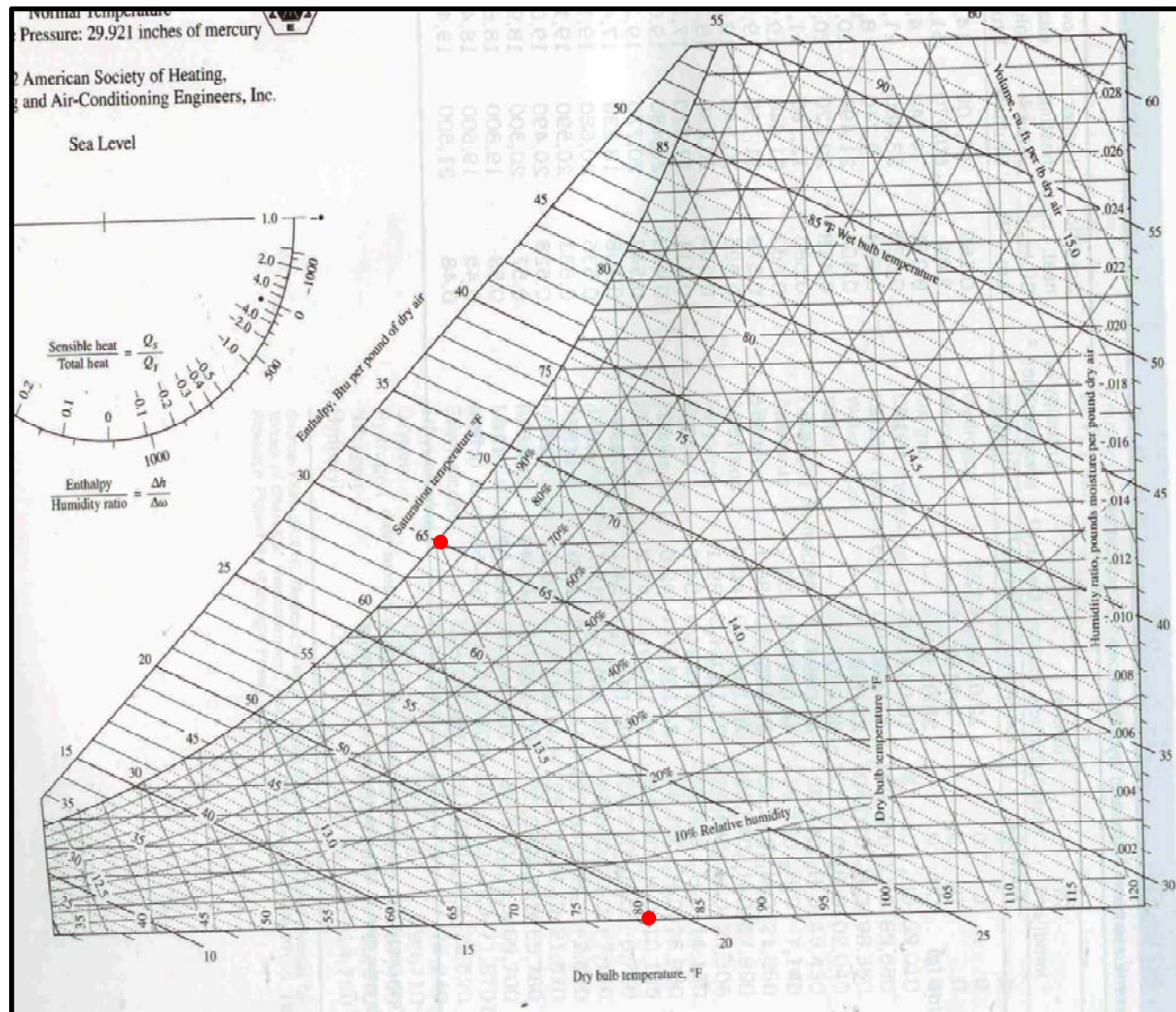3. The dew point temperature.

Given: $T_{DB} = 80°F$; $T_{WB} = 65°F$; $p = 14.7$ psia

To Find: a) ω; b) ϕ; c) T_{DP}

Solution:

Locate the properties $T_{DB} = 80°F$ and $T_{WB} = 65°F$ on the psychrometric chart.

