Gyroplane questions – from Rotorcraft PRIVATE bank

(From Rotorcraft questions that obviously are either gyroplane or not helicopter)

FAA Question Number: **3.1.3.3**
FAA Knowledge Code: **B09**
No person may begin a flight in a rotorcraft under VFR unless there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly thereafter for at least

X **A.** 20 minutes.
B. 30 minutes.
C. 1 hour.

FAA Question Number: **3.3.1.7**
FAA Knowledge Code: **H70**
Angle of attack is defined as the angle between the chord line of an airfoil and the

A. rotor plane of rotation.
B. pitch angle of an airfoil.
X **C.** direction of the relative wind.

FAA Question Number: **3.3.1.8**
FAA Knowledge Code: **H71**
Figure 10 for this question
(Refer to figure 10.) During flight, if cyclic control pressure is applied which results in a maximum increase in pitch angle of the rotor blade at position A, the rotor disc will tilt

X **A.** forward.
B. left.
C. aft.

FAA Question Number: **3.3.1.9**
FAA Knowledge Code: **H71**
The lift differential that exists between the advancing main rotor blade and the retreating main rotor blade is known as

A. hunting tendency.
X **B.** dissymmetry of lift.
C. transverse flow effect.

Comment: Dissymmetry of lift is the accepted correct answer. However, it might be more correct to refer to this as a "dissymmetry of relative wind". There really is no "differential" of lift between the retreating and advancing blades. Precession, due to any unequal lift between the retreating and advancing blades automatically tilts the rotor disk up - against the forward (or lateral) movement. The resulting cyclic action, higher AOA

of the retreating blade than the advancing blade, serves to balance the lift on each side! Yes, this is due to unequal lift, but in reality the two lifts are equalized due to precession and cyclic. The DISTRIBUTION of lift along the retreating blade compared to the advancing blade is truly not symmetrical, but the composite lift on both blades is equalized due to cyclic flapping in forward (or any direction) flight - as Cierva discovered is basic to rotorcraft flight! – Greg Gremminger

FAA Question Number: **3.3.2.0**
FAA Knowledge Code: **H71**
During forward cruising flight at constant airspeed and altitude, the individual rotor blades, when compared to each other, are operating

- **A.** with a decreasing angle of attack on the advancing blade.
- **X** **B.** at unequal airspeed, unequal angles of attack, and equal lift moment.
- **C.** with increased lift on the retreating blade.

Comment: C is not correct because cyclic action equalizes the lift (moment) on both sides. A is not correct because, on the advancing blade, the blade AOA is decreasing from the 180 degree point to the 270 degree point, and then INCREASING from the 270 degree point to the opposite, 90 degree retreating blade point. The advancing blade is both decreasing and then increasing AOA on the advancing side! The result though is that the advancing blade has overall less AOA (below nominal). The retreating blade has overall more AOA (above the nominal fore/aft position AOA. – Greg Gremminger

FAA Question Number: **3.3.2.1**
FAA Knowledge Code: **H71**
The upward bending of the rotor blades resulting from the combined forces of lift and centrifugal force is known as

- **A.** blade slapping.
- **X** **B.** coning.
- **C.** inertia.

FAA Question Number: **3.3.2.2**
FAA Knowledge Code: **H71**
When a blade flaps up, the CG moves closer to its axis of rotation giving that blade a tendency to

- **X** **A.** accelerate.
- **B.** stabilize its rotational velocity.
- **C.** decelerate.

FAA Question Number: **3.3.2.4**
FAA Knowledge Code: **H71**

Which is a result of the phenomenon of ground effect?

- **A.** The lift vector becomes more horizontal.
- **B.** The induced angle of attack of each rotor blade is increased.
- **X** **C.** The angle of attack generating lift is increased.

