SUMMARY OF 60:1 RULES & FORMULAS

CLIMBS AND DESCENTS

The 60:1 Rule

1° = 1 NM at 60 NM

1° = 100 FT at 1 NM

Climb and Descent Gradients

$$\text{Required gradient (FT/NM)} = \frac{\text{Altitude to lose (or gain)}}{\text{Distance to travel}}$$

$$\text{Pitch Change} = \frac{\text{Gradient}}{100}$$

(1° pitch change = 100 FT/NM)

VVI

VVI = Gradient (or pitch × 100) × TAS in minutes

$$\text{VVI for a 3° glideslope} = \frac{GS \times 10}{2}$$

$$\text{VVI for a 2.5° glideslope} = \frac{GS \times 10}{2} - 100$$

Determine TAS in NM/MIN

TAS = IAS + (FL / 2)

NM/MIN = TAS / 60

Steps to Determine Required Pitch and VVI (Winded Application). Mathematical Steps

NOTE: For practical applications, each 60 kts of wind will change pitch 1°

Required Gradient:

$$\text{Gradient} = \frac{\text{Altitude to Lose}}{\text{Dist to Travel}}$$

Required VVI with wind:

VVI = gradient × groundspeed (NM/MIN)

Required Pitch Change:

$$\text{Pitch Change} = \frac{\text{Gradient}}{100}$$

TURNS

Turn Radius (TR)

Turn Diameter (TD) = 2 × TR

Distance to turn 90° using 30° of Bank

$$TR = \text{NM/MIN} - 2 \quad \text{OR} \quad \frac{(\text{NM/MIN})^2}{10}$$

Distance to turn 90° using SRTs and ½ SRTs

SRT = ½% of TAS (or groundspeed)

½ SRT = 1% of TAS (or groundspeed)

Bank for Rate Turns

$$\text{Bank for SRT} = \frac{TAS}{10} + 7$$

$$\text{Bank for ½ SRT} = \frac{TAS}{20} + 7$$

Lead Point for Radial to Arc or 90° Intercept of an Arc

Lead point in DME = Desired ARC ± TR

Lead Point for Arc to Radial or 90° Intercept of an Radial

$$\text{Lead point (in degrees)} = \frac{60}{\text{Arc}} \times \text{TR (in NM)} \quad \text{OR} \quad \frac{60}{\text{DME}} \times \text{TR (in NM)}$$

For Turns Less or More Than 90°, Use the Following (These cover most situations)

Degrees to Turn	Fraction of 90° Turn	Degrees to Turn	Fraction of 90° Turn
180°	2	90°	1
150°	1 5/6	60°	1/2
135°	1 2/3	45°	1/3
120°	1 ½	30°	1/6

Bank Angle Required to Maintain an Arc

$$\text{Required Bank Angle} = \frac{30}{\text{Arc}} \times \text{TR} \quad \text{OR} \quad \frac{\text{Radial Lead Point}}{2}$$

HOLDING

Teardrop Holding Calculations

$$\text{Offset in degrees} = \frac{TD \times 60}{\text{Outbound Distance}} \quad \text{OR} \quad \frac{TR \times 120}{\text{Outbound Distance}}$$

Holding Time

≤ 14,000 = 1+00 minutes

> 14,000 = 1+30 minutes

Outbound Correction for Inbound

1+00 Correction = 3600 / inbound time = outbound time
1+30 Correction = 8100 / inbound time = outbound time

Using SCNS

Ground Speed (GS) – TAS = Δ
For more accurate results use the GS & TAS from your inbound leg

60 sec ± Δ = time outbound
Use 2/3 of that time to be more precise

Triple Drift

Into Wind Turn = 30° Bank
Inbound to fix = Course heading ± drift

Other Turn = 30° Bank
Outbound Leg = outbound heading ± (drift × 3)

- Hold tripe drift for same amount of time as the time in the 180° turn
- $180° \text{ TURN} = \frac{1\% \text{ TAS}}{2}$
- Ex: 240 TAS = 2.4/2 = 1.2 Min = 1 + 12

Drift Calculation

$$\text{Drift} = \frac{\text{Crosswind Component}}{\text{NM/Min of TAS}}$$

APPROACH

Teardrop Penetration Calculation

Determine Outbound Distance for 30° bank turn:

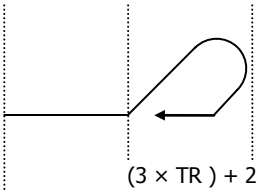
$$\text{Outbound Distance} = \frac{TD \times 60}{\text{Degrees Between Radials}} \quad \text{OR} \quad \frac{TR \times 120}{\text{Degrees Between Radials}}$$

Determine bank angle required for teardrop penetration (When 30° bank will not work):

$$\text{Bank Angle Required} = \frac{TD \times 60}{\text{Distance Between Radials}}$$

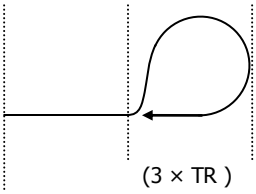
Procedure Turn Calculations

45/180 Maneuver Distance = (3 × TR) + 2



Remain within distance

80/260 Maneuver Distance = 3 × TR



Remain within distance

<u>British Technique:</u>
Tail Wind: 2 × Drift Angle and shorten turn
Head Wind: 2 ×Drift Angle and add it in seconds

VDP Calculation

$$\text{VDP (in NM) From the } \textit{end of the runway (EOR)} = \frac{\text{HAT}}{\text{Gradient (normally 300)}}$$

$$\text{VDP (in timing) From the FAF} = (\text{FAF to EOR Distance, in NM}) - \frac{\text{HAT}}{\text{Gradient (normally 300)}} = \text{FAF to VDP Dist}$$

$$\frac{\text{Timing to MAP (from timing box)}}{\text{NM from FAF to MAP}} = \text{Seconds per Mile} \quad \text{or} \quad \frac{60}{(\text{TAS} / 60)} = \text{Seconds per Mile}$$

(Seconds per Miles) × FAF to VDP Dist (NM) = Time (in Seconds)