Psychrometric chart with T_{DB} = 80°F and T_{WB} = 65°F indicated.

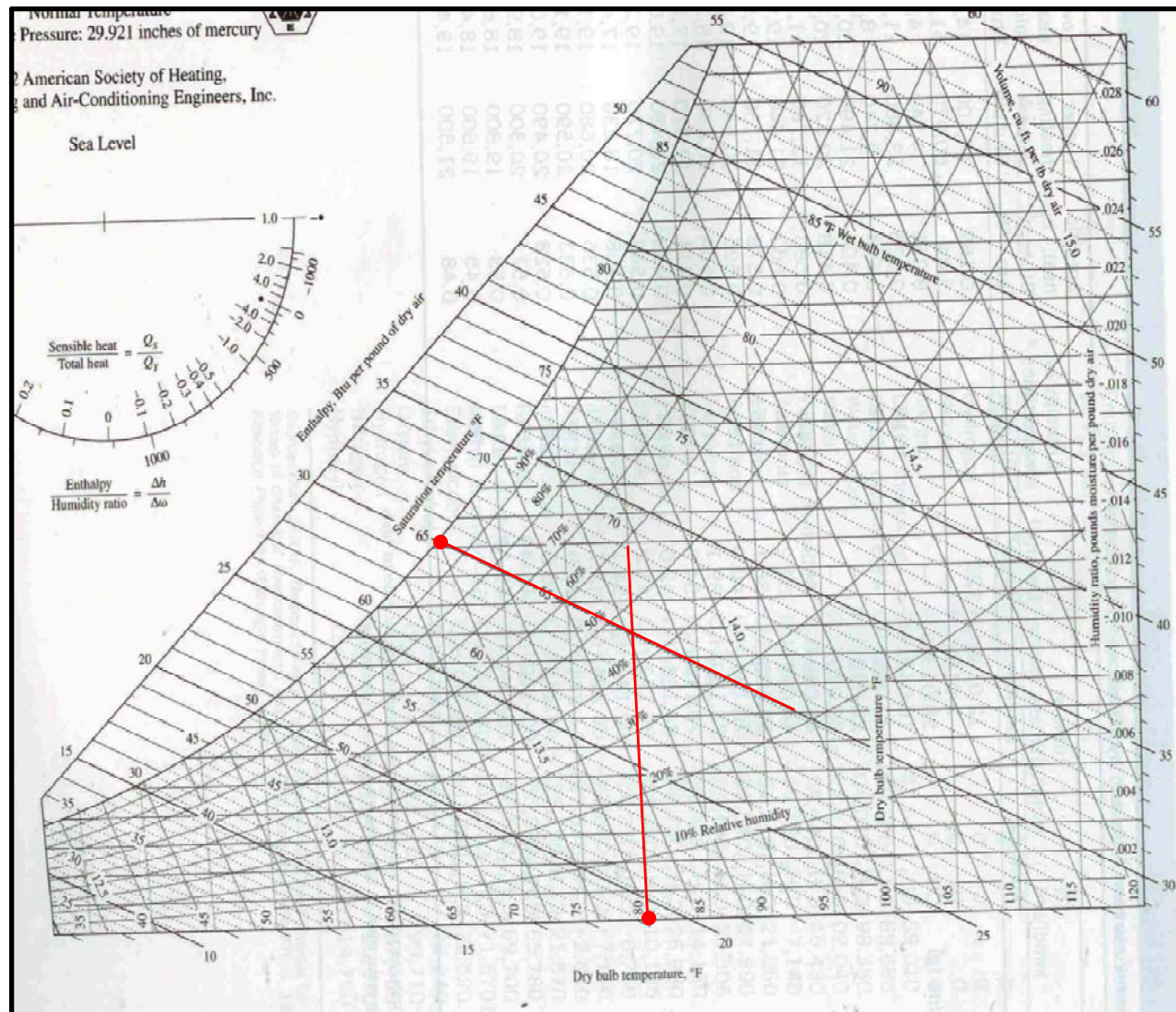## Solution (cont'd):

Draw a vertical line from $T_{DB} = 80^\circ F$ which crosses the $T_{WB} = 65^\circ F$ diagonal line.

The intersection of these two lines indicates the state of the atmospheric air.

