Pilot Career Solutions

Driving to flying

The flying experience, taught through the car, one lesson at a time.
Fifteen lessons from safety first to owning the machine,
each one tied to the FAA handbooks by chapter and page.

November 2026 edition

Read it, rehearse it in the car, then fly it.

Free. Print it, share it, take it on your next drive.
Pilot Career Solutions teaches in ground and simulator settings only, never in a real aircraft.

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WELCOME ABOARD

You already know more about flying than you think.

Every time you drive, you check the machine, read the gauges, judge the weather, plan the route and share a busy road with everyone else. Pilots do all of it too, with different names. This guide shows you the airplane hiding in your car: fifteen short lessons, free, to read and rehearse alongside your first flights.

1

Do it in the car

Something you do in, beside, or as a passenger in a car you already know.

2

Find the airplane

See the same idea in a training airplane, with the FAA's own book open to the page.

3

Teach it back

Explain it to someone in your own words. If you can teach it, you've got it.

A TASTE OF WHAT'S INSIDE

- **LESSON 4** Feel lift in your hands when you pass a semi on the highway.
- **LESSON 7** Fly the traffic pattern at a four-way stop.
- **LESSON 9** Plan a hundred-mile road trip on a real pilot's nav log, then drive it.
- **LESSON 12** Talk on the radio the way drivers take turns at a stop sign.

Safety first: the driver only drives.

Nothing here takes your eyes or hands off the road: parked, in the driveway, from the passenger seat, or said aloud as you drive.

The full safety note is on the next page, "Before you start".

BEFORE YOU START

Before you start: how it works, and staying safe

Remember learning to drive?

Picture it, or picture the day ahead of you. Most people remember a high-stress car and a voice telling them things they were never briefed on: stop at the stop sign, no, the other one, who has the right of way, why are you in this lane. "Adjust your mirrors" was the whole ground school. Nobody sat down first with the state's driver's manual and the owner's manual, taught the signs and the priorities and the switches, and drew the route on a map before the car moved. It was on-the-job training in the worst classroom there is, and it worked only because cars are forgiving and the road has a shoulder. The airplane is less forgiving, the sky has no shoulder, and the classroom costs a lot of money an hour with an instructor in the right seat. So the ground lesson happens here, for free, in the car, alongside your first flights rather than ahead of them. Read, rehearse, fly.

Foundations, alongside the first flights

Nothing in this guide is a gate. You do not finish it before your first lesson, and no flight school will ask whether you did. Go feel the airplane; then read the lesson that matches what you just flew, rehearse it in the car during the week, and the next hour in the airplane is spent on flying instead of on words. The syllabus and the workbook this guide feeds into say the same thing: the ground work runs alongside the flying, never ahead of it.

How each lesson is built

Objective. One sentence: what you will be able to do or explain when the lesson is done.

Do this. Steps you can do in a car you drive or ride in, or in the driveway with the engine off, with no airplane and no money.

Similarities. The road on the left, the airplane in the middle, and on the right the thing to notice: where the two match exactly, and where they break.

What the books say. A table of references: the Pilot's Handbook of Aeronautical Knowledge, the Airplane Flying Handbook (AFH), the Airman Certification Standards (ACS: what the examiner will test, by task and element code), and the regulations (CFR). Each gives the chapter and section, the page number printed in the book, and the page number in the free PDF, linked so it opens on that page in most browsers.

Teach it back. Explain the lesson to someone else in your own words, with your hands in your lap. If you can teach it, you have it.

Safety, and who is responsible

Everything in this guide happens in or around a car, on public roads or in a driveway, under your state's laws, with a licensed driver at the wheel: you, or whoever drives you. **The driver drives; the navigator reads, writes, and watches the clock.** Nothing here asks you to read a map, write on a log, look at a phone, or take a hand off the wheel while the car is moving; alone, you pull over. Do the exercises only in a safe and controlled setting: a calm day, familiar roads, within the speed limit, never while passing, merging, or in traffic, and never at the expense of driving the car. Work around a parked car with the engine off and cool, the parking brake set, on level ground, outdoors, and with the area clear of people. These are educational exercises and nothing more. Pilot Career Solutions does not supervise them and accepts no liability for any accident, injury, damage, or citation that arises from them. If an exercise ever competes with driving, the exercise loses. Pilot Career Solutions teaches in ground and simulator settings only, never in a real aircraft; the airplane parts of this guide are things to read about and rehearse, then learn with an instructor at a flight school.

If you do not drive yet

Nothing in this guide needs a license. Plenty of pilots fly before they drive: you can solo an airplane at sixteen and hold a private pilot certificate at seventeen. If you are learning to drive now, do the exercises with the adult who supervises you. If you are not old enough yet, take the navigator's seat, which is the harder job and the one the airplane needs most, and do the driveway steps with an adult. Wherever this guide says 'the driver', read it as whoever is driving, and 'you' as the one who is learning.

How to read a reference

"Pilot's Handbook of Aeronautical Knowledge, Chapter 7, Anti-Ice and Deice Systems, p. 7-40, PDF p. 200" means: in the printed book (or the page number printed at the bottom of the page), turn to 7-40; in the free full-book PDF from faa.gov, go to page 200 of the file. They differ because the PDF counts the cover and front pages. Most links open the full-book PDF on that page; the Airplane Flying Handbook links open the FAA's chapter files instead, so their PDF page ("Ch. 2 PDF p. 5") counts from the start of that chapter's file. The FAA re-issues its books, so when a new edition comes out, the chapter and section names stay the best guide and the page numbers move.

Rows marked MORE or LATER are optional: the FAA book one click deeper (MORE), or one you will meet at a later certificate (LATER, with the rating named). None of them is required for anything in this guide or in the syllabus it feeds. Every page number in this guide, core and optional, was checked against the FAA's own PDFs on October 26, 2026.

How to read a claim. Where this guide says something that is not from an FAA book or a regulation, it says whose it is: **Industry data** (a number with a source, such as the Cessna 172N figures from its 1978 POH), **Industry practice** (how flight schools and airlines do it), **PCS analysis** (our reasoning), or **Captain's take** (the author's opinion). An FAA handbook or the AIM is guidance; a regulation or an ACS element is a requirement.

1

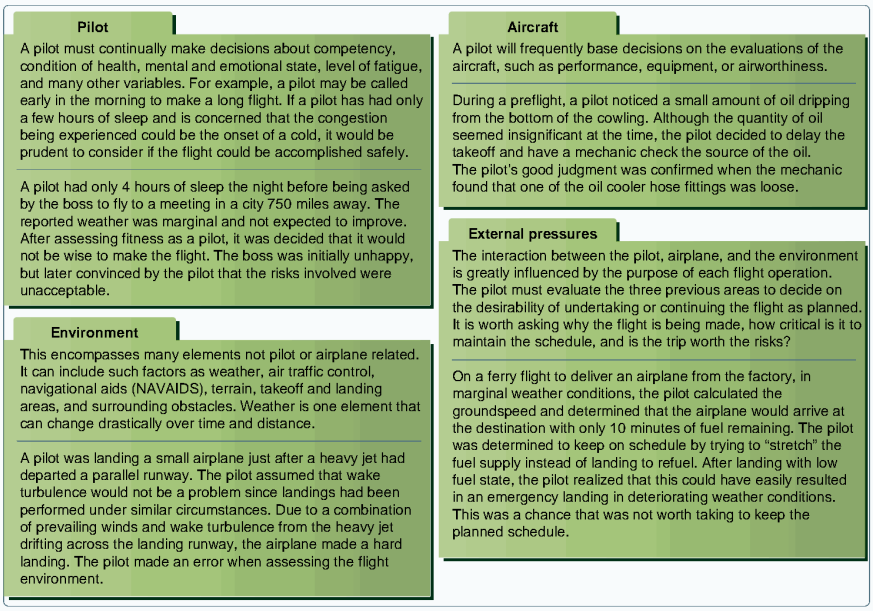
Safety first: fit to drive, fit to fly, and the decision to go

Every lesson in this guide, and every flight you will ever make, starts here: am I fit, is the machine fit, is the day fit, and is anyone pushing me. Pilots learn it as a set of named checklists. Drivers already live it, mostly without the names.

OBJECTIVE

Name and use the IMSAFE and PAVE checklists, the 3P model (Perceive, Process, Perform, with CARE and TEAM), and the five hazardous attitudes with their antidotes: first as the FAA teaches them for the airplane, then on every drive this week.

THE RISK STEP All four PAVE letters and all three Ps: this lesson is the spine the other fourteen hang on.



PAVE: the four things to check before every flight, the same four that decide a drive. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 2-7. Public domain.

The aviation version first

The FAA treats good judgment as a skill with steps, not a personality trait, and it gives you the steps. **IMSAFE** is the pilot's own fitness check before every flight: Illness, Medication, Stress, Alcohol, Fatigue, Emotion. **PAVE** sorts the risks of a flight into four piles: the Pilot in command, the Aircraft, the enVironment (weather, terrain, airports, daylight), and External pressures (the meeting, the passengers, the sunk cost of the rental). The **3P model** is how you use them: **Perceive** the hazards (with PAVE), **Process** them by asking what could go wrong (with CARE: Consequences, Alternatives, Reality, External factors), and **Perform** by choosing what to do about each one (with TEAM: Transfer, Eliminate, Accept, or Mitigate), then do it again, because the situation keeps changing. The **five hazardous attitudes** are the ways good pilots talk themselves into bad decisions, and each one has an antidote you say to yourself out loud.

HAZARDOUS ATTITUDE	WHAT IT SOUNDS LIKE	ON THE ROAD	IN THE AIRPLANE	THE ANTIDOTE
Anti-authority	"Don't tell me."	The speed limit is for other people; the no-phone law is for bad drivers	The weather minimums, the checklist, the instructor's limits are for someone else	Follow the rules. They are usually right.
Impulsivity	"Do it quickly."	Late for work: the yellow light you run, the lane you cut into, the seat belt "after I back out"	The rushed preflight, the skipped checklist, the takeoff before the engine is warm	Not so fast. Think first.
Invulnerability	"It won't happen to me."	One text at sixty miles an hour; one more drive while tired	One more leg with the fuel low; one more mile into the lowering clouds	It could happen to me.
Macho	"I can do it."	Beating the light, racing the merge, showing a friend what the car can do	Showing a friend what the airplane can do, low; taking off in a crosswind beyond your skill	Taking chances is foolish.
Resignation	"What's the use?"	Stuck behind the truck in the storm: "nothing I can do," so you stop driving defensively	In an emergency, stopping flying the airplane and letting it happen	I'm not helpless. I can make a difference.

The example: you are late for work

Perceive. The clock says you will be ten minutes late. Notice what comes with it: the quicker pulse, the urge to make up time, the voice that says the yellow light is long enough. That urge is **impulsivity**, and the clock is an **external pressure**, the E in PAVE.

Process (CARE). Consequences: ten minutes late is an awkward conversation; a crash is everything. Alternatives: call or text before you start the car, take the route with fewer lights, accept the ten minutes. Reality: driving faster saves about two minutes on most commutes. External factors: the boss, the meeting, the people in the other cars.

Perform (TEAM). Eliminate the pressure you can (send the message while parked), mitigate the rest (leave the following distance, drive the limit), and say the antidote out loud: "Not so fast. Think first." Late is a schedule problem. A crash is not.

In the airplane the same pressure has its own name, get-there-itis, and it is in the FAA's decision-making chapter for a reason: it shows up again and again in accident reports. The fix is the same in both seats. Decide before you leave what would make you stop, and then honor it.

The habits you already have, named

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
The two-second following distance	Margins: fuel beyond the reserve, altitude beyond the minimum, airspeed beyond the stall, weather beyond the legal floor	Exact match. Margins are the whole of safety, and they are chosen in advance, not found in the moment.
"Aim high in steering": look far down the road	The scan, and thinking two steps ahead: where will I be in two minutes, and what will I need to have done by then	Exact match.
Road rage, tailgating, the driver who has to get there first	The hazardous attitudes: anti-authority, impulsivity, invulnerability, macho, resignation. Each has an antidote you say to yourself, and they are on the knowledge test	Exact match. Watch other drivers for a week and you will see all five.
Drunk driving	Eight hours from bottle to throttle, no flying with a blood alcohol of 0.04 or above or while impaired by anything (91.17)	Stricter than the road, for the same reason the road rule exists.
Phone in hand	The sterile flight deck: no unnecessary conversation during taxi, takeoff, approach and landing. Airlines require it, and the Pilot's Handbook of Aeronautical Knowledge recommends it to every pilot (Chapter 2, p. 2-25)	Exact match.
Driving tired	IMSAFE: Illness, Medication, Stress, Alcohol, Fatigue, Emotion, asked before every flight	Exact match, made into a checklist so it actually gets asked.
The passenger who says "just go, it will be fine"	Passenger pressure, with a name and a place in the FAA's decision-making chapter	Exact match. The pilot in command answers to the regulations, not to the back seat.
At 70 mph you can stop in a few hundred feet	You cannot stop. You can only decide earlier	The break that all the others come from.

DO THIS

1. Before every drive this week, parked, before the engine starts, run IMSAFE out loud: Illness, Medication, Stress, Alcohol, Fatigue, Emotion. If one of them is a yes, decide what you will do about it before you go: someone else drives, you wait, or you go with a plan.
2. For one real trip, write PAVE on a card, one line per letter: you, the car, the route and the weather, and whatever is pushing you to go. That card is the first page of every flight you will ever plan.
3. Keep a seven-day threat log (one threat per drive and what you did about it), then name which hazardous attitude, if any, you caught in yourself or in another driver. You will see all five in a week.
4. The next time you are running late, say "Not so fast. Think first," send the message before the car moves, never while it is moving, and drive the limit. Notice how little time hurrying would have saved.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 2, Aeronautical Decision-Making: Hazardous Attitudes and Antidotes (Figure 2-4)	p. 2-5	PDF p. 44
Pilot's Handbook of Aeronautical Knowledge	Chapter 2: the IMSAFE checklist and The PAVE Checklist	p. 2-8	PDF p. 47
Pilot's Handbook of Aeronautical Knowledge	Chapter 2: Perceive, Process, Perform (3P) Model	p. 2-15	PDF p. 54
Pilot's Handbook of Aeronautical Knowledge	Chapter 2: the CARE checklist (review hazards, evaluate risks) and the TEAM choices	p. 2-16	PDF p. 55
Pilot's Handbook of Aeronautical Knowledge	Chapter 2: External Pressures (get-there-itis, the passengers, the schedule)	p. 2-9	PDF p. 48
Pilot's Handbook of Aeronautical Knowledge	Chapter 2: Single-Pilot Resource Management, including 'use a sterile flight deck'	p. 2-25	PDF p. 64
Airplane Flying Handbook	Chapter 2, Ground Operations: Risk and Resource Management (hazard, risk, SRM, ADM; the ADM heading is on 2-14)	p. 2-12	Ch. 2 PDF p. 12
ACS	Area I, Task H, Human Factors: PA.I.H.K1 (stress, fatigue, and the rest), K2-K3 (alcohol and drugs), K4 (ADM), R2 (hazardous attitudes)	p. 8	PDF p. 16
ACS	Area II, Task A, Preflight Assessment: PA.II.A.K1, pilot self-assessment	p. 11	PDF p. 19
ACS	Appendix 2, Safety of Flight: Aeronautical Decision-Making, Risk Management, CRM and SRM, assessed throughout the practical test	p. 75	PDF p. 83
14 CFR 91.3	Responsibility and authority of the pilot in command	-	eCFR
14 CFR 91.17	Alcohol or drugs: 8 hours, 0.04, or impaired	-	eCFR
14 CFR 61.53	Prohibition on operations during medical deficiency (paragraph (b) applies even without a medical certificate)	-	eCFR
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 3, Identifying Hazards: the five hazardous attitudes, with the example of a pilot named Steve (pp. 3-2 to 3-3)	p. 3-2	PDF p. 20
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 1, Introduction to Risk Management: a real accident (a failed vacuum pump) worked through PAVE	p. 1-2	PDF p. 11
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 3: the PAVE checklist and a risk assessment matrix worked on one flight (pp. 3-10 to 3-11)	p. 3-10	PDF p. 28
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 6, Threat and Error Management: what the word 'threat' means in your seven-day threat log	p. 6-1	PDF p. 44
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Appendix B, Risk Management Tools: PAVE, the FRAT, the matrix, 3P, CARE, TEAM and DECIDE on four pages	p. B-1	PDF p. 60
Pilot's Handbook of Aeronautical Knowledge MORE · PRIVATE	Chapter 2: the 5 Ps (plan, plane, pilot, passengers, programming), a second way to run the same check at set points in a flight	p. 2-13	PDF p. 52

TEACH IT BACK

Tell a passenger the five hazardous attitudes and their antidotes, using one story from your own driving for each. Then run IMSAFE and PAVE on the trip you are about to make together, out loud, before the car moves.

YOUR NOTES

2 The owner's manual: limitations, warning lights, and the engine

The owner's manual is a Pilot's Operating Handbook that nobody reads. This lesson reads it the way a pilot reads a POH: the limitations first, then the warning lights, then the engine.

OBJECTIVE

Make a written list of your car's limitations from its owner's manual and its door-pillar placard, identify every warning light with the ignition on, and describe the engine; then find each of those things in the airplane's books.

THE RISK STEP PAVE: Aircraft. 3P: Perceive, the machine's limits before you move it. The attitude it checks: invulnerability ("the light is probably nothing").



Every airplane has its own manual, like every car. The POH is the one you will learn by heart. FAA figure: Airplane Flying Handbook (FAA-H-8083-3C), Figure 2-3. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
The state driver's manual: the rules of the road, the signs, right of way, the permit test comes straight out of it	14 CFR Part 91 (the rules of the air), the Aeronautical Information Manual (how the system works: airports, airspace, radio, weather services), and the Pilot's Handbook of Aeronautical Knowledge (how the machine flies)	Exact match, three books instead of one. All three are free PDFs from the FAA; the knowledge test comes straight out of them the way the permit test comes out of the manual.
The owner's manual in the glove box: specs, limits, warning lights, service intervals	The Pilot's Operating Handbook (POH) for the exact airplane: General, Limitations, Emergency, Normal, Performance, Weight and Balance, Systems, Handling	Exact match. The Preflight-your-car worksheet at the end of this lesson puts it on one sheet to fill in. Use the POH for the exact airplane you fly; your school has it (the 1978 172N POH this guide quotes is free on the site). One difference: the POH's limitations are law for that airplane, not suggestions.
The DMV website and its forms	IACRA (the FAA's online application system) and the medical (MedXPress, then an aviation medical examiner)	Same bureaucracy, different acronyms. The student pilot certificate is free through IACRA; the medical is the one thing that can stop the whole plan, so it is done first (see the medical section of the site).

Use the worksheet. The two pages right after this lesson, Preflight your car, put Parts A to C on one sheet with blanks to fill in, plus the walk-around and your own ten-line checklist. Print them, take them to the car, and fill them in as you go.

