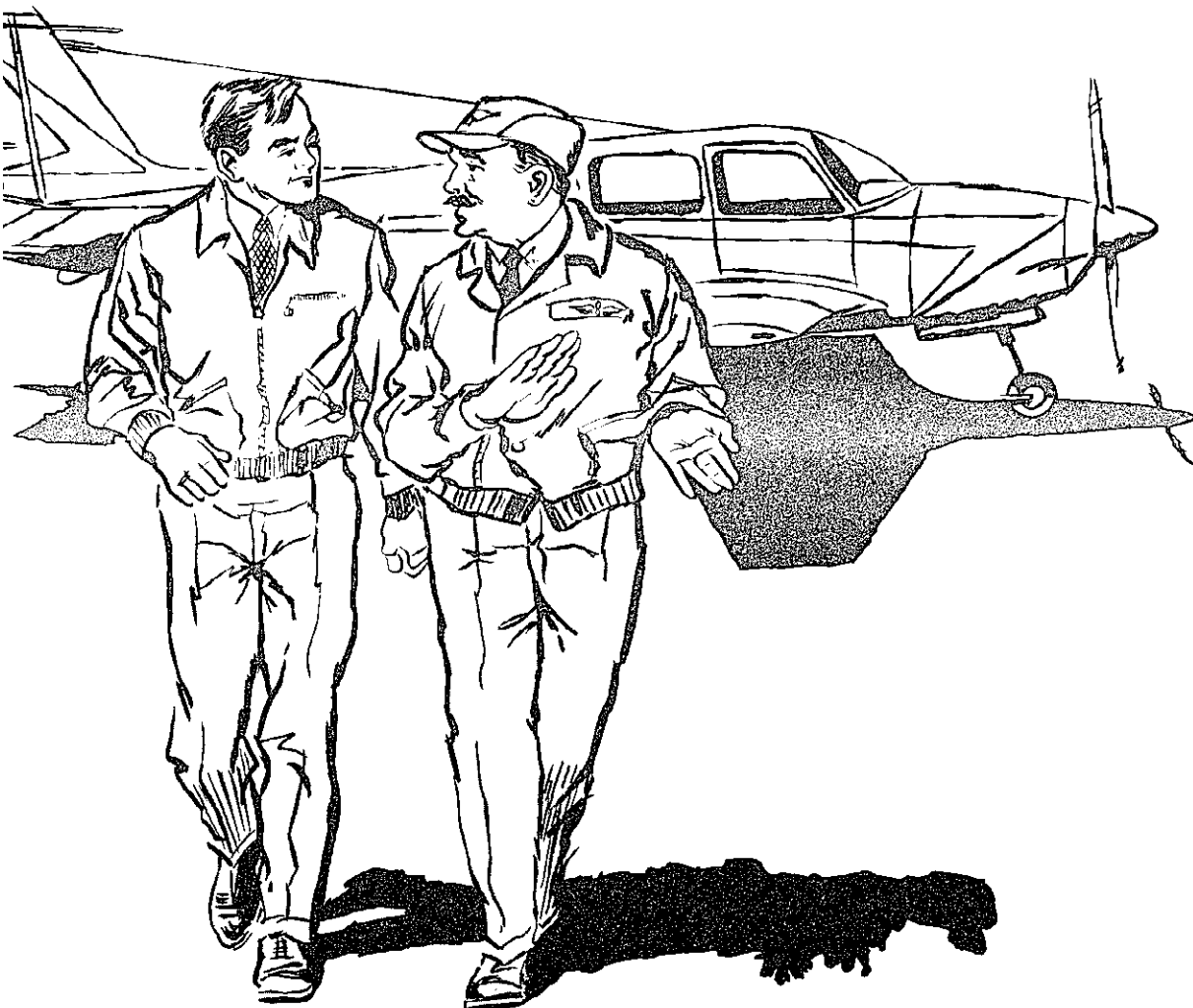


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# FLIGHT INSTRUCTOR

## *Written Test Guide*



**DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION**

# AIRPLANE FLIGHT INSTRUCTOR WRITTEN TEST GUIDE



REVISED

1972

**DEPARTMENT OF TRANSPORTATION**

**FEDERAL AVIATION ADMINISTRATION**

*Flight Standards Service*

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## PREFACE

The Flight Standards Service of the Federal Aviation Administration has issued this Airplane Flight Instructor Written Test Guide to provide information to prospective airplane flight instructors and other persons interested in Federal Aviation Administration certification of flight instructors.

The guide contains information about certification requirements, application procedures, and the required written test. Its purpose is to guide prospective applicants toward a clear understanding of the requirements, reference material, tests, and testing procedures. A sample test is presented with explanations of the correct answers.

This guide is issued as Advisory Circular 61-11B and supersedes the Airplane Flight Instructor Examination Guide, Advisory Circular 61-11A, dated 1967.

Comments regarding this publication should be directed to the Department of Transportation, Federal Aviation Administration, Flight Standards Technical Division, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

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# AIRPLANE FLIGHT INSTRUCTOR WRITTEN TEST GUIDE

## INTRODUCTION

This study guide was developed to assist prospective instructors in their preparation for the Airplane Flight Instructor Written Test. It was designed by personnel in the FAA Flight Standards Technical Division, Operations Branch, who are also responsible for developing the written tests.

This publication is merely a guide directing the applicant to the knowledge areas required of professional flight instructors. There is no quick and easy way for the individual to obtain the experience, knowledge, and skill that is so essential for molding a student into a safe, efficient pilot. The intent of this guide, therefore, is to define and narrow the field of study, insofar as possible, to the basic knowledge required for flight instructor certification.

## CERTIFICATION REQUIREMENTS

To meet the general qualifications for an airplane flight instructor certificate, the applicant must possess a combination of experience, knowledge, and skill. For specific information pertaining to certification of pilots and flight instructors, each applicant should review carefully the applicable sections of Federal Aviation Regulations, Volume IX, Part 61.

## TYPE OF WRITTEN TEST

The Airplane Flight Instructor Written Test is very comprehensive because, to be an effective instrument, it must test the applicant's knowledge in many subject areas. In addition to knowing *what* to do and *how* to do it, the instructor also needs to understand *why* a maneuver or procedure is performed in a certain manner and the results of improper execution. Neither the pilot with considerable knowledge but little skill, nor the pilot who is skillful but lacks aeronautical knowledge, is adequately equipped for present-day flying. Both

knowledge and skill are of equal importance in meeting the responsibilities of a safe, efficient pilot.

In addition to aviation qualifications, the flight instructor should be capable and well versed in one more important area that is not required for any other pilot certificate. The flight instructor should be a *teacher*. To teach students effectively, he should have an understanding of the learning processes, the basic teaching principles, and the general application of these principles. There is much truth in the saying, "If there is no learning, there is no teaching."