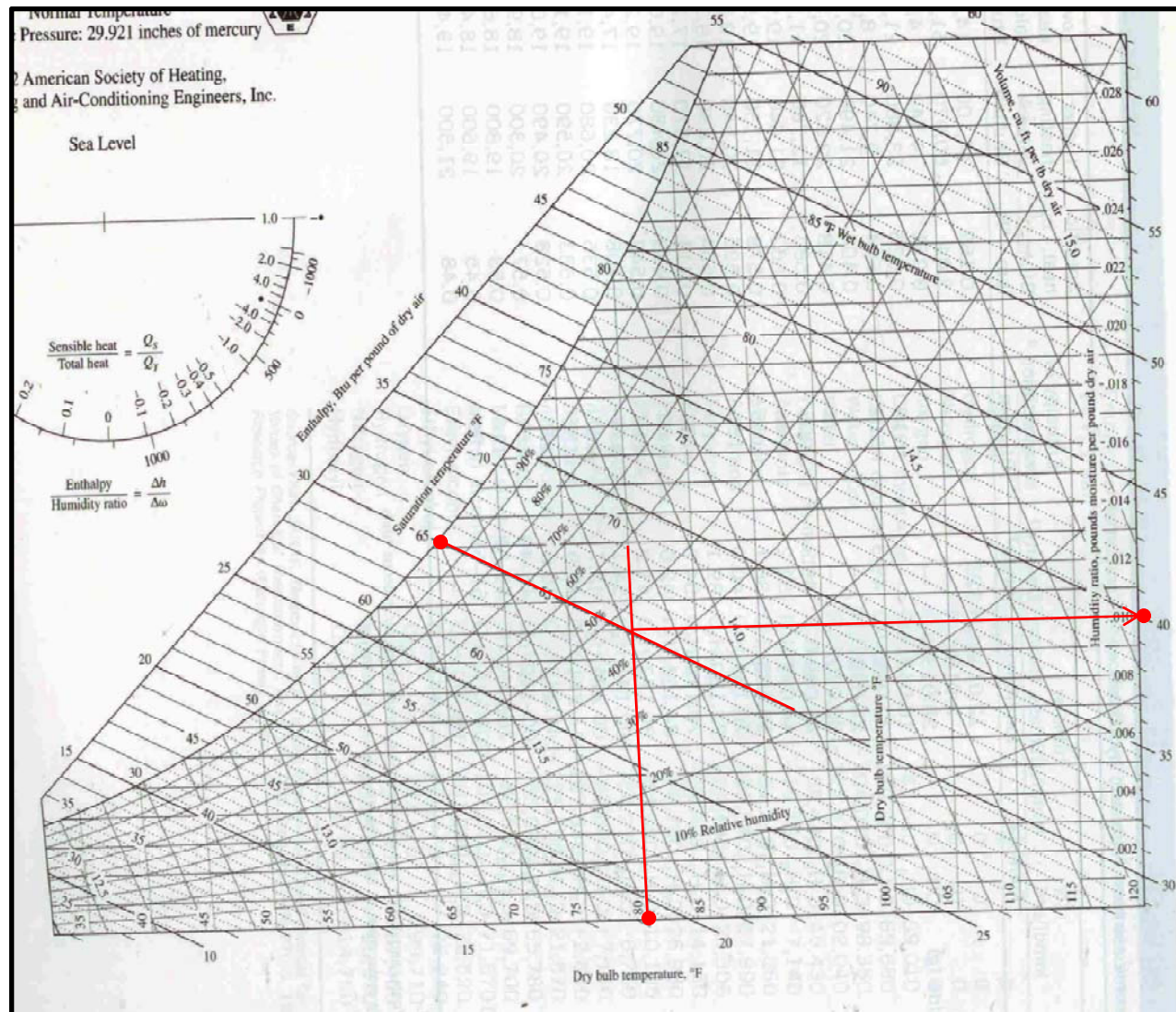# Psychrometric chart with lines drawn in.

