PRACTICE EXAM 15

1. Density altitude is best defined as which of the following?

A. The altitude shown when set to local pressure

B. The height of the aircraft above the ground

C. The altitude at which icing always begins

D. Pressure altitude corrected for nonstandard temperature

2. Which combination of factors raises density altitude and degrades performance?

A. Low elevation, low temperature, low humidity

B. A strong headwind on the runway

C. High elevation, high temperature, high humidity

D. A cool, dry day at sea level

3. As density altitude increases, the wings produce what effect?

A. More lift, shortening the takeoff roll

B. No change in lift at all

C. Greater thrust from the propeller

D. Less lift, lengthening the takeoff roll

4. As density altitude increases, the engine does what?

A. Produces more power from denser air

B. Runs cooler with no power change

C. Gains efficiency at altitude

D. Produces less power because it draws in less air

5. A headwind affects takeoff and landing distance in what way?

A. It shortens both takeoff and landing distance

B. It lengthens both distances

C. It has no effect on either distance

D. It only affects the climb rate

6. A tailwind affects takeoff and landing distance in what way?

A. It lengthens both takeoff and landing distance

B. It shortens both distances

C. It has no effect on distance

D. It only changes the stall speed

7. Best angle of climb (Vx) provides which benefit?

A. The fastest altitude gain over time

B. The lowest fuel burn in cruise

C. The smoothest ride in turbulence

D. The greatest altitude gain over the shortest horizontal distance

8. Best rate of climb (Vy) provides which benefit?

A. The steepest climb to clear an obstacle

B. The slowest controllable airspeed

C. The maximum range at cruise

D. The greatest altitude gain over time

9. Climb performance depends primarily on what?

A. The color of the aircraft

B. The number of passengers only

C. Excess power beyond that needed for level flight

D. The fuel grade used

10. Interpolation on a performance chart means doing what?

A. Reading only the highest value listed

B. Ignoring values between table entries

C. Using only the lowest value listed

D. Estimating a value that falls between two known values

11. The datum in weight and balance is best described as which of the following?

A. The maximum allowable gross weight

B. An imaginary reference line from which arms are measured

C. The center of gravity itself

D. The total moment of the aircraft

12. The arm in weight and balance is best described as which of the following?

A. The total weight of an item

B. The turning tendency of a weight

C. The maximum gross weight

D. The horizontal distance from the datum to a weight's center

13. The moment of an item is calculated by which operation?

A. Dividing the weight by the arm

B. Adding the weight to the arm

C. Subtracting the arm from the weight

D. Multiplying the weight by the arm

14. The center of gravity is best described as which of the following?

A. The heaviest single item aboard

B. The forward limit of loading

C. The point at which total weight is considered concentrated

D. The maximum takeoff weight

15. Empty weight, under modern standards, includes which of the following?

A. Full usable fuel and all occupants

B. The pilot but no fuel

C. Unusable fuel and full operating fluids, but no usable fuel or occupants

D. Half fuel and average baggage

16. Useful load is best defined as which of the following?

A. The empty weight of the aircraft

B. The weight of the engine and propeller

C. The total moment divided by weight

D. The difference between maximum gross weight and empty weight

17. Maximum gross weight is best described as which of the following?

A. The empty weight plus the fuel only

B. The maximum weight at which the airplane is approved to operate

C. The weight of the payload alone

D. The center of gravity location

18. The center of gravity is found by which calculation?

A. Total weight divided by total moment

B. Total moment divided by total weight

C. Total weight multiplied by total arm

D. The sum of all arms divided by the number of items

19. When computing weight and balance, fuel must first be converted to weight using approximately what figure?

A. 3 pounds per gallon

B. 4.5 pounds per gallon

C. 6 pounds per gallon

D. 8.5 pounds per gallon

20. Two independent checks must both pass in weight and balance. They are which of the following?

A. Fuel quantity and oil quantity