The airplane flight instructor written test is divided into two sections: Section I, "Fundamentals of Flight Instruction," and Section II, "Performance and Analysis of Flight Training Maneuvers." A detailed outline of the subject areas covered in each section appears later in this guide.

The time required for the test is approximately 4 hours. Test items are of the objective, multiple-choice type, and each can be answered by the selection of a single item as the correct choice. This method saves the applicant's time, the scorer's time, and eliminates subjective treatment when determining grades.

The applicant's answer sheet is forwarded to the FAA Aeronautical Center for grading by ADP computers. When returned to the applicant, the report of the test results includes, in code, the subject areas in which he incorrectly answered questions. This code is related to a Subject Matter Outline which accompanies the report. In this manner the applicant can determine the subject areas in which he should strengthen his knowledge.

## TAKING THE TEST

Communication between individuals, through the use of words, is a complicated process. Since the test involves the use of written language, communication between the test writer and the person being tested becomes a problem if care is not exercised.

Considerable effort is expended to write each test item in a clear, concise manner. Therefore, applicants should carefully read the information and instructions given in the test, as well as each test item.

First, read the entire test item and be sure that you understand its objective before selecting an answer. Look through the list of alternative answers and second, after working the problem or analyzing the statements, select the answer from those given which you believe to be most nearly correct.

There is only *one* answer given that is completely correct. The others are derived from incorrect computations, lack of knowledge of the subject, or from common misconceptions of the subject.

There are no "trick" questions injected into the test with the intention of confusing the applicant. Examine each item and alternative answer carefully but do not search for hidden meanings or read into the item something that is not there. The question and answers mean exactly what is stated and refer to the general rule rather than the exceptions to the rule.

If you find that you have considerable difficulty with a particular test item, do not spend too much time on it, but continue on with the other items and answer those questions which are less difficult. Then go back and reconsider those which you passed over. This will enable you to use the time available to maximum advantage in demonstrating your knowledge of the subject.

## RECOMMENDED STUDY MATERIALS

Professionalism in flight instruction is as important as it is in medical, legal, or engineering vocations. One thing that enhances professionalism, and which the flight instructor should have in common with doctors, lawyers, or engineers, is the possession of a technical library. By obtaining study materials that are beneficial and appropriate to his preparation for certification, the prospective flight instructor will be laying the foundation upon which to build his aeronautical library for use throughout his career. The list below identifies essential source materials but does not include all the useful material that is available. Other ex-

cellent textbooks, audio-visual training aids, and instructional materials may be obtained from various bookstores and fixed-base operators engaged in flight training.

**Flight Instructor's Handbook.** AC 61-16A. Revised 1969. (\$1.25—GPO). TD 4.408:In 7/3. Designed for the information and guidance of pilots who are preparing to apply for flight instructor certificates and for use as a reference by certified flight instructors.

**Flight Training Handbook.** AC 61-21. Reprinted 1969. (\$1.25—GPO). FAA 1.8:F 64/4. Provides information and direction in the introduction and performance of training maneuvers for student pilots, pilots who are re-qualifying or preparing for additional ratings, and for flight instructors.

**Airman's Information Manual (AIM).** Presents, in four Parts, information necessary for the planning and conduct of flights within the National Airspace System. Besides providing frequently updated airport and NAVAID data, the AIM includes instructional and procedural information and is designed for use in the cockpit. Each Part is available on a separate annual subscription to better serve the needs of the individual pilot.

PART 1—BASIC FLIGHT MANUAL AND ATC PROCEDURES. (\$7.00 domestic; \$8.75 foreign—GPO): Issued quarterly. TD 4.12:pt. 1/. (BFAP).

PART 2—AIRPORT DIRECTORY. (\$7.00 domestic; \$8.75 foreign—GPO): Issued semi-annually. TD 4.12:pt. 2/(ADP).

PART 3 AND 3A—OPERATIONAL DATA AND NOTICES TO AIRMEN. (\$22.00 domestic; \$27.50 foreign—GPO): Issued every 56 days supplemented by NOTICES TO AIRMEN every 14 days during the 56-day cycle. TD 4.12:pt. 3/ODNA).

PART 4—GRAPHIC NOTICES AND SUPPLEMENTAL DATA. (\$9.50 domestic; \$12.00 foreign—GPO): Issued quarterly. TD 4.12:pt. 4/.

For additional information concerning AIM, see page 46.

**Pilot's Handbook of Aeronautical Knowledge.**

AC 61-23A. (\$4.00—GPO). TD 4.408:p 64/5. Contains essential, authoritative information used in training and guiding private pilots, and covers all subject areas in which an applicant may be tested. Tells how to use the Airman's Information Manual, data in FAA-approved airplane flight manuals, and basic instruments for airplane attitude control.

**Aviation Weather.** — AC 00-6 (\$4.00 GPO): Catalog No. FAA 5.8/2:W 37. Contains information on weather phenomena for pilots and other flight operations personnel whose interest in meteorology is primarily in its application to flying.

**Private Pilot (Airplane) Flight Training Guide.** AC 61-2A. September 1964. (\$1.50—GPO). FAA 5.8/2:P 64/4/964. Assists flight instructors in planning the flight training of primary students. It is designed for the use of instructors who do not operate under a curriculum offered by a certified flying school. It is not intended for a study guide for either flight instructors or student pilots.

**Density Performance Computer (Fixed Pitch Propeller).** Safety education series #8. (50¢—GPO). FAA 5.8/2:C 73. A density altitude computer for use in aircraft with fixed pitch propellers. It is intended to supplement and **not** replace manufacturer's published performance information.

**Density Computer (Variable Pitch Propeller).** Safety Education Series #8. (50¢—GPO). FAA 5.8/2:C 73/2. A density altitude computer for use in aircraft with variable pitch propellers. It is intended to supplement and **not** replace manufacturer's published performance information.

**Terrain Flying.** AC 91-15. February 1967. (85¢—GPO). TD 4.2:T 27. This pocket-size booklet is designed by FAA as a flying "tool" for the average private pilot. It contains observations, opinions, warnings, and advice from veteran pilots.