Solution (cont'd):

To determine ω, draw a horizontal line from the "state point" to the right and read the <u>humidity ratio</u> .

$$\left(\omega = 0.010 \frac{lbm, moisture}{lbm, dry \ air} \right)$$

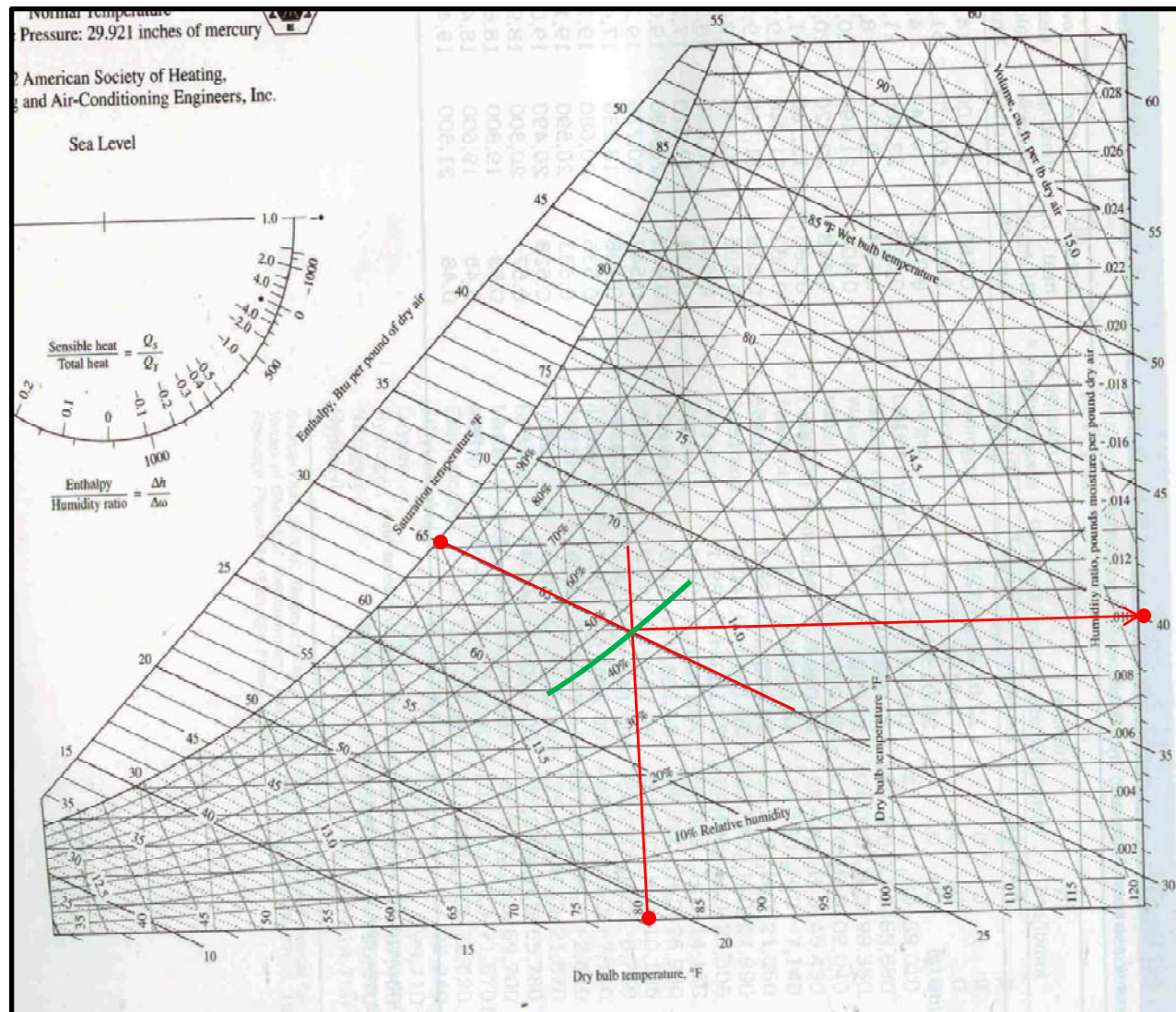# Psychrometric chart with ω indicated.