Part A. Find the limitations

DO THIS

1. Find the owner's manual: the glove box, or the free PDF on the maker's website (search the make, model, year and "owner's manual").
2. Find the specifications or capacities section and write a limitations list on one card: engine oil (type, viscosity such as 0W-20, and capacity), fuel (octane, and whether premium is required or only recommended), tire size and cold tire pressure (front, rear, spare), the maximum load, the towing limit, and the engine's red line on the tachometer.
3. Open the driver's door and find the tire and loading information placard on the door pillar. Federal law requires it on cars and light trucks, and it states the maximum combined weight of occupants and cargo, the seating capacity, and the cold tire pressures. Compare it with your card. Nearby is the certification label with the gross vehicle weight rating.
4. Mark each item on your card with where you found it (manual page or placard). That is exactly how you will learn the airplane: the POH's Section 2, Limitations, and the placards in the flight deck.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Engine oil: type, viscosity, capacity	Aviation oil of the grade the POH lists for the temperature, the capacity on the dipstick, and the minimum to fly (in a 172N, the POH's preflight checklist says never less than four quarts, and six for a long flight; the sump holds 6 quarts: Industry data, the 1978 172N POH, as are the other 172N numbers in this guide)	Same idea, checked far more often: the airplane's dipstick is read on every preflight, not at every oil change.
Fuel: 87 octane, or premium required	Only the POH's approved grades: in a 172N, 100LL (dyed blue) or 100 (green); jet fuel in a piston engine can destroy it	The car with the wrong fuel needs a repair. The airplane with the wrong fuel can lose its engine in flight. Check the color in the sample cup and the label on the truck.
Tire pressure on the door placard	Tire pressure in the POH's servicing section; tires, struts and brakes looked at on every preflight	Exact match, except that you will look at the airplane's tires every time, not when the warning light comes on.
Maximum load on the placard; gross vehicle weight rating	Maximum takeoff weight (2,300 pounds in a 172N, normal category) and the center-of-gravity limits	The car placard is safety information; the airplane's weight limit is the law (91.9). An overloaded car handles badly. An overloaded airplane may not climb.
The red line on the tachometer	The red line on the tachometer (2,700 RPM in a 172N) and the color arcs on the airspeed indicator: white flap range, green normal, yellow caution, red line never exceed	Exact match. In the airplane the colors are limitations, and they are on the knowledge test.
"Premium recommended"	"Approved fuel grades": there is no "recommended" in a POH limitation	The airplane's limitations are not advice.

Part B. The warning lights

SAFETY FIRST

Do this outdoors, never in a closed garage (if the engine starts by mistake, carbon monoxide builds fast), with the car in Park (or in gear with the engine off, for a manual) and the parking brake set, on level ground, and with the area around the car clear of people. Do not start the engine. Keep the ignition on for no more than a minute or two: with the engine off, the ignition and accessories drain the battery.

DO THIS

1. Open the owner's manual to the warning and indicator lights page and keep it in your lap.
2. Turn the ignition to ON without starting the engine: the key one or two clicks short of START, or on many push-button cars, the start button pressed without your foot on the brake (your manual says which).
3. Most lights come on for a few seconds as a self-test and then go out. Take a photo of the dashboard with your phone right away, while they are all lit.
4. Turn the ignition off. Now, with the car off and the photo on your phone, go through every light with the manual: its name, its color, and what you would do if it came on while driving. Red usually means stop now, amber means caution, green or blue means a system is on.
5. Write the three lights that would make you pull over immediately (in most cars: oil pressure, engine temperature, brakes). Those are the car's emergency procedures.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Ignition on, engine off: every light tests itself	Master switch on during the preflight to read the fuel gauges and check the lights, then master off (172N POH Section 4; the 172N has no annunciator panel). The 172N's stall warning is not electric: it is a reed horn, checked by suction at the opening on the left wing's leading edge	Close match. The airplane's walk-around also starts in the flight deck, with the master on to read the fuel gauges and check the lights.
The battery runs down if you leave the ignition on	The battery runs down if you leave the master on, and a dead battery is how people end up hand-propping an engine, which the AFH says takes two trained people	Exact match, with a sharper edge: a dead battery in a car is a jump start; in an airplane it is a good reason not to fly that day.
The oil pressure light	The oil pressure gauge (and a low-oil-pressure light in many airplanes)	Same message, same urgency: pull over now, or land now.
The battery or charging light	The ammeter, which shows a discharge when the battery is carrying everything, and in the 172N the red HIGH VOLTAGE light, which comes on when the over-voltage sensor shuts the alternator off (172N POH Section 7, p. 7-26)	Exact match. In both, the battery buys you time, not a trip. Turn off what you do not need and land.
Red, amber, green	Red, yellow (caution) and green arcs and lines on the instruments; in the 172N, one red HIGH VOLTAGE warning light	Exact match in meaning. The airplane just puts the colors on the gauges themselves.
The photo on your phone	Knowing what normal looks like before you start	The habit is the point: you cannot spot abnormal until you know normal.

Part C. What kind of engine is it?

DO THIS

1. In the manual's specifications, find: the number of cylinders and their layout (in a row, in a V, or flat "boxer"), the displacement, whether it is fuel-injected, whether it is turbocharged or naturally aspirated, the fuel it burns (gasoline, diesel, hybrid), and how it is cooled (almost every car: liquid, with a radiator).
2. With the engine off and cool, open the hood with an adult if you are not a driver. Find, without touching anything hot or moving: the oil dipstick, the coolant reservoir, the washer-fluid reservoir, the battery, and the air filter box. That is the airplane's cowling inspection in miniature.
3. Write one sentence: "My car has a ___-cylinder, ___ (turbocharged or naturally aspirated), ___-cooled engine." Then write the same sentence for a Cessna 172N from the table below.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
A four-stroke gasoline piston engine	The same: intake, compression, power, exhaust. The 172N has a Lycoming O-320-H2AD, four cylinders, 160 horsepower	Exact match. The engine in a training airplane is closer to an old car engine than to anything on a jet.
A flat "boxer" engine (some Subarus and Porsches)	Horizontally opposed cylinders, the usual light-airplane layout: short, flat, and easy to cool	Exact match, if your car has one.
Fuel injection	A carburetor: the 172N's O-320 is carbureted, so it has a carburetor heat knob and can make carburetor ice (Lesson 10); newer 172 models are fuel-injected	A partial match: the car's system is the fuel injection of newer 172 models, and the 172N's carburetor adds a hazard cars no longer have.
Turbocharged or naturally aspirated	The 172N is naturally aspirated: it loses power as it climbs, because the air gets thinner. A turbocharged airplane keeps sea-level power to a higher altitude	The car's turbo is mostly for power from a small engine. The airplane's turbo is mostly for altitude. Either way, thinner air means less power without one.
Liquid-cooled, with a radiator and a coolant temperature gauge	Air-cooled, with fins, baffles and the oil carrying heat away; you watch oil temperature and often cylinder head temperature	No radiator. The airplane cools itself with airspeed, which is why a long climb at low speed makes it hot.
One ignition system, run by the battery	Two magnetos and two spark plugs in every cylinder, independent of the battery, tested one at a time at the run-up	A real difference: the engine keeps running if the battery dies, and a propeller can turn the engine over even with the key off. Treat every propeller as live.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 9, Flight Manuals and Other Documents: what the POH contains	p. 9-1	PDF p. 231
Pilot's Handbook of Aeronautical Knowledge	Chapter 9: Limitations (Section 2): airspeeds, powerplant, weight and loading, kinds of operation	p. 9-2	PDF p. 232
Pilot's Handbook of Aeronautical Knowledge	Chapter 9: Placards	p. 9-4	PDF p. 234
Pilot's Handbook of Aeronautical Knowledge	Chapter 8, Flight Instruments: Airspeed Indicator Markings (the color arcs)	p. 8-9	PDF p. 211
Pilot's Handbook of Aeronautical Knowledge	Chapter 8: Tachometer	p. 8-13	PDF p. 215
Pilot's Handbook of Aeronautical Knowledge	Chapter 7, Aircraft Systems: Reciprocating Engines	p. 7-2	PDF p. 162
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Carburetor Systems (and carburetor icing, p. 7-9)	p. 7-8	PDF p. 168
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Superchargers and Turbosuperchargers	p. 7-12	PDF p. 172
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Ignition System (the two magnetos)	p. 7-15	PDF p. 175
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Oil Systems (oil pressure and temperature gauges)	p. 7-16	PDF p. 176
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Engine Cooling Systems	p. 7-17	PDF p. 177
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Fuel Grades (colors) and Fuel Contamination	p. 7-27	PDF p. 187
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Electrical System (ammeter, load meter, low-voltage light)	p. 7-30	PDF p. 190
Pilot's Handbook of Aeronautical Knowledge	Chapter 10, Weight and Balance	p. 10-1	PDF p. 245
Airplane Flying Handbook	Chapter 2, Ground Operations: Visual Preflight Assessment	p. 2-4	Ch. 2 PDF p. 4
Airplane Flying Handbook	Chapter 2: the flight deck check, master switch on, annunciator panels checked	p. 2-5	Ch. 2 PDF p. 5
Airplane Flying Handbook	Chapter 2: Fuel and Oil (sampling, grade, quantity, the dipstick)	p. 2-7	Ch. 2 PDF p. 7
Airplane Flying Handbook	Chapter 2: Landing Gear, Tires, and Brakes	p. 2-10	Ch. 2 PDF p. 10
Airplane Flying Handbook	Chapter 2: Engine and Propeller	p. 2-11	Ch. 2 PDF p. 11
Airplane Flying Handbook	Chapter 2: Hand Propping (why a dead battery matters)	p. 2-16	Ch. 2 PDF p. 16
ACS	Area I, Task B, Airworthiness Requirements: PA.I.B.K1 (certificates, inspections), K3d (placards)	p. 2	PDF p. 10
ACS	Area I, Task F, Performance and Limitations: PA.I.F.K1, K2e-f (loading, weight and balance)	p. 6	PDF p. 14
ACS	Area I, Task G, Operation of Systems: PA.I.G.K1c (powerplant), K1e (fuel, oil), K1f (electrical), K1h (instruments), K2 (abnormalities)	p. 7	PDF p. 15
ACS	Area II, Task A, Preflight Assessment: PA.II.A.K3, the preflight inspection and the reasons for each item	p. 11	PDF p. 19

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
ACS	Area I, Task H, Human Factors: PA.I.H.K1f, carbon monoxide poisoning (why the garage door stays open)	p. 8	PDF p. 16
Pilot's Handbook of Aeronautical Knowledge	Chapter 17, Aeromedical Factors: Carbon Monoxide (CO) Poisoning	p. 17-12	PDF p. 434
14 CFR 91.9	Civil aircraft flight manual, marking, and placard requirements: operate within the limitations	-	eCFR
14 CFR 91.7	Civil aircraft airworthiness: the pilot in command decides whether it is safe for flight	-	eCFR
49 CFR 571.110	Federal Motor Vehicle Safety Standard 110: the tire and loading information placard on the driver's door pillar	-	eCFR
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 1: Opposed or O-Type Engines (the flat layout of nearly every light airplane)	p. 1-4	PDF p. 25
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 1: Operating Cycles and Figure 1-36, the four-stroke cycle drawn (pp. 1-25 to 1-26)	p. 1-25	PDF p. 46
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 2: Carburetor Icing; and Fuel-Injection Systems (p. 2-21)	p. 2-8	PDF p. 90
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 4: how a magneto works (p. 4-1), and Performing Ignition System Checks, the run-up mag check (p. 4-31)	p. 4-1	PDF p. 160
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 6: Functions of Engine Oil (p. 6-1); wet and dry sumps (p. 6-4); Engine Cooling Systems, baffles and cowl flaps (p. 6-32)	p. 6-1	PDF p. 247
AMT Handbook, Powerplant (FAA-H-8083-32B; 215 MB) MORE · PRIVATE	Chapter 11: Engine Keeps Running With Ignition OFF, which is why every propeller is treated as live	p. 11-23	PDF p. 456
AMT Handbook, General (FAA-H-8083-30B; 93 MB) MORE · PRIVATE	Chapter 1: safety around airplanes (p. 1-4) and fuel servicing, types of fuel and their colors (p. 1-25)	p. 1-4	PDF p. 25

TEACH IT BACK

Show a friend your limitations card and the photo of the lit dashboard. Explain what a red light means in the car, then what the red line on the airplane's tachometer means, and why one is advice and the other is law.

FREE · START TODAY · NO AIRPLANE, NO SIMULATOR

Preflight your car

Ten things to find with the owner's manual in your hand. The facts are not the point; the habits are: read the manual first, walk around the same way every time, know what a light means before it comes on, know your limits from the placard. The airplane asks for the same four habits.

1 The engine and the oil

What engine is in your car, how much oil does it take, and what grade? Open the hood, find the dipstick, check the level the way the manual says. Write numbers, not "fine."

ENGINE _____ OIL CAPACITY / GRADE _____ LEVEL TODAY _____

2 The fuel

What grade does the manual call for? How big is the tank? Which side is the fuel door? (The little arrow beside the pump icon has been telling you for years.) Is the cap tight?

GRADE _____ TANK SIZE _____ FUEL DOOR: L / R _____ CAP TIGHT: Y / N _____

3 The placard on the door jamb

Open the driver's door and read the sticker: seating capacity, the most weight the car may carry in people and cargo, tire pressures. That number is your car's useful load, and you have never checked it.

SEATS _____ MAX PEOPLE + CARGO (LB) _____ TIRES FRONT / REAR (PSI) _____

4 The walk-around

Same direction every time. Tires: a gauge, the tread, cuts. Every light, with someone outside. Wipers, mirrors, glass. Under the car: anything that was not there yesterday. The fuel cap.

[ ] TIRES [ ] LIGHTS [ ] WIPERS / GLASS [ ] UNDER THE CAR [ ] CAP

WHAT YOU FOUND _____

5 The warning lights

Find every warning light in the manual before one comes on. For each of these, write what the manual says to do. "Pull over" in the car is "land" in the airplane.

OIL PRESSURE _____ CHARGING _____ TEMPERATURE _____ CHECK ENGINE _____

6 The documents

Registration, insurance, inspection: where are they, and when does each expire? An airplane carries the same kind of paperwork, and a pilot can say where every piece is.

REGISTRATION EXPIRES _____ INSURANCE EXPIRES _____ INSPECTION DUE _____

7 The service records

Last oil change, next one due, tires rotated, any open recall. If you do not know, find out. An airplane's logbooks answer these on demand.

LAST OIL CHANGE _____ NEXT DUE _____ RECALLS OPEN _____

8 The performance numbers

Range on a full tank. Stopping distance from 60 (the manual or a published test). Towing capacity. Every airplane has the same three numbers: range, landing distance, maximum weight.

RANGE (MILES) _____ STOPPING FROM 60 (FT) _____ TOWING (LB) _____

9 Before you drive

Before the next drive, run the two pilot checks on yourself. IMSAFE: illness, medication, stress, alcohol, fatigue, emotion. PAVE: pilot, aircraft (the car), environment, external pressures. The drive to the airport counts.

ONE THING IMSAFE OR PAVE CAUGHT THIS WEEK _____

10 The checklist

Write a ten-line checklist for your car from what you found. Use it before every drive for one week, out loud. Using a checklist you do not need is how you learn to use one you do.

THEN

Bring this sheet and your checklist to your first lesson, or to the systems lesson (G3) in the free Private Pilot Syllabus, where you compare your car's manual to the airplane's POH section by section. Everything is free at pilotcareersolutions.com/learn-to-fly-at-home.

An educational exercise, done at your own risk in a safe and controlled setting; no license needed. Pilot Career Solutions accepts no liability for accidents or injury. Engine off and cool, parking brake set, level ground, nothing under the car but your eyes. Kids: with a parent.

PREFLIGHT YOUR CAR · THE BACK OF THE SHEET

An airplane with the wings off

Every line on the front has a match in the airplane. Read them side by side once; then the first real preflight will feel like something you have already done.

In your car	In the airplane
The owner's manual: specs, limits, warning lights, service	The POH: the same sections in the same order (General, Limitations, Emergency, Normal, Performance, Weight and Balance, Systems, Handling)
The door-jamb placard: seats, max weight of people and cargo, tire pressures	Weight and balance, the limitations placards, the tire pressures in the POH
The dipstick: oil grade, capacity, level	The dipstick: oil grade, capacity, the minimum for flight, and looking instead of trusting
The fuel gauge arrow, the grade in the manual, the cap	Fuel grade, usable fuel, the cap secured, sumping, a visual check because the gauge is not trusted
The walk-around: tires, lights, wipers, mirrors, leaks, damage	The preflight: tires, struts, brakes, lights, control surfaces, hinges, leaks, pitot and static, stall warning
The cluster: oil pressure, charging, temperature, check engine, tire pressure	The engine gauges: oil pressure and temperature, the ammeter and the red HIGH VOLTAGE light, fuel, suction; an emergency checklist for each; "land" where the car says "pull over"
Registration, insurance, inspection in the glove box	The ARROW documents: airworthiness, registration, radio license if needed, operating handbook, weight and balance
Service records: oil changes, recalls, the next inspection	The maintenance logs, the annual, the 100-hour, airworthiness directives
Range on a tank, stopping distance, towing capacity	Range and endurance, takeoff and landing distance, maximum weight
Tired, medicated, running late, bad weather	IMSAFE and PAVE, before every flight and, once you have the habit, before every drive

MY TEN-LINE CHECKLIST

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

This sheet retires at your first solo. By then the habits are yours and the car is just a car again.

3 The dashboard and the controls: the same gauges, and the feet

This lesson is about what the gauges mean and what your hands and feet do, because the feet are the first surprise.

OBJECTIVE

Read the car's gauges as a scan (an order, never a stare), name each one's airplane counterpart, and know why the feet and the trim are the first surprises.

THE RISK STEP PAVE: Aircraft, and the Pilot's hands and feet. 3P: Perceive, a scan that misses nothing. The attitude: resignation, the stare at one gauge.



