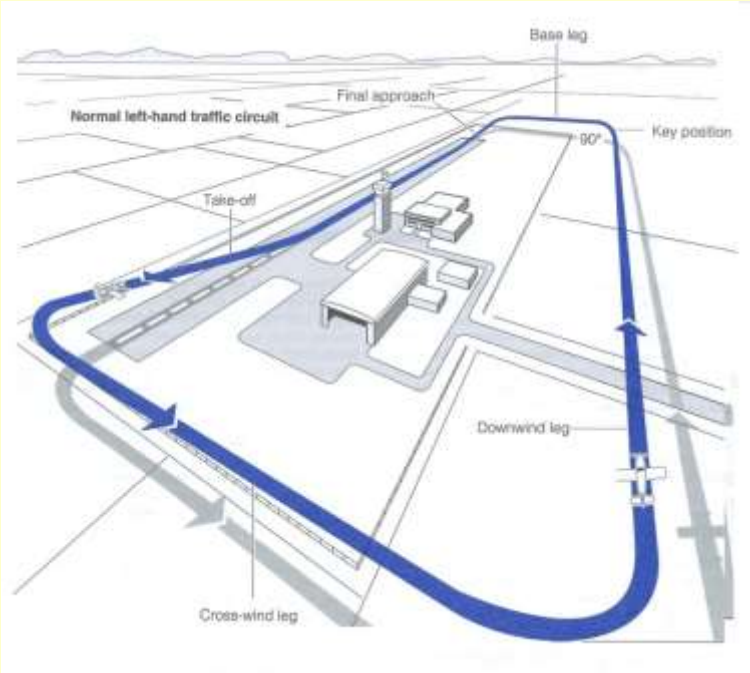
Airfield Traffic Patterns

- Flying the Circuit -

Version 2



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An **airfield traffic pattern** is a standard path, or series of **legs**, followed by aircraft when taking off or landing, while maintaining visual contact with the airfield.

The circuit
At an airport, the pattern, or **circuit** is a standard path for coordinating air traffic. It differs from "straight-in approaches" in that aircraft using a traffic pattern remain close to the airport. Patterns are usually employed at small general aviation (GA) airfields and military airbases. Many large controlled airports avoid the system, unless there is GA activity as well as commercial flights. However, some kind of a pattern may be used at airports in some cases, such as when an aircraft is required to go around — but this kind of pattern at controlled airports may be very different in form, shape and purpose to the standard traffic pattern as used at GA airports.

Why are circuits necessary?
To ensure that air traffic flows into and out of an airport are in an orderly manner, an airfield traffic pattern is established. The pattern is appropriate to the local conditions, including the direction and placement of the pattern, the altitude at which it is to be flown, and the procedures for entering and leaving the pattern. Unless the airport displays approved visual markings indicating that turns should be made to the right, the pilot should make all turns in the pattern to the left.

When operating at an airport with a control tower, the pilot receives by radio a clearance to approach or depart as well as pertinent information about the traffic pattern. If there is no control tower, it is the pilot's responsibility to determine the direction of the traffic pattern, to comply with the appropriate traffic rules, and to display common courtesy toward other pilots operating in the area.

The pilot is not expected to have intimate knowledge of all traffic patterns at all airports, but if familiar with the basic rectangular pattern, it will be easy to make proper approaches and departures from most airports, regardless of whether they have control towers. At tower controlled airports, the tower operator may instruct pilots to enter the traffic pattern at any point or to make a straight-in approach without flying the usual rectangular pattern. Many other deviations are possible if the tower operator and the pilot work together in an effort to keep traffic moving smoothly. It must be recognized that jets or large, heavy aircraft will frequently be flying wider and/or higher patterns than lighter aircraft and in many cases will make a straight-in approach for landing.

Compliance with the basic rectangular traffic pattern reduces the possibility of conflicts at airports where air traffic is not being controlled by a control tower. The majority of midair collisions occur in the vicinity of uncontrolled airports, under visual flight rules (VFR) weather conditions. It is imperative then, that the pilot form the habit of exercising constant vigilance in the vicinity of airports even though the air traffic appears to be light.

Let’s hope this doesn’t happen to you!

The circuit

The airfield circuit consists of five legs – **upwind** (or take-off), **crosswind**, **downwind**, **base** and **final**. Flown correctly, the circuit is a symmetrical rectangular pattern. See Figure 1.