**Federal Aviation Regulations.** All parts of the Federal Aviation Regulations (FARs) are now grouped in 11 volumes. Volumes may be individually purchased, with subsequent changes being supplied free, from Superintendent of Documents. Separate Parts are not available. See page 4 for additional information. Suggested Parts for study are:

	Price	Additional for foreign mailing
Volume I, Part 1, Definitions and Abbreviations, May 1969 (GPO). TD 4.6/3:vl.	\$ 2.50	\$0.75
Volume III, Part 23, Airworthiness Standards—Normal, Utility, and Acrobatic Category Airplanes, December 1969 (GPO). TD 4.6/3:v3.	\$13.50	\$3.50
Volume VI, Part 91, General Operating and Flight Rules, August 1969 (GPO). TD 4.6/3:v6.	\$ 9.00	\$2.25
Volume IX, Part 61, Certification: Pilots and Flight Instructors, July 1970 (GPO). TD 4.6/3:v9.	\$ 6.00	\$1.50

**National Transportation Safety Board.** NTSB Part 430. (Free). This publication deals with procedures required in dealing with accidents and lost or overdue aircraft in the United States, its territories, and possessions. Upon request, it is free from the National Transportation Safety Board, Publications Section, Washington, D.C. 20591.

**Plane Sense.** AC 20-5A (Free). This booklet helps to acquaint the prospective airplane owner with some fundamentals of owning and operating an airplane. Upon request, it is free from the Department of Transportation, Distribution Unit, TAD 484.3, Washington, D.C. 20590.

**Wake Turbulence.** AC 90-23C. May 1972. (Free—FAA). Presents information on the subject of wake turbulence and suggests techniques that may help pilots avoid the hazards associated with wingtip vortex turbulence.

**VFR Pilot Exam-O-Grams.** Dealing with selected topics of particular importance to safety in flight operations, these brief summaries of essential points provide concise information on the specific subjects which pilot tests have indicated need clarification to correct common mistakes, misconceptions, and lack of information. A list of the currently available Exam-O-Grams appears in the Appendix on page 45. They are available free of charge from: FAA Aeronautical Center, Flight Standards Technical Division, Operations Branch, AC-240,

Post Office Box 25082, Oklahoma City, Oklahoma  
73125.

**Airplane Flight Manuals and Owners Manuals.**

Aircraft manufacturers issue manuals for each aircraft model. These may be obtained from individual aircraft manufacturing companies or from local dealers and distributors.

**HOW TO OBTAIN GPO PUBLICATIONS**

1. Use an order form, not a letter unless absolutely necessary. Order forms (such as shown on page 47 of the Appendix, *which may be duplicated by the user*, are included in the catalog "FAA Publications" sent free upon request from:

Distribution Unit, TAD 484.3  
Department of Transportation  
Washington, D.C. 20590

2. Send separate orders for a subscription and a nonsubscription item.

3. Give the exact name of the publication and the agency number.

4. Send a check or money order, not cash. Send the exact amount.

5. Enclose a self-addressed mailing label if you have no order blank.

6. Use special delivery when needed.

7. Use GPO bookstores.

8. All prices are subject to change.

Several GPO bookstores have been established throughout the country for sales publications. The public is encouraged to avail themselves of the mail order service offered by these facilities.

GPO bookstores are located at the following addresses:

GPO Bookstore  
Room 100, Federal Building  
275 Peachtree Street NE.  
Atlanta, Georgia 30303

GPO Bookstore  
Room 102A, 2121 Building  
2121 Eighth Avenue North  
Birmingham, Alabama 35203

GPO Bookstore  
Room G25, John F. Kennedy Federal Building  
Sudbury Street  
Boston, Massachusetts 02203

GPO Bookstore  
Federal Office Building  
201 Cleveland Avenue SW.  
Canton, Ohio 44702

GPO Bookstore  
Room 1463—14th Floor  
Everett McKinley Dirksen Building  
219 South Dearborn Street  
Chicago, Illinois 60604

GPO Bookstore  
Room 1C46  
Federal Building—U.S. Courthouse  
1100 Commerce Street  
Dallas, Texas 75202

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Room 1421  
Federal Building—U.S. Courthouse  
1961 Stout Street  
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Los Angeles, California 90012

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Room 110  
26 Federal Plaza  
New York, New York 10007

GPO Bookstore  
U.S. Post Office and Courthouse  
Main Lobby  
Ninth and Chestnut Streets  
Philadelphia, Pennsylvania 19107

GPO Bookstore  
Room 1023, Federal Office Building  
450 Golden Gate Avenue  
San Francisco, California 94102

Mail orders may also be directed to:  
Superintendent of Documents  
U.S. Government Printing Office  
Washington, D.C. 20402



## STUDY OUTLINE

### SECTION I. FUNDAMENTALS OF FLIGHT INSTRUCTION

#### A. PRINCIPLES OF TEACHING AND LEARNING

##### 1. *How people learn*

a. Perception — Understand its role in relation to learning and the important factors which affect a student's perception, such as—

- (1) Individual mental, emotional, and physiological characteristics.
- (2) Needs and requirements.
- (3) Goals and values.
- (4) Self-concept.
- (5) Time and opportunity to perceive.
- (6) The element of threat.

b. Insight — Understand its relationship to perception and the instructor's role in—

- (1) Cultivating receptiveness to new experiences.
- (2) Organizing demonstrations, explanations, and directed student practice.
- (3) Pointing out related perceptions as they occur.
- (4) Supervising the "trial and error" process.
- (5) Assisting the student to group associated perceptions into meaningful wholes or "blocks" of learning.

c. Motivation — *Understanding its dominant role* in relation to student progress and ability to learn—

- (1) Types of motivation.
  - (a) Negative.
  - (b) Positive
  - (c) Tangible.
  - (d) Intangible.
- (2) Use of factors which affect motivation.
  - (a) Gain or reward.
  - (b) Comfort and security.
  - (c) Favorable self-image.
  - (d) Group approval.
  - (e) Short- and long-range goals.

(f) Praise.

(g) Criticism.

d. Obstacles to learning — Understand the effect of each of the following on the learning process and how they may be modified or eliminated—

- (1) Self-consciousness.
- (2) Antagonism or feeling of unfair treatment.
- (3) Impatience.
- (4) Worry or lack of interest.
- (5) Physical discomfort, fatigue, and illness.
- (6) Apathy fostered by poor instruction.
- (7) Fear, anxiety, and timidity.
- (8) Lack of confidence.
- (9) Airsickness.

e. Habits and transfer — Understand the influence of perceptions and insight on the development of performance habit patterns and the influence of such habit patterns in subsequent learning and transfer of learning—

- (1) The importance of the formation of correct habit patterns.
- (2) The importance of habit patterns in aircraft control.
- (3) The promotion of transfer of learning through use of the flight syllabus.
- (4) Positive transfer.
- (5) Negative transfer.
- (6) The influence of the "building block" technique of instruction in habit development.

2. *Levels of learning* Understand the progressive levels of learning as exemplified by the "building block" concept—

- a. Rote performance.
- b. True understanding.