The controls and the panel of a training airplane: the dashboard, a yoke for a wheel, and pedals that steer. FAA figure: Airplane Flying Handbook (FAA-H-8083-3C), Figure 3-1. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Speedometer	Airspeed indicator: speed through the air, not over the ground. Groundspeed is on the GPS. The difference between them is the wind	The first real break. A 172 flying at 100 knots through the air into a 20-knot headwind is doing 80 over the ground. Lesson 9 is built on this.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Tachometer	Tachometer	Identical, and more important: in a fixed-pitch 172 the RPM is how you set power. 2,300 RPM is a cruise setting the way 2,000 RPM is a highway setting.
Fuel gauge, trusted	Fuel gauges, cross-checked but never trusted. Fuel is known by time: dip the tanks before the flight, note the time, burn the POH gallons per hour, and land with the reserve still there	The second real break, and the one that kills people. Lesson 9 again.
Temperature gauge and the oil light	Oil temperature and oil pressure gauges	Exact match, same rule: oil pressure falling with oil temperature rising is the engine telling you it is in trouble; you land as soon as practical, with a field picked in case it quits first.
Odometer and trip odometer	Hobbs meter (engine running time, what you pay for) and tach time (the maintenance clock); the nav log is the trip odometer	Exact match. The Hobbs is why the lesson at home is free and the lesson in the airplane is not.
Compass in the mirror	The magnetic compass, which lies during turns and speed changes, and the heading indicator, which is set from it every fifteen minutes in level flight	Same instrument, less trusted; the airplane version comes with rules about when it is wrong.
GPS on the phone	GPS in the panel or on the tablet	Same convenience, same trap. The chart is the map; the GPS is a nice way to see where you are on it. The checkride's navigation tasks expect you to navigate without it.
Glancing at the gauges while you drive: speed, RPM, temperature, fuel, the mirrors, and back to the road	The instrument scan. The attitude indicator is the hub and the eyes go hub, airspeed, hub, altimeter, hub, heading, hub, vertical speed, with the engine gauges (RPM, oil, fuel quantity) every few minutes. Flying by the window, most of the time is outside with brief looks in; the instrument rating later formalizes the same scan for flight with no window at all	Same habit: a fixed order, never a stare. The instrument handbook names three scan errors, fixation (staring at one gauge), omission (skipping one) and emphasis (trusting one too much), and every driver who drifted while staring at the speedometer has made the first one.
The trip computer: average miles per gallon, range to empty	Fuel burn in gallons per hour, endurance in hours and minutes, and the fuel-remaining column on the nav log	Range to empty is endurance. The airplane version is computed on the ground from the POH and checked against the clock in flight, because the gauges are cross-checked and never trusted (Lesson 9).
Cruise control	The autopilot	A convenience you earn after you can hold altitude and heading by hand. Same as cruise control: it does not know about the curve ahead.
Check-engine light	The engine gauges: tachometer, oil pressure and oil temperature (the 172N has no annunciator panel; its one red warning light, HIGH VOLTAGE, is electrical and goes with the charging light in Lesson 2)	A close match, except you cannot ignore it until the next oil change.
Mirrors and blind spots	No mirrors. Your eyes, a scan pattern, clearing turns before every maneuver, and the radio	A break that becomes a habit fast: you look before you turn, every time, out loud.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Steering wheel	The yoke: it banks the wings, and the bank turns the airplane. The feet on the rudder pedals keep the turn coordinated	The wheel is close; the feet are new. In a car your feet do speed; in the airplane your feet do direction on the ground and coordination in the air.
Gas pedal	The throttle, in your right hand	Power is a hand control in a 172. Drivers reach for it with a foot for the first hour.
Brake pedal	Toe brakes: the tops of the rudder pedals, used on the ground	On the ground you steer with your feet and brake with your toes. This is the single biggest surprise for a driver, and the first taxi lesson is entirely about it.
Gear shift	Flaps: they change the shape of the wing for slow flight and landing	Not a match, really. There is no gearbox; the closest idea is that flaps are a setting for a phase of flight, the way a low gear is for a hill.
Manual transmission: clutch and gas together	Coordination: aileron and rudder together, shown by the ball in the turn coordinator	The best match on the panel. Anyone who learned a stick shift knows the feeling of two controls that only work as one. Step on the ball.
Nothing	Trim: a wheel that takes the pressure off the yoke so the airplane holds an attitude by itself	No match. Think of it as setting the wheel so the car holds its lane hands-off; the first time you trim properly, the airplane flies itself and you finally have a hand free for the chart.

DO THIS

1. In the driveway, parked, engine off, parking brake set, eyes closed, touch every control by name in the order you would use them to start and go. That is a "flow," and the 172 has one too; the POH panel diagram is the picture to practice on next.
2. On the highway, add the tach to your glances at the speedometer. Notice that a steady RPM holds a steady speed. That is how you will set cruise power.
3. Every time you brake, say "toes." Every time you turn, say "feet." It sounds ridiculous, and it saves an hour of taxi practice.
4. Build a scan, from the passenger seat first: every thirty seconds, say it in the same order, "speed, RPM, temp, fuel, mirrors," glancing, never staring. Once it runs itself, the driver can say it, a glance per word, eyes back on the road between them; the mirrors-and-gauges glance is the one thing here the driver already does. After a week the order runs itself. That is what the instrument scan becomes in the airplane, and later under the hood, where it is the whole job.
5. If you are learning to drive with a supervising adult, practice the handoff the FAA writes into every lesson. Parked, engine off: the one giving up the wheel says "you have the controls," the one taking it says "I have the controls," and the first one confirms "you have the controls," with a look to see that the hands really did change. Three sentences, every time, in the airplane too (AFH 1-16). Nobody ever wonders who is flying.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 8, Flight Instruments: Pitot-Static Flight Instruments (airspeed, altimeter, vertical speed)	p. 8-1	PDF p. 203
Pilot's Handbook of Aeronautical Knowledge	Chapter 8: Tachometer	p. 8-13	PDF p. 215
Pilot's Handbook of Aeronautical Knowledge	Chapter 7, Aircraft Systems: Oil Systems (oil pressure and temperature gauges)	p. 7-16	PDF p. 176
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Fuel Gauges	p. 7-26	PDF p. 186
Airplane Flying Handbook	Chapter 3, Basic Flight Maneuvers: Attitude Flying	p. 3-4	Ch. 3 PDF p. 4
Airplane Flying Handbook	Chapter 3: Integrated Flight Instruction (outside references and instruments together)	p. 3-5	Ch. 3 PDF p. 5
ACS	Area I, Task G, Operation of Systems: PA.I.G.K1a-b (flight controls), K1h (flight instruments)	p. 7	PDF p. 15
ACS	Area VIII, Basic Instrument Maneuvers, Task A, Straight-and-Level Flight (the scan put to work)	p. 46	PDF p. 54
Airplane Flying Handbook	Chapter 1, Introduction to Flight Training: the three-step positive exchange of flight controls	p. 1-16	Ch. 1 PDF p. 16
Airplane Flying Handbook	Chapter 1: Use of Checklists (a checklist is not a do-list: flow first, then check)	p. 1-15	Ch. 1 PDF p. 15
Instrument Flying Handbook (FAA-H-8083-15B) LATER · INSTRUMENT RATING	Chapter 6, Attitude Instrument Flying: the three scan errors, Fixation (p. 6-27), Omission and Emphasis (p. 6-28)	p. 6-27	PDF p. 160

TEACH IT BACK

Teach the scan to the passenger: what to look at, in what order, and why nothing gets stared at. Then let them say it while you drive.

YOUR NOTES

4

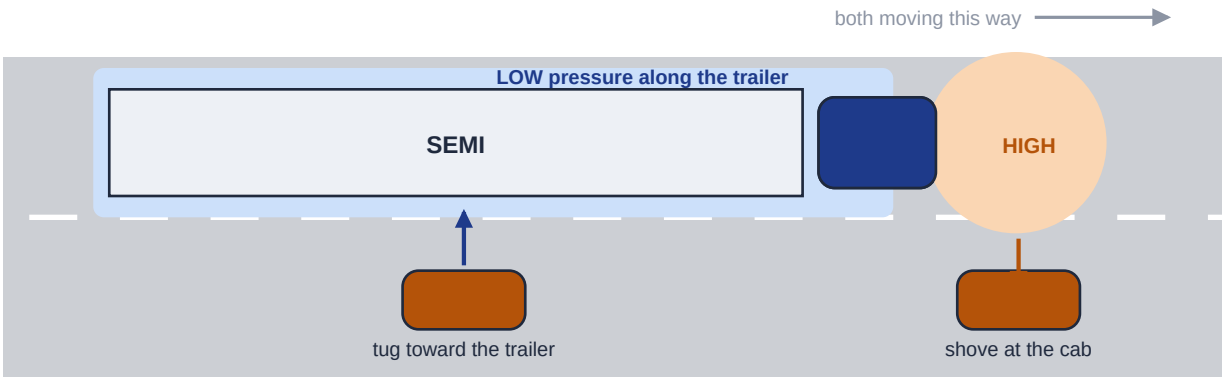
Passing the semi: the lift you can feel

Lift is a pressure difference, and the highway hands you one every time you pass a truck. You feel it in the wheel, or in your seat as a passenger: the tug toward the trailer, then the shove as you clear the cab. That is the theory of flight, turned on its side, at seventy miles an hour.

OBJECTIVE

Explain lift as a pressure difference you have felt beside a truck, and angle of attack and the stall with your hand in front of a fan.

THE RISK STEP PAVE: Aircraft. 3P: Perform, the hands that answer a gust or a stall before fear does. The attitude: macho, the steep slow turn to show someone.



On a wing the same pressures act up and down: lower pressure over the top, higher underneath. That difference is lift.

Passing a semi, seen from above: the low pressure along the trailer pulls you in; the bow wave at the cab pushes you out. Drawing: Pilot Career Solutions.

Every ground school starts lift with a drawing of a wing and two names, Bernoulli and Newton, and most students nod and feel nothing. You have felt it for years, from either seat. The air squeezed between your car and a trailer speeds up, and air that speeds up loses pressure; the ordinary pressure on your far side is now higher, and it pushes you toward the truck. Then the cab arrives with the pile of high-pressure air it shoves ahead of itself, and you are pushed away. A wing is the same two pressures arranged top and bottom instead of side to side: faster air over the curved top and lower pressure there, so the pressure underneath is the higher one and the wing is pushed up. Most of the lift comes from the lowered pressure above the wing; the underside adds the rest. (The full story adds the air the wing turns downward, Newton's third law; the handbook gives both views and both are right. The pressure difference is the part you can feel.)

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Coming up alongside a semi, the car is tugged toward the trailer	Air that speeds up loses pressure. Over the curved top of the wing the air moves faster than under it, the pressure above drops below the pressure beneath, and the difference, added up across the whole wing, is lift	The same idea, sideways: faster air, lower pressure. The air between you and the trailer plays the air over the wing; your far side plays the underside. It is an analogy for pressure and airflow, not the same flow: the truck's bow wave and its wake muddy it, which is why the pull comes and goes.
As you clear the cab, the car is shoved away	The high-pressure region a blunt shape carries ahead of itself. On the wing it is the stagnation point at the leading edge, where the air is brought to a stop and the pressure is highest	The shove is pressure too: the cab's bow wave. Under and ahead of the leading edge the wing has the same high-pressure air, but most of the wing's lift comes from the lower pressure above it; the higher pressure underneath adds the rest.
Your hand corrects on the wheel before you have thought about it	Aileron and rudder corrections for gusts, automatic after a few hours	Same reflex, learned the same way. The correction is small and early; a driver who waits for the shove is in the next lane, and a pilot who waits for the gust is off heading.
The crosswind on an open bridge or in the gap between two hills, and the lean you hold on the wheel	The crosswind on final: the crab into the wind on approach, then the wing-low slip to keep the nose on the centerline	Same force, same lean into it. The car's crosswind takes one hand; the airplane's takes a hand and a foot, and it changes when a hangar or a treeline blocks the wind on short final, exactly as the lean changes when a truck blocks it on the bridge.
The old hand-out-the-window game, done the safe way: the passenger's hand, at low speed on an empty road, never the driver's; or the same hand in front of a box fan at home	Angle of attack. Tilt the wing a little into the air and lift grows; tilt it too far and the air lets go of the top and the lift collapses: a stall	The demonstration every instructor uses on the first lesson. The hand lifts, then at a steep enough angle it stops lifting and shakes, which is the buffet before a stall, and it happens at that angle whatever the speed. That is the rule, said plainly: a wing stalls when it exceeds its critical angle of attack, and only then, so an airplane can stall at any speed and in any attitude. It is the angle, not the speed.
A tarp on a pickup bed, or a convertible top, bulging upward at highway speed	Lift on a flat surface: the fast air over the top has lower pressure than the still air trapped underneath, so the surface rises	A wing with no shape at all still lifts, which tells you the curve of the wing helps but is not the whole story: angle and speed make lift too.
Wind noise and fuel burn at 80 versus 60	Parasite drag rises with the square of the speed: twice the speed, four times the drag, and the fuel burn follows	Exact match, and the reason a 172 cruises where it does rather than as fast as it can.
The buffet behind a truck when you pull out, and the quiet pocket right behind it	Wake turbulence: the two vortices a heavy airplane leaves behind its wingtips (Lesson 11)	Same source, bigger machine; the hazards chapter covers what to do about it.

DO THIS

1. Passing is a driving decision first: only when it is safe and legal, and never to feel the physics. The next time you pass a semi on a calm day, notice the sequence you have ignored for years: the tug toward the trailer, the shove at the cab, your hand's correction. If you are the passenger, say "low pressure" and "high pressure" as you feel each; if you are driving, just notice, and say it once the pass is complete. That is lift, sideways.
2. On a windy day on an open stretch, notice how much you lean the wheel into the wind, and what happens to the lean when a hill, a sound wall, or a truck blocks the wind for a moment. That is the crab on final, and the gust that takes it away on short final.
3. At home: hold a sheet of paper by the near edge, let it droop, and blow across the top; it rises. Then a hand flat in front of a box fan, tilted a little, then a lot. Two minutes, and you have felt lift, angle of attack, and a stall.
4. Then read the Principles of Flight chapter of the Pilot's Handbook of Aeronautical Knowledge once (Chapter 4 in the current edition). The Bernoulli and Newton paragraphs will read like something you have already felt, because they are.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 4, Principles of Flight: Newton's Basic Laws of Motion	p. 4-5	PDF p. 92
Pilot's Handbook of Aeronautical Knowledge	Chapter 4: Bernoulli's Principle of Differential Pressure	p. 4-6	PDF p. 93
Pilot's Handbook of Aeronautical Knowledge	Chapter 5, Aerodynamics of Flight: Lift (angle of attack, the stall)	p. 5-3	PDF p. 100
Pilot's Handbook of Aeronautical Knowledge	Chapter 5: Avoiding Wake Turbulence (the buffet behind the truck, airplane size)	p. 5-9	PDF p. 106
Airplane Flying Handbook	Chapter 5, Upset Prevention and Recovery: Stalls	p. 5-12	Ch. 5 PDF p. 12
ACS	Area VII, Task A, Maneuvering During Slow Flight: PA.VII.A.K1, angle of attack, airspeed and load factor	p. 42	PDF p. 50
ACS	Area VII, Task C, Power-On Stalls: PA.VII.C.K1, the aerodynamics of the stall	p. 44	PDF p. 52

TEACH IT BACK

Hand a friend a sheet of paper and have them blow across it; then explain the semi, the fan, and the stall. The test is whether they can explain why an airplane can stall at any speed.

5

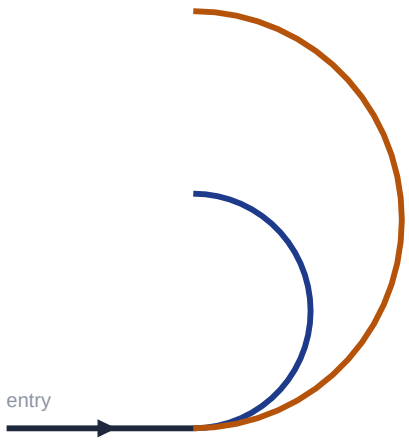
The on-ramp: speed, bank, and the size of the turn

Hold the wheel still on a curving ramp and change only the speed, and the car runs wide as you speed up and tightens as you slow. Hold the bank still in an airplane and change only the speed, and the same thing happens, by the square of the speed.

OBJECTIVE

Explain why a faster turn is a wider turn in both machines, use the ramp's advisory speed sign as the proof, and connect it to steep turns and turns around a point in the airplane.

THE RISK STEP PAVE: Aircraft and enVironment (the wind on the circle). 3P: Perform, a bank chosen for the speed. The attitude: macho, taking the ramp fast.



Same 30-degree bank, two speeds

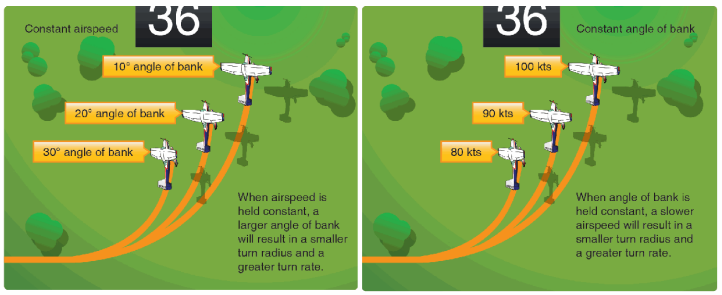
One third more speed, about 1.8 times the circle.

In the car: same wheel angle, more speed, and you run wide.

90 knots: about 2,500 ft across

120 knots: about 4,400 ft across

The radius of a turn grows with the square of the speed. Drawing: Pilot Career Solutions, from the turn-radius formula in the Pilot's Handbook of Aeronautical Knowledge.



Bank and airspeed set the rate and the radius of every turn. FAA figure: Airplane Flying Handbook (FAA-H-8083-3C), Figure 3-14. Public domain.

> ⚠ **SAFETY FIRST**
>
> Never experiment with speed on a real ramp or curve. The posted advisory speed is there because of exactly this physics. Notice it as a passenger, or as a driver at the posted speed; feel it with the string-and-keys demonstration below; and leave the rest to the airplane, with an instructor.

A car in a turn needs a sideways push from its tires, and the push it needs grows with the square of the speed: on the same curve, twice the speed takes four times the push. Most passenger cars are built to understeer, so when you hold the wheel still and add speed, the tires cannot quite supply the extra push and the car drifts toward the outside of the curve. Ease off and it tightens back in. That is why the yellow sign at the start of the ramp says 25 or 35 miles an hour: the engineers drew the curve for that speed.

An airplane turns by banking: the wing's lift tilts, and the sideways part of the lift does what the tires do. Hold the bank constant and the sideways force is fixed, so the faster you go, the bigger the circle, again by the square of the speed. At a 30-degree bank, a turn at 90 knots draws a circle about 2,500 feet across; at 120 knots, about 4,400 feet. To turn just as tightly at the higher speed, you must bank more. That is the arithmetic behind steep turns, and it is the whole of turns around a point: as the wind raises your groundspeed on the downwind side, you steepen the bank to keep the circle the same size, and as it slows you on the upwind side, you shallow it.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Wheel held still, speed added: the car runs wide	Bank held still, airspeed added: the radius grows with the square of the speed	Same result, different cause: the car runs out of tire grip; the airplane's fixed sideways lift simply carries it farther.
The yellow advisory speed sign on the ramp	The speed you plan a turn at: the pattern, the steep turn, the turn to final	Exact match: a speed chosen so the curve works.
Easing off the gas tightens the turn	Slowing down tightens the turn at the same bank	Exact match, and a real technique on the turn to final: slow is tight, fast is wide.
Being pushed toward the door on a fast curve	Load factor: a level 60-degree bank is 2 G, so you and the airplane weigh twice as much and the stall speed rises about 41 percent	Where it breaks: the car pushes you sideways, but a coordinated airplane presses you straight down into the seat, twice your weight at 60 degrees. A sideways push in the airplane means a slip or a skid: the ball is out. The load factor also raises the stall speed, which is why steep, slow turns near the ground are dangerous.
Steering harder to stay on the ramp	Banking steeper to hold a circle when the groundspeed rises (turns around a point)	Exact match in thinking. The airplane's version is a checkride task.