Comment: The answer explanation can be found on page 16 of "Basic Helicopter Handbook" AC 61-13B under the topic of ground effect Ground effect.-- As the downwash velocity is reduced, the induced angle of attack of each rotor blade is reduced and the lift vector becomes more vertical. Simultaneously, a reduction in induced drag occurs. In addition, as the induced angle of attack is reduced, the angle of attack generating lift is increased. The net result of these actions is a beneficial increase in lift and a lower power requirement to support a given weight.
Comment: There needs to be a discussion of what angle of attack is, and what induced angle of attack is, and what the difference between the two.
Comment: Your answer is wrong. When in ground effect your angle of attack is reduced. When out of ground effect your blades angle of attack is increased. Thus it takes more power to hover out of ground effect and less power to hover in ground effect.
Comment: None of the answers is right. Induced drag is reduced would be the right answer.
Comment: See discussion on page 3-3 of the newer Rotorcraft Flying Handbook FAA-H-8083-21 that has replaced the Basic Helicopter Handbook. This discussion relates to helicopters!
Comment: What is Knowledge code H71? Is this Helicopter or Gyroplane? The question should apply to both! I concur, none of these answers seems correct! Page 3-3 of the RFH discusses ground effect in HOVER! This question probably will not appear on gyroplane tests! - Greg Gremminger

FAA Question Number: **3.3.2.9**
FAA Knowledge Code: **H78**
High airspeeds, particularly in turbulent air, should be avoided primarily because of the possibility of

- **A.** a low-frequency vibration developing.
- **X** **B.** retreating blade stall.
- **C.** an abrupt pitchup.

Comment: What is Knowledge Code H78 - helicopter or gyroplane? I consider this a very deceptive question. The answer the FAA probably wants is "retreating blades stall". But, before there would be a true retreating blade stall, both A and C might occur first! As the flapping limits (cyclic limits) are reached due to the mismatch of the blade lifts, two-per-rev bumping of the flapping limits would develop. When the bumping is severe - max up in the forward blade position, and max down in the aft blade position, abrupt pitch-up could occur - since the flapping action is at its limits, the only thing left to do is pitch up the whole craft! If, due to turbulence, this happens suddenly, the rotorcraft could experience an abrupt pitchup! For a gyroplane, this is not true full retreating blade stall,

just an extreme mis-match of lift between retreating and advancing blade due to increasing stalled portion of the retreating blade! I am probably arguing semantics! Maybe this question will not appear on gyroplane tests! – Greg Gremminger

FAA Question Number: **3.3.3.1**
FAA Knowledge Code: **H78**
When operating at high forward airspeeds, retreating blade stalls are more likely to occur under which condition?

X **A.** Steep turns in turbulent air.
B. High RPM and low density altitude.
C. Low gross weight and low density altitude.

Comment: A is obviously the answer the FAA wants. But, this implies that the retreating blade is totally stalled - which does not happen in a gyroplane at least! A more correct question might be when are the flapping limits reached or when would risk of increasing rotor vibration occur - or when is the risk of an abrupt pitchup more likely? Flapping limits are reached due to a high mis-match of the lift moments between the advancing blade and the retreating blade. True, the reduced retreating blade lift moment is less at higher speeds due the expanding stalled region of the retreating blade, but the flapping limits are reached long before the blade totally stalls. This may be semantics - but it could be argued that the term "retreating blade stall" is an inaccurate over-simplification. Not sure if this question would be on gyroplane tests? – Greg Gremminger

FAA Question Number: **3.3.3.2**
FAA Knowledge Code: **H78**
Ground resonance is most likely to develop when

A. on the ground and harmonic vibrations develop between the main and tail rotors.
X **B.** a series of shocks causes the rotor system to become unbalanced.
C. there is a combination of a decrease in the angle of attack on the advancing blade and an increase in the angle of attack on the retreating blade.

Comment: Ground resonance applies for three or more rotor blade systems. Mostly a helicopter issue, but gyroplane tests often have Air & Space 18A questions on them! Answer A is the FAA's obvious intent on this question. But, I'm not sure B is a correct answer either. "Ground Resonance" is a resonance reaction between the landing gear suspension natural frequency and the three blade rotating frequency that excites both the landing gear and rotor system to resonate destructively with each other. I'm not sure a series of shocks causes the 18A rotor system to become unbalanced – it just starts flexing wildly up/down and lead/lag when it starts resonating with the landing gear going up and down – my opinion – Greg Gremminger

FAA Question Number: **3.3.3.5**
FAA Knowledge Code: **H78**
The principal reason the shaded area of a Height vs. Velocity Chart should be avoided is

A. turbulence near the surface can dephase the blade dampers.

X **B.** insufficient airspeed would be available to ensure a safe landing in case of an engine failure.

C. rotor RPM may decay before ground contact is made if an engine failure should occur.

Comment: The shaded area of the H vs V chart identifies when the combination of BOTH height and airspeed is inadequate to achieve adequate airspeed for landing if the engine quits. But, in any of the shaded area it can be said there is "insufficient airspeed". – Greg Gremminger

FAA Question Number: **3.3.3.9**
FAA Knowledge Code: **H766**
What precaution should be taken while taxiing a gyroplane?