B. Empty weight and useful load

C. Total weight within gross limit, and CG within forward and aft limits

D. Arm and datum location

21. A forward center of gravity affects the airplane in which way?

A. More stable, with a higher stall speed and heavier controls

B. Less stable, with a lower stall speed

C. More responsive and easier to maneuver

D. Lower stall speed and faster cruise

22. An aft center of gravity affects the airplane in which way?

A. More stable with heavier controls

B. A much higher stall speed

C. Slower cruise and more stability

D. Less stable, more responsive, with a slightly lower stall speed

23. Why is an aft CG beyond the limit especially dangerous?

A. Recovery from a stall or spin may be difficult or impossible

B. The stall speed rises sharply, preventing takeoff

C. The controls become extremely heavy to move

D. The engine overheats during climb

24. A CG envelope graph is used to do what?

A. Determine the fuel burn rate

B. Confirm the plotted weight and CG fall within approved limits

C. Set the altimeter

D. Measure the wind correction angle

25. Why does a forward CG produce a higher stall speed?

A. The wings make excessive lift on their own

B. The propeller pushes the nose down

C. The engine runs hotter at forward CG

D. The tail must produce more download, increasing the wing's effective load

26. A soft, wet, or grass runway surface affects takeoff distance how?

A. It shortens the takeoff roll

B. It has no effect on takeoff

C. It increases the takeoff distance

D. It eliminates the need for a headwind

27. An uphill runway gradient affects takeoff distance in what way?

A. It lengthens the takeoff distance

B. It shortens the takeoff distance

C. It has no effect on the takeoff

D. It only affects the landing roll

28. A heavier aircraft requires what for takeoff and landing compared to a lighter one?

A. Less runway for both

B. More runway for both

C. The same runway in all cases

D. Runway only for landing, not takeoff

29. Why does high density altitude reduce the propeller's effectiveness?

A. The propeller spins more slowly

B. The blades become heavier

C. There is less dense air for the propeller to act upon

D. The pitch automatically increases

30. Vx, the best angle of climb speed, is which relative to Vy?

A. The slower of the two speeds

B. The faster of the two speeds

C. Equal to Vy in all aircraft

D. The same as maneuvering speed

31. A performance chart gives takeoff distances at 0°C and 20°C. To find the distance at 10°C, a pilot would do what?

A. Use the 0°C value only

B. Interpolate to a value midway between the two

C. Use the 20°C value only

D. Add the two values together

32. A loading that is within maximum gross weight but has the CG aft of the rear limit should be treated how?

A. As unsafe; the airplane must be reloaded

B. As safe because weight is within limits

C. As beneficial because it lowers stall speed

D. As acceptable for short flights only

33. Payload is best described as which of the following?

A. The weight of occupants, cargo, and baggage, excluding fuel

B. The empty weight of the aircraft

C. The maximum gross weight

D. The unusable fuel and operating fluids

34. Why must takeoff and climb performance be carefully computed at a high-elevation airport on a hot day?

A. The compass becomes unreliable

B. High density altitude lengthens takeoff and reduces climb, risking obstacle clearance

C. The fuel weighs more at altitude

D. The magnetos lose power at elevation

35. A pilot computes total weight by doing what?

A. Dividing the total moment by the number of items

B. Summing the weights of all loaded items

C. Multiplying the empty weight by the fuel quantity

D. Subtracting the baggage from the fuel

36. Which factor does NOT increase takeoff distance?

A. High density altitude

B. A heavy aircraft load

C. A strong headwind component

D. A soft or wet runway surface

37. The total moment of an aircraft is found by doing what?

A. Dividing each weight by its arm

B. Multiplying the total weight by the datum

C. Summing the individual moments of all items

D. Adding all the arms together

38. Why is being within maximum gross weight necessary but not sufficient for a safe loading?

A. The CG must also fall within the approved forward and aft limits

B. The fuel must always be full

C. The baggage must be empty

D. The aircraft must also be at sea level

39. An airplane with a useful load of 550 lb carries two occupants weighing 340 lb and 20 lb of baggage. How much weight remains for fuel?