Solution (cont'd):

To determine Φ, note the curved line (indicated in green) that passes through the state point.

$$\Phi = 45\%$$

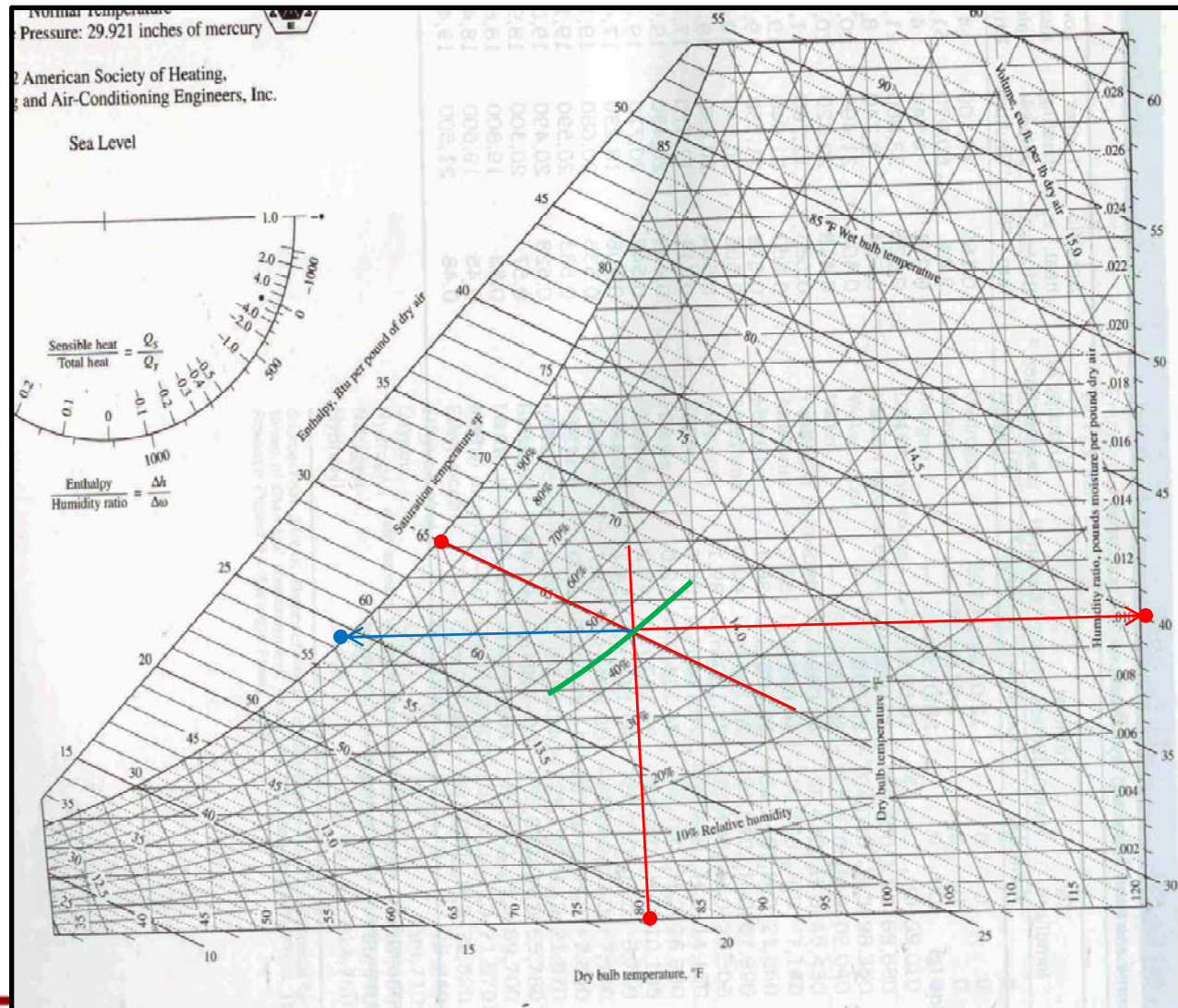# Psychrometric chart with green line.

Solution (cont'd):

The dew point temperature is defined as the temperature at which condensation commences from the atmospheric air. The T_{DP} state point will have the same ω as the atmospheric air state point, but the Φ will be 100%

Solution (cont'd):

Draw a horizontal line from the atmospheric air state point to the "Saturation temperature °F" line. T_{DP} = 57.5°F.

Psychrometric chart with horizontal line to the saturation temperature line.

Summary:

$\omega = 0.010$

$\Phi = 45\%$

$T_{DP} = 57.5°F$