Calculating V_A

1. Beginning with the basic equation for lift

$$L = C * A * P/2 * V^2$$

where: L = lift

C = the coefficient of lift (lift produced by wing config, flaps and AOA)

A = the wing area

P = rho, the air density

V = velocity

2. For a given instance in flight at either max ramp weight or our specific weight for which we want to calculate V_A the wing area and air density will be the same for either case and can be dropped from the equation. Since maneuvering speed is the velocity where the aircraft will stall, (max coefficient of lift), before damage will occur, C will be the same for both instances as well and can be dropped leaving us with the simple equation...

$$L = V^2$$

3. In level flight we can substitute weight for lift and we get

$$W = V^2 \text{ or } \sqrt{W} = V$$

4. Now we find the ratio of our specific weight to max ramp weight

$$\frac{\sqrt{W_s} = V_s}{\sqrt{W_{max}} = V_{max}}$$

5. A little algebra and we have

$$\frac{\sqrt{W_s}}{\sqrt{W_{max}}} * V_{max} = V_s$$

6. Example: 215 lbs. pilot plus full fuel, ramp weight equals 1985 lbs. for 69J. Given: max ramp weight is 2,500 lbs. and maneuvering speed is 131 mph.

$$\frac{\sqrt{1{,}985}}{\sqrt{2{,}500}} * 131 \text{ mph} = V_s$$

$$V_s = 116.7 \text{ mph}$$