02/09/2026

Quiz

Aerodynamics of Thrust and Drag

Question 1

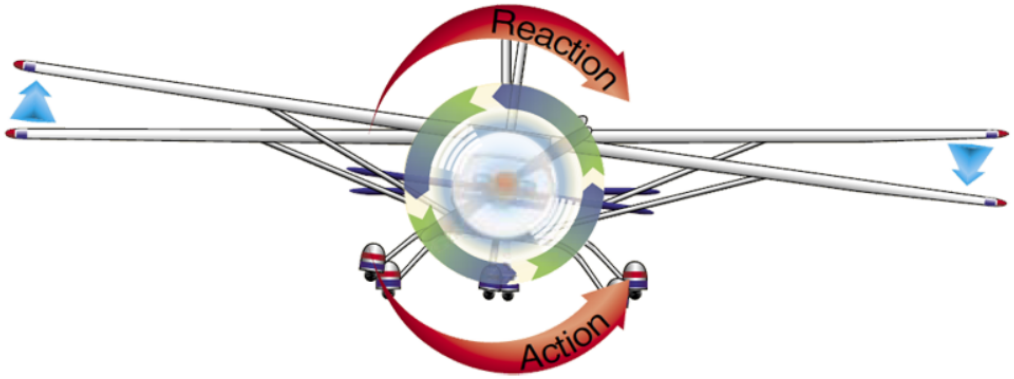
In what flight condition are torque effects more pronounced in a single-engine airplane?

- **Low airspeed, high power, high angle of attack.**
- **Low airspeed, low power, low angle of attack.**
- **High airspeed, high power, high angle of attack.**

Question 1

> The effect of torque increases in direct proportion to engine power, airspeed, and airplane attitude. **If the power setting is high, the airspeed slow, and the angle of attack high, the effect of torque is greater**. During takeoffs and climbs, when the effect of torque is most pronounced, the pilot must apply sufficient right rudder pressure to counteract the left-turning tendency and maintain a straight takeoff path.

Torque reaction involves Newton's Third Law of Motion: for every action, there is an equal and opposite reaction. As applied to the aircraft, this means that as the internal engine parts and propeller are revolving in one direction, an equal force is trying to rotate the aircraft in the opposite direction



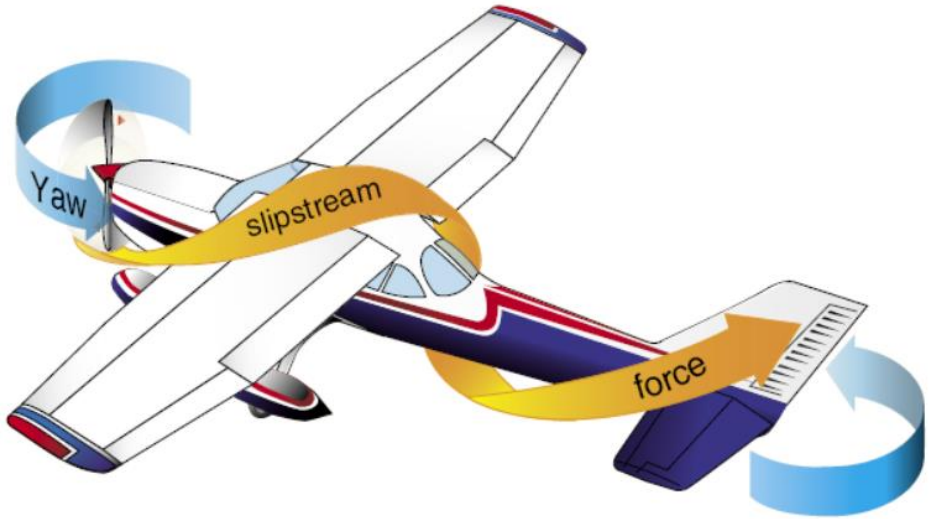
When the aircraft is airborne, this force is acting around the longitudinal axis, tending to make the aircraft roll. To compensate for roll tendency, some of the older aircraft are rigged in a manner to create more lift on the wing that is being forced downward. The more modern aircraft are designed with the engine offset to counteract this effect of torque.

Question 2

A propeller rotating clockwise, as seen from the rear, creates a spiraling slipstream that tends to rotate the aircraft to the

- right around the vertical axis, and to the left around the longitudinal axis.
- left around the vertical axis, and to the left around the longitudinal axis.
- left around the vertical axis, and to the right around the longitudinal axis.