A. The cyclic stick should be held slightly aft of neutral at all times.

X **B.** Avoid abrupt control movements when blades are turning.

C. The cyclic stick should be held in the neutral position at all times.

Comment: Confusing and likely mis-informed answers! Gyroplanes rotors should be stopped when taxiing. Taxiing with the rotors spinning can lead to severe bumping - but true if taxiing with the rotors turning slowly, any movement of the cyclic will be a handful for the pilot to handle as the rotor flaps against its flapping limits. The more correct answer, IMHO, could be C. Even if the rotor is turning, a neutral position would reduce the possibility of the rotor flapping to hit the prop or something else, and the minimal blade AOA that a neutral cyclic presents reduces the effects of gusty winds while taxiing. Answer C is the only answer similar to choices in Commercial (5.7.3.8) and Instructor (7.0.9.2) similar test questions. **For this reason, I think C is the answer the FAA expects!** The more correct answer would be to taxi with the rotor stopped, aligned fore/aft, and with the stick near full forward in the laterally neutral position. This results in a mostly level rotor, well clear of the prop and other aircraft components, presenting minimal blade AOA to gusty winds, and avoiding inadvertently hitting things with the rotor while taxiing. Some people suggest to have the rotor spinning significantly to avoid severe flapping on rough ground.
– Greg Gremminger

FAA Question Number: **3.6.9.9**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Determine the total landing distance to clear a 50-foot obstacle in a gyroplane. The outside air temperature (OAT) is 75°F and the pressure altitude at the airport is 2,500 feet.

A. 521 feet.
X **B.** 525 feet.
C. 529 feet.

FAA Question Number: **3.7.0.0**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Approximately how much additional landing distance will be required for a gyroplane to clear a 50-foot obstacle with an increase in temperature from 40 to 60 °F at 3,200 feet pressure altitude?

A. 8 feet.
B. 12 feet.
X **C.** 4 feet.

FAA Question Number: **3.7.0.1**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Determine the total landing distance to clear a 50-foot obstacle in a gyroplane. The outside air temperature (OAT) is 80 °F and the pressure altitude is 3,500 feet.

A. 521 feet.
B. 526 feet.
X **C.** 531 feet.

FAA Question Number: **3.7.0.2**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Determine the total takeoff distance required for a gyroplane to clear a 50-foot obstacle if the temperature is 95 °F and the pressure altitude is 1,700 feet.

X **A.** 2,030 feet.
B. 1,910 feet.
C. 1,825 feet.

FAA Question Number: **3.7.0.3**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Determine the total takeoff distance required for a gyroplane to clear a 50-foot obstacle if the temperature is standard at sea level pressure altitude.

X **A.** 1,200 feet.
B. 1,090 feet.
C. 950 feet.

FAA Question Number: **3.7.0.4**
FAA Knowledge Code: **H317**
Figure 40 for this question
(Refer to figure 40.) Approximately how much additional takeoff distance will be required for a gyroplane to clear a 50-foot obstacle if the temperature increases from 75 to 90 °F at a pressure altitude of 2,300 feet?

X **A.** 160 feet.
B. 2,020 feet.
C. 200 feet.

FAA Question Number: **3.7.2.9**
FAA Knowledge Code: **H76**
Figure 45 for this question
Figure 46 for this question
(Refer to figures 45 and 46.) What is the new CG of the gyroplane after a 10-gallon fuel burn if the original weight was 1,450 pounds and the MOM/1000 was 108 pound-inches?

A. Within limits near the forward limit.
X **B.** Out of limits forward.
C. Out of limits aft.

FAA Question Number: **3.7.3.0**
FAA Knowledge Code: **H76**
(Refer to figures 45 and 46.) What is the condition of the weight and balance of the gyroplane as loaded?

	WEIGHT (LB)	MOMENT (1000)
Empty weight	1,074	85.6
Oil, 6 qt	---	1.0
Pilot and passenger	247	---
Fuel, 12 gal	---	---
Baggage	95	---

A. Overweight.
X **B.** Within limits.
C. Out of limits aft.

FAA Question Number: **3.7.3.1**
FAA Knowledge Code: **H76**
(Refer to figures 45 and 46.) Approximately how much baggage, if any, may be carried in the gyroplane, without exceeding weight and balance limits?