Circuit height varies according to the type of aircraft being flown as indicated below:

1500 feet AGL High-performance aircraft with circuit speed above 150 knots (jets, turbo props)
1000 feet AGL Typical general aviation aircraft, 55 – 150 knots (typical single engine piston aircraft)
500 feet AGL Helicopters and ultralights, less than 55 knots.

For the typical single-engine training aircraft such as the Cessna 172, the circuit height is 1000 feet above ground level (AGL).

Unless otherwise indicated by air traffic control, the standard direction of flight is to fly a left-hand turn circuit pattern. This is particularly important at uncontrolled airports.

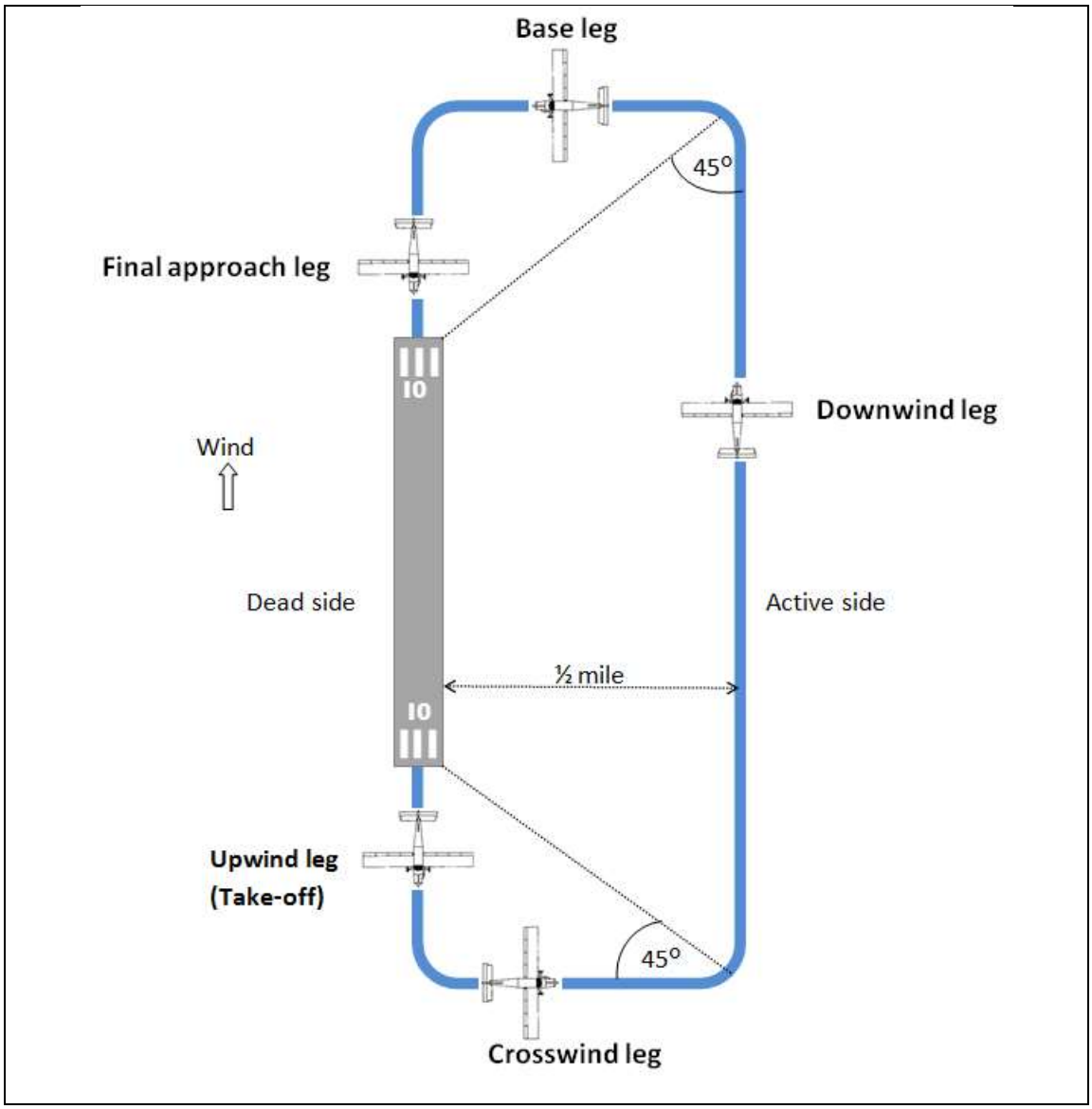


Figure 1: The standard traffic pattern for a circuit

Entering the circuit pattern

When arriving at an uncontrolled airfield a standard traffic pattern should be established. The standard pattern always involves **left turns** unless otherwise specified as, for example, in the case of parallel runway operations. A radio call is required before entering the circuit to announce your intentions.