A. 360 lb

B. 190 lb

C. 250 lb

D. 90 lb

40. Which best states the effect of high humidity on density altitude?

A. It lowers density altitude and improves performance

B. It has no effect on density altitude

C. It only affects the fuel system

D. It slightly raises density altitude because water vapor is lighter than dry air

41. A pilot loads items with moments of 54,600, 12,580, and 8,640 lb-in. What is the total moment?

A. 70,000 lb-in

B. 75,820 lb-in

C. 67,180 lb-in

D. 80,000 lb-in

42. A total moment of 80,000 lb-in and a total weight of 2,000 lb produce what center of gravity?

A. 40.0 inches

B. 38.0 inches

C. 42.0 inches

D. 36.0 inches

43. Why does an uphill takeoff combined with a tailwind produce the longest takeoff distance?

A. The headwind component is increased

B. The runway surface becomes firmer

C. Both the slope and the tailwind work against acceleration to flying speed

D. The density altitude decreases

44. Why is interpolation necessary when using performance charts?

A. Because actual conditions often fall between the published table values

B. Because the charts are always inaccurate

C. Because the aircraft has no published data

D. Because fuel cannot be converted to weight

45. A pilot converting 25 gallons of avgas to weight obtains approximately what?

A. 150 pounds

B. 100 pounds

C. 200 pounds

D. 75 pounds

46. The CG limits exist primarily to balance what?

A. Fuel economy against range

B. Stability against controllability

C. Takeoff distance against landing distance

D. Cruise speed against climb rate

47. Why does a tailwind on landing increase the required landing distance?

A. It reduces the stall speed dangerously

B. It increases the groundspeed at touchdown

C. It firms up the runway surface

D. It lowers the density altitude

48. A pilot loading the airplane must check the plotted point against the CG envelope to confirm what?

A. The fuel grade is correct

B. The wind correction angle is accurate

C. The loading falls within the approved limits

D. The altimeter setting is current

49. Which condition produces the greatest takeoff distance?

A. High density altitude with a tailwind and a heavy load

B. Low density altitude with a strong headwind

C. Cool temperatures at a sea-level field

D. A firm, dry, downhill runway into the wind

50. Why is excess power important to climb performance?

A. It determines the maximum cruise speed

B. The climb rate depends on power available beyond that needed for level flight

C. It sets the never-exceed speed

D. It controls the aircraft's stability

Answer Key & Explanations

1. D — Density altitude is pressure altitude corrected for nonstandard temperature — the altitude at which the airplane performs. High density altitude degrades takeoff, climb, and overall performance.

2. C — Density altitude rises with high elevation, high temperature, and high humidity — the "three H's" — all of which thin the air. Less dense air reduces lift, thrust, and engine power.

3. D — As density altitude increases, the wings produce less lift, lengthening the takeoff roll. A higher true airspeed is needed to generate the same lift in thinner air.

4. D — At high density altitude, the engine produces less power because it draws in less air, and therefore less oxygen, per stroke. This compounds the loss of lift and thrust.

5. A — A headwind shortens both takeoff and landing distance by reducing the groundspeed needed to fly and at touchdown. This is why takeoffs and landings are made into the wind.

6. A — A tailwind lengthens both takeoff and landing distance by increasing the groundspeed required. It is a common factor in runway-overrun accidents.

7. D — Best angle of climb (Vx) gives the greatest altitude gain over the shortest horizontal distance, used to clear an obstacle. Best rate of climb (Vy) gains altitude fastest in time.

8. D — Best rate of climb (Vy) provides the greatest altitude gain over time, getting the airplane to altitude most quickly. Vx, by contrast, gives the steepest angle.

9. C — Climb performance depends on excess power, the power available beyond that needed for level flight. High density altitude and heavy weight reduce excess power and climb rate.

10. D — Interpolation means estimating a value that falls between two known values on a chart. It is used when actual conditions lie between published table entries.

11. B — The datum is an imaginary reference line from which all horizontal distances, or arms, are measured. It is the starting point for balance calculations.

12. D — The arm is the horizontal distance from the datum to the center of a weight, expressed in inches. Multiplying weight by arm gives the moment.

13. D — The moment of an item is found by multiplying its weight by its arm. It represents the turning tendency of that weight about the datum.

14. C — The center of gravity is the point at which the airplane's total weight is considered concentrated, the balance point. It must fall within the approved limits.

15. C — Empty weight includes unusable fuel and full operating fluids, but no usable fuel or occupants. It is the baseline from which useful load is calculated.

16. D — Useful load is the difference between maximum gross weight and empty weight, the weight available for fuel, occupants, and baggage. It defines how much can be carried.

17. B — Maximum gross weight is the maximum weight at which the airplane is approved to operate. Exceeding it degrades performance and is unsafe.

18. B — The center of gravity is found by dividing the total moment by the total weight. This locates the balance point relative to the datum.