Question 2



The spiraling slipstream from the propeller twists its way around the aircraft and:

- Hits the vertical stabilizier on the left, causing the nose to yaw left ("left around the vertical axis")
- Hits the left side of the horizontal stabilizer from the bottom and the right side of the horizontal stabilizer from the top, causing the aircraft to roll right ("right around the longitudinal axis).

So remember: **Spiraling Slipstream = Yaw Left, Roll Right.**

Question 3

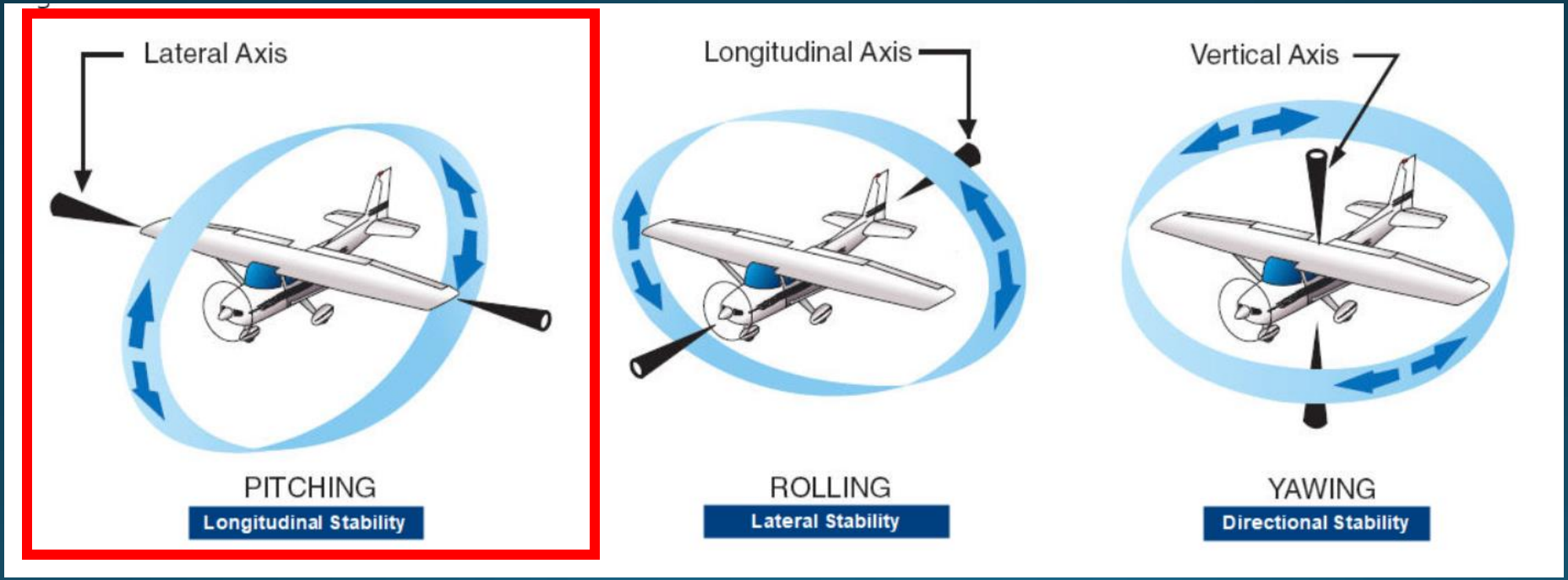
What type of stability does the horizontal stabilizer provide during flight?

M+

- Airspeed.
- **Longitudinal.**
- Lateral.

Question 3

The horizontal stabilizer provides longitudinal (pitch) stability about the lateral axis (wingtip to wingtip). Don't let this confuse you: the lateral axis runs (more or less) wingtip to wingtip and when the aircraft pitches it rotates around this lateral axis. So, longitudinal stability exists around the lateral axis. See how this corresponds to the image outlined in red, below:



Without a horizontal stabilizer, the aircraft would be longitudinally unstable. Put another way, the pilot would have no way of controlling it around the lateral axis.

Question 4

Which would provide the greatest gain in altitude in the shortest distance during climb after takeoff?