	WEIGHT (LB)	MOMENT (1000)
Empty weight	1,074	85.6
Oil, 6 qt	---	1.0
Fuel, Full	---	---
Pilot (FWD)	224	---

A. None, overweight.
B. 100 pounds.
X **C.** 70 pounds.

FAA Question Number: **3.7.4.6**
FAA Knowledge Code: **H81**
Which action would be appropriate for confined area operations?
X **A.** Plan the flight path over areas suitable for a forced landing.
B. Takeoffs and landings must be made into the wind.
C. A very steep angle of descent should be used to land on the selected spot.

FAA Question Number: **3.7.4.8**
FAA Knowledge Code: **H81**
Which is a correct general rule for pinnacle and ridgeline operations?
X **A.** A climb to a pinnacle or ridgeline should be performed on the upwind side.
B. Gaining altitude on takeoff is more important than gaining airspeed.
C. The approach path to a ridgeline is usually perpendicular to the ridge.

Comment: Confined area operations questions and pinnacle and ridgeline operations are probably helicopter questions, but could possibly be used for gyroplane tests to test understanding of operations over congested areas and wind currents over terrain obstacles. – Greg Gremminger

The following gyroplane questions were added to the Sport Pilot test in 2007. It appears these are the gyroplane specific questions that have been added to the Sport Pilot Written questions. These are same or similar to questions in other tests.

FAA Question Number: **2350**
FAA Knowledge Code: **H777**
(Refer to Figure 36.)

GIVEN:	**Weight**	**Moment**
Gyroplane basic weight	1,315	150.1 (oil included)
Pilot weight	140	?
Passenger weight	150	?
27 gal fuel	162	?

The CG is located

- **A.** Outside the CG envelope; the maximum gross weight is exceeded.
- **B.** Outside the CG envelope; the maximum gross weight and the gross-weight moment are exceeded.
- **X** **C.** Within the CG envelope; neither maximum gross weight nor gross-weight moment is exceeded.

Total the weights and moments to determine if the CG is within limits.

Item	Weight	Moment
Gyroplane	1,315	150.1
Pilot	140	7.2
Passenger	150	12.6
27 gallons gas	+ 162	+ 17.8
Total	1,767	187.7

These figures fall within permitted weight and CG. — FAA-H-8083-1, Chapter 7

FAA Question Number**: 2351**
FAA Knowledge Code: **H777**
(Refer to Figure 36.)

GIVEN:	**Weight**	**Moment**
Gyroplane basic weight	1,315	154.0 (oil included)
Pilot weight	145	?
Passenger weight	153	?
27 gal fuel	162	?

The CG is located

A. Outside the CG envelope; the maximum gross weight is exceeded.
X **B.** Outside the CG envelope; the maximum gross weight and the gross-weight moment are exceeded.
C. Within the CG envelope; neither maximum gross weight nor gross-weight moment is exceeded.

Total the weights and moments to determine if the CG is within limits.

Item	**Weight**	**Moment**
Gyroplane	1,315	154.0
Pilot	145	7.4
Passenger	153	12.8
27 gallons gas	+ 162	+ 17.6
Total	1,775	191.8

These figures fall within permitted weight but outside CG. — FAA-H-8083-1, Chapter 7

FAA Question Number: **2349**
FAA Knowledge Code: **H780**
What precaution should be taken while taxiing a gyroplane?

A. The cyclic stick should be held in the neutral position at all times
X **B.** Avoid abrupt control movements when blades are turning.
C. The cyclic stick should be held slightly aft of neutral at all times.

Answer: Avoid abrupt control motions while taxiing. — FAA-H-8083-21, Chapter 20

Comment: Confusing and likely mis-informed answers! Gyroplanes rotors should be stopped when taxiing. Taxiing with the rotors spinning can lead to severe bumping - but true if taxiing with the rotors turning slowly, any movement of the cyclic will be a handful for the pilot to handle as the rotor flaps against its flapping limits. The more correct answer, IMHO, could be A. Even if the rotor is turning, a neutral position would reduce the possibility of the rotor flapping to hit the prop or something else, and the minimal blade AOA that a neutral cyclic presents reduces the effects of gusty winds while taxiing. Answer A is the only answer similar to choices in Commercial (5.7.3.8) and Instructor (7.0.9.2) similar test questions. **For this reason, I think A is the answer the FAA expects!** The more correct answer would be to taxi with the rotor stopped,

aligned fore/aft, and with the stick near full forward in the laterally neutral position. This results in a mostly level rotor, well clear of the prop and other aircraft components, presenting minimal blade AOA to gusty winds, and avoiding inadvertently hitting things with the rotor while taxiing. Some people suggest to have the rotor spinning significantly to avoid severe flapping on rough ground.
– Greg Gremminger

FAA Question Number: **2328**
FAA Knowledge Code: **H781**
Select the true statement concerning gyroplane taxi procedures.

