General Aviation Rules of Thumb

Standard Pressure, Temperature, and Lapse Rate

- Sea level standard pressure = 29.92" hg
- Standard lapse rate = -1" hg. for each 1000' increase in altitude
- Sea level standard temperature = 15°C / 59°F
- Standard Lapse Rate = -2°C / -3.5°F for each 1000’ increase in altitude

Take Off

- T/O distance increases 15% for each 1000' DA above sea level
- A 10% change in A/C weight will result in a 20% change in T/O distance
- If you don't have 70% of your take off speed by runway midpoint, abort the take off
- Subtract 10% ground roll for each 12 knots of head wind.
- Add 10% ground roll for each 2 knots of tailwind up to 10 knots.
- An upslope of 1% causes a 22% increase in ground roll at sea leve
- A 1% down slope only decreases the ground roll by 7%.

Climb

- Available engine HP decreases 3% for each 1000' of altitude above sea level
- Fixed pitch, non-turbo A/C climb performance decreases 8% for each 1000' DA above sea level
- Variable pitch, non-turbo A/C climb performance decreases 7% for each 1000' DA above sea level
- During each 1000' of climb, expect to see a loss of approximately 1” of manifold pressure
- During each 1000' of climb, expect TAS to increase 2%
- Level Off – Lead your level off by 10% of airplane’s rate of climb. e.g. – 500'/minute rate of climb; lead level off by 50'
- Pressure Altitude – Set A/C altimeter to 29.92 and read PA from the altimeter
- DA increases or decreases 120' for each 10°C the temperature varies from standard temperature
- Standard temperature (ISA) decreases 2°C Per 1000' increase in altitude
- TAS increases 2% over IAS for each 1000' above sea level

Maneuvering

- Maneuvering speed Va = ~1.7 x Vs1
- Va decreases 1% for each 2% reduction in gross weight
- Vx increases ~ ½% for each 1000' increase DA
- Vy decreases ~1% for each 1000' increase DA
- Vy, Vx and Vg decreases ~1/2 Knot for Each 100 pounds Under MGW
- Vr = ~1.15 x Vs
- V speeds change with wgt $(\sqrt{W1 / Wg})$ x V. Where: W1=current wgt, Wg=Max Gross Wgt, V=Published V-speed
- Standard Rate Turn vs Bank -- (AS/10)+5 or 170K = 22°

Cruise

- The width of one finger = ~5NM on a sectional chart (average person)
- Tip of the thumb to the knuckle = ~10NM on a sectional chart (average person)
- Cruise fuel consumption of a non-turbocharged A/C engine = ~1/2 the rated HP/10
- Cruise climb airspeed should be reduced by 1% for each 1000' of climb
- To determine a relatively proficient cruise climb speed, take the difference between Vx and Vy and add that sum to Vy. For example, if Vx = 65 and Vy = 75, the difference is 10KTS. Add 10KTS to Vy (75KTS) and you have a cruise climb of 85KTS

Descents

- 3 deg glide path – Ground speed / 2 then add zero (100 knots ground speed = 100/2 + zero = 500fpm
- 3 deg glide path – Ground speed x 5 (100x5=500fpm)
- Be level and at glide slope speed at OM then lower nose 3 degrees.
- If instrument approach speed is the same as missed approach speed, it will make the missed approach easier.

Landing

- Final Approach Speed = 1.3 x Vso. Also known as Vref
- A tailwind of 10% of your final approach speed increases your landing distance by 20%; A headwind of 10% decreases landing distance by 20%
- A 10% change in airspeed will cause a 20% change in stopping distance
- A slippery or wet runway may increase your landing distance by 50%
- For each knot above Vref over the numbers, the touchdown point will be 100' further down the runway

- For each 1000' increase in field elevation, stopping distance increases 4%
- Every 2.5 knots over POH speed on landing will add about 10% to the landing roll. So if less flaps adds 5 knots, then landing roll increases 20%A 10 Reduction in Approach Angle Will Increase Landing Distance 13%
- 10° – 25° of flaps add more lift than drag; 25° – 40° flaps add more drag than lift

Maximum Glide

- Weight has no effect on max. glide range or ratio
- Weight does have an effect on max. glide airspeed
- Reduce glide speed 5% for each 10% decrease in gross weight
- Tailwinds increase glide range; headwinds reduce glide range
- With a 10, 20 or 30 KT tailwind, reduce glide speed by 4, 6 or 8 KT, respectively
- With a headwind, increase glide speed by 50% of the headwind component
- Maximum Glide = Minimum Drag. Low on fuel? Fly an airspeed equal to maximum glide to achieve maximum endurance

Other

- Rollout from a turn – Lead your rollout by an amount equal to ½ your bank angle. e.g. – 30° angle of bank; lead rollout by 15° prior to new heading
- The radius of a standard rate turn in meters = TAS x 10
- Most structural icing occurs between 0°C to –10°C
- Deviate 10-20 miles upwind around thunderstorms; Don't fly under anvil
- Hail may be found 10 miles or more underneath the anvil
- Dew point of 10°C or 53°F = Enough moisture present for severe thunderstorms

Effects on takeoff and landings:

Runway Slope

An uphill runway increases the take off run and a downhill runway increases the landing roll. A upslope of 2% adds 10% to your take off distance and a downslope of 2% decreases it by some 10%. So everything else being equal: take off downhill and land uphill. It is as simple as that. Be prepared that local rules might require otherwise.

Grass runways

Grass, snow or soft grounds increase the rolling friction and ground runs will take longer than on paved runways. Dry grass can increase take off runs by some 20%. Long wet grass can increase this number again depending on the length of the grass and how wet it is. Aircraft wheel size and the type of aircraft can play a role too.

Long grass

Taking off in long wet grass on a short runway could not be advisable. Even more so when puddles of standing water are present shortly after a rain shower, acceleration through water is very sluggish.

Landing on such a runway can increase the ground roll due to the fact that the brakes are not as effective as on a dry runway. Grip of the tires on wet grass is much less, on long wet grass it could mean a very large increase of ground roll.

Rough runway surface

Runways with uneven surfaces also increase take off distances, plus that the nose gear takes a beating from all those bumps. The soft field technique helps to prevent against any damage to the nose gear.

Runway contamination

At some point in time runways will be contaminated with rain, snow or slush. You will have to allow for these circumstances as the result can be directional control problems, reduced braking action (or hydroplaning) and more drag on take-off.

When show depth is more than 2" or if water, slush or wet snow covers the runway to more than 1/2", take-off is not recommended. And operating from a slippery runway with a crosswind more than 10 kts, or with a tailwind, take-off should also not be attempted.

Accelerated Stop Distance Available (ASDA)

When calculating the take-off distance with all known factors one should also account for the accelerated stop distance available, this should be at least twice the take-off distance on a paved runway and 2.6 times the take-off distance on a grass runway.

Aircraft weight at the beginning of the take-off run will have a great influence on the ASDA and therefore you need to know the TORA (Takeoff run available) of the runway.

Landing performance

Any water (heavy rain showers), snow or slush can and will have an adverse effect on the landing distance and the danger of hydroplaning (with no wheel braking and loss of directional control) is very real and has led to loss of life in the past already.