DO THIS

1. As a passenger, on the next ramp, read the advisory speed sign out loud before the curve and notice the push toward the door at that speed. Say: "twice the speed, four times the push."
2. At home: put your keys on a lanyard or a string about two feet long, outdoors with room around you, and swing them in a slow circle. Speed the swing up without changing the string's length and feel the pull in your hand grow. The pull is the sideways force the tires supply on the ramp and the bank supplies in the airplane.
3. With a calculator: 90 squared is 8,100; 120 squared is 14,400. That ratio, about 1.8, is how much bigger the airplane's circle gets when you go from 90 to 120 knots at the same bank.
4. Read the Pilot's Handbook of Aeronautical Knowledge pages on rate and radius of turn, then the AFH's turns around a point. They will read like the ramp.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 5, Aerodynamics of Flight: Forces in Turns	p. 5-22	PDF p. 119
Pilot's Handbook of Aeronautical Knowledge	Chapter 5: Load Factors in Steep Turns	p. 5-34	PDF p. 131
Pilot's Handbook of Aeronautical Knowledge	Chapter 5: Rate of Turn (the 1,091 formula; more speed, less rate at the same bank)	p. 5-38	PDF p. 135
Pilot's Handbook of Aeronautical Knowledge	Chapter 5: Radius of Turn (bank constant, speed up, radius up)	p. 5-39	PDF p. 136
Airplane Flying Handbook	Chapter 3, Basic Flight Maneuvers: Level Turns	p. 3-11	Ch. 3 PDF p. 11
Airplane Flying Handbook	Chapter 7, Ground Reference Maneuvers: the purpose, and wind's effect on groundspeed	p. 7-1	Ch. 7 PDF p. 1
Airplane Flying Handbook	Chapter 7: Turns Around a Point (steeper bank at higher groundspeed)	p. 7-7	Ch. 7 PDF p. 7
Airplane Flying Handbook	Chapter 10, Performance Maneuvers: Steep Turns	p. 10-1	Ch. 10 PDF p. 1
ACS	Area V, Task A, Steep Turns: PA.V.A.K2d (load factor), K2e (rate and radius of turn)	p. 36	PDF p. 44
ACS	Area V, Task B, Ground Reference Maneuvers: PA.V.B.K3, effects of bank angle and groundspeed on rate and radius of turn	p. 36	PDF p. 44

TEACH IT BACK

Swing the keys for a friend and explain the ramp sign with them. Then explain why the airplane steepens its bank on the downwind side of a turn around a point. If they can tell it back to you, you both have it.

YOUR NOTES

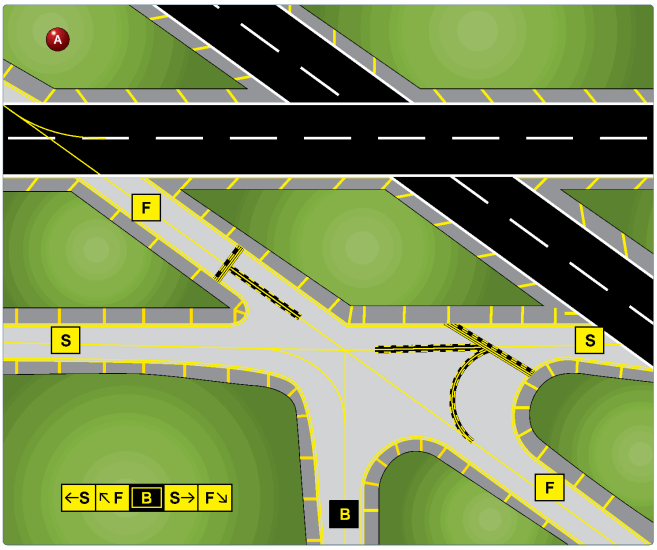
6 Signs, markings and lights: the airport is a road system painted in yellow

You learned road signs by shape and color before you could read them. Airport signs work exactly the same way, and there are only six kinds.

OBJECTIVE

Read airport signs, markings and lights by shape and color the way you read road signs, and know which ones mean stop.

THE RISK STEP PAVE: enVironment, the airport. 3P: Process, what each sign means for the next hundred feet. The attitude: anti-authority, the hold-short line as a suggestion.



Airport signs and markings: a road system painted in yellow, with its own colors and shapes. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 14-20. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
STOP sign and the white stop line	The runway holding position marking (two solid and two dashed yellow lines; you hold on the solid side) and the red mandatory sign with the runway number	At a towered airport you never cross it without a clearance. At a non-towered airport you stop, look down final, announce, and then go. A stop sign is the same rule with a shorter wait.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Street name signs (green, white letters)	Location signs: black with yellow letters, "you are on taxiway A"	Exact match. If you know only one sign, know this one; "where am I" is the taxiing question.
Guide signs with arrows (green)	Direction and destination signs: yellow with black letters and an arrow	Exact match. Yellow means "this way to"; black means "you are here"; red means "stop and get permission".
Lane lines: dashed white to change lanes, solid yellow not to cross, double yellow never	Taxiway centerline: one solid yellow line you keep the nosewheel on. Runway centerline: white dashes. Runway edges: solid white. Hold-short lines: the double yellow of the airport	The colors are a code: yellow is taxiway, white is runway. Cross from yellow onto white and you are on a runway; that is the moment of the runway incursion, the airport's version of running a red light.
Route numbers (I-80, US-30)	Runway numbers: the magnetic heading of the runway divided by ten. Runway 27 points about 270 degrees, west; the same pavement from the other end is runway 9	Not arbitrary like a route number. Read the runway number and you know which way you will be pointed, which tells you where the wind should be coming from.
Traffic lights: green, yellow, red	Light gun signals from the tower when the radio fails (AIM 4-3-13). In the air: steady green cleared to land; flashing green return for landing; steady red give way to other aircraft and keep circling; flashing red airport unsafe, do not land. On the ground: steady green cleared for takeoff; flashing green cleared to taxi; steady red stop; flashing red taxi clear of the runway in use; flashing white return to your starting point. Either place, alternating red and green: exercise extreme caution	The radio is the normal way; the light gun is the backup. Every private pilot is tested on these, and almost nobody has seen one used. Learn them like the traffic light: you do not think, you act.
WRONG WAY and DO NOT ENTER	A large white or yellow X on the pavement: the runway is closed. The red no-entry sign (a symbol, like the road's DO NOT ENTER) at a taxiway you may not use	Exact match.
The speed limit sign	The airplane's own speeds from the POH (never-exceed, maneuvering, flap speeds), plus airspace limits: 250 knots below 10,000 feet; 200 knots at or below 2,500 feet within 4 nautical miles of a Class C or D airport, and under a Class B shelf (91.117)	A car has one speed limit set by the road. The airplane has limits set by the airplane (structure) and by the airspace (traffic). A private pilot in a 172 will never touch the airspace limits; the POH limits are the ones that matter.
Headlights on at dusk	Position lights on from sunset to sunrise; the anti-collision lights on whenever the airplane is operated, day or night, unless the pilot in command judges them unsafe in the conditions (91.209)	Same rule, same reason: be seen.
"Exit 1 mile" and distance signs	Runway distance-remaining signs: black, white numerals, thousands of feet left	Exact match, used the same way: is there enough left to stop, or to go.
The lane-departure beep	The stall warning horn	Both are a sound that says you are at the edge of what the machine can do. In the car you drift back. In the airplane you lower the nose. Lesson 14.

DO THIS

1. For one week, name every sign by shape and color before you read the words: octagon stop, triangle yield, diamond warning, rectangle regulatory, green guide, orange work zone. That is the skill; the airport just has six types, told apart by color.
2. Look up the six airport sign types in Chapter 14 of the Pilot's Handbook of Aeronautical Knowledge and draw each one from memory on a card. Then draw the hold-short line. Ten minutes, and the taxi lesson at the flight school becomes review.
3. Learn the light-gun table the way you learned traffic lights: cover the right column and recite it as a passenger, or parked; the driver recites from memory only. Nobody expects to use it, and one day someone does.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 14, Airport Operations: Airport Markings and Signs, Runway Markings and Signs	p. 14-5	PDF p. 339
Pilot's Handbook of Aeronautical Knowledge	Chapter 14: Airport Signs (the six types)	p. 14-15	PDF p. 349
Pilot's Handbook of Aeronautical Knowledge	Chapter 14: Runway Incursion Avoidance	p. 14-31	PDF p. 365
Airplane Flying Handbook	Chapter 2, Ground Operations: Taxiing	p. 2-18	Ch. 2 PDF p. 18
ACS	Area II, Task D, Taxiing: PA.II.D.K1 (the Chart Supplement and airport diagrams), K3 (markings, signs and lights)	p. 13	PDF p. 21
ACS	Area III, Task A, Communications, Light Signals, and Runway Lighting Systems: PA.III.A.K3, light signals	p. 16	PDF p. 24
AIM (Change 3, July 9, 2026) MORE · PRIVATE	2-3-5, Holding Position Markings; 2-3-8, Mandatory Instruction Signs (PDF p. 162); 2-1-9, Airport Beacons (PDF p. 132). FAA guidance	p. 2-3-5	PDF p. 151
AIM (Change 3, July 9, 2026) MORE · PRIVATE	4-3-13, Traffic Control Light Signals (the light-gun table); 4-3-18, Taxiing, including the read-back of hold-short instructions (PDF p. 260); 4-3-24, Use of Aircraft Lights (PDF p. 266). FAA guidance	p. 4-3-13	PDF p. 256

TEACH IT BACK

Draw the six airport sign types from memory for a friend and say what each one means. Then quiz them at the next intersection: what would this sign look like at an airport?

7

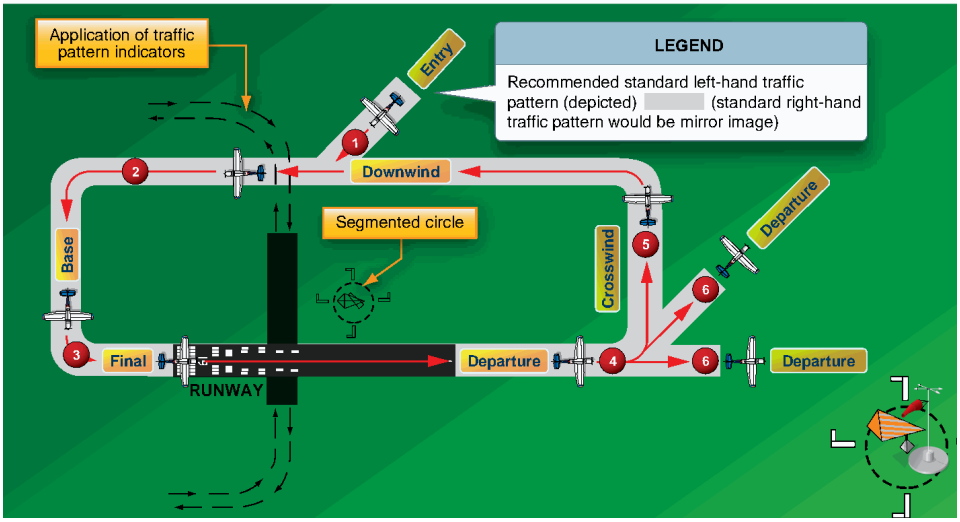
Right of way and the traffic pattern: the four-way stop, in the air

The rules of who goes first are almost the same in the air as on the road, with one famous exception, and the traffic pattern is a roundabout with a radio.

OBJECTIVE

State the right-of-way rules of the air from the four-way stop you already know, and narrate a traffic pattern entry from a highway merge.

THE RISK STEP PAVE: enVironment, the other traffic. 3P: Process, who goes first and where the gap is. The attitude: impulsivity at the merge.



The traffic pattern: entry, downwind, base, final. The four-way stop of the airport. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 14-39. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Four-way stop: first to arrive goes first; tie goes to the car on the right	Two aircraft converging at about the same altitude: the aircraft on the other's right has the right of way (91.113)	Exact match. Say it out loud at every four-way stop for a week and it is yours forever.
Head-on on a narrow road: both move right	Head-on: each aircraft alters course to the right	Exact match.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Passing: on the left	Overtaking: the airplane being overtaken has the right of way; you pass on the RIGHT	The one famous break. Passing on the right is the opposite of the highway habit, which is why it is worth saying out loud.
Pull over for the ambulance	An aircraft in distress has the right of way over everything. Then the less maneuverable wins: a balloon over a glider, a glider over an airship, an airship over an airplane. An aircraft towing or refueling another has it over engine-driven aircraft	The principle is the same: the one that can least get out of the way gets the way.
Merging onto the highway: match the speed, find the gap, signal, ease in	Entering the traffic pattern: at pattern altitude, on a 45-degree leg to the downwind, with a radio call on the common frequency, sequenced behind the airplane ahead	Exact match in every respect, including the fact that the merge is where most beginners are nervous and most conflicts happen.
The roundabout: one direction, yield to traffic already in the circle	The traffic pattern: left turns unless the airport's markings or lights show right traffic (91.126; check the Chart Supplement too); the lower aircraft on final has the right of way, but may not use that to cut in front of another (91.113)	Exact match. The pattern is the only place in the sky with lanes, which is why it has the most rules.
Pulling out of a driveway into traffic	Taking the runway: at a towered field, only with a clearance; at a non-towered field, after a look down final and a call	"Lined up and waiting" is a clearance, not a habit. The driveway rule applies: you do not pull out because you are tired of waiting.
Lanes everywhere	Lanes nowhere except the pattern. Everywhere else it is "see and avoid" (91.113(b)), helped by radar advisories from ATC ("flight following") when you ask for them	The biggest structural difference. On the road the paint keeps you apart; in the air your eyes do. That is why the scan is taught from lesson one, and why flight following is the highway patrol that talks to you.

DO THIS

1. At every four-way stop, say the aviation rule: "converging, the one on the right." At every pass, say "in the airplane I would go right." It sounds silly and it works.
2. As a passenger, narrate the driver's next merge as a pattern entry (if you are driving, narrate it afterward, once you are settled in the lane): "pattern altitude, forty-five to the downwind, call, sequence behind the truck." Same decisions, same timing.
3. Read 91.113 once. It is one page. It is the whole of Lesson 7.
4. Before the next on-ramp, the passenger gives a "merge briefing" out loud: the speed we will match, the gap we are aiming for, and what we do if the gap closes (stay in the acceleration lane, go behind). That is the takeoff briefing the AFH wants said aloud before every takeoff, even alone: the runway, the speeds, and the plan if the engine quits, with the altitude below which you land straight ahead (AFH 2-22).

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 14, Airport Operations: Traffic Patterns	p. 14-20	PDF p. 354
Pilot's Handbook of Aeronautical Knowledge	Chapter 14: Collision Avoidance (see and avoid)	p. 14-28	PDF p. 362
Airplane Flying Handbook	Chapter 1, Introduction to Flight Training: Collision Avoidance	p. 1-10	Ch. 1 PDF p. 10
Airplane Flying Handbook	Chapter 8, Airport Traffic Patterns	p. 8-1	Ch. 8 PDF p. 1
Airplane Flying Handbook	Chapter 2, Ground Operations: the Takeoff Briefing, made out loud even with no one else aboard (the before-takeoff check begins on 2-21)	p. 2-22	Ch. 2 PDF p. 22
ACS	Area III, Task B, Traffic Patterns: PA.III.B.K3, right-of-way rules	p. 16	PDF p. 24
AIM (Change 3, July 9, 2026) MORE · PRIVATE	4-3-3, Traffic Patterns (the recommended entry); 4-1-15, Radar Traffic Information Service, which pilots call flight following (PDF p. 214)	p. 4-3-3	PDF p. 239
14 CFR 91.113	Right-of-way rules: except water operations	-	eCFR
14 CFR 91.126	Operating on or in the vicinity of an airport in Class G airspace (left turns unless marked)	-	eCFR

TEACH IT BACK

At the next four-way stop, explain the converging rule, the head-on rule and the overtaking rule to your passenger, then predict who goes next.

YOUR NOTES

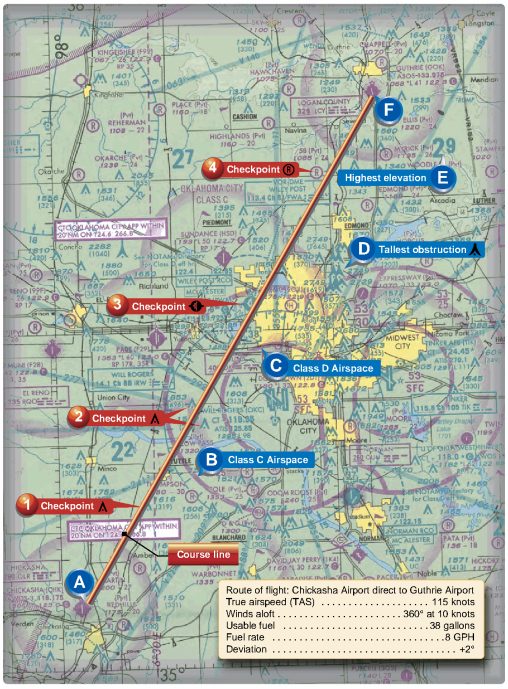
8 The road atlas and the sectional chart: the same map with a third dimension

A VFR sectional is a road atlas with altitudes on it. The legend is on the edge, the roads are still there, and the cities have turned into airports.

OBJECTIVE

Find anything on a sectional chart or in the Chart Supplement by knowing where the legend is, not by memorizing it, and plan a drive on paper the way you will plan a flight.

THE RISK STEP PAVE: enVironment, the map. 3P: Process, what the third dimension does to the route. The attitude: invulnerability, flying on an old chart.



A sectional chart with a route drawn on it: the road atlas with a third dimension. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 16-25. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
The legend on the first page	The legend on the edge of the chart	Exact match. Read it once, the way nobody reads the atlas legend, and the chart stops looking like a rash.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Interstates	Victor airways: lines between VOR stations (VHF omnidirectional range, a ground radio navigation station), mostly for instrument flying	Related, not the same. A VFR pilot usually flies direct or from landmark to landmark; the airways are there when you want a road.
State roads and highways	The same roads, printed on the chart	Exact match, and the best landmarks there are. A road that crosses a railroad by a lake is a checkpoint you cannot miss.
Cities and towns	Airports: magenta for no control tower, blue for a tower; the symbol tells you the runway length and whether there is fuel	Exact match, with more information per dot. The identifier (three or four characters) is the airport's name in the system.
Toll roads, HOV lanes, roads closed to trucks	Special-use airspace: Prohibited (never), Restricted (only when inactive or with permission), Military Operations Areas (you may enter VFR; call and ask whether it is hot), Warning areas offshore	Exact match: some roads you may not use, some you may use with a permit, some you use with care.
Downtown, where you need a permit to drive	Class B airspace, around the biggest airports: you need a clearance to enter, a transponder, and a private certificate or a specific endorsement	Exact match. "Cleared into the Bravo" is the permit; without those words you stay out, and the Mode C veil (30 miles) is the transponder requirement around it.
The suburbs, with a checkpoint on the way in	Class C, around medium airports: two-way radio contact established before entering, transponder required	Exact match.
A small town with one police officer	Class D, around airports with a tower: two-way radio contact, then do what the tower says	Exact match, including the officer.
County roads	Class E: controlled airspace where a VFR pilot needs no permission, only the weather minimums	Most of the map. This is where most of your training happens.
Dirt roads	Class G: uncontrolled, usually the first 700 or 1,200 feet above the ground away from airports	The lowest minimums and the least help. Fine on a clear day.
Mile markers and exit numbers	Checkpoints you choose yourself: a tower, a lake, a highway crossing, a town, every 10 to 15 miles along the line you drew	The road gives you mile markers; the sky makes you pick your own. Lesson 9 is how.
Mountain passes and elevation signs	Terrain contours, obstruction symbols, and the Maximum Elevation Figure in every chart box: the highest terrain or obstacle in the box plus a margin, in thousands and hundreds of feet	The third dimension. On the road the pass is a road; in the air the pass is a number you must fly above.
Construction zones and detours	NOTAMs (notices to air missions) and Temporary Flight Restrictions, checked before every flight	Exact match. A TFR is a road closure that can end your certificate if you drive through it.
An old atlas	A sectional chart expires every 56 days	The road changes slowly; frequencies, towers and airspace change fast. Expired chart, expired knowledge.
"One inch equals ten miles"	One inch on a sectional is about 6.9 nautical miles (1:500,000)	Exact match, once you learn to think in nautical miles.
Rest areas	Alternate airports: for every leg, the airport you would go to if the plan changed	Exact match, chosen before you leave.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
North is up	True north is up, but the compass reads magnetic; the dashed lines of magnetic variation on the chart are the correction	The one bit of arithmetic drivers never needed: true course plus or minus variation gives the magnetic course you actually fly.