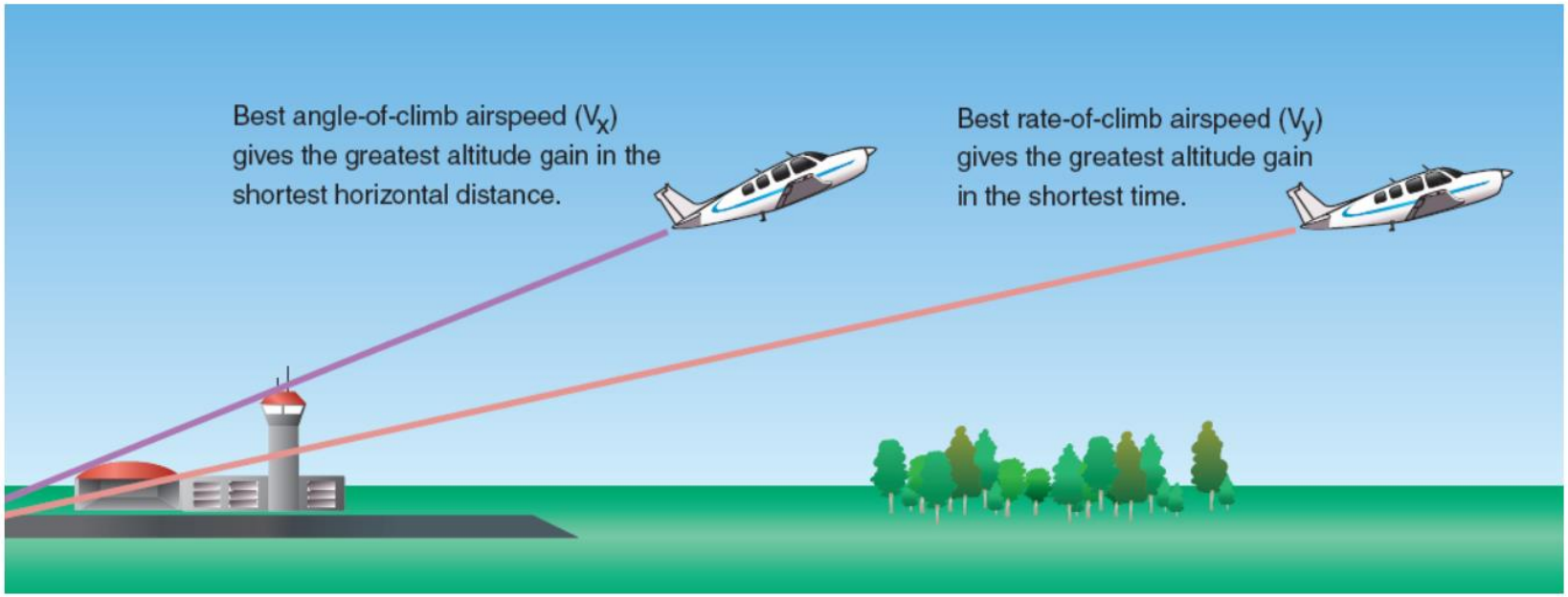
V_Y.

V_A.

V_X.

Question 4

- Flying at **V_X provides the best ANGLE of climb**, that is, the greatest gain in altitude for the shortest distance after takeoff.
- V_Y is the best RATE of climb speed, that is, you get the most altitude in the shortest TIME when you fly at V_Y.
- V_A is maneuvering speed.



Question 5

How will frost on the wings of an airplane affect takeoff performance?