The standard circuit pattern entry is to join the downwind leg, midfield at 45 degrees, at circuit height, giving way to aircraft already on the downwind leg. Non-standard entries are not recommended, but may be used. Aircraft entering from the dead side of the circuit should join crosswind between midfield and the departure end of the runway, at circuit height, to join midfield downwind, giving way to aircraft on downwind. For straight-in approaches you must be established in finals not less than 3 miles from the runway threshold. You must broadcast "on finals" at 3 nm. With base leg entries you must ensure you can safely join the leg and give way to other aircraft in the circuit.

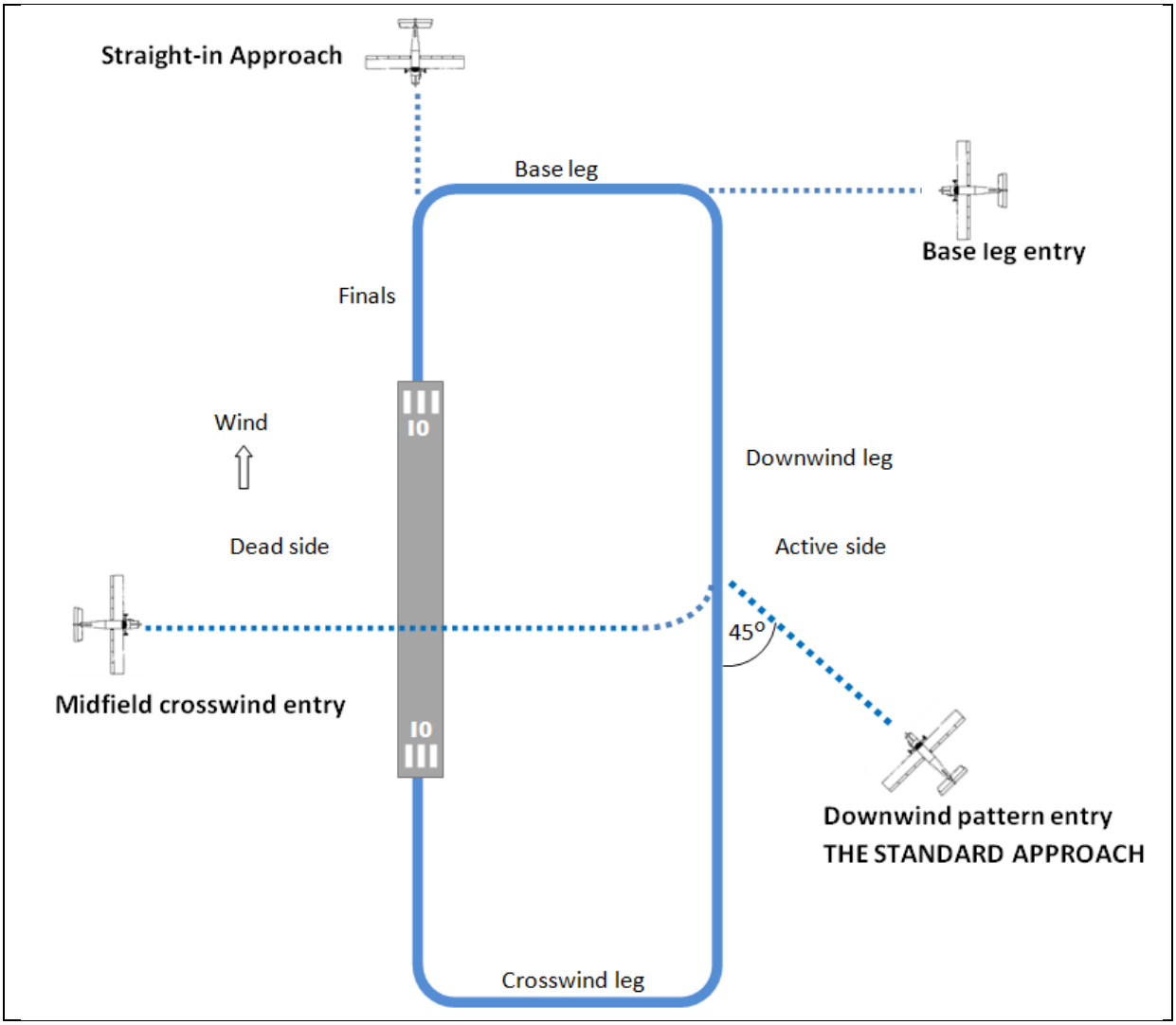


Figure 2: Circuit pattern entry possibilities

Flying the circuit

The following procedures apply to a light aircraft such as the Cessna 172, engaging in a standard left traffic pattern, at a circuit height of 1000 feet AGL.

The Take-off Leg

After you complete your runup checks (TMATMAT) line up on the assigned or active runway. The active runway is the one where you take off into the wind since lift is dependent on airflow over the wing from the leading edge flowing over the trailing edge. The wing doesn't care whether the lift is from wind blowing over it, or from the power of the engine moving the aircraft forward.

- Release the brakes
- Apply full power through about 3 seconds. Never slam the throttle to its maximum. Anticipate with right rudder for slipstream and gyroscopic effects that try to turn off the centre-line to the left.
- On the roll, pull the yoke back slightly to keep the nose wheel light to prevent "wheel barrowing" of the plane and stress on the nose wheel.
- Keep a check on your engine instruments to ensure you have full power. It should be 2600 RPM.
- At 65 KIAS rotate, and wait for the aircraft to fly itself off the runway. This is where the relevance "Trim set for take-off" in checklists (TMPFISH)come into play.