Where to get the maps, free

The road map: free from your state. Every state's department of transportation publishes its official state highway map as a free PDF, and most will mail a free printed copy if you ask (a typical state DOT posts the front and back of its map as PDFs and mails one on request by email). The welcome center at the state line hands them out, and so do most rest areas. For the hundred-mile exercise in Lesson 9, the free state map is the right map; you do not need the whole country.

If you want the whole country in one book: the Rand McNally Road Atlas covers all fifty states, Canada and Mexico; the 2026 edition lists at about $28 and sells for less in discount stores. Worth it for a road-trip family; not needed for this exercise.

Terrain, free: the U.S. Geological Survey publishes its topographic maps as free downloads (topoView and the National Map). They are the nearest thing on the road side to the sectional's contour lines and elevation figures.

The sectional: free from the FAA. The FAA publishes every VFR sectional as a free PDF and GeoTIFF on its Digital Products page, updated on a 56-day cycle; the page shows the current edition date and the next one, so you always know whether your chart is current. Free websites such as SkyVector show the same charts on screen, and the flight-planning apps carry them by subscription. A printed sectional costs about ten dollars from a pilot shop, and a printed one is worth having for the exercise: you can draw on it.

DO THIS

1. Get the sectional for where you live from the FAA's free download page, or open it on a free chart website (the box above). Find your house, the nearest airport, the airspace over your house, and the Maximum Elevation Figure of your box. Those four things are the first hour of the navigation lesson.
2. Plan your next real drive on a paper map or a printed one, not the phone: draw the line, pick a checkpoint every 10 to 15 miles, and write them down. Lesson 9 turns that list into a nav log.

WHAT THE BOOKS SAY: READ THESE NEXT

The Airplane Flying Handbook does not teach charts: it teaches flying. The charts are Chapter 16 of the Pilot's Handbook of Aeronautical Knowledge, the Chart Users' Guide, and the legends themselves.

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 16, Navigation: Aeronautical Charts and Sectional Charts	p. 16-2	PDF p. 389
Pilot's Handbook of Aeronautical Knowledge	Chapter 16: Flight Planning, and the use of the Chart Supplement U.S.	p. 16-17	PDF p. 404
Pilot's Handbook of Aeronautical Knowledge	Chapter 14, Airport Operations: Aeronautical Charts and the Chart Supplement as airport information sources	p. 14-3	PDF p. 337
Pilot's Handbook of Aeronautical Knowledge	Chapter 15, Airspace (the classes printed on the chart)	p. 15-1	PDF p. 376
Chart Users' Guide	Explanation of VFR Terms and Symbols: the sectional's legend, explained symbol by symbol	p. 10	PDF p. 10
Chart Users' Guide	VFR Sectional and Terminal Area Charts: the symbols as they appear on the chart	p. 23	PDF p. 23
Chart Supplement (FAA)	Free PDFs on the 56-day cycle; each volume opens with its own legend explaining every abbreviation in an airport entry	-	open
VFR sectional charts (FAA)	Free PDF and GeoTIFF sectionals on the 56-day cycle; the legend is printed on the chart's panel	-	open
ACS	Area I, Task D, Cross-Country Flight Planning: PA.I.D.S2, apply information from current charts and Chart Supplements	p. 4	PDF p. 12
ACS	Area I, Task E, National Airspace System: PA.I.E.K1 (airspace classes), K2 (chart symbols)	p. 5	PDF p. 13
ACS	Area VI, Task A, Pilotage and Dead Reckoning: PA.VI.A.K3 (topography), K4c (checkpoints)	p. 38	PDF p. 46
14 CFR 91.103	Preflight action: become familiar with all available information	-	eCFR
Chart Users' Guide (July 9, 2026) MORE · PRIVATE	Maximum Elevation Figure (p. 13); airspace classes as charted (pp. 16-17); airspace symbols (p. 26); navigational and procedural information (p. 32); culture, meaning roads and railroads, the car's own landmarks (p. 34); hydrography (p. 37); relief (p. 40)	p. 13	PDF p. 13
AIM (Change 3, July 9, 2026) MORE · PRIVATE	3-2-3, Class B Airspace (the clearance, the Mode C veil); 5-1-3, Notices to Air Missions (PDF p. 324); 7-1-5, Preflight Briefing (PDF p. 524). FAA guidance	p. 3-2-3	PDF p. 179

TEACH IT BACK

Hand a passenger the map and the legend, name a symbol, and time how long it takes them to find what it means. Then do the same with a sectional and the Chart Users' Guide. The skill is the finding, not the remembering.

9

The road trip is a cross-country with a shoulder

Distance, speed, time, fuel, checkpoints, a map on the passenger seat, and someone at home who knows when you should arrive. You have already flown a cross-country; you did it at 70 miles an hour.

OBJECTIVE

Plan and drive (or navigate) a hundred-mile trip with checkpoints, times and fuel written down first, then score it, the way you will fly your first cross-country.

THE RISK STEP PAVE: enVironment and External pressures (the arrival time). 3P: Process the groundspeed check, then Perform the recompute. The attitude: invulnerability ("the gauge says we are fine").

The arithmetic

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Miles and miles per hour	Nautical miles and knots. A nautical mile is 1.15 statute miles; 100 knots is 115 mph	Same numbers in different units. The sectional is drawn in nautical miles; the wind is reported in knots; the airspeed indicator reads knots.
Time = distance divided by speed	Time = distance divided by groundspeed, and groundspeed is airspeed corrected for wind	The break that makes the wind the most important number on the trip. A 20-knot headwind on a 100-knot airplane adds a quarter to the time and the fuel.
Miles per gallon	Gallons per hour. A 172N burns roughly 7 gallons an hour in cruise; the exact number is in the POH performance section for the power setting and altitude	Fuel is burned by the hour, not the mile, because the engine runs the same whether the wind is helping or not. Slow trip, more fuel.
"We will fill up in the next town"	Fuel on board minus the legal reserve is what you may plan with: 30 minutes by day, 45 minutes at night, at cruise, after reaching the destination (91.151). Personal minimums are usually an hour (Industry practice)	The gas light gives a car 30 miles of warning. The airplane gives none; the reserve is the warning, and it lives on paper before you take off.
The gas gauge	Time. Dip the tanks (a clear tube shows the gallons), note the time you took off, and stop the flight before the plan says the fuel runs low, whatever the gauge shows	Fuel-related problems are on the FAA's own short list of leading causes of fatal general aviation accidents, with loss of control, flight into terrain and engine failure (Risk Management Handbook 3-4), and they happen to people who trusted a gauge. Lesson 14.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Mile markers and "we should hit the state line at 3:10"	Checkpoints with an estimated time between each pair, written on the nav log before the flight, and the actual time written next to it as you pass	Exact match, made formal. Two checkpoints and a watch tell you your real groundspeed, and the real groundspeed tells you whether the fuel plan still holds.
"We are ten minutes behind"	A groundspeed check: 12 nautical miles in 8 minutes is 90 knots (12 statute miles would be 78); if the plan said 105, the headwind is stronger than forecast, and every leg after this one is recomputed	The car driver shrugs; the pilot recomputes, because ten minutes behind is more than a gallon.
The atlas on the passenger seat	The chart folded to the leg and the nav log clipped where you can see it; the passenger reads it out in a car, and in the airplane you learn to do it yourself with one hand while flying with the other (trim, Lesson 3)	Exact match.
A detour: the road is closed, find another way	A diversion: weather ahead, an unexpected closure, a passenger who needs the ground. Pick a new airport, estimate heading, distance, time and fuel to it, in about a minute, with the chart on your knee	A required task on the checkride, because it is what real flights turn into.
"Text me when you get there"	A VFR flight plan filed with Flight Service, opened when you depart and closed when you land, so a search starts if you do not; and flight following, radar advisories from ATC on the way	The road version is a courtesy; the air version is a search-and-rescue trigger. Close the flight plan or the phone rings.
Stop every two hours, switch drivers	IMSAFE before the flight, and legs planned around your bladder and your attention, not the airplane's range	A 172N can fly well over four hours on full tanks. Most pilots should not (Captain's take).
"Just going around the block"	The traffic pattern and the practice area: the first flights stay within sight of the airport	Exact match, including the fact that "around the block" is where you learn to drive and the pattern is where you learn to fly.
The first real road trip	The solo cross-country. For the private certificate: 5 hours of solo cross-country, including one flight of at least 150 nautical miles with full-stop landings at three airports and one segment of more than 50 nautical miles straight-line between takeoff and landing, plus a night cross-country of over 100 nautical miles total distance with the instructor (61.109). "Cross-country" for these hours means a landing more than 50 nautical miles away	This is the trip the whole certificate builds toward, and it is a road trip with the same list: map, checkpoints, times, fuel, weather, someone who knows when you should be back.

THIS MONTH, IN THE CAR: THE HUNDRED-MILE CROSS-COUNTRY

1. Pick a drive of about 100 miles you would make anyway. Plan it on paper the night before: the line on the map, a checkpoint every 10 to 15 miles, the distance between them, and the time between them at the speed limit. Write the estimated time of arrival at each checkpoint on the nav log page at the back of this document.
2. Before you leave, fill the tank and zero the trip odometer. That is dipping the tanks and noting the time.
3. A passenger writes the actual time at each checkpoint next to your estimate. After two checkpoints, compute your real average speed and re-estimate the rest. That is the groundspeed check.
4. Halfway, the passenger says "we are going to X instead" (a town off the route). The navigator has one minute, with the map, to give the driver the turn, the distance, the time and whether the fuel covers it (driving alone, pull over to work it). That is the diversion.
5. At the end, fill the tank again. Gallons used, divided by hours driven, is your gallons per hour; miles divided by gallons is your miles per gallon. Write both on the log. Now you have done fuel planning once with real numbers.
6. Send someone your route and your arrival time before you leave, and tell them when you arrive. That is the flight plan, opened and closed.

The rules, so it stays a lesson and not a stunt

The phone is on, in the glove box. "No phone" means no navigating by it, not no phone in the car. It is there for an emergency and for the cross-check at the end.

The driver never reads the map. The passenger is the navigator; that is the navigator's job, which in the airplane is yours, and it is half the lesson. Alone, the rule is "pull over to look," and every stop gets counted on the log, because a stop is exactly the thing the airplane will not let you do.

The route needs turns and towns. A hundred miles of one interstate is too easy; the mile markers do the navigating. Use some interstate for the mile-marker feel (that is the DME, distance-measuring equipment, counting down), then state roads where the checkpoints have to be found. At least four turns and two towns.

The lost leg. For one ten-mile leg the navigator closes the map. At the end of it the driver says where they are from what they have seen: the water tower, the railroad, the road that bent left. That is pilotage, and it is the muscle the GPS lets die.

Score it, or it is just a drive. Arrival at each checkpoint within five minutes of the estimate; the fuel estimate within ten percent of the pump; the diversion answered in a minute; the number of stops. Write the scores on the log.

The GPS comes out at the end, not the start. On the way home, turn the phone on and compare its route and its time with the paper plan. That is how the GPS is used in the airplane: a cross-check on a plan that already exists, never the plan itself.

It is a driving lesson too. A parent doing this with a sixteen-year-old teaches the ground lesson the passenger seat never did: the map, the plan, the checkpoints, the fuel. Same exercise, same log, and the teenager learns to drive somewhere instead of merely to drive.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 16, Navigation: Pilotage	p. 16-12	PDF p. 399
Pilot's Handbook of Aeronautical Knowledge	Chapter 16: Dead Reckoning	p. 16-13	PDF p. 400
Pilot's Handbook of Aeronautical Knowledge	Chapter 16: Lost Procedures	p. 16-34	PDF p. 421
ACS	Area I, Task D, Cross-Country Flight Planning	p. 4	PDF p. 12
ACS	Area VI, Task A, Pilotage and Dead Reckoning	p. 38	PDF p. 46
ACS	Area VI, Task C, Diversion	p. 39	PDF p. 47
ACS	Area VI, Task D, Lost Procedures	p. 40	PDF p. 48
14 CFR 91.103	Preflight action	-	eCFR
14 CFR 91.151	Fuel requirements for flight in VFR conditions	-	eCFR
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 3: the FAA's leading causes of fatal general aviation accidents (loss of control, terrain, powerplant, fuel)	p. 3-4	PDF p. 22
AIM (Change 3, July 9, 2026) MORE · PRIVATE	5-1-3, Notices to Air Missions (checked before every flight); 4-1-15, Radar Traffic Information Service, flight following (PDF p. 214). FAA guidance	p. 5-1-3	PDF p. 324

TEACH IT BACK

After the trip, walk the navigator through the nav log line by line: planned versus actual, where the time went, and what the fuel did. That debrief is what an instructor does after your first cross-country.

YOUR NOTES

10

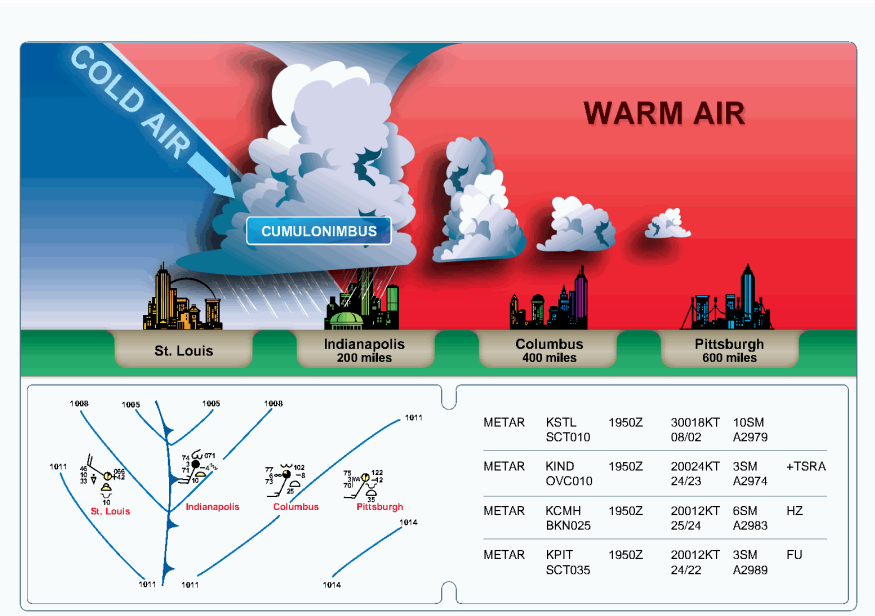
Weather: on the road you slow down, in the air you decide before you leave

Every driver has driven through weather they should have waited out, and got away with it because the car has a shoulder and a brake. The airplane has neither, so the decision moves to the kitchen table.

OBJECTIVE

Make the go or no-go decision before you leave, from a forecast, and name the weather that would make you stop; then tell anti-ice from deice on the car and the airplane, and know that most training airplanes are not certified to fly in icing at all.

THE RISK STEP PAVE: enVironment. 3P: Perform, the go or no-go made at the kitchen table. The attitude: get-there-itis, the External pressure with its own name.



A cold front, the line of weather that a driver slows down for and a pilot decides about on the ground. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 12-26. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Rain, fog, ice, wind: slow down, turn on the wipers, pull over if it gets bad	Light rain can be fine; thunderstorms never are; low cloud and low visibility are not, for a VFR pilot; ice is never fine in a 172; wind is a number compared with a limit. The decision is go or no-go, made on the ground, and the in-flight version is a 180-degree turn made early	The biggest break in this whole document. There is no slowing down and no pulling over. There is only deciding earlier.
The weather app	The standard briefing: METARs (the weather now, at airports), TAFs (the forecast at airports), winds aloft, AIRMETs and SIGMETs (warnings for the area), PIREPs (what other pilots just saw), all from aviationweather.gov or Flight Service, free	Same information, more of it, in a code you learn in a week. The checkride expects you to read a METAR out loud.
"Visibility was terrible"	VFR requires, in most airspace, 3 statute miles of visibility and specified distances from clouds (91.155). Your personal minimums are higher: many instructors start students at 5 miles and a 3,000-foot ceiling (Industry practice). The Risk Management Handbook, Chapter 2, gives six steps for writing yours down, and the workbook has the sheet for it	The law is the floor, not the plan.
Black ice	Carburetor ice (the 172N is carbureted: carburetor heat is checked at the run-up, pulled ON before power reductions and before landing, and pushed in for takeoff; 172N POH Section 4, and Section 3 for carburetor icing) and airframe ice, which a 172 is not equipped for at all	The car slides; the airplane stops flying. Known icing is a no-go, full stop.
A crosswind on a bridge	A crosswind landing. The 172N POH gives 15 knots as the maximum demonstrated crosswind, which is a test-pilot figure, not a limit, and a student's personal limit starts far lower	Same push on the side of the machine; the difference is that you are trying to touch down straight.
Driving into fog with the headlights on	Flying into a cloud without an instrument rating. The training answer is taught under the hood during training (3 hours are required for the private certificate, 61.109(a)(3)): keep the wings level on the instruments and make a 180-degree turn back to where it was clear	A VFR pilot in cloud can lose control within minutes. It is the accident this guide exists to talk people out of (Captain's take; the FAA's procedure is AFH 18-17).
The drive home through the storm because you wanted to be home	The flight home through the weather because you wanted to be home. Pilots call it get-there-itis and it has its own line in the FAA's decision-making chapter	Exact match, except the car usually makes it. The fix is the same both places: decide before you leave what would make you stop, and then honor it.
The car feels slow in the mountains	Density altitude: on a hot day at a high airport the air is thin, the engine makes less power and the wing makes less lift. The POH performance charts give the takeoff distance for the day	Same physics: a normally aspirated engine loses roughly 3 percent of its power per thousand feet in both machines (PCS analysis, a rule of thumb; the POH performance tables are the source for the airplane). The car merely feels slow; the airplane may not clear the trees.

DO THIS

1. Every morning for a week, open aviationweather.gov, read the METAR and TAF for the airport nearest you, and decide "VFR or not" for a pretend lesson at 10 a.m. In the evening, check what the day actually did. You will be reading METARs fluently by Friday.
2. Before your next drive in bad weather, say out loud what would make you turn around. Then notice whether you honor it.