- c. Correlation of previous learning, understanding, and skill with new tasks, problems, techniques, and procedures.

**3. Rates of learning** Have a knowledge and understanding of:

- a. The characteristics of a typical learning curve—
  - (1) Initial learning rate.
  - (2) Slumps or plateaus and their causes.
  - (3) Reversals and their causes.
- b. The role of memory and the effect of forgetting in the achievement of satisfactory student progress—
  - (1) Relationship between memory and habit patterns.
  - (2) Usefulness of drill, recitation, and quizzing.
  - (3) Continued usage, practice, and application.
- c. Significant principles which reinforce memory—
  - (1) Praise.
  - (2) Association.
  - (3) Favorable attitude.
  - (4) Learning with all the senses.
  - (5) Meaningful repetition.

**4. Common misconceptions about learning**

- a. Fear is the best motivator.
- b. Making it easy to learn is contrary to the principles of sound teaching.
- c. Pictures, illustrations, and diagrams are, *per se*, more effective than written or verbal presentations of information.
- d. The greater the experience, the better the performance.
- e. The impersonal approach is more effective than the friendly attitude in teaching.
- f. Competition is the key to successful learning.
- g. Frustration and failure are essential to learning.

**B. HOW TO GUIDE THE LEARNING PROCESS**

**1. Plan the instructional activity**

- a. Establish clear objectives or goals.
- b. Identify the block of learning.
- c. Provide for student participation.
- d. Diagnose student ability.

- e. Use a teaching sequence that "makes sense."
- f. Work from the known to the unknown.
- g. Work from the easy to the difficult.
- h. Plan so the student will see the necessity and logic of each succeeding step.

**2. The flight training syllabus**

- a. Arrange for efficient sequence in "blocks" of training.
- b. Use syllabus as a guide.
- c. Keep flexibility in teaching procedures.

**3. The lesson plan**

- a. Lesson planning is essential to teaching success.
- b. Items to include in lesson plan—
  - (1) Lesson objectives.
  - (2) Elements involved in satisfactory fulfillment of lesson objectives.
  - (3) Allocation of time available.
  - (4) Equipment needed.
  - (5) Activity required of the instructor.
  - (6) Activity required of the student.
  - (7) Evaluation of student performance.

**4. The flight instruction breakdown**

- a. Useful in preparing meaningful lesson plans.
- b. Useful for guidance in offering effective instruction.
- c. Requires personal analysis of maneuver.
- d. Requires personal analysis of proposed procedure for teaching maneuver.

**5. Presentation of the instruction material**

- a. Establish atmosphere of cooperation.
- b. Explain, demonstrate, and direct.
- c. Require student participation.
- d. Keep goal in sight.
- e. Be brief, clear, and to the point in explanations.
- f. Use analogies as link between known and unknown.
- g. Question technique: use and importance.
- h. Deal with the individual needs of both poor students and apt students.

**6. Performance**

- a. Usually integrated with presentation.
- b. Require discipline.
- c. Make it realistic.
- d. Guide student efforts.

- c. Progress from easy to difficult.
- f. Relate to previous explanations and practice.
- g. Provide adequate practice but control blind "trial and error."
- h. Understand factors relating to length and frequency of practices.
- i. Use of briefings and critiques.
- j. Skill versus knowledge.
- k. Role of repetition in learning and retention.

## 7. Evaluate the performance

- a. An integral part of each lesson.
- b. Establishes need for selective re-teaching or review.
- c. Acquaint student with his progress.
- d. Should include evaluation of things previously learned.
- e. Should be based on standards established by the training syllabus.

## C. ANALYSIS OF EFFECTIVE METHODS AND TECHNIQUES

### 1. The four basic steps in the teaching process

- a. Preparation (See Section 1B, "How to Guide the Learning Process").
- b. Presentation—
  - (1) Telling or explaining—the lecture method:
    - (a) Does not permit student participation.
    - (b) Can be combined with other methods for greater effectiveness.
  - (2) Techniques of discussion—
    - (a) Develop cooperative spirit.
    - (b) Clarify problem.
    - (c) Encourage participation.
    - (d) Avoid dominating discussion.
    - (e) Summarize frequency.
  - (3) Demonstration or showing—
    - (a) Usually combined with explanations.
    - (b) Makes explanations concrete.
    - (c) Aids student understanding.
    - (d) Saves learning time.
    - (e) Effective with both large and small groups.
    - (f) Gives student overall perspective.
    - (g) Appeals to several senses.
    - (h) Has dramatic appeal.

### c. Doing – trial and practice—

- (1) Essential to the learning process.

- (2) Constitutes student's activity based on instructor's preparation and presentation.
- (3) Requires careful guidance and correction.
- (4) Requires student and instructor evaluation.
- (5) Concentrate on strengthening weak points of performance.

### d. Review and evaluation.

- (1) Organizes thinking.
- (2) Develops understanding of basic principles.
- (3) Helps the student to see relationships.
- (4) Measures the success of a teaching program.
- (5) Tests for both understanding and performance.
- (6) Characteristics of good evaluation—
  - (a) Validity – does it measure what it is supposed to measure?
  - (b) Reliability – are the results consistent?
  - (c) Objectivity – does it limit the undesirable errors introduced by personal judgment in grading?
  - (d) Differentiation or discrimination – does it identify small but significant differences in achievement?
  - (e) Comprehensiveness – does it provide adequate sampling of the skill or proficiency being graded?
- (7) Common techniques of evaluation—
  - (a) Oral and written quizzes.
  - (b) Demonstrations of ability.
  - (c) Examination and tests.

## D. THE FLIGHT INSTRUCTOR'S ROLE IN HELPING STUDENTS TO LEARN

### 1. Be a professional

- a. Train and prepare.
- b. Follow a program of self-improvement.
- c. Adhere to ethical standards.
- d. Be of real service.
- e. Believe in your work.
- f. Maintain a positive attitude – be sincere, enthusiastic, friendly, and patient.
- g. Be proficient as a pilot.
- h. Be proficient as a teacher.

## **2. The instructor/student relationship**

- a. Gain the student's confidence.
- b. Appreciate the student's problems.
- c. Assess the student's personality, thinking, and ability.
- d. Allow for individual differences.
- e. Keep student aware of progress.

## **3. Safety practices**

- a. Practice what you preach—
  - (1) Use the checklists.
  - (2) Observe established safety practices.
  - (3) Observe regulations.
  - (4) Teach respect for limitations of self and equipment.

## **4. Use of training aids** Choose with care—

- a. Models.
- b. Charts, diagrams, and performance tables.
- c. Audiovisual courses.
- d. Programmed instruction.
- e. "Handees" (gestures and improvisations).