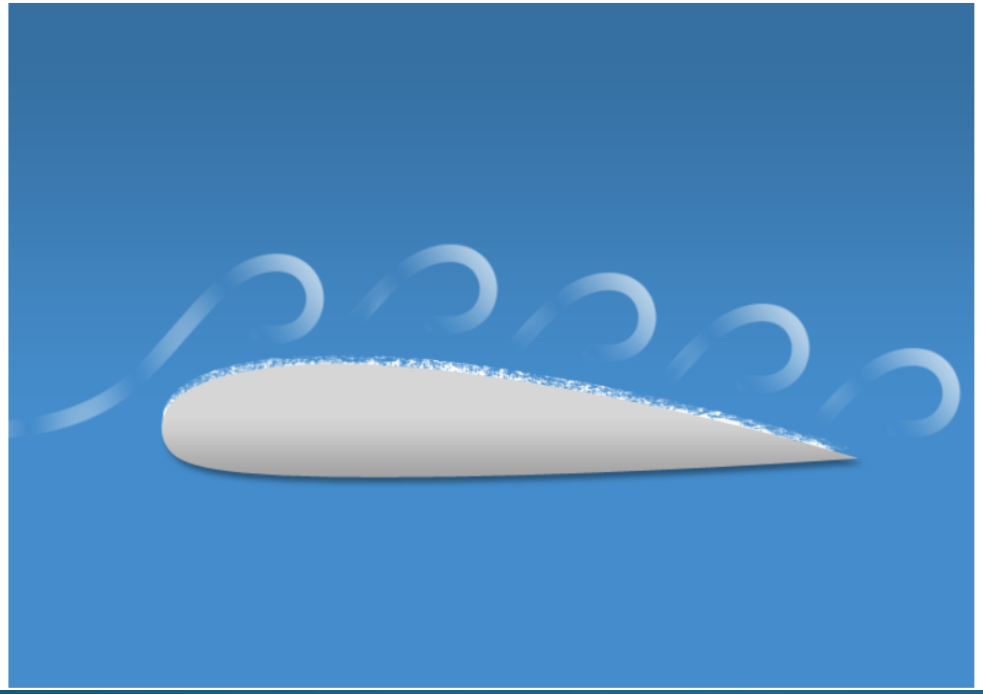
M+

- Frost will cause the airplane to become airborne with a higher angle of attack, decreasing the stall speed.
- Frost will change the camber of the wing, increasing its lifting capability.
- **Frost will disrupt the smooth flow of air over the wing, adversely affecting its lifting capability.**

Question 5

Both of the incorrect answers make reference to notions that the presence of frost somehow increases performance. If this were true, enterprising individuals would sell cans of frost for you to apply to the wings before takeoff.

Of course, this is not true. Acting as a sort of aerodynamic sandpaper, **frost will disrupt the smooth airflow over the wing, adversely affecting its lifting capacity**.



