

**The precise pilot does not fly by rules of thumb,
axioms, or formulas.
But there are times when knowledge of an
approximate way to calculate things or knowledge
of a simple rule can pay big dividends.**

Takeoff Performance

A 1° C change in temperature from ISA will increase or decrease the takeoff ground roll by 10%.

Takeoff distance increases by 15% for each 1000' DA (Density Altitude) above sea level

Rotation speed V_r is equal to approximately 1.15 times V_s

A headwind of 10% takeoff speed will reduce ground roll by 20%

A 10% change in aircraft weight will result in a 20% change in takeoff distance.

The maximum crosswind component is approximately equal to $0.2 \times V_{s1}$

Abort the takeoff if 70% of takeoff speed is not reached within 50% of the available runway.

Available engine horsepower decreases 3% for each 1000' of altitude above sea level.

Fixed Pitch, Non turbo aircraft - Climb performance decreases 8% for each 1000' DA above sea level.

Variable Pitch, Non turbo aircraft – Climb performance decreases 7% for each 1000' DA above sea level.

Expect to lose 1" of manifold pressure every 1000' in a climb.

TAS increase 2% for each 1000' in a climb.

Standard temperature decreases 2° for each 1000'

Flight Manoeuvres

Use ½ the bank angle for the lead rollout heading.
i.e 30° of bank angle
Start rollout 15° before desired heading.

To make a **6° change** in heading, use a standard rate turn then immediately level the wings.

To make a **3° change** in heading use ½ standard rate turn.

The diameter of the “cone of confusion” while passing over a VOR or NDB in NM is ½ the altitude in thousands.

Eg Altitude = 6000'
 $6000 \div 2 = 3 \text{ NM}$

Maneuvering speed $V_a = 1.7 \times V_{s1}$

V_a decreases 1% for each 2% reduction in weight

V_y decreases ½ to 1kt for each 1000' DA

V_y V_x and V_g (best glide) decrease ½ kt for each 100lbs under MGW

at gross weight. To calculate speeds for lighter weights, decrease the speed by half the percentage of the weight decrease. For example, flying a 3,000-pound-gross airplane at 2,400 pounds, a 20-percent reduction in weight, reduce the applicable speeds by 10 percent to hold the margins the same as at gross.

Much more to follow soon.....

What are the 2 most important things in flying??

The NEXT 2 things you are going to do.....

forecast, it means that the weather may become worse than forecast — especially if the temperature aloft is warmer than forecast. Higher temperature means the atmosphere can hold more moisture. More southerly and stronger winds mean there is a stronger than forecast low or front or trough to the west, heading your way (Northern Hemisphere only).

70 knots is 118 feet per second, and 60 is 101 fps. So if the approach speed should have been 60 knots and is 70, and if it takes five seconds to dissipate the extra speed, the airplane will have traveled about 550 feet in the float. No firm rule of thumb, but 10 knots extra on the approach speed usually uses about 500 extra feet of runway.

The air is conditionally **unstable** if the temperature drops more than 2° per 1,000 feet on ascent.

When the surface wind shifts to the north or northeast after passage of a cold front, that front may well be back as a warm front in a day or so.

To descend 500 feet per minute to the destination, start the descent 5 miles out for each 1,000 feet to be lost if the groundspeed is 150 knots. For each 30 knots in either direction, add or subtract 100 fpm. At 180 knots, you'd need 600 fpm; at 450 knots, 1,500 fpm.

A VOR course deviation indicator reflects 10° off course when full scale in either direction. One degree equals 1 mile when the aircraft is 60 miles from the station, so if you are 60 miles out with a full scale, you are 10 miles off course. If 30 miles out and a half scale (5°), you would be 2.5 miles off course.

Performance speeds — such as maneuvering, approach, and climb speeds — are often given in the POH only for operations

$$V_r = 1.15 \times V_s$$

$$TAS = IAS \text{ (kts)} + \frac{FL}{2}$$

$$\begin{aligned} FL \text{ 300, IAS} &= 240 \\ TAS &= 240 + 150 = 390 \text{ Kts} \end{aligned}$$

Flight Planning / Navigation

Best Cruise climb speed is the difference between V_x and V_y and add this to V_y .

$$\begin{aligned} \text{Eg } V_x &= 65, V_y \text{ 75} \\ \text{Difference is } &10\text{kts} \\ 10\text{kts} + V_y &75 \\ &=85\text{Kts} \end{aligned}$$

Enroute Wind Correction Angle — first find the Max Wind Correction Angle (WCA max) as if the wind were a direct 90° crosswind. For practical purposes assume max drift is at 60° to track

$$\begin{aligned} \text{WCA (max)} &= \frac{\text{Wind Velocity}}{\text{NM per minute}} \\ \text{Wind} &= 20\text{Kts} \\ \text{Airplane Speed} &= 120\text{Kts} \\ \text{WCA(max)} &= 20 \div 2 \\ \text{WCA(max)} &= 10^\circ \end{aligned}$$

Now find the Wind Correction Angle WCA for the actual forecast wind direction.

WCA = WCA(max) x sine of the wind angle

E.g. Wind 330° at 20 kts

Course 360°

Wind Angle = 10° x 0.5 (sine 30°)

WCA = 5°

Heading = 355°

OAT = 13° C ISA = 3° C

DA = 6000 + 120 (13-3)

DA = 6000 + 120 * 10

DA = 6000 + 1200

DA = 7200'

Weight has no effect on max glide range or ratio.

Weight has an effect on max glidespeed.

Reduce glide speed by 5% for each 10% decrease in gross weight.