## **E. MAINTAIN STUDENT INTEREST AND MOTIVATION**

### **1. Motivation – basic to all learning**

- a. Utilize interests noted during analysis of the student.
- b. Direct and control student's attention.
- c. Appeal to all the student's senses.
- d. Contrive interesting experiences.
- e. Teach from the known to the unknown.
- f. "Watch your language" – explain technical terms.
- g. Emphasize the positive.
- h. Utilize the incentive provided by rewards.

## **F. IMPORTANT AEROMEDICAL INFORMATION**

### **1. The general health factor**

### **2. Specific aeromedical factors – their symptoms and control**

- a. Fatigue, boredom, inattention.
- b. Hypoxia.
- c. Alcohol.
- d. Drugs.
- e. Vertigo.

- f. Carbon monoxide.
- g. Vision.
- h. Middle ear discomfort.

## **3. Scuba diving – "Airman's Bends"**

### **4. Psychological factors in flying**

- a. Anxiety.
- b. Normal and abnormal reactions to stress.
- c. The "difficult" student.
- d. The seriously abnormal student.

## **G. FLIGHT INSTRUCTOR RESPONSIBILITIES**

### **1. Foster student learning**

- a. Know the objective.
- b. Devise a plan of action.
- c. Create a positive instructor/student relationship.
- d. Present information and guidance effectively.
- e. Transfer responsibility to the student as he learns.
- f. Evaluate teaching effectiveness through evaluation of student's learning and proficiency.

### **2. Instruction of student pilots**

- a. Provide adequate instruction.
- b. Require an adequate standard of performance.
- c. Give adequate supervision.
- d. Endorse student pilot certificates.
- e. Endorse student logbooks.
- f. Maintain adequate records.

### **3. Flight test recommendations**

### **4. Aircraft checkouts**

- a. Use appropriate guides.
- b. Be fully qualified.

### **5. Refresher training**

- a. Know the objectives.
- b. Know the standards.

### **6. The flight instructor image**

- a. Be sincere.
- b. Accept the student as he is.
- c. Maintain professional appearance and habits.
- d. Avoid objectionable language.
- e. Develop and maintain a calm, thoughtful, and disciplined demeanor.

## SECTION II. THE PERFORMANCE AND ANALYSIS OF FLIGHT TRAINING MANEUVERS

A. AERODYNAMICS Have a knowledge and understanding of—

1. **Aerodynamic terms and definitions**
2. **Airplane loading**
  - a. Weight and balance and flight performance.
  - b. Effects of load on airplane structure.
  - c. Effects of loading on stability and controllability.
  - d. Load factor principles—
    - (1) Load factors and stalling speeds.
    - (2) Load factors and flight maneuvers.
3. **Forces acting on an airplane in flight**
4. **The airplane's axes of rotation**
5. **Functions of the control surfaces and trim tabs**
6. **Use of flaps**
  - a. Effects on flight performance.
  - b. Effects on stability.
7. **Angle of attack**
  - a. In stalls.
  - b. As an index of performance.
8. **Airspeed**
  - a. Control effectiveness.
  - b. Maximum performance speeds—
    - (1) Slow flight.
    - (2) Cruise.
    - (3) Best rate-of-climb ( $V_y$ ).
    - (4) Best angle-of-climb ( $V_x$ ).
    - (5) Relationship between speed, angle of bank, and rate of turn.
9. **Turns**
  - a. Forces acting on an aircraft in a normal turn.
  - b. Changes of lift in a turn.
  - c. Changes of drag in a turn.

10. **Ground effect**

- a. As a factor in takeoffs.
- b. As a factor in landings.
- c. Its use in emergencies.

11. **Torque and "P" factor**

- a. Aircraft rigging.
- b. Asymmetrical loading of the propeller.
- c. Action of the spiral slipstream.
- d. Gyroscopic action of the propeller.
- e. Torque reaction.

12. **Controllable propellers**

- a. How a propeller works.
- b. Purpose of controllable propellers.
- c. Operation of controllable propellers—the relationship between manifold pressure, RPM, and BMEP (Brake Mean Effective Pressure).

B. FLIGHT TRAINING MANEUVERS AND PROCEDURES

1. **Know how and when to introduce maneuvers and procedures**

(Item 5 below).

2. **Know the correct technique for the maneuvers and procedures**

3. **Be able to recognize and analyze common student errors**

4. **Be familiar with effective methods of correcting student errors**

5. **Know the required maneuvers and procedures**

- a. Preflight (including check of airplane documents and records), starting, warm-up, taxi, before takeoff and inflight and postflight checks and procedures.
- b. Use of radio for voice communication.
- c. Straight-and-level flight, turns (including slips and skids), and confidence maneuvers.
- d. Climbs and glides (including powered descents).

- e. Ground track maneuvers—
    - (1) "S" turns across a road.
    - (2) Turns about a point, including 720° steep turns.
    - (3) Rectangular courses.
    - (4) Traffic patterns.
  - f. Stalls, stall recoveries, and flight at minimum controllable speeds.
  - g. Takeoffs and landings—
    - (1) Normal.
    - (2) Crosswind.
    - (3) Short-, soft-, and rough-field.
    - (4) Slips and slips to a landing.
    - (5) Downwind landings.
    - (6) Power approaches.
    - (7) Touch-and-go landings.
    - (8) Wheel landings (tailwheel type airplanes), stall landings (nosewheel-type airplanes).
    - (9) Go-arounds.
    - (10) Emergencies, including those applicable to multi-engine aircraft.
    - (11) Solo flight.
  - h. Eights on pylons (shallow and steep).
  - i. Chandelles and lazy 8's.
  - j. Steep turns (including 720° power turns).
  - k. Constant radius power-off spirals.
  - l. Spins.
  - m. Post-solo emergencies.
- 6. Cross-country flying**
- a. Planning.
  - b. Pilotage.
  - c. Dead reckoning.
  - d. Use of radio aids. (See Section E, "Use of Radio.")
  - e. Cross-country emergencies—
    - (1) Lost.
    - (2) Engine failure.
    - (3) Adverse or marginal weather.
    - (4) Icing.
    - (5) Loss of or restriction to visual references.
    - (6) Imminent fuel exhaustion.
- C. THE INTEGRATION OF INSTRUCTION IN VISUAL AND INSTRUMENT FLYING**
- 1. Objectives**
- a. Development of habit patterns.
  - b. Accuracy of flight control.
  - c. Operating efficiency.
  - d. Emergency capability.
- 2. Procedures**
- 3. Safety precautions**
- 4. Flight instructor qualifications**
- D. FUNDAMENTALS OF INSTRUMENT FLIGHT**
- 1. The three major components of attitude instrument flight**
- a. Instrument coverage (cross-check).
  - b. Instrument interpretation.
  - c. Aircraft control.
- 2. Instrument characteristics**
- a. Attitude indicator (artificial or gyro horizon).
  - b. Heading indicator (directional gyro or gyro-compass).
  - c. Vertical speed indicator.
  - d. Turn-and-slip indicator.
  - e. Airspeed indicator.
  - f. Altimeter.
  - g. Magnetic compass.
- 3. How to determine attitude by instrument indications**
- 4. How to recognize incorrect use of controls by flight instrument references**
- 5. The relationship between rate-of-turn, radius-of-turn, true airspeed, and angle of bank**
- 6. Standard rate turns**
- 7. Physiological reactions and sensory illusions**
- 8. Required maneuvers for a private pilot certificate with an airplane rating**
- a. Straight and level.
  - b. Normal turns of at least 180°, left and right, to within 20° of a preselected heading.
  - c. Shallow climbing turns to a predetermined altitude.
  - d. Shallow descending turns at reduced power to a predetermined altitude.
  - e. Recovery from the approach to a climbing stall.
  - f. Recovery from the start of a power-on spiral.