- As soon as you are airborne, release the back pressure a little to build up airspeed relying on the ground effect to keep you off the runway
- When you reach your rate of climb (ROC) speed, rotate more for your climb.
- Trim for climb to maintain 75 to 80 KIAS.
- By 300 feet AGL, do your after take-off checks (FLARE).
- At 500 feet AGL, retract the flaps – if set.

The Crosswind Leg

- At 500 feet AGL begin a 15° climbing turn into the crosswind leg, maintaining airspeed and pitch.
- Turn until you are flying at a 90° angle to the runway.
- Keep climbing until you have reached a 45° angle to the runway from your present position. This is when it is time turn onto the downwind leg.

The Downwind Leg

- You may reach your circuit altitude of 1000 feet AGL before your turn to downwind, in which case do a normal medium 30° turn into downwind.
- If you are still climbing to your circuit altitude of 1000 feet AGL when it is time to turn into downwind, then perform a climbing turn as before.
- If you reach 1000 feet AGL during your turn, just lower your nose to your medium turn attitude to remain within the white arc on the airspeed indicator in anticipation of soon needing to lower flaps, and roll out of the turn when parallel to the runway on downwind.
- Midway along the leg, do your downwind checks (FUMPS) and radio call (if relevant).
- Deploy flaps 10°. Trim as needed.
- Hold off for wind as needed throughout the circuit so you fly a nice rectangular pattern over the ground.
- Things start happening quickly from here, so full attention is required.

Judging your distance

A good rule of thumb so that you know you are about the right distance from the airfield, is that the airfield must appear about two-thirds up your Cessna's strut. If you are in a low wing aircraft such as a Piper Cherokee, then the airfield must be seen about two-thirds up from the wing root.