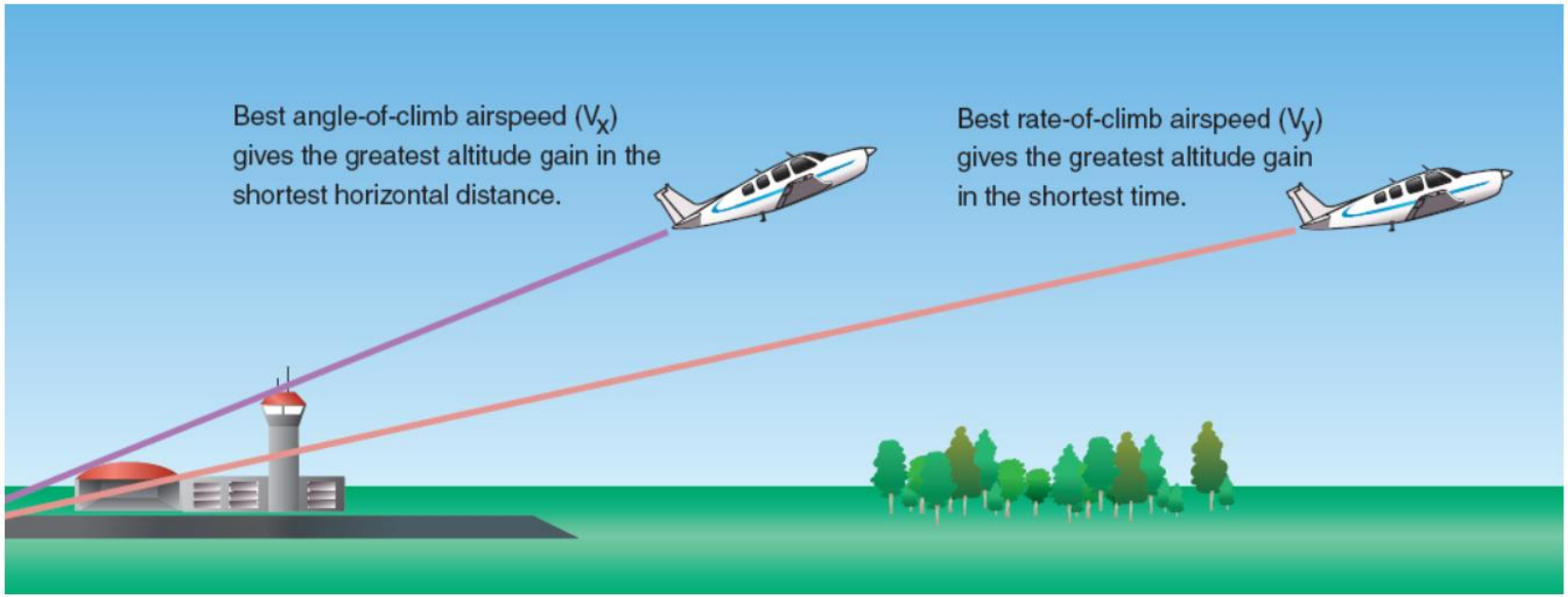
Question 6

Which V-speed represents best-rate-of-climb speed?

- V_Y.
- V_A.
- V_X.

Question 6

- **V_Y is the best RATE of climb speed**, that is, you get the most altitude in the shortest TIME when you fly at V_Y.
- Flying at V_X provides the best ANGLE of climb, that is, the greatest gain in altitude for the shortest distance after takeoff.
- V_A is maneuvering speed.



Question 7

An airplane said to be inherently stable will

- not spin.
- require less effort to control.
- be difficult to stall.

Question 7

AC 61-23, chapter 1 states:

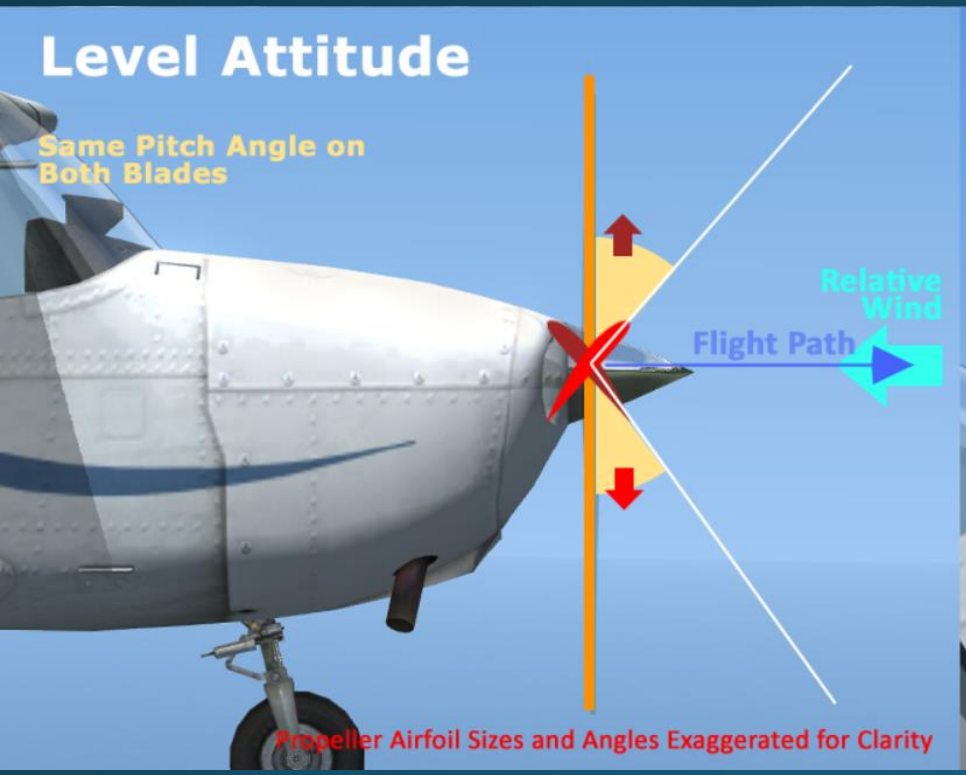
> A stable airplane will tend to return to the original condition of flight if disturbed by a force such as turbulent air. This means that a stable airplane is easy to fly; however, this does not mean that a pilot can depend entirely on stability to return the airplane to the original condition. Even in the most stable airplanes, there are conditions that will require the use of airplane controls to return the airplane to the desired attitude. However, a pilot will find that a well-designed airplane **requires less effort to control the airplane because of the inherent stability**.