E. USE OF RADIO—Understand the basic characteristics, operations, frequency spectrum, advantages and limitations of—

**1. VHF communications equipment**

- a. The “line-of-sight” range of transmissions.
- b. Understand how to utilize VHF/DF (direction finding) service and radar assistance from ground stations.

**2. VOR equipment**

- a. Understand the meaning of the radio class designations of “H”, “L”, and “T” for VOR/VORTAC/TACAN stations.
- b. Know the components of the VOR receiver.
- c. Understand a radial as a line of magnetic bearing extending from a VOR station.
- d. Understand how to determine your approximate position relative to the station by interpreting the setting of the bearing selector, the position of the LEFT-RIGHT Needle, and the indication of the TO-FROM Indicator.
- e. Understand the use of VOR for time and distance checks and for off-course navigation.
- f. Understand the methods of checking VOR receiver accuracy.

**3. ADF equipment** Understand—

- a. How to determine magnetic directions and relative positions.
- b. How to interpret bearing information when using ADF.
- c. The use of ADF in checking time and distance to radio stations.
- d. Tracking outbound and inbound on ADF.
- e. Operational characteristics and precautions to observe in use of L/F radio equipment.

F. USE OF PILOT INFORMATION PUBLICATIONS

**1. Airman's Information Manual** Know how to use and interpret the data contained in this important publication, such as—

- a. Air navigation radio aids (NAVAIDS).
- b. Airport and air navigation lighting and marking aids.
- c. Altimetry.
- d. Good operating practices.
- e. Radar.
- f. Radiotelephone phraseology and techniques.
- g. Safety of flight.

h. Weather.

- i. ATC operations and procedures.
- j. Flight data and special operations.
- k. Notice to Airmen (NOTAMS).
- l. Airport directory.
- m. Airport/Facility Directory.

**2. Airplane flight manual and owner's manual** As applicable to the airplane(s) in the instruction program, understand the material in these manuals and how to use it.

- a. Know how to consult the weight and balance data to determine that the aircraft is properly loaded. Know how to compute empty weight, useful load, and gross weight. Know how to compute moments from weight and center of gravity arms.
- b. Know the grade and quantity of fuel and oil required.
- c. Know flight load factor limitations and air-speed limitations.
- d. Be able to use performance charts as required for:
  - (1) Takeoff data.
  - (2) Climb data.
  - (3) Landing distance data.
  - (4) Cruise performance data (cruise power settings, approximate true airspeeds, fuel consumption rate).
- e. Be able to use tables such as:
  - (1) Stall speed versus angle-of-bank table.
  - (2) Airspeed calibration or correction table.

**3. Federal regulations governing aviation** The Airplane Flight Instructor should be familiar with the following National Transportation Safety Board Regulations and Federal Aviation Regulations—

- a. NTSB Part 430, Rules Pertaining to the Notification and Reporting of Aircraft Accidents, Incidents, and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, and Records.
- b. Federal Aviation Regulations—
  - (1) Part 1, Definition and Abbreviations.
  - (2) Part 61, Certification: Pilots and Flight Instructors.
  - (3) Part 91, General Operating and Flight Rules.

G. AIRFRAME AND POWERPLANT—Have a working knowledge of—

1. **Aircraft structures**
2. **Airframe components and control surfaces**
3. **Fuel and fuel systems**
4. **Oil and oil systems**
5. **Electrical system fundamentals**
6. **Reciprocating engine principles and components**
7. **Carburetion and fuel injection**
8. **Ignition**
9. **Propellers**
10. **Engine instruments**

H. OTHER AREAS OF IMPORTANCE

1. **The altimeter**

- a. Know the effect of nonstandard temperature and pressure on the indications of the altimeter.
- b. Understand how to apply altimeter settings to the Kollsman window of the altimeter.
- c. Understand how to obtain the pressure altitude.
- d. Be able to interpret the indications of the altimeter at all altitudes (including altitudes above 10,000 ft.).

2. **The airspeed indicator**

- a. Know the eight airspeed ranges and limitations that are reflected by the standard marking system on the face of the airspeed indicator (white, green, and yellow arcs, and the red line)—
  - (1) Flap operating range.
  - (2) Normal operating range.
  - (3) Caution range.
  - (4) Power-off stalling speed with the wing flaps and the landing gear in the landing position ( $V_{SO}$ ).
  - (5) Power-off stalling speed: "Clean-wing" flaps and landing gear retracted ( $V_{SI}$ ), if retractable-gear type.
  - (6) Maximum flap extended speed ( $V_{FE}$ ).
  - (7) Maximum structural cruising speed ( $V_{NO}$ ).
  - (8) Never-exceed speed ( $V_{NE}$ ).

b. Know and understand the reason for other pertinent airspeed limitations such as the design maneuvering speed ( $V_A$ ).

3. **Aircraft stability** Understand both static and dynamic stability.

4. **Meaning of colored lights at an airport**

- a. Runway.
- b. Taxiway.
- c. Threshold.
- d. Beacon.
- e. Visual approach slope indicator.
- f. Nonstandard traffic light (controlled airports).
- g. Obstruction.

5. **Special procedures for multi-engine instruction** Understand the importance of—

- a. Minimum control speed ( $V_{MC}$ ) for single-engine operation.
- b. Proper use of single-engine best angle-of-climb speed and best rate-of-climb speed (single-engine  $V_X$  and  $V_Y$ ).
- c. Maneuvers and standards stipulated in *Multi-engine Airplane Class or Type Rating Flight Test Guide*, AC No. 61-4A.

