

Advanced Engineering Systems and Design

Name: _____

Activity 5.1.7 Lift, Stall & VTOL

Period: _____

Part I – Lift Fundamentals

1. Define lift in your own words.

2. List three factors that affect lift.

a) _____

b) _____

c) _____

Part II – Angle of Attack

3. What is angle of attack?

4. What happens to lift as angle of attack increases (before stall)?

5. Why does increasing angle of attack eventually stop increasing lift?

Part III – Stall

6. What is a stall?

7. What physically happens to the airflow during a stall?

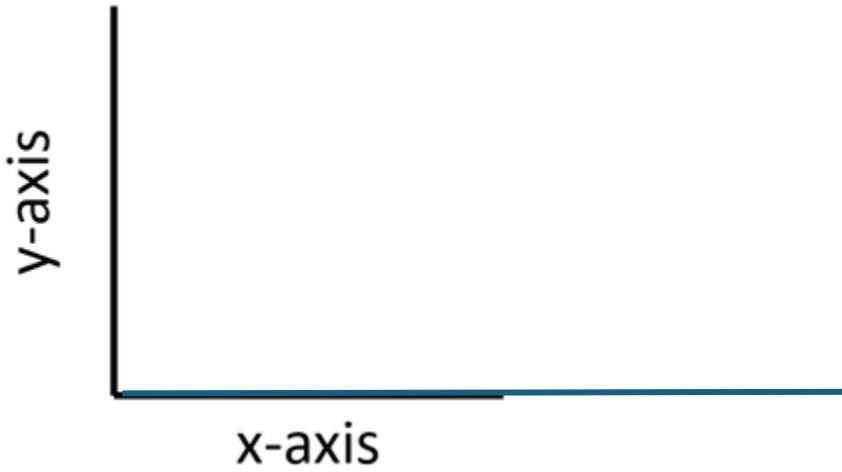
8. True or False: A stall occurs when the engine fails.

Circle one: TRUE / FALSE

Explain:

Part IV – Graph Interpretation

9. Sketch the relationship between lift and angle of attack (Label axes clearly). Identify on your graph: Linear region, Maximum lift, and Stall region.



Part V – Lift Equation

Lift equation:

$$L = \frac{1}{2} \rho v^2 A C_L$$

10. What does each variable represent?

ρ (rho): _____

v: _____

A: _____

C_L : _____

11. If velocity doubles, how does lift change?

12. If velocity triples, how does lift change?

13. Why is velocity the most important variable in the lift equation?

Part VI – Proportional Reasoning

14. If air density decreases, what happens to lift?

15. If wing area increases, what happens to lift?

Part VII – Engineering Thinking

16. Why don't engineers simply increase angle of attack to maximize lift?

17. What tradeoff occurs when increasing lift?

Part VIII – VTOL (Lift vs Thrust)

18. In a traditional airplane, what balances weight?

19. In a VTOL aircraft, what balances weight?

20. Why does a VTOL aircraft require much more energy than a traditional airplane?

21. Which system is more efficient for long-distance travel?

Circle one:

Lift-based flight

Thrust-based flight

Explain:

Part IX – Application

22. Match the aircraft to its best use:

A. Commercial airplane

B. Helicopter

C. Fighter jet (VTOL capable)

____ Long-distance travel

____ Vertical landing in small area

____ Short runway or flexible deployment

Part X – Challenge

23. If velocity increases slightly, why can lift increase dramatically?

24. Explain why stall is dangerous during takeoff or landing.