Tailwinds increase glide range, Headwinds decrease glide range.

10° - 25° of flaps add more lift than drag; 25° - 40° flaps add more drag than lift.

Maximum glidespeed = Minimum Drag = Maximum endurance, remember this if low on fuel.

The radius of a standard rate turn in metres = TAS x 10

Most structural icing occurs between 0° to -10°

Dew point of 10° = Enough moisture for a severe thunderstorm.

The ability of the atmosphere to hold moisture doubles with each 11° Celsius temperature rise.

Difference in Dew point and temperature x 400ft is where you will find visible moisture. i.e. cloud base.

When the wind aloft is more southerly and stronger than

Estimation of Wind Drift and Groundspeed

To estimate drift for each 10Kts of windspeed that you are flying.

Maximum drift is when the wind is 90° to the track. For practical purposes assume max drift is at 60° to track

To estimate max drift assess the wind angle as a proportion of 60.

Airspeed	60 Kts	70 Kts	80 Kts	90 Kts	100 Kts	110 Kts	120 Kts	150 Kts
Max Drift for each 10kt of Wind	10°	9°	7°	6°	6°	5°	5°	4°

Examples:

Air Speed 100kts

Heading 360°

Wind 300° / 20kts

Wind Angle = More than 60°

100kts

360°

330° / 10

Wind Angle 30°
(½ of Max Drift)

Max Drift = 12°

3°

Quick Tips

On a **multi engine** aircraft – a 50% loss of thrust results in a loss of 80% of climb performance.

On an **ILS approach** – One dot on the Localiser is approximately 300ft at the outer marker. 100ft at the middle marker.

One dot on the glide slope is approximately 50ft at outer marker and 8ft at the middle marker.

ADF Flying – 1° deviation of the ADF needle is equal to 100ft per NM

Compass Flying – Overshoot North – Undershoot South
UNOS

Compass Flying - Accelerate North – Decelerate South
ANDS

Weight & Balance – An airplane will be more stable and stall at a higher airspeed with a forward CG location.

Weight & Balance – An airplane will be less stable and stall at a lower airspeed with an aft CG location.

Density Altitude increases or decreases 120ft for each 1°C that varies from ISA

$$DA = PA + 120 (OAT - ISA)$$

DA = Density Altitude

PA = Pressure Altitude

OAT = Outside Air Temperature

ISA = international Standard Temperature

E.g. PA = 6000'

To estimate Ground Speed

Angle of Wind	Up to 30°	45°	60°	75°	90°
Proportion of total wind on Nose or Tail	Max	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	Nil

Examples

Windspeed	20kts	10kts	20Kts
Wind angle	60°	60°	75°
Groundspeed	±10kts	± 5Kts	± 5kts
Timing =	±10 Secs	± 5 Secs	± Secs

Increase speed by 10% when flying into a headwind and decrease by 5% with a tailwind

For maximum TAS and Range, Load the airplane as close to the aft Centre of Gravity limit as allowable

Descent Planning

One in Sixty Vertical Navigation. One degree climb or descent angle closely equals 100' / Nm.

This is because 1 Nm in 60 Nm is also $6076' / 60 \text{ Nm} = 100' / \text{Nm}$

Glide Angle = 3°

Distance to Runway = 1 Nm

$3 \times 100' = 300\text{ft}$ Height above runway

To determine the NM distance to start a 3° enroute descent.

Divide the altitude to lose (in Flight Levels) by 3

$$\text{NM} = \frac{\text{Flight Level}}{3}$$

e.g. Altitude to lose = 6,000 (FL 60)
 $60 / 3 = 20$ nm to start descent

OR To determine the NM distance to start a 3° enroute descent.

Multiply to altitude to descend (in 1000's) by 3 and add 10%

$$\begin{aligned} 6 \times 3 &= 18 \\ \text{add } 10\% &= 1.8 \text{ (2)} \\ 18 + 2 &= 20 \text{ nm} \end{aligned}$$

For a 3° Rate of Descent (ROD) multiply your groundspeed by 5.

Descent Groundspeed = 120
 $120 \times 5 = 600$ fpm ROD

OR For a 3° Rate of Descent (ROD) take half your groundspeed and add a zero.

Descent Groundspeed
 $120 \times \frac{1}{2} = 60$
600 fpm ROD

Climb Planning

Add 1 minute to your flight plan for every 1000' climb to cruise altitude.

Cruise altitude = 8000'
Time to add = 8 mins to ETE

To find the Rate of Climb required (ROC) multiply the % gradient by the groundspeed.

$$\begin{aligned} \% \text{ Gradient} &= 3.3\% \\ \text{Groundspeed} &= 120 \text{ Kts} \\ 3.3 \times 120 &= 400 \text{ fpm} \end{aligned}$$

To find the Feet per Minute (FPM), multiply the gradient % by 60

$$\begin{aligned} 3.3 \% \text{ Gradient} \times 60 \\ &= 200 \text{ fpm} \end{aligned}$$

Approach & Landing

A 10% change in airspeed will cause a 20% change in stopping distance.

A narrow runway may give the appearance of being longer, a wide runway may give the appearance of being short.

A slippery or wet runway may increase your landing distance by 50%.

Use $V_{so} \times 1.3$ (V_{ref}) for approach speed over the threshold.

Plan to touchdown in the first $\frac{1}{3}$ of the runway or go around.

For each knot of airspeed above V_{ref} over the numbers, the touchdown point will be 100ft further down the runway.

For each 1000' increase in field elevation above Sea Level, stopping distance increases by 4%.