WHAT THE BOOKS SAY: READ THESE NEXT

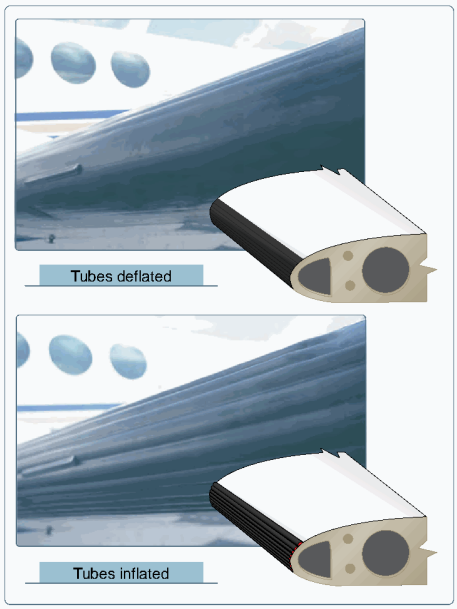
SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 12, Weather Theory	p. 12-1	PDF p. 285
Pilot's Handbook of Aeronautical Knowledge	Chapter 12: Ceiling and Visibility	p. 12-17	PDF p. 301
Pilot's Handbook of Aeronautical Knowledge	Chapter 13, Aviation Weather Services	p. 13-1	PDF p. 311
Pilot's Handbook of Aeronautical Knowledge	Chapter 11, Aircraft Performance: Density Altitude	p. 11-3	PDF p. 259
Airplane Flying Handbook	Chapter 18, Emergency Procedures: Inadvertent VFR Flight Into IMC (the 180-degree turn, step by step)	p. 18-17	Ch. 18 PDF p. 17
ACS	Area I, Task C, Weather Information: PA.I.C.K2 (the products), K3 (meteorology), R (making the go or no-go decision)	p. 3	PDF p. 11
14 CFR 91.155	Basic VFR weather minimums	-	eCFR
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 2, Personal Minimums: the six-step process (p. 2-1) and Figure 2-9, the adjustments for a new pilot (p. 2-5, PDF p. 17)	p. 2-1	PDF p. 13
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	3.3.1 Weather Briefings (p. 3-3) and 3.3.3 Self-Briefing (p. 3-5, PDF p. 28): what a standard briefing contains	p. 3-3	PDF p. 26
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	24.4 METAR and SPECI, decoded field by field (the morning exercise above)	p. 24-5	PDF p. 289
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	27.4 Terminal Aerodrome Forecast (TAF)	p. 27-6	PDF p. 407
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	24.5.1 Pilot Weather Reports (PIREP)	p. 24-26	PDF p. 310
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	26.2 SIGMET (p. 26-2) and 26.3 AIRMET, shown graphically as G-AIRMETs (p. 26-15, PDF p. 382)	p. 26-2	PDF p. 369
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	18.1.1 Fog (p. 18-2) and 18.2.1 Low Ceiling (p. 18-12, PDF p. 232)	p. 18-2	PDF p. 222
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	Chapter 20, Icing: 20.1 to 20.3 (pp. 20-1 to 20-2) and 20.4.1 Carburetor Icing (p. 20-7, PDF p. 249)	p. 20-1	PDF p. 243
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	Chapter 22, Thunderstorms (p. 22-1) and 22.8.2, the avoidance guidance (p. 22-21, PDF p. 276)	p. 22-1	PDF p. 256
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	10.7.1 Crosswind (p. 10-16) and 10.7.2 Gust (p. 10-17, PDF p. 132)	p. 10-16	PDF p. 131

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Aviation Weather Handbook (FAA-H-8083-28B, April 2026) MORE · PRIVATE	16.9 Density Altitude (p. 16-17) and 16.2 Mountain Waves (p. 16-2, PDF p. 191; see also Lesson 11)	p. 16-17	PDF p. 206
AIM (Change 3, July 9, 2026) MORE · PRIVATE	7-1-5, Preflight Briefing: what to ask Flight Service for, in order. FAA guidance	p. 7-1-5	PDF p. 524

TEACH IT BACK

Before a real drive in doubtful weather, tell your passenger out loud what would make you turn around, before you leave. Then keep the promise.

Ice: anti-ice versus deice



Deicing boots on a wing: they inflate to crack ice off after it forms. That is deice; anti-ice stops it forming. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Chapter 7, page 7-40 (the FAA's own caption reads Figure 6-48). Public domain.

Ice is the weather hazard a car teaches best and an airplane tolerates least. Anti-ice prevents ice from forming; deice removes ice that has already formed. Your car has both, and the difference between them is the whole of this part.

The FAA's definition is one sentence: anti-icing equipment is designed to prevent the formation of ice, while deicing equipment is designed to remove ice once it has formed. The same piece of equipment can be either, depending on when you turn it on. The rear-window defroster switched on before the frost forms is anti-ice; switched on to clear a frosted window, it is deice. The airplane is no different, and the timing is written in its manual.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
The scraper and brush in the driveway	Removing all frost, ice and snow from the wings, tail and windshield before flight	Exact match on the ground, with a much stricter standard. A car can drive away through a scraped peephole; frost as thin as sandpaper on a wing disrupts the airflow and the wing stalls earlier. The airplane leaves clean or not at all.
Windshield washer fluid, with antifreeze in it	Alcohol windscreen anti-ice: alcohol sprayed on the windscreen early, before ice builds	Exact match: anti-ice, used before. Used late, both just smear.
The rear-window defroster grid (electric heat)	Electrically heated windscreens and propeller blades; some newer airplanes heat the wing's leading edge electrically	Exact match. Anti-ice if switched on before the ice, deice if after.
The front defroster: warm air on the glass	Cabin heat and defrost, which in most small airplanes is air warmed around the exhaust, so a leak can bring carbon monoxide into the cabin	Similar job, one new hazard. The CO detector on the panel is the reason.
Heated side mirrors	The heated pitot tube, which keeps the airspeed indicator working; often the only ice protection a light airplane has	Exact match: a small heater to keep one sensor working, not protection for the whole machine.
Windshield wipers	None on a 172. In rain you look around and through it, or you are somewhere you should not be	No match. The car's plan for bad weather does not transfer.
Gas-line antifreeze in a bottle	Fuel system icing and anti-icing fuel additives; carburetor heat, which the FAA calls an anti-icing system	Close match: water in the fuel freezes in both. Carburetor heat has no car equivalent anymore.
Rubber blades scraping ice that has formed	Inflatable deicing boots on the leading edges: they inflate to crack ice that has already formed	Exact match in kind: deice, used after.
"Bridge ices before road"	Structural icing in visible moisture at or below freezing; the freezing level and icing forecasts in every weather briefing	The car slides on ice; the airplane carries it and gets heavier while its wing gets worse. Most trainers are not certified for flight in icing, and the Pilot's Handbook of Aeronautical Knowledge says aircraft without that certification must leave icing conditions immediately.

DO THIS

1. Look up defrost, defog, washer, and heated mirrors (and heated seats, wipers and windshield if your car has them) in the owner's manual index. List every item.
2. Mark each one A (anti-ice), D (deice), or A/D (either, depending on when you use it).
3. Read the label on the washer-fluid jug: what temperature does it protect to? That is a limitation, and the airplane's version is in the POH.
4. On the next frosty morning, parked outdoors (never in a closed garage), time how long the defroster takes to clear the whole windshield. Then picture needing every square inch of a wing that clean before you could move.
5. Ask your flight school to show you the Kinds of Operation list in a trainer's POH, Section 2. Find the line about flight into known icing.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 7, Aircraft Systems: Anti-Ice and Deice Systems (the definitions; most light aircraft have only a heated pitot tube)	p. 7-40	PDF p. 200
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Windscreen Anti-Ice, Propeller Anti-Ice, Other Anti-Ice and Deice Systems	p. 7-41	PDF p. 201
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: carburetor heat as an anti-icing system	p. 7-10	PDF p. 170
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Fuel System Icing (and anti-icing additives)	p. 7-28	PDF p. 188
Pilot's Handbook of Aeronautical Knowledge	Chapter 7: Exhaust Systems (cabin heat and carbon monoxide)	p. 7-18	PDF p. 178
Pilot's Handbook of Aeronautical Knowledge	Chapter 17, Aeromedical Factors: Carbon Monoxide (CO) Poisoning (the symptoms, and why the detector)	p. 17-12	PDF p. 434
Pilot's Handbook of Aeronautical Knowledge	Chapter 5, Aerodynamics of Flight: ice, snow and frost on the wing and the stall	p. 5-26	PDF p. 123
Pilot's Handbook of Aeronautical Knowledge	Chapter 12, Weather Theory: Icing	p. 12-24	PDF p. 308
Airplane Flying Handbook	Chapter 13: Anti-Icing/Deicing Equipment (in the multiengine chapter; the principles are the same)	p. 13-9	Ch. 13 PDF p. 9
ACS	Area I, Task G, Operation of Systems: PA.I.G.K1i (environmental), K1j (deicing and anti-icing)	p. 7	PDF p. 15
ACS	Area I, Task C, Weather Information: PA.I.C.K3i, icing and freezing level information (the task begins on p. 3)	p. 4	PDF p. 12
14 CFR 91.9	Operate within the limitations in the flight manual, markings and placards, including the kinds of operation	-	eCFR

TEACH IT BACK

On the next cold morning, explain anti-ice and deice to whoever is in the car using the washer fluid and the scraper. Then tell them why the airplane at the flight school stays on the ground when there is frost on the wing.

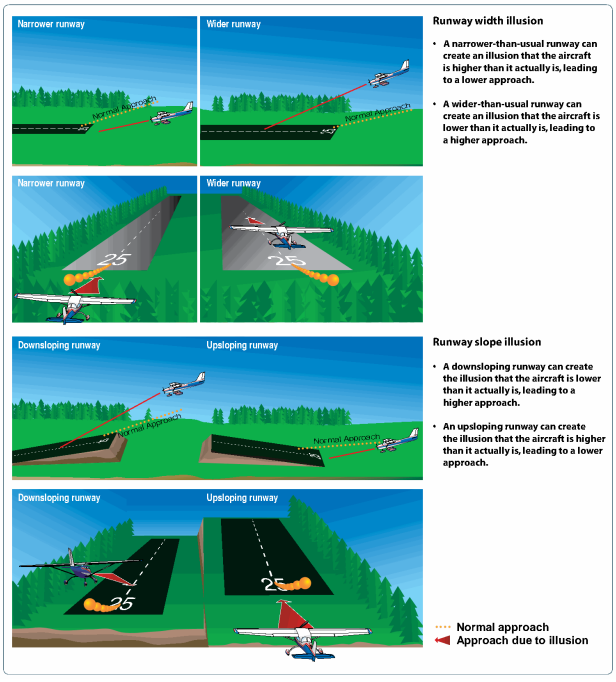
11 Night, mountains, animals and the truck ahead

The road has a hazards chapter too, and most of it transfers.

OBJECTIVE

Carry the road's hazards (night, terrain, wildlife, the truck's wake) into the air, and know which ones change.

THE RISK STEP PAVE: enVironment, after dark and over the ridge. 3P: Perceive the hazard the road never taught. The attitude: invulnerability at night.



Runway illusions at night and on sloped or unusual runways: why the instruments and the approach lights get the final say. FAA figure: Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), Figure 17-7. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Night driving: harder to judge distance, easy to overdrive the headlights	Night flying: harder to judge height, illusions on approach (a runway with no lights around it looks higher than it is), a flashlight with a red lens, and three takeoffs and three full-stop landings at night (1 hour after sunset to 1 hour before sunrise) in the last 90 days before you carry a passenger at night (61.57(b))	Exact match in the sense that you trust the instruments and the procedure more and your eyes less. The private certificate requires 3 hours of night training that include a cross-country of over 100 nm and 10 takeoffs and 10 landings to a full stop (61.109(a)(2)).
Driving in the mountains: gears, brakes, passes	Mountain flying: the Maximum Elevation Figure, downdrafts on the downwind side of a ridge, crossing a ridge at an angle so you can turn away, and density altitude (Lesson 10)	The car has the road; the airplane has the air moving over the ridge, which the road never taught you about.
Deer on the road at dusk	Deer and birds on the runway, and birds at low altitude at dawn and dusk. You look at the whole runway before you land on it, and you go around if something is on it	Exact match. The go-around is the airplane's brake.
Tailgating a truck	Wake turbulence: a heavy airplane leaves two invisible horizontal tornadoes behind it that sink and drift. You take off before its rotation point and land beyond its touchdown point, and you stay above its path	The truck's draft pushes a car; the airliner's wake can roll a 172 onto its back. The tower says "caution, wake turbulence" and means it.
Stop-and-go traffic	Sequencing in the pattern: extend the downwind, slow down, or go around; never cut in	Exact match.
Parking-lot speed	Taxi speed: a brisk walk is the rule of thumb in training (Industry practice), slower near other airplanes and people	Exact match. Fast taxiing is how students bend airplanes.
The driveway	The ramp: chocks, tie-downs, and the propeller, which is treated as live, always	The one new rule: nobody stands in front of a propeller, ever.
Tolls and parking meters	Landing fees, ramp fees, overnight tie-down fees, and the FBO (the airport's service business: fuel, parking, a lounge) that waives them if you buy fuel	Exact match, and worth asking about before the cross-country.

DO THIS

1. On a night drive, notice how you judge distance to the car ahead by its lights, and how wrong you can be. That is the approach illusion, and the airplane has a light system (the PAPI, four lights beside the runway: two red and two white means you are on the path) to correct for it.
2. Behind a truck on the highway, notice the buffet when you pull out to pass. Then read the AIM's wake turbulence section once. Same idea, larger.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 17, Aeromedical Factors: Night Vision	p. 17-22	PDF p. 444
Pilot's Handbook of Aeronautical Knowledge	Chapter 14, Airport Operations: Wake Turbulence	p. 14-26	PDF p. 360
Airplane Flying Handbook	Chapter 11, Night Operations	p. 11-1	Ch. 11 PDF p. 1
Airplane Flying Handbook	Chapter 11: Night Illusions (the dark runway, the lights that seem closer; pp. 11-4 to 11-5)	p. 11-4	Ch. 11 PDF p. 4
Airplane Flying Handbook	Chapter 11: Night Emergencies	p. 11-13	Ch. 11 PDF p. 13
Pilot's Handbook of Aeronautical Knowledge	Chapter 17: Runway Width Illusion, Featureless Terrain Illusion (the whole list is pp. 17-10 to 17-11)	p. 17-10	PDF p. 432
ACS	Area XI, Task A, Night Operations	p. 63	PDF p. 71
AIM (Change 3, July 9, 2026) MORE · PRIVATE	8-1-5, Illusions in Flight (PDF p. 643); 7-6-7, Mountain Flying (PDF p. 621); 7-5-2, Reducing Bird Strike Risks, and 7-5-1, Migratory Bird Activity (PDF p. 615); 7-4-1 to 7-4-6, Wake Turbulence (PDF pp. 606-611). FAA guidance	p. 8-1-5	PDF p. 643
14 CFR 61.57	Recent flight experience: pilot in command (three takeoffs and landings at night to carry passengers at night)	-	eCFR
14 CFR 91.209	Aircraft lights	-	eCFR

TEACH IT BACK

On a night drive, explain to your passenger why distances are harder to judge, and why a pilot trusts instruments and procedures more at night.

YOUR NOTES

12

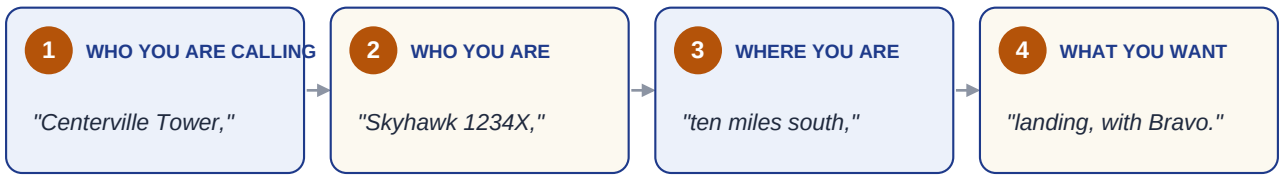
Talking: the radio is a four-way stop where everyone says what they are doing

Drivers communicate with signals and horns. Pilots say it out loud, in a format, and everyone on the frequency builds the same picture.

OBJECTIVE

Make a radio call in the standard order (who you are calling, who you are, where you are, what you want) and predict the next call in real traffic.

THE RISK STEP PAVE: External pressures, and the Pilot who can say "unable." 3P: Perform, out loud. The attitude: resignation, accepting a clearance you cannot fly.



The four-way stop, out loud: say who you are, where you are and what you will do, then listen for your turn.

A first call to a tower in four parts. Drawing: Pilot Career Solutions.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Turn signal	The radio call: who you are calling, who you are, where you are, what you want ("Podunk traffic, Cessna 12345, ten miles south, inbound for landing, runway 27, Podunk")	Exact match in purpose: tell everyone what you are about to do before you do it.
Spelling a name over the phone	The phonetic alphabet, learned in an evening: Alpha, Bravo, Charlie...	Exact match. You will use it for the rest of your life, in and out of airplanes.
Following a police officer's hand signals at an intersection	A clearance or instruction from the tower, read back word for word so the controller knows you heard it	The read-back is the difference. "Cleared to land runway 27, Cessna 345" is a contract.
Saying no to a passenger who wants you to speed	"Unable." One word, a complete sentence, and controllers respect it	Exact match. The pilot in command decides; the controller sequences.
Listening to the police scanner	Listening to LiveATC.net, free, from your couch (the site has a page on it)	Have the local tower frequency playing for a week, in the kitchen or in the car as a passenger, and the radio lesson becomes review; the driver keeps the radio off and the attention on the road.

DO THIS

1. Set up a busy tower on LiveATC before the car moves and just listen. Predicting each call out loud (whose turn it is, what they will do next) is for a passenger, or parked. When you can predict the next call, you can make it.
2. As a passenger, learn the phonetic alphabet by spelling license plates; drivers practice on parked cars, or from memory. It takes three days.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 14, Airport Operations: Radio Communications, and Lost Communication Procedures (p. 14-23)	p. 14-22	PDF p. 356
ACS	Area III, Task A, Communications, Light Signals, and Runway Lighting Systems: PA.III.A.K2 (phraseology), K5 (lost communications)	p. 16	PDF p. 24
AIM (Change 3, July 9, 2026) MORE · PRIVATE	4-2-2, Radio Technique (listen before you transmit; PDF p. 227); 4-2-3, Contact Procedures, the four-part call (PDF p. 228); 4-2-7, Phonetic Alphabet (PDF p. 232); 6-4-1, Two-way Radio Communications Failure (PDF p. 512). FAA guidance	p. 4-2-3	PDF p. 228

TEACH IT BACK

Make a mock pattern call for your passenger at each turn on a drive home, then have them make one. Who, who, where, what.

13

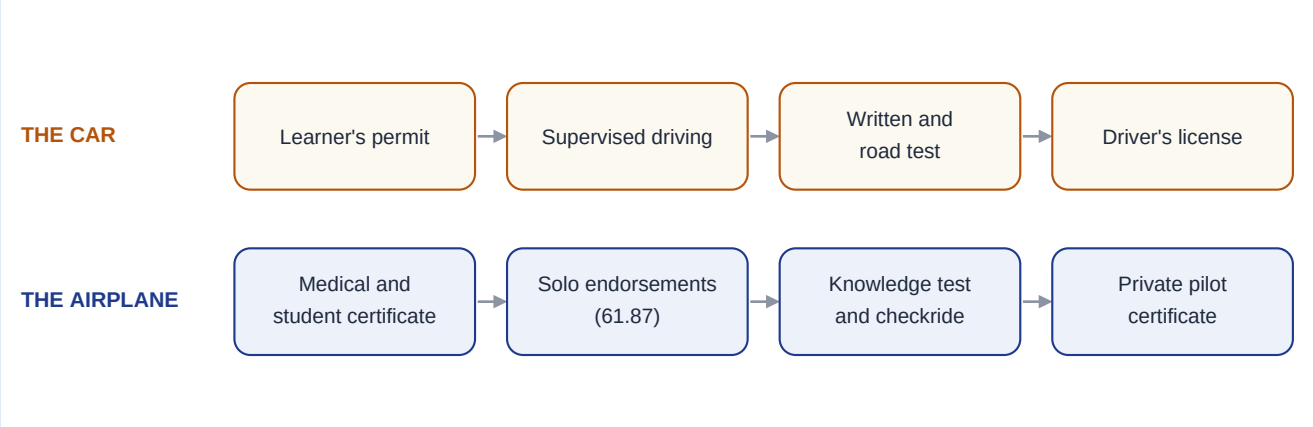
The permit, the test, the license: the DMV and the FAA

Everyone remembers the sequence: the permit, the written, the road test, the restrictions, the renewal. The FAA runs the same sequence with different names and one thing the DMV never had: the medical.