6. **Understand the special procedures for sea-plane instruction**

7. **Understand and be able to use pertinent charts, such as—**

- a. Density altitude charts.
- b. Load factor chart.
- c. Oxygen duration charts.

8. **Safe flying practices** Have a thorough understanding of—

- a. Density altitude and its effects on aircraft performance:
  - (1) Understand that density altitude INCREASES with a decrease in pressure, increase in temperature, or an increase in relative humidity.
  - (2) Understand that if density altitude increases, aircraft performance DECREASES.
- b. Carburetor icing—
  - (1) Symptoms in aircraft with fixed-pitch propellers and with constant-speed propellers.
  - (2) Use of carburetor heat.



- c. Know the effects of snow, ice, and frost on an airfoil and realize the importance of their removal prior to flight.
- d. Dangers associated with aircraft wake turbulence, *i.e.*, wingtip vortices; rotortip vortices; propeller, jet engine, and helicopter rotor wash—

- (1) Conditions and circumstances most conducive to such turbulence.
  - (2) How to avoid these dangers.
  - (3) Procedure to use if inadvertently encountered.
- e. Fuel contamination—
    - (1) Causes.
    - (2) Precautions to take.

## SAMPLE TEST

The following test items are only samples to indicate the general form of those used in the actual test. They are included for one purpose—to familiarize you with the type of test items you may expect to find on the FAA tests. Ability to answer these sample items *does not* indicate that you are fully prepared to take the test, since all topics on which you will be tested are not included.

You should concentrate on the section of this study guide entitled “Study Outline for the Airplane Flight Instructor Written Test.” A knowledge of all the topics mentioned in this outline—not just the mastery of the sample test items—should be

used as the criterion for determining that you are properly prepared to take the FAA written test. Proper preparation requires considerable time, effort, and the guidance of a competent instructor.

Correct answers to the sample test items, along with an explanation of each test item, start on page 21. In some sample test items, reference will be made to certain illustrations. These illustrations will be found in the Appendix of this guide. These are representative of illustrations which may be found in the written test and with which the applicant should be familiar.

## SECTION I. FUNDAMENTALS OF FLIGHT INSTRUCTION

1. In a good flight curriculum, the presentation of maneuvers should be arranged—
  - 1—in the order in which they are used in normal flight.
  - 2—in groups or stages to systematize flight instruction.
  - 3—so that each successive maneuver is less difficult than the last.
  - 4—so that each teaches an extension of the principles of previous ones.
2. On which of the following is the teaching success of a flight instructor considered to be most dependent?
  - 1—Personality of the instructor.
  - 2—Presentation by the instructor.
  - 3—Flying ability and flight experience.
  - 4—Proper planning of lessons.
3. Motivation is a key factor in learning. In properly motivating students, a flight instructor should remember that—
  - 1—Students are innately able to evaluate their proficiency and rate of progress and will instinctively tend to arrive at correct self-concepts if properly motivated.
  - 2—It is best to emphasize long-range goals more than short-range goals.
  - 3—Positive motivations are characteristically more effective than negative motivations.
  - 4—All of the above statements are considered true.
4. Worry and emotional difficulties which are sometimes associated with flight training are usually a result of—
  - 1—personality problems of the student affected.
  - 2—inadequacies in the training course or flight instructor.
  - 3—personality conflicts between student and instructor.
  - 4—the type of maneuvers, or the phase of training with which the student is concerned at the time the difficulties arise.
5. The flight instructor's first step in teaching is to—
  - 1—gain the student's confidence.
  - 2—determine whether the student really wants to learn to fly.
  - 3—teach the student to fly straight and level.
  - 4—require the student to complete a short verbal or written quiz to test his ability to assimilate instruction.
6. If a student shows slow progress in learning to perform normal landings because of lack of confidence, his flight instructor should—
  - 1—continue the instruction on the landings but in a more energetic manner so that the student will apply himself with greater diligence.
  - 2—use praise to a greater extent after each landing attempt.
  - 3—assign him goals that are less difficult.
  - 4—point out the student's errors by exaggerated demonstrations of the errors.
7. A student who has been very quick to absorb instruction and has made few mistakes suddenly begins to perform poorly during his dual instruction flights. The instructor correctly analyzes this poor performance to be a result of student overconfidence. The proper corrective action by the instructor should be to—
  - 1—lower the standard of performance expected by the student.
  - 2—demand greater effort from the student by raising the standard of performance on each lesson.
  - 3—praise the student only when he deserves it.
  - 4—do nothing, as this phase in learning is normal for this type of student and will correct itself in time.
8. The integration of instruction in aircraft control, through the use of outside visual references and through use of flight instruments only—

- 1- tends to inhibit student progress if introduced prior to solo flight.
  - 2- is best accomplished during dual cross-country flights.
  - 3- will improve a student's precision, efficiency, and safety in flight.
  - 4- prepares a student pilot for extended operations in difficult weather situations.
9. The most effective level of communication (teaching) normally occurs when an instructor provides the student with—
- 1- all facts and knowledge pertaining to a learning problem.
  - 2- appropriate facts and knowledge in a manner which assures that the student receives it accurately.
  - 3- appropriate facts and knowledge in a manner which assures student understanding.
  - 4- facts and knowledge in such a way that his behavior is properly affected.
10. In what way is a negative self-concept likely to affect a student? A negative self-concept may introduce psychological factors which—
- 1- can affect unfavorably a student's ability to receive perceptions and inhibit his ability to perform after perceiving.
  - 2- can affect unfavorably a student's ability to receive perceptions but, once he perceives, will have no effect on his ability to do or perform.
  - 3- will have negligible effect on a student's ability to receive perceptions or on his ability to perform.
  - 4- will result in a student being less "on the defensive."
11. The use of training films, slides, charts, models, mockups, etc. is—
- 1- generally considered good teaching practice because their use lightens the load on the flight instructor.
  - 2- justified only if the students feel that they are useful and the instructor has time to include them in the course.
  - 3- justified when they are used as aids to teaching and are utilized in a meaningful manner along with other teaching methods.
  - 4- justified if they have been approved by the Federal Aviation Administration.
12. Fear, anxiety, and timidity are all factors which—
- 1- should be used only to stimulate the apathetic student.
  - 2- limit a student's perceptive ability.
  - 3- can be used by the instructor to control the overly aggressive student.
  - 4- the instructor can utilize to his advantage if he is familiar with the psychology of learning.
13. Lesson plans or course syllabuses should be—
- 1- followed exactly if maximum benefit is to be derived from their use.
  - 2- adapted to the learning situation and changed when necessary.
  - 3- used primarily by inexperienced instructors.
  - 4- used primarily by those instructors who must teach students who have already received part of their flight training from another instructor.
14. The responsibilities of today's flight instructor are very real and very complex. The instructor can best live up to these responsibilities by—
- 1- requiring a high standard of proficiency in his students.
  - 2- establishing his effectiveness as an instructor on the basis of an objective evaluation of his own flying proficiency.
  - 3- discouraging from further instruction those students who do not have a natural physical and mental capacity to fly.
  - 4- a keen analysis of his students and a deep personal interest in their welfare.
15. The four basic steps in effective instruction are—
- 1- straight and level, climbs, glides, and turns.
  - 2- preflight, air work, traffic patterns, and emergencies.
  - 3- preparation, explanation and demonstration, trial and practice, and review and evaluation.
  - 4- analysis, explanation, performance, and practice.