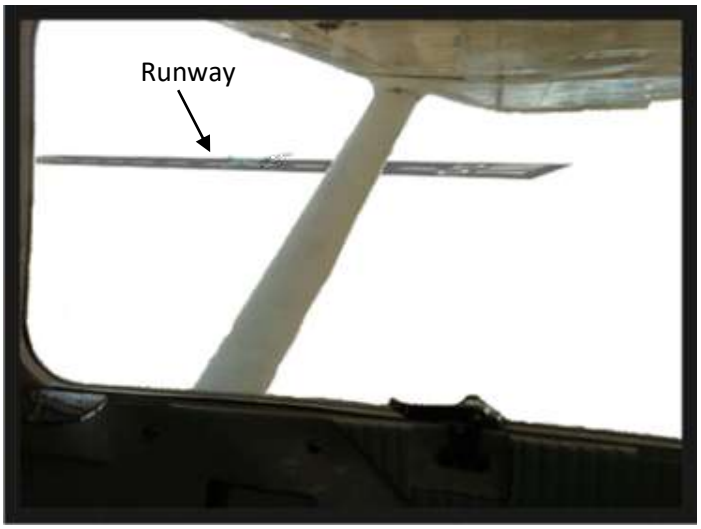


Figure 3: The correct distance from the airport

Another good rule of thumb exists on when to turn from downwind to the base leg. Some tricky changes of view to the rear are needed here using the POV switch which will only get better with practice.

You turn when you look back to see a 45° angle between your current position and the end of the runway on which you will be landing. What you see at this position should look something like in Figure Y below.

Figure 4: Downwind at YMAV Avalon, about to turn base

The Base Leg

- At the end of the downwind leg, when you reach the 45° angle point to turn, as described above, do a medium 30° turn onto base.
- Extend flaps to 20°, decrease speed to 80 KIAS, trimming as needed, 2300 RPM
- Descend to 500 feet at 400 Feet per minute (FPM).

The Final Leg

Flying the leg

- When you reach 500 feet AGL, you should be at the point to make your turn onto the final leg.
- If you flying circuits at a regular airfield, select a point of reference to mark your turning point.
- Do a normal 30° turn to line up with the centre line of the runway.
- Deploy full flaps, decrease speed to 75 KIAS, trimming as needed, 2200 RPM.
- Maintain a 3° nose down attitude right down to the runway.

Points to remember

There are two main points to remember here:

1. Your AIRSPEED is controlled by your aircraft's ATTITUDE (elevator)
2. Your RATE OF DESCENT is controlled by your POWER setting (throttle)

This means: POWER + ATTITUDE = PERFORMANCE

Since everything is inter-related, changing the power setting will affect the airspeed, so a small attitude adjustment would be required as well. Conversely, changing the airspeed will affect the rate of descent, so a power adjustment may be required.

Your aim is to control your airspeed and rate of descent so you fly down a smooth "path" all the way to the runway, at an angle of about 3°.

When you add flap on final approach, it is usually drag flap. Doing this will slow your aircraft down and increase your rate of descent resulting in a steeper approach and falling short of the runway threshold. To counteract this, you need to lower your nose to keep up your speed, or accept a slower approach speed, and apply power to reduce your rate of descent so you will actually reach the airstrip.

You want to see the runway numbers 1/3 up from your nose cowling in your windscreen the whole way down. The runway numbers must stay in the same relative position on your windscreen the whole way to the runway, they must just get bigger as you get closer. Judge the slop by eye-balling the runway as in the pictures below.

Source: PPL Flight Training.com

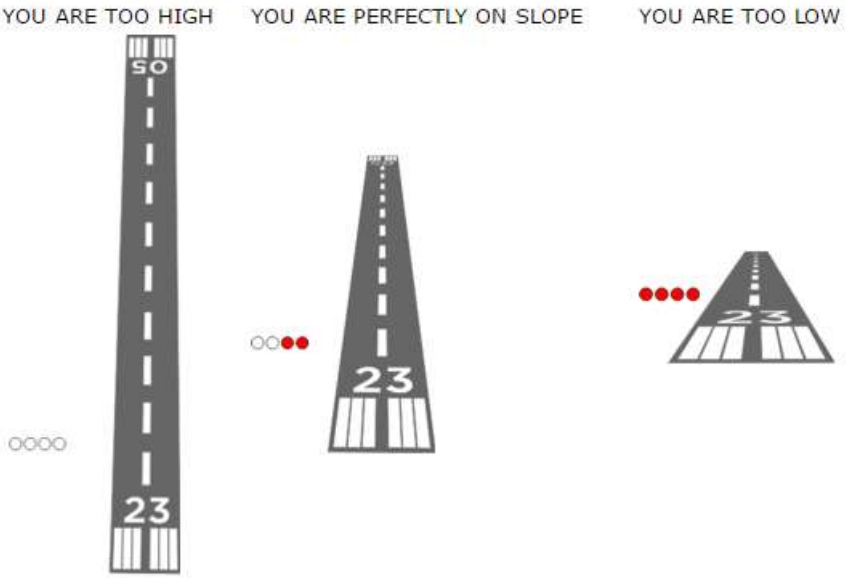
PAPIs

PAPI's are "Precision Approach Path Indicators". They are designed for to assist pilots in poor visibility such as instrument conditions and for night landings; but are also useful in good weather. PAPPIs are generally found in flight simulator platforms at airports that have paved surfaces.