19. C — Fuel must be converted to weight at about 6 pounds per gallon before computing moments. Using gallons instead of pounds would produce a wildly incorrect result.

20. C — Two independent checks must pass: total weight within the maximum gross limit, and CG within the forward and aft limits. Being within one does not excuse violating the other.

21. A — A forward CG makes the airplane more stable but raises the stall speed and increases control forces. It can also make the landing flare more difficult at extreme forward CG.

22. D — An aft CG makes the airplane less stable and more responsive, with a slightly lower stall speed. Beyond the limit it can make recovery impossible.

23. A — An aft CG beyond the limit is especially dangerous because recovery from a stall or spin may be difficult or impossible due to insufficient elevator authority. This is the most hazardous loading error.

24. B — A CG envelope graph confirms the plotted weight and CG fall within approved limits. The point must lie inside the printed envelope.

25. D — A forward CG requires the tail to produce more download, effectively increasing the load the wing must support and raising the stall speed. It also increases stability and control forces.

26. C — A soft, wet, or grass runway surface increases the takeoff distance by adding rolling resistance. Firm, dry, paved surfaces require the least distance.

27. A — An uphill runway gradient lengthens the takeoff distance because the airplane must accelerate against the slope. A downhill gradient would shorten it.

28. B — A heavier aircraft requires more runway for both takeoff and landing. It needs a higher speed to fly and more distance to stop.

29. C — High density altitude reduces propeller effectiveness because there is less dense air for the blades to act upon. This compounds the reductions in lift and engine power.

30. A — Vx, the best angle of climb speed, is the slower of the two speeds. Vy, the best rate of climb, is faster.

31. B — To find the takeoff distance at 10°C, a pilot interpolates to a value midway between the 0°C and 20°C entries. Interpolation estimates values between published points.

32. A — A loading within gross weight but with the CG aft of the rear limit is unsafe and must be reloaded. Weight and CG are independent checks.

33. A — Payload is the weight of occupants, cargo, and baggage, excluding fuel. It is part of the useful load.

34. B — At a high-elevation airport on a hot day, high density altitude lengthens the takeoff and reduces the climb, risking obstacle clearance. Careful computation is essential to safety.

35. B — Total weight is computed by summing the weights of all loaded items. This gross weight is checked against the maximum.

36. C — A headwind component decreases takeoff distance, so it does not increase it. High density altitude, heavy weight, and soft surfaces all increase takeoff distance.

37. C — The total moment is found by summing the individual moments of all items. Dividing it by total weight gives the CG.

38. A — Being within gross weight is necessary but not sufficient because the CG must also fall within the forward and aft limits. A legal weight in the wrong place is unsafe.

39. B — Remaining for fuel = 550 − 340 − 20 = 190 lb. This is the weight available for fuel within the useful load.

40. D — High humidity slightly raises density altitude because water vapor is lighter than dry air, reducing density. The effect is smaller than temperature or elevation but still degrades performance.

41. B — Total moment = 54,600 + 12,580 + 8,640 = 75,820 lb-in. Summing the individual moments gives the total used to find CG.

42. A — CG = 80,000 ÷ 2,000 = 40.0 inches. Dividing total moment by total weight locates the balance point.

43. C — An uphill takeoff with a tailwind produces the longest distance because both the slope and the tailwind work against acceleration to flying speed. Each factor independently lengthens the roll.

44. A — Interpolation is necessary because actual conditions often fall between the published table values. It provides an accurate estimate for the real conditions.

45. A — Avgas weighs about 6 pounds per gallon, so 25 × 6 = 150 pounds. Converting fuel to weight is essential before computing moments.

46. B — The CG limits exist to balance stability against controllability. Within the range, the airplane is both stable enough to be safe and responsive enough to maneuver.

47. B — A tailwind on landing increases the groundspeed at touchdown, lengthening the required landing distance. The higher groundspeed means more distance to stop.

48. C — Checking the plotted point against the CG envelope confirms the loading falls within approved limits. The point must lie inside the envelope for a legal loading.

49. A — High density altitude with a tailwind and a heavy load produces the greatest takeoff distance, as all three factors lengthen the roll. Each works against accelerating to flying speed and getting airborne.

50. B — The climb rate depends on excess power — the power available beyond that needed for level flight. High density altitude and heavy weight reduce this excess and flatten the climb.