

# ATPL FORMULA SHEET

## Radio Aids to Navigation

$$\text{VHF/UHF reception range} = .23 \times \sqrt[3]{\text{Height above station}}$$

$$\text{Time to a navigation facility in minutes (NDB or VOR)} = \frac{\text{Time to pass station (seconds)}}{\text{Degrees of bearing change}}$$

$$\text{Distance from a navigation facility in nautical miles (NDB or VOR)} = \frac{\text{Groundspeed (knots)} \times \text{Time to station (minutes)}}{60}$$

$$\text{Distance from DME station} = \sqrt[2]{\text{Slant range}^2 - \text{Height above station}^2}$$

## High Speed Flight

$$\text{Local Speed of Sound (knots)} = 39 \times \sqrt[2]{\text{OAT (Kelvin)}}$$

$$\text{Temperature in Kelvin} = \text{Temperature in Celsius} + 273$$

$$\text{Mach number} = \frac{\text{True airspeed (knots)}}{\text{Local speed of sound (knots)}}$$

## Point of Equal Time (PET) or Critical Point (CP)

$$\text{Distance to Point of Equal Time} = \frac{\text{Total Distance of Flight (nm)} \times \text{Ground speed return (knots)}}{\text{Groundspeed return (knots)} + \text{Groundspeed outbound (knots)}}$$

$$\text{Time to Point of Equal Time} = \frac{\text{Distance to point of equal time (nm)}}{\text{Groundspeed in cruise}}$$

## Point of No Return (PNR)

$$\text{Distance to Point of No Return} = \frac{\text{Fuel endurance (hours)} \times \text{Ground speed return (knots)} \times \text{Groundspeed outbound (knots)}}{\text{Ground speed return (knots)} + \text{Groundspeed outbound (knots)}}$$

$$\text{Time to Point of No Return} = \frac{\text{Distance to Point of No Return (nm)}}{\text{Ground speed outbound (knots)}}$$

## Specific Range

$$\text{Specific air range} = \frac{\text{True airspeed(knots)}}{\text{Fuel flow (pounds or gallons per hour)}}$$

$$\text{Specific ground range} = \frac{\text{Ground speed(knots)}}{\text{Fuel flow (pounds or gallons per hour)}}$$