They are made up of four lights, side by side, generally on the left-hand side of the runway. Depending on the angle you are approaching at, they show red or white. See the diagram below for an explanation of how they work.

○○○○	You are MUCH too high on your approach
○○○●	You are still too high on your approach
○○●●	You are perfectly on your approach slope
○●●●	You are too low on your approach
●●●●	You MUCH too low on your approach

Judge the slope by eye-balling the runway as seen in the pictures below:



The Landing

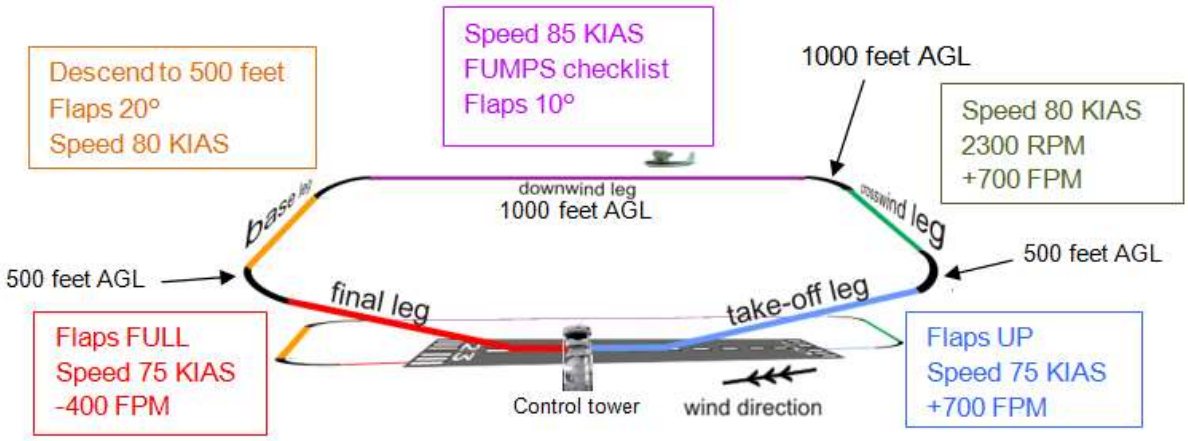
To **flare** means bringing the aircraft into a level attitude in preparation for landing, with reduced in or no power, then coming all the way back on the control column. This can happen quite rapidly.

So, from a good approach, when coming up over the numbers:

1. Flare to fly level with the runway. Shift your gaze to the end of the runway so that your peripheral vision can orientate you and pick up when your aircraft begins to sink.
2. If you haven't already done so, close your throttle. In 1 to 3 seconds you will begin to sink. The rate at which this happens depends on your speed and flap settings (inertia and drag).
3. When you begin to sink, the trick is to catch it, as though you are trying to maintain your current altitude while entering a stall.
4. Then, usually about a second later, you need to start flaring all the way back quite smartly. You want to hear the stall warning here, then you know you are touching down at your slowest

possible speed. In effect, you are trying to remain airborne, but since you have no power to assist in creating lift, your aircraft will stall, and be gently "caught" by the ground, the neat, smooth runway surface will make this a smooth transition.

The diagram below summarises the procedures for undertaking a circuit pattern.
If you want to do a touch-and-go, after all three wheels are on the ground, retract the flaps (if used) apply full power and do it all over again.



Practice, practice, practice

It would be highly unlikely that you get your landings right in your first few hours of flying. It takes a considerable amount of practice to get it right; and even after that you are likely to mess it up from time to time. This particularly applies to flying the base and final legs. It is therefore recommended that you spend time doing circuits at your favourite to hone the skills required for producing a "greaser" of a landing. It's a good idea not to select a busy major airport, but a quieter small airport that is simple to define and not cluttered with a whole lot of infrastructure and air traffic.

Good luck and happy landings!

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