OBJECTIVE

Lay the driver's license path (permit, written test, road test, restrictions) beside the pilot's (student certificate, medical, knowledge test, checkride) and know the order.

THE RISK STEP PAVE: Pilot. 3P: Perceive your own fitness and currency before the law does. The attitude: anti-authority ("the medical is a formality").



The car's path to a license beside the airplane's path to a certificate. Drawing: Pilot Career Solutions.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Learner's permit	Student pilot certificate, applied for free through IACRA	Exact match. Both let you operate only under supervision, and then alone only with permission.
The eye chart at the DMV, and the driver's license itself	The FAA medical: an aviation medical examiner, Third Class for a private pilot (or BasicMed later, once you have held a medical). Since October 2025 (the MOSAIC rule, the FAA's 2025 light-sport rule) a sport pilot may fly by day on a valid U.S. driver's license instead of a medical, in many light four-seat airplanes (61.316: a stall speed of not more than 59 knots calibrated, up to four seats, one passenger; whether a particular 172 qualifies depends on its POH stall-speed table); night needs a medical or BasicMed. Checked on October 26, 2026	A partial match now: for sport pilots the driver's license is the medical. For the private certificate this guide points at, the medical is the step that can stop the plan, so it happens first; the site's medical section says what actually disqualifies and what does not.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
The written test	The knowledge test: 60 questions, 70 percent to pass, at a testing center, with an instructor's endorsement to take it	Exact match, including the fact that people who read the manual pass and people who memorize the app struggle on the oral later.
The road test with the examiner	The checkride with a Designated Pilot Examiner: an oral exam first, then the flight	Exact match, longer. The DMV examiner watches you drive for fifteen minutes; the DPE spends the morning finding out whether you understand why.
Graduated license: no passengers, no night, for the first months	Student pilot limits: never a passenger, solo only with a current endorsement (renewed every 90 days), no flying for hire, and the instructor's written limits on wind and weather (61.87, 61.89)	Exact match in spirit. The endorsements are the instructor's signature saying "this one, this airplane, these conditions."
License renewal every few years	The certificate never expires, but the right to use it does: a flight review with an instructor every 24 calendar months (61.56), and three takeoffs and landings in the last 90 days before you carry a passenger, at night three full-stop night landings (61.57)	The break: the DMV renews you for a fee; the FAA makes you prove currency. A pilot who has not flown in six months is legal to fly alone and illegal to carry you.
Registration and the state inspection sticker	The airplane's papers, remembered as ARROW: Airworthiness certificate, Registration, Radio station license (only for flights outside the U.S.), Operating limitations (the POH and placards), Weight and balance. Plus the annual inspection (91.409)	Exact match, and checked on every checkride. Lesson 15 covers the maintenance side.
Car insurance	Renter's insurance, which the school's policy does not replace	The school's hull insurance protects the school. Ask about the deductible you would owe.
Points on your license	FAA enforcement can suspend or revoke a certificate. The Aviation Safety Reporting System (the "NASA form") lets a pilot report an honest mistake and, within limits, avoid the penalty	No match at the DMV. The safety-reporting system exists because aviation decided it learns more from honest reports than from punishment. Partial match: points punish; the NASA report rewards the honest admission. Use it.

DO THIS

1. Take your license and registration out of the glove box and name what each proves. Then find the ARROW list in Chapter 9 of the Pilot's Handbook of Aeronautical Knowledge and match them up.
2. Make an IACRA account now if you are serious; it costs nothing and the FTN (the tracking number) follows you through every certificate you ever earn.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 9, Flight Manuals and Other Documents: Certificate of Aircraft Registration	p. 9-6	PDF p. 236
Pilot's Handbook of Aeronautical Knowledge	Chapter 9: Airworthiness Certificate	p. 9-7	PDF p. 237
ACS	Area I, Task A, Pilot Qualifications: PA.I.A.K1-K5 (certification, privileges, medical, documents, BasicMed)	p. 2	PDF p. 10
ACS	Appendix 1: eligibility (61.39, 61.103) and the knowledge test (60 questions, 70 to pass; the ACS prints 2.5 hours, and the FAA's ACS Knowledge Test Table corrects that to 2.0)	p. 66	PDF p. 74
14 CFR 61.83	Eligibility requirements for student pilots	-	eCFR
14 CFR 61.87	Solo requirements for student pilots	-	eCFR
14 CFR 61.103	Eligibility requirements: private pilot	-	eCFR
14 CFR 61.109	Aeronautical experience: private pilot (airplane)	-	eCFR

TEACH IT BACK

Explain to someone who has a driver's license what the pilot's version of each step is, in order, and which step comes first and why (the medical).

YOUR NOTES

14

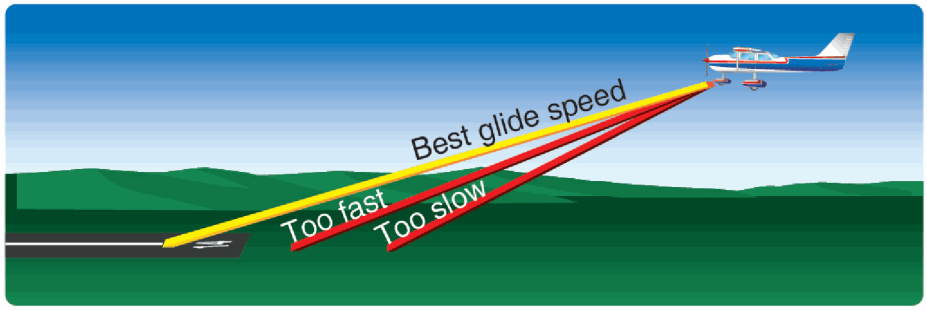
Emergencies: the flat tire with no shoulder

The car's emergency plan is "pull over and call someone." The airplane's plan is memorized, because the shoulder has to be chosen while the engine is still running.

OBJECTIVE

Pick the 'shoulder' before you need it, say the first lines of an engine-failure checklist from memory, and know why the stall and skid recoveries fight instinct.

THE RISK STEP PAVE: all four, in flight. 3P: Perform. "Where would I put it right now" is Perceive; the field you choose is Process; the ABC flow is Perform (Risk Management Handbook, Chapter 8). The attitude: resignation, the one that stops flying the airplane.



Best glide speed: too fast or too slow and the airplane lands short. The number to know before you need it. FAA figure: Airplane Flying Handbook (FAA-H-8083-3C), Figure 3-24. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
A flat tire: pull onto the shoulder	An engine failure: the airplane becomes a glider with a glide ratio of about 9 to 1 in a 172, which means from a mile up you can reach a field about nine miles away. The steps are memorized as ABC: Airspeed (best glide, 65 knots in a 172N), Best field, Checklist (restart attempts), then Declare on the frequency you are using (or 121.5 if you are talking to no one) and squawk 7700	No shoulder, so the shoulder is picked in advance: on every cross-country you know which field or road you would use right now. A road is a runway with wires beside it; a field is a runway with a soft surface. The choice is practiced from the first lessons.
The booklet in the glove box that nobody opens	The emergency checklist, whose first items you commit to memory because there is no time to read (some manuals print them in bold; the 172N POH does not)	Exact match, with a rule: memorize the first line of every emergency, read the rest.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
A skid: steer into it, do not stamp the brake	A stall: lower the nose to reduce the angle of attack first, roll the wings level, then add power as needed, then return to the desired flight path, in that order (AFH 5-16). A spin: power off, ailerons neutral, full opposite rudder, then nose down, and as the rotation stops, neutral rudder and a smooth pull-out (the AFH template; the POH sequence governs)	The best match in the lesson: both recoveries are the opposite of instinct, and both are taught until the wrong instinct is gone. The stall horn is the lane-departure beep; you answer it with your hands, not your fear.
A blowout at speed: hold it straight, ease off	A flat on landing, a crosswind gust, a bounced landing: keep it straight with the feet, and go around if in doubt	Exact match: straight first, everything else second.
Engine fire: pull over, everyone out	Engine fire in flight: mixture to idle cutoff, fuel selector off (the 172N has no separate shutoff valve), master off, cabin heat and air off, 100 knots, then a forced landing, per the POH; the airplane is now a glider and the ABC list applies	Same priorities: cut the fuel, get out of the machine. The airplane just takes longer to reach the ground.
Running out of gas	Fuel exhaustion, or fuel starvation (fuel aboard that does not reach the engine: wrong tank, water in the fuel). The fuel sumps checked before every flight, the tanks dipped, and the time watched	On the FAA's short list of leading fatal causes (Risk Management Handbook 3-4), and the car version is merely embarrassing.
Lost	The four Cs: Climb (to see more and be heard farther), Communicate (121.5 and a nearby tower or approach control will help), Confess (say the words "I am lost"), Comply (do what they say). The letters are an industry mnemonic; the substance is AIM 6-3-2 and the Pilot's Handbook of Aeronautical Knowledge, p. 16-34	The road version is the phone; the air version is the radio, and the hard part is the third C.
A medical problem in the car: pull over, call 911	A passenger in trouble: the nearest suitable airport, "pan-pan" or "mayday" on the frequency, and the controller clears the way	Exact match: the emergency word is the 911 call, and it gets everyone out of your way.

DO THIS

1. On every drive, once, ask "if the engine quit right now, where would I put it?" and answer out loud. On the highway the answer is easy. On the country road it makes you look. That is the habit, and it is the 3P model from Lesson 1 running in flight: the question is Perceive, the field you pick is Process, and the ABC flow is Perform (Risk Management Handbook, Chapter 8). Pick once; the AFH says not to change your mind more than once about the field.
2. Open the 172N POH to Section 3, Engine Failure During Flight (p. 3-4), and learn its first items: airspeed 65 KIAS, carburetor heat ON, fuel selector BOTH, mixture RICH, ignition switch BOTH (or START if the propeller has stopped), primer IN and LOCKED. ABC (airspeed, best field, checklist) is the memory hook around them, not the POH's wording. Say them in the car until they are boring.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Airplane Flying Handbook	Chapter 18, Emergency Procedures	p. 18-1	Ch. 18 PDF p. 1
Airplane Flying Handbook	Chapter 18: Terrain Selection ('do not change your mind more than once')	p. 18-4	Ch. 18 PDF p. 4
Airplane Flying Handbook	Chapter 18: Engine Failure After Takeoff (Single-Engine) and the turn-back decision, Figure 18-5 (pp. 18-7 to 18-8)	p. 18-7	Ch. 18 PDF p. 7
Airplane Flying Handbook	Chapter 18: In-Flight Fire	p. 18-9	Ch. 18 PDF p. 9
Airplane Flying Handbook	Chapter 18: Inadvertent VFR Flight Into IMC	p. 18-17	Ch. 18 PDF p. 17
Airplane Flying Handbook	Chapter 5, Upset Prevention and Recovery: Stall Recovery, the six-step template (angle of attack, wings level, power, flight path)	p. 5-16	Ch. 5 PDF p. 16
Airplane Flying Handbook	Chapter 5: Spin Procedures (the recovery template; the POH governs)	p. 5-23	Ch. 5 PDF p. 23
Airplane Flying Handbook	Chapter 9, Approaches and Landings: Emergency Approaches and Landings (Simulated)	p. 9-28	Ch. 9 PDF p. 28
Pilot's Handbook of Aeronautical Knowledge	Chapter 16, Navigation: Lost Procedures (climb, use the radios; the four Cs are an industry mnemonic)	p. 16-34	PDF p. 421
ACS	Area IX, Task A, Emergency Descent; Task B, Emergency Approach and Landing (Simulated)	p. 51	PDF p. 59
ACS	Area IX, Task C, Systems and Equipment Malfunctions	p. 52	PDF p. 60
14 CFR 91.3	Pilot in command authority, including deviation in an emergency	-	eCFR
Risk Management Handbook (FAA-H-8083-2A) MORE · PRIVATE	Chapter 8, Aeronautical Decision-Making in Flight: the 3P loop while the airplane is moving	p. 8-1	PDF p. 54
AIM (Change 3, July 9, 2026) MORE · PRIVATE	6-3-1, Distress and Urgency Communications (mayday, pan-pan); 6-3-2, Obtaining Emergency Assistance, including 'climb, if possible, for improved communications' (PDF p. 504). FAA guidance	p. 6-3-1	PDF p. 504

TEACH IT BACK

On a drive, say out loud where you would put the airplane right now if the engine quit, and why (the driver says it; the passenger may point). Then have your passenger do it at the next mile.

15

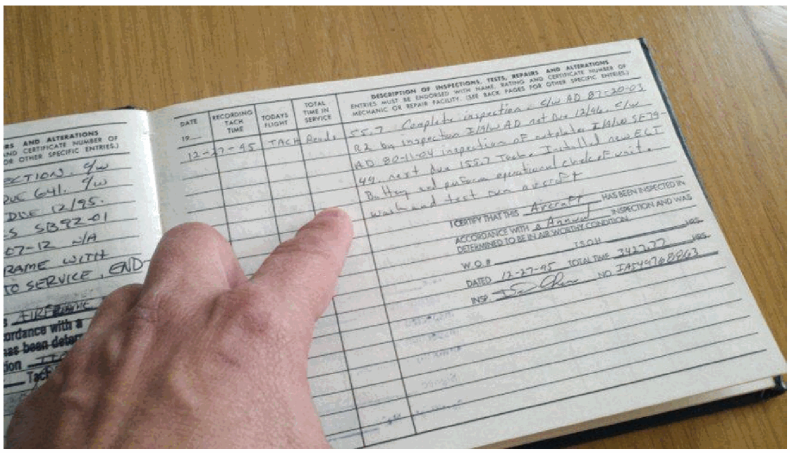
Owning and maintaining: the same garage, a stricter schedule

Everything you already do to keep a car legal and running has a match, and the match has a logbook.

OBJECTIVE

Match the car's maintenance schedule to the airplane's required inspections and records, and know who may sign for what.

THE RISK STEP PAVE: Aircraft. 3P: Perceive, the logbook before the walk-around. The attitude: anti-authority, the overdue inspection as paperwork.



The maintenance logbook: the airplane's service record, checked before every flight.
FAA figure: Airplane Flying Handbook (FAA-H-8083-3C), Figure 2-1. Public domain.

ON THE ROAD	IN THE AIRPLANE	SIMILARITY, OR WHERE IT BREAKS
Oil change every 5,000 miles	Oil change on the POH's schedule: in the 172N, every 50 hours without an oil filter; with a filter, after the first 50 hours the interval may be extended to 100 hours; and at least every 6 months, whatever the hours (Industry data: 172N POH Section 8, p. 8-11). The engine also has a manufacturer's recommended overhaul time (for the O-320-H2AD, the figure in Lycoming Service Instruction 1009, the engine maker's guidance), mandatory for some commercial operators and advisory for most private owners	Same idea, by hours and months instead of miles.
The dealer's service schedule and the state inspection	The annual inspection (91.409), a 100-hour inspection if the airplane is used for hire or instruction, the transponder check every 24 months (91.413), the ELT inspected every 12 calendar months and its battery (91.207), and the altimeter and static system check every 24 months if flown IFR (91.411)	Exact match, with the law spelling out the intervals. The rental airplane you train in is on the 100-hour cycle; ask to see the sticker.
Recalls	Airworthiness Directives (14 CFR Part 39): mandatory fixes ordered by the FAA for a known problem, tracked by serial number	Exact match, except that flying with an overdue AD makes the airplane unairworthy, not merely un-recalled.
The mechanic	The A&P mechanic (airframe and powerplant), and the IA (inspection authorization) who signs the annual	Exact match, with a license and a signature.
The service records the buyer asks for	The maintenance logbooks: airframe, engine, propeller. The buyer reads them before buying the airplane	Exact match, taken more seriously.
Tires and brake pads	Tires and brake pads, plus the nose strut and the spark plugs you learn to read	Exact match.
Rent a car, lease a car, buy a car	Rent from the school, join a club, buy into a partnership, or own. The site's buy-versus-rent section does the arithmetic	Exact match, and the arithmetic favors renting for almost every student.
Car insurance	Hull (the airplane) and liability (everyone else), plus the renter's policy from Lesson 13	Exact match.

DO THIS

1. Open your car's maintenance schedule and write down the next three things due and when. Then ask your flight school to show you the airplane's last annual entry and the next 100-hour due time. Same list, different signatures.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 9: Preflight Inspections, and aircraft maintenance and inspections	p. 9-9	PDF p. 239
Pilot's Handbook of Aeronautical Knowledge	Chapter 9: Airworthiness Directives (ADs)	p. 9-12	PDF p. 242
ACS	Area I, Task B, Airworthiness Requirements: PA.I.B.K1b (inspections and logbooks), K1c (ADs), K2 (preventive maintenance)	p. 2	PDF p. 10
14 CFR 91.409	Inspections (the annual and the 100-hour)	-	eCFR
14 CFR 91.417	Maintenance records	-	eCFR
14 CFR 91.413	ATC transponder tests and inspections	-	eCFR
14 CFR 91.207	Emergency locator transmitters	-	eCFR
Plane Sense (FAA-H-8083-19A, 2008) MORE · PRIVATE	Chapter 7, Aircraft Maintenance: who is responsible, preventive maintenance, the 100-hour and the annual (pp. 7-1 to 7-2). Plane Sense is the FAA's owner's book; its 2008 edition predates BasicMed, MOSAIC, ADS-B and the current registration rules, so read it for the maintenance side and take the rest from the current regulations	p. 7-1	PDF p. 69
Plane Sense (FAA-H-8083-19A, 2008) MORE · PRIVATE	Chapter 8, Maintenance Records: the owner's duties, AD compliance entries, the 91.413 and 91.207 entries (pp. 8-1 to 8-3)	p. 8-1	PDF p. 73
Plane Sense (FAA-H-8083-19A, 2008) MORE · PRIVATE	Chapter 9, Airworthiness Directives	p. 9-1	PDF p. 81
Plane Sense (FAA-H-8083-19A, 2008) MORE · PRIVATE	Chapter 1, Aircraft Owner Responsibilities: logbooks and insurance (pp. 1-1 to 1-2); Chapter 2, Buying an Aircraft: the documents and records to ask for (p. 2-3, PDF p. 39)	p. 1-1	PDF p. 17
AMT Handbook, General (FAA-H-8083-30B; 93 MB) LATER · OWNERS	Chapter 10: Airworthiness Directives from the mechanic's side	p. 10-4	PDF p. 380

TEACH IT BACK

Show someone your car's service record and the airplane's last annual entry side by side, and explain which one is optional.

AFTER THE LESSONS

Where the similarities stop

Ten places where the road stops helping. Every one of them is a lesson the airplane teaches new, and knowing them in advance is most of the lesson.