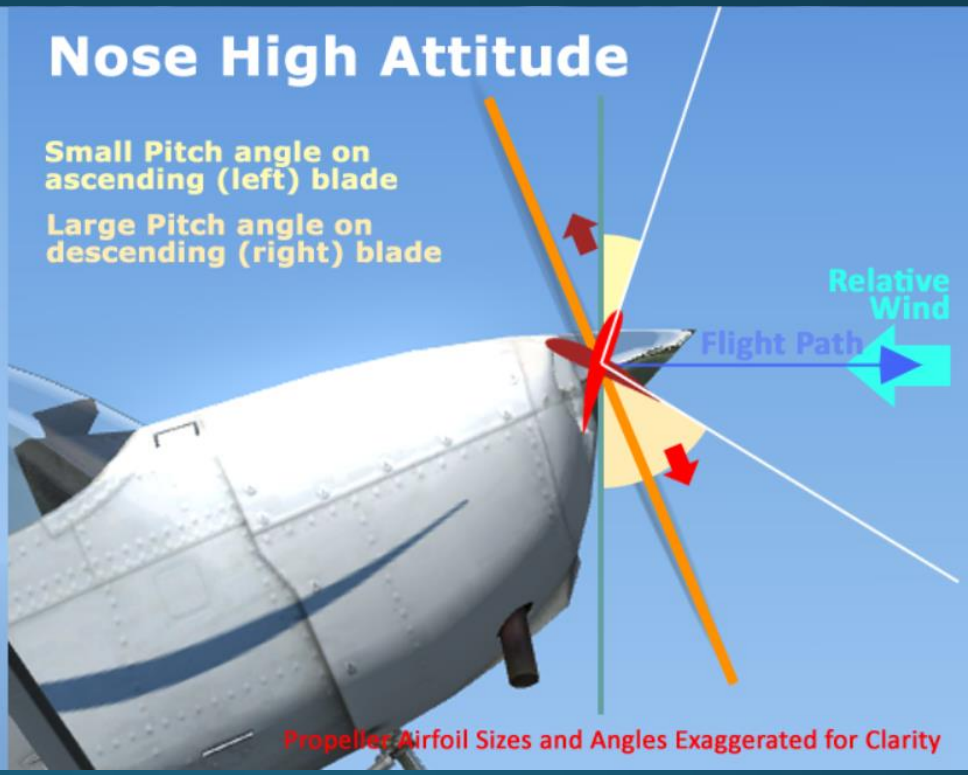
Question 8

When does P-factor cause the airplane to yaw to the left?

- **When at high angles of attack.**
- **When at high airspeeds.**
- **When at low angles of attack.**

Question 8


Level Attitude
Same Pitch Angle on Both Blades
Relative Wind
Flight Path
Propeller Airfoil Sizes and Angles Exaggerated for Clarity


Nose High Attitude
Small Pitch angle on ascending (left) blade
Large Pitch angle on descending (right) blade
Relative Wind
Flight Path
Propeller Airfoil Sizes and Angles Exaggerated for Clarity

Question 9

The left turning tendency of an airplane caused by P-factor is the result of the

- propeller blade descending on the right, producing more thrust than the ascending blade on the left.
- clockwise rotation of the engine and the propeller turning the airplane counter-clockwise.
- gyroscopic forces applied to the rotating propeller blades acting 90° in advance of the point the force was applied.

Question 9

Indeed, this whole question is a 'definition' type question. The clockwise (as viewed from the cockpit) rotation of the engine and the propeller turning the airplane counter clockwise does indeed turn the airplane to the left. However, this phenomenon is known as torque, not P-factor.

Gyroscopic forces also turn the airplane to the left as described. However, this is known as gyroscopic precession, not P-factor.

Question 10

V_{S0} is defined as the

M+

stalling speed or minimum steady flight speed in a specified configuration.

stalling speed or minimum steady flight speed in the landing configuration.

stalling speed or minimum takeoff safety speed.

- **V_{S0} is defined as the stalling speed or minimum steady flight speed in the landing configuration** and is generally indicated on the airspeed indicator by the bottom of the white arc.
- V_{S1}, on the other hand, is defined as the stalling speed or minimum steady flight speed in a specified configuration. In a regular fixed-gear training aircraft, this usually means "with flaps up."

Remember, S0 (S-zero) looks like SO (S-letter O) and S1 looks like SI. Remember

- SO - stuff (flaps, gear) out.
- SI - stuff (flaps) in.