X **A.** Taxi speed should be limited to no faster than a brisk walk in ideal conditions.
B. The cyclic stick should be held in the neutral position at all times.
C. The cyclic stick should be held slightly aft of neutral at all times.

Answer: A gyroplane should not be taxied in close proximity to people or obstructions while the rotor is turning. In addition, taxi speed should be limited to no faster than a brisk walk in ideal conditions, and adjusted appropriately according to the circumstances. — FAA-H-8083-21, Chapter 20

FAA Question Number: **2331**
FAA Knowledge Code: **H766**
Select the true statement concerning gyroplane taxi procedures.

X **A**. Avoid abrupt control movements when blades are turning.
B. The cyclic stick should be held in the neutral position at all times.
C. The cyclic stick should be held slightly aft of neutral at all times.

Answer: A gyroplane should not be taxied in close proximity to people or obstructions while the rotor is turning. In addition, taxi speed should be limited to no faster than a brisk walk in ideal conditions, and adjusted appropriately according to the circumstances. Avoid abrupt control motions while taxiing.— FAA-H-8083-21, Chapter 20

FAA Question Number: **2329**
FAA Knowledge Code: **H796**
If ground resonance is experienced during rotor spin-up, what action should you take?

A. Taxi to a smooth area.
B. Make a normal takeoff immediately.
X **C.** Close the throttle and slowly raise the spin-up lever.

Answer: A corrective action for ground resonance is an immediate takeoff if RPM is in proper range (for helicopters) or an immediate closing of the throttle and placing the blades in low pitch if the RPM is low. “During spin-up” implies low RPM, so closing the throttle is appropriate.— FAA-H-8083-21, Chapter 21

Comment: This question is inappropriate for the Sport Pilot test. Sport Pilots are limited to flying semi-rigid 2-blade rotors. Ground resonance only occurs with 3 or more rotor blades. This is actually a helicopter question, but watch for it on the test!!???
– Greg Gremminger

FAA Question Number: **2330**
FAA Knowledge Code: **H796**
If the pilot experiences ground resonance, and the rotor RPM is not sufficient for flight,

- **A.** Open the throttle full and liftoff.
- **X** **B.** Apply the rotor brake and stop the rotor as soon as possible.
- **C.** Attempt to takeoff at that power setting.

Answer: Ground resonance is an aerodynamic phenomenon associated with fully-articulated rotor systems. It develops when the rotor blades move out of phase with each other and cause the rotor disc to become unbalanced. This condition can cause a helicopter to self-destruct in a matter of seconds. However, for this condition to occur, the helicopter must be in contact with the ground. If you experience ground resonance, and the rotor RPM is not yet sufficient for flight, apply the rotor brake to maximum and stop the rotor as soon as possible. If ground resonance occurs during takeoff, when RPM is sufficient for flight, lift off immediately.— FAA-H-8083-21, Chapter 21

Comment: This question is inappropriate for the Sport Pilot test. Sport Pilots are limited to flying semi-rigid 2-blade rotors. Fully-articulated rotor systems are not allowed for Sport Pilots! Ground resonance only occurs with 3 or more rotor blades.
– Greg Gremminger

FAA Question Number: **2332**
FAA Knowledge Code: **H766**
During the transition from pre-rotation to flight, all rotor blades change pitch

- **A.** Simultaneously to the same angle of incidence.
- **X** **B.** Simultaneously but to different angles of incidence.
- **C.** To the same degree at the same point in the cycle of rotation.

Answer: Compensation for dissymmetry of lift requires constant change in the blade angle of incidence, with one increasing as another simultaneously decreases. During the transition from prerotation to flight (or any time there is dissymmetry of lift) all rotor blades change pitch simultaneously, but to different angles of incidence. — FAA-H-8083-21, Chapter 20