1. **You cannot pull over.** Every decision has to be made earlier than it would be in a car, and the important ones are made on the ground: go or no-go, fuel, the field you would use, the weather that would turn you around.
2. **Speed and height are one bank account.** Pull the nose up and speed becomes height; push it down and height becomes speed. There is no brake pedal in the air; slowing down is planned, and the ground is the only thing that stops you.
3. **The map has a third dimension.** Airspace has floors and ceilings; the same spot on the ground can be Class G at 500 feet, Class E at 1,500, and Class B at 4,000.
4. **Airspeed is not groundspeed.** The wind is invisible and always there; the airplane flies through the air, and the air is moving. Every trip is planned with it.
5. **On the ground you steer with your feet.** In the air you turn with your hands and coordinate with your feet. Drivers fight both for an hour.
6. **The fuel gauge is not the fuel.** Time is. Dip the tanks, note the clock, know the burn.
7. **Weather is a decision, not a speed.** Light rain can be fine; storms, cloud and ice are not, and the decision is made before the engine starts.
8. **The meter is running.** The driveway is free and the airplane is not, which is the entire reason to read, rehearse, and then fly: read and rehearse alongside your lessons, so every minute you already understand is a minute the airplane is spent on flying.
9. **The airplane wants to fly.** Trim a 172 and let go and it flies straight and level; let go of a car and it finds the ditch. A stable airplane is more forgiving of a still hand than a driver expects, and less forgiving of a busy one.
10. **The decision is yours by law.** The pilot in command is directly responsible for, and the final authority as to, the operation of the aircraft (91.3). No passenger, controller, or instructor on the ground can take that from you, and none of them can be blamed for it.

And the one thing that is exactly the same

Patience. The parent in the passenger seat who yelled at the stop sign taught you less than the one who explained the stop sign the night before. The instructor who grabs the yoke teaches less than the one who talks you through it. Hands off, words on, as long as it is not a safety-critical moment; and the way to keep the moments from becoming safety-critical is the ground lesson, done alongside the flying, in the week between lessons. That is what this whole document is: the ground lesson, taught by the car you already ride in.

FOR THE CURIOUS, AND FOR INSTRUCTORS

Why the car works

Ask any student pilot what lift is and you will hear a definition: a pressure difference, Bernoulli, Newton. Ask what it feels like and most of them go quiet. The FAA has a name for that gap. Its instructor's handbook describes four levels of learning: **rote** (repeating something without understanding it), **understanding** (being able to explain it), **application** (using it to do something new), and **correlation** (connecting it to everything else you know). It says correlation should be the objective of aviation instruction, and the examiner on your checkride is told to judge you at the level each task calls for, which is rarely rote.

The car is how you skip straight past rote. Everyone can recite the definition of lift; the student who has felt a semi pull the car toward its trailer and then shove it away at the cab has **understood** it, and the student who then opens the handbook to the lift pages and finds the same pressure difference drawn on a wing has **correlated** it. Each lesson in this guide does that on purpose: you do something in or around a car, you notice what it means, and then the references table sends you to the exact chapter and page in the FAA's own books where the airplane version lives. Talking about it, reading about it, and explaining it to someone else is how it becomes yours, and it is also how instructors are made: a student who can teach the car version of a lesson is already rehearsing the job most new commercial pilots do first.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Aviation Instructor's Handbook (FAA-H-8083-9B, 2020)	Chapter 3, The Learning Process: the levels of learning (rote, understanding, application, correlation), pp. 3-14 to 3-15 and Figure 3-10 (PDF p. 66). Correlation 'should be the objective of aviation instruction'. The chapter file is 05_aih_chapter_3.pdf	p. 3-14	PDF p. 65
ACS	Appendix 1, Use of the ACS During a Practical Test: the examiner assesses 'in accordance with the level of learning most appropriate for the specified Task'	p. 66	PDF p. 74

THE EXERCISE

The hundred-mile cross-country: the car nav log

Lesson 9's road trip is planned and logged on a simple car nav log, built in the same shape as the FAA's: a planning sheet on top, a log of checkpoints below, estimated and actual side by side. It uses only driving inputs: mile markers and exits, points of interest, the road, miles, minutes, miles per hour and the trip meter. No altitude, no wind arithmetic, no compass. Simple first; the complex version comes later, and when it does, every box will already have a place to go.

Where it is going: this is the FAA's version, the Pilot's Planning Sheet and Visual Flight Log from the Pilot's Handbook of Aeronautical Knowledge (Figure 16-26), worked for a short flight between two small airports. You do not need it yet. Look at it once, notice how much of it you already recognize from the car log, and come back to it in ground school.

PILOT'S PLANNING SHEET

PLANE IDENTIFICATION: N123DB DATE:

COURSE	TC	WIND Knots	WIND From	ALTITUDE	WCA R+ L-	TH	MAG VAR W+ E-	MH	DEV	CH	TOTAL MILES	GS	TOTAL TIME	FUEL RATE	TOTAL FUEL
From Chickasha	031°	10	360°	8000	3° L	28	7° E	21°	+2°	23	53	106 kts	35 min	8 GPH	38 gal
To Guthrie															
From															
To															

VISUAL FLIGHT LOG

TIME OF DEPARTURE	NAVIGATION AIDS	COURSE	ALTITUDE	DISTANCE	ELAPSED TIME	GS	CH	REMARKS
POINT OF DEPARTURE Chickasha Airport	NAVAID IDENT. FREQ.	TO / FROM	TO / FROM	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL	ESTIMATED / ACTUAL	ESTIMATED / ACTUAL	WEATHER AIRSPACE ETC.
CHECKPOINT #1			8000 / 10000	11 NM	6 min +5	106 kts	023°	
CHECKPOINT #2			8000 / 10000	10 NM / 21 NM	6 min	106 kts	023°	
CHECKPOINT #3			8000 / 10000	10.5 NM / 31.5 NM	6 min	106 kts	023°	
CHECKPOINT #4			8000 / 10000	13 NM / 44.5 NM	7 min	106 kts	023°	
DESTINATION Guthrie Airport				8.5 NM / 53 NM	5 min			

Figure 16-26 from the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25C), p. 16-20: Pilot's planning sheet and visual flight log. Reproduced from the FAA handbook, a U.S. government work. The text on pp. 16-19 to 16-21 walks through every number.

WHAT THE BOOKS SAY: READ THESE NEXT

SOURCE	CHAPTER, SECTION, AND WHAT TO READ FOR	BOOK PAGE	PDF PAGE
Pilot's Handbook of Aeronautical Knowledge	Chapter 16, Navigation: the worked flight planning example (the chart, the plotter, the heading formula TC +/- WCA = TH +/- VAR = MH +/- DEV = CH)	p. 16-20	PDF p. 407
Pilot's Handbook of Aeronautical Knowledge	Chapter 16: the same example continued (time, fuel, and the flight plan)	p. 16-21	PDF p. 408
ACS	Area I, Task D, Cross-Country Flight Planning: PA.I.D.S1 (prepare, present and explain a cross-country plan), S2 (charts and Chart Supplements), S3 (create a navigation plan), S4 (recalculate fuel reserves)	p. 4	PDF p. 12

YOUR NOTES

THE CAR NAV LOG Fill in the night before from a printed map. The navigator fills the actual halves during the drive. The driver drives; the navigator reads and writes; alone, pull over. The safety rules and the liability statement on the Before-you-start page apply to this exercise.

TRIP PLANNING SHEET

DRIVER _____ NAVIGATOR _____ VEHICLE _____ DATE _____

ROUTE	MAIN ROADS	GENERAL DIRECTION	TOTAL MILES	PLANNED AVG. MPH	TOTAL TIME	MILES PER GALLON	GALLONS PER HOUR	TOTAL FUEL (GAL)	FUEL AT START	WEATHER FORECAST
From										
To										
From										
To										

IMSAFE RUN ON THE DRIVER: Y / N PAVE CARD DONE: Y / N WHAT WOULD MAKE US TURN AROUND: _____

TRIP LOG

CHECKPOINT	MILE MARKER OR EXIT	ROAD AND DIRECTION	DISTANCE	ELAPSED TIME	CLOCK TIME	AVERAGE SPEED	TRIP METER	REMARKS
START: TIME AND PLACE Time ____ _____	ON THE MAP OR SIGN	e.g. I-80 E US-30 W	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL	ESTIMATED / ACTUAL	EST. / ACT.	EST. / ACT.	WEATHER, CONSTRUCTION, REST STOP (ALTERNATE)
#1 point of interest: town, river, landmark								
#2 point of interest: town, river, landmark								
#3 point of interest: town, river, landmark								
#4 point of interest: town, river, landmark								
#5 point of interest: town, river, landmark								
#6 point of interest: town, river, landmark								
#7 point of interest: town, river, landmark								
#8 point of interest: town, river, landmark								
DESTINATION								

THE EXERCISE

Filling it in, and where each box goes next

Every box on the car log grows into a box on the FAA's log. Fill the simple one now; the right-hand column is what the same box becomes in ground school.

Car nav log	How to fill it in the car	Becomes, on the FAA's log
Driver, navigator, vehicle, date	Who drives, who navigates (never the driver), which car	Plane identification and date
Route: from, to	Your start and your finish; a second line if the trip has two legs	Course: from, to
Main roads; general direction	The roads you will take, and the overall direction of the trip (north, southwest)	True course, then the full heading arithmetic: wind, variation, deviation
Total miles	From the map, or the mileage numbers between towns	Total miles, in nautical miles
Planned average speed	The average you expect, not the speed limit: towns, lights and turns pull it down	Groundspeed, from true airspeed and the wind
Total time	Total miles divided by the planned average speed	Total time
Miles per gallon; gallons per hour; total fuel	Gallons per hour = average speed / miles per gallon; total fuel = gallons per hour x hours	Fuel rate and total fuel, from the POH, plus the required reserve
Fuel at start	Full tank, or what the gauge and the last fill-up say	Fuel on board, checked by dipping the tanks
Weather forecast	The forecast for the route and the time you will drive	Weather briefing; wind and altitude columns
Checkpoint (point of interest)	Something you cannot miss, every 10 to 15 miles: a town, a river bridge, a water tower, a big interchange	Checkpoint, picked on the sectional
Mile marker or exit	The mile marker or exit number at the checkpoint, from the map or a sign	Navigation aids: identifier and frequency
Road and direction	The road you are on at that point and its direction (I-80 E)	Course, to and from
Distance: point to point, cumulative	Miles since the last checkpoint, and since the start	The same
Elapsed time; clock time: estimated, actual	Planned minutes for the leg and the clock time you expect to pass the checkpoint; then the real ones	Elapsed time, estimated and actual
Average speed: estimated, actual	Planned average; actual = miles between two checkpoints / minutes x 60	Groundspeed, estimated and actual
Trip meter: estimated, actual	Where the trip meter should read at the checkpoint, and where it does	Fuel remaining at each checkpoint
Remarks	Weather you saw, construction, and the rest stop you would use if the plan changed (your alternate)	Remarks: weather, airspace, alternates
(nothing yet)	Altitude, wind correction, magnetic variation, compass deviation	Added later in training, when there is a sky to use them in

The trip record: fill it in before you leave and when you arrive

BEFORE YOU LEAVE		AFTER YOU ARRIVE	
IMSAFE run on the driver (yes/no); PAVE card done (yes/no)		Turn-around rule kept (yes/no); what tested it	
What would make us turn around (write it)		Total time	
Route drawn on the map (yes/no)		Average speed (mph)	
Total distance (miles)		Fuel to refill (gallons)	
Speed you plan to average (mph)		Miles per gallon	
Estimated total time		Gallons per hour	
Tank full, trip meter zeroed (yes/no)		Diversion: checkpoint, then to where	
Departure time		Diversion: direction, distance, time, fuel ok	
Told someone the route and arrival time: who		Checkpoints within 5 minutes (how many of how many)	
Navigator (the driver never reads the map)		Fuel within 10% (yes/no); stops (how many)	
Phone on, in the glove box (yes/no)		Lost leg: where the driver said we were; right?	
Lost leg: from checkpoint, to checkpoint		One thing to do differently next time	

Told them you arrived, and what you would do differently next time:

YOUR NOTES

SOURCES

Sources

Each lesson carries its own references table. These are the documents behind them, the editions used, and when each was checked. Handbook page numbers were checked by the build itself: for every citation, the page printed in the book and a heading on that page were matched against the FAA's PDF, and the build stops if one does not match. The optional rows are checked the same way against the FAA's text.

- Pilot's Handbook of Aeronautical Knowledge, FAA-H-8083-25C, full-book PDF from faa.gov (the same file name as the copy used for the page check).
- Airplane Flying Handbook, FAA-H-8083-3C, chapter PDFs from faa.gov (each link opens the chapter file on the cited page).
- Private Pilot for Airplane Category Airman Certification Standards, FAA-S-ACS-6C (supersedes 6B Change 1). Printed page 1 is PDF page 9.
- Aeronautical Chart Users' Guide, effective July 9, 2026 (aeronav.faa.gov); printed and PDF page numbers are the same.
- 14 CFR (eCFR, up to date as of October 13, 2026, checked October 15, 2026): 61.53, 61.56, 61.57, 61.83, 61.87, 61.89, 61.95, 61.103, 61.109; 91.3, 91.7, 91.9, 91.17, 91.103, 91.113, 91.117, 91.126, 91.131, 91.151, 91.155, 91.205, 91.207, 91.209, 91.409, 91.411, 91.413, 91.417; Part 39. 49 CFR 571.110 (the tire and loading placard), checked October 15, 2026.
- Aeronautical Information Manual, Basic with Changes 1-3 (July 9, 2026), cited by paragraph number and PDF page in the lessons (2-1-9, 2-3-5, 2-3-8, 3-2-3, 4-1-15, 4-2-2, 4-2-3, 4-2-7, 4-3-3, 4-3-13, 4-3-18, 4-3-24, 5-1-3, 6-3-1, 6-3-2, 6-4-1, 7-1-5, 7-4-1 to 7-4-6, 7-5-1, 7-5-2, 7-6-7, 8-1-5); the AIM renumbers at the December 24, 2026 Basic, so the paragraph title travels with the number. FAA guidance, not regulation. Checked on October 26, 2026.
- The optional MORE and LATER rows: Risk Management Handbook FAA-H-8083-2A; Aviation Weather Handbook FAA-H-8083-28B (April 2, 2026); Plane Sense FAA-H-8083-19A (2008; stale on registration expiry, BasicMed, MOSAIC and ADS-B, which the Lesson 15 row says); Aviation Maintenance Technician Handbook, General FAA-H-8083-30B (93 MB) and Powerplant FAA-H-8083-32B (215 MB); Instrument Flying Handbook FAA-H-8083-15B; Aviation Instructor's Handbook FAA-H-8083-9B (2020). Each row's PDF page was checked against the FAA file by the build on October 26, 2026.
- Cessna 172N figures (Lycoming O-320-H2AD, 160 horsepower, carbureted, air-cooled, four cylinders horizontally opposed; 100LL or 100; 2,700 RPM red line; 2,300 pounds maximum in the normal category; best glide 65 KIAS; 15 knots demonstrated crosswind; 6-quart sump) checked on November 3, 2026 against the 1978 Cessna 172N POH, free on the site at /cessna-172-calculator/Cessna-172N-POH-1978.pdf. Industry data: check each against the POH of the airplane the student flies.
- The Private Pilot Syllabus and Workbook, November 2026 edition, for the lesson structure these exercises feed into (checked on November 3, 2026).
- Maps: the FAA VFR chart and Chart Supplement download pages (free PDFs, 56-day cycle; Chart Supplement edition of October 29, 2026, next December 24, 2026, checked on November 7, 2026); state DOT official highway maps; USGS topoView and the National Map; Rand McNally Road Atlas 2026 (about $28, checked September 28, 2026).

REVISION HISTORY

Revision history

Date	What changed
October 15, 2026	First published edition: fifteen lessons, from safety, risk and decision-making to owning the machine, with the Preflight-your-car worksheet (Lesson 2) and the car nav log (Lesson 9). Every handbook page checked against the FAA PDFs, and every regulation against the eCFR, on October 15, 2026.
October 18, 2026	Corrections from the October 18 review of the books. Lesson 13's medical row adds the driver's-license match that MOSAIC created for sport pilots (by day; night needs a medical or BasicMed). Lesson 6's light-gun table now carries the ground signals as well as the airborne ones (AIM 4-3-13), and the anti-collision rule follows 91.209 (on whenever the airplane is operated, unless the pilot judges otherwise). Lesson 4 states the stall rule outright (critical angle of attack); Lesson 5 says 2 G and about 41 percent; Lesson 9's groundspeed check says nautical miles; the oil-gauge row says land as soon as practical; the deicing-boot figure is cited by page (the FAA's own caption misnumbers it). The scan exercise and the tower-frequency tip now keep the driver's attention on the road, as the guide's own rule promises.
October 18, 2026 (evening)	Corrections from the evening re-checks of October 18. The cover's promise now says what the lessons actually do: nothing takes the driver's eyes or hands off the road (a few exercises are said aloud while driving, the way you would talk to a passenger). Lesson 4's semi-truck row calls the comparison an analogy for pressure and airflow rather than the same physics. Lesson 13's night row states the full private-pilot night requirement: 3 hours including a cross-country of over 100 nm and 10 full-stop landings (61.109(a)(2)). The car nav log's footer names Lesson 9, the road trip, and both companion sheets now carry their edition and date.
October 26, 2026	The October 26 fix pass from the FAA library review. Lesson 1's ACS row now points at Appendix 2 (Safety of Flight), which is where ADM and risk management live; the AFH row starts at 2-12 where the definitions begin. Lesson 14's stall recovery follows the Airplane Flying Handbook's order: angle of attack first, wings level, then power. Every lesson opens with a one-line risk step (which PAVE letter, which 3P step, which hazardous attitude), so the spine of Lesson 1 runs through all fifteen. Optional 'more' rows name the FAA books the lessons were quietly built on: the Risk Management Handbook (Lessons 1, 10, 14), the Aviation Weather Handbook (Lesson 10), Plane Sense (Lesson 15), the mechanic's Powerplant handbook (Lesson 2), the Instrument Flying Handbook (Lesson 3), and AIM paragraphs by number and page. The car nav log and trip record carry an IMSAFE box and a turn-around line. Non-FAA statements carry their label (Industry data, Industry practice, PCS analysis, Captain's take). The guide now says plainly that it runs alongside the first flights, not before them. The state-map example no longer names a state. Checked on October 26, 2026.
November 3, 2026	The Cessna 172N (1978, carbureted Lycoming O-320-H2AD, 160 horsepower) becomes the course airplane in every table: 2,300 pounds, a 6-quart sump with a four-quart minimum, best glide 65 knots, about 7 gallons an hour, carburetor heat and carburetor ice as the airplane's own hazard, the engine gauges and the red HIGH VOLTAGE light in place of an annunciator panel, and the engine-fire items with the fuel selector. The sources page points at the 1978 POH hosted on the site. Checked on November 3, 2026.
November 7, 2026	Fixes from the monthly review of November 6. The Pilot's Handbook of Aeronautical Knowledge is named in full everywhere. Lesson 4 says that the lower pressure above the wing does most of the lifting. Lesson 14 sends you to the first items of the 172N POH's Engine Failure During Flight checklist (Section 3, p. 3-4), with ABC as the memory hook around them. Lesson 2: the 172N's stall warning is pneumatic, checked by suction at the opening on the left wing's leading edge, and the car's charging light maps to the ammeter and the red HIGH VOLTAGE light. Lesson 15 gives the oil-change intervals from the 172N POH, Section 8. Lesson 5 says that a coordinated turn presses you down into the seat. DME, FBO, VOR and MOSAIC are explained where they first appear. The cover carries the ground-and-simulator sentence; the welcome page's safety line wraps inside its box; the worksheet's notes no longer print over it and its checklist is numbered 1 to 10; the nav log example no longer names a place; this history is kept by date. Checked on November 7, 2026.

The current edition is always at pilotcareersolutions.com/learn-to-fly-at-home.