## SECTION II. PERFORMANCE AND ANALYSIS OF FLIGHT TRAINING MANEUVERS

16. It would be correct to instruct students that when entering a turn of constant altitude and power from straight-and-level flight—
  - 1- centrifugal force holds the airplane in the turn once it is established.
  - 2- there must be a decrease in angle of attack if the vertical component of lift is to equal weight.
  - 3- all forces are in equilibrium.
  - 4- the angle of attack must be increased to compensate for the reduction in the magnitude of the vertical lift component.
17. To check his trim while in straight-and-level cruising flight, you have your student release elevator control pressure. The nose rises. What is the best control and trim technique to teach him for correcting this condition and similar ones?
  - 1- Adjust elevator trim to return to straight-and-level flight.
  - 2- Apply forward elevator control pressure and "nose-down" trim simultaneously.
  - 3- Apply forward elevator control pressure to return to straight-and-level flight, then relieve this pressure with elevator trim.
  - 4- All of the above have equal merit.
18. When teaching students to make short-field approaches with power, you should instruct them to control—
  - 1- descent primarily with throttle adjustments and control airspeed primarily with elevator control.
  - 2- descent primarily with elevator control and control airspeed primarily with throttle adjustments.
  - 3- airspeed primarily with throttle adjustments.
  - 4- descent primarily with the elevator control.
19. A correct performance of "S" turns across a road and turns about a point requires that the bank must be steepest when—
  - 1- flying directly downwind.
  - 2- flying directly crosswind on the downwind side.
  - 3- entering the turn on the upwind side.
  - 4- flying directly crosswind on the upwind side.
20. Because of various factors which can cause a tailwheel-type airplane to deviate from the desired direction on the takeoff roll, many beginner students experience considerable difficulty on takeoff in such airplanes. To help the student overcome this difficulty, it would be best for the instructor to—
  - 1- thoroughly explain "P" factor (asymmetrical thrust).
  - 2- make certain that the student understands the relationship between control effectiveness and speed.
  - 3- give repeated demonstrations of the correct technique.
  - 4- demonstrate how crosswinds influence directional control on the ground.
21. Which of the following statements pertaining to angle of attack is correct?
  - 1- If a constant airspeed can be maintained, the angle of attack will increase as the pitch is increased.
  - 2- It is possible for the wing of an airplane to pass through the air at a high angle of attack even though a constant altitude is maintained.
  - 3- An airplane in a power-off descent will normally have a negative angle of attack.
  - 4- Regardless of the angle of attack, stalls will occur only at low or comparatively low airspeeds.
22. When performing the maneuver "eights on pylons" at a constant throttle setting during a strong wind, the pivotal altitude will—
  - 1- remain constant.
  - 2- decrease slightly when flying into the wind in the turns.

- 3— increase slightly when flying into the wind in the turns.
- 4— decrease slightly when flying downwind in the turns.
23. Although spins are not required on flight tests for private or commercial pilot certificates, airplane flight instructors should be familiar with the principles of spins and with spin performance and recovery procedures. A spin can be entered—
- 1— only if the airplane first enters a stall.
  - 2— without first stalling the airplane if the pilot wishes to force it into the spin.
  - 3— only from a stall encountered at a high-pitch attitude.
  - 4— without first stalling the airplane only when the entry is made from a tight diving spiral.
24. After scanning the instrument group which appears in Figure 11 in the Appendix, a pilot normally should interpret these indications to mean that the airplane is—
- 1— descending, but because the primary instrument and supporting instruments for the turn do not agree it is impossible to determine the direction without cross-checking the directional gyro or the compass.
  - 2— descending in a standard rate turn to the right.
  - 3— descending at 1,200 ft. per min. with a bank of approximately 23° to the left.
  - 4— descending in a slipping turn to the left.
25. In order to impress students with the importance of the performance charts in the *Airplane Flight Manual*, a flight instructor requires his students to compute the takeoff distance at two separate airports. The conditions at these two airports are assumed to be as follows:

	Airport "A"	Airport "B"
Elevation of Airport -----	30 ft.	6,250 ft.
Temperature -----	84° F.	36.5° F.
Windspeed (headwind component) -----	15 m.p.h.	Calm
Runway -----	Hard	Hard
	surface	surface
Gross weight -----	1,900 lbs.	2,200 lbs.

Assuming normal engine operation and normal pilot technique, the distance that the airplane travels from the beginning of the takeoff roll until it reaches an altitude of 50 ft. (above the

runway) is approximately (refer to Figure 15 in the Appendix)—

- 1— 370 ft. for takeoff at Airport "A" and 1,300 ft. for takeoff at Airport "B."
  - 2— one and one-half times as long for takeoff at Airport "B" as for takeoff at Airport "A."
  - 3— twice as long for takeoff at Airport "B" as for takeoff at Airport "A."
  - 4— three times as long for takeoff at Airport "B" as for takeoff at Airport "A."
26. You should instruct your student to expect which of the following during a downwind landing?
- 1— A faster airspeed at touchdown, a longer ground roll, and better control throughout the landing roll.
  - 2— A faster touchdown groundspeed, a longer ground roll, and the likelihood of under-shooting the spot for which he is aiming.
  - 3— A faster airspeed at touchdown, a shorter ground roll, and the likelihood of under-shooting the spot for which he is aiming.
  - 4— A faster touchdown groundspeed, a longer ground roll, and the likelihood of overshooting the spot for which he is aiming.

27. Referring to Figure 12 in the Appendix, assume that the sets of instruments labelled A, B, and C are located in three different airplanes. Each airplane is flying at the same altitude and in the same atmospheric conditions. Match each set of instruments (airspeed and attitude indicator) with the turn-and-slip indicator which most nearly represents its rate of turn. The correct combination is—

- 1— (A, N-2), (B, N-2), (C, N-2).
- 2— (A, N-3), (B, N-1), (C, N-1).
- 3— (A, N-3), (B, N-2), (C, N-1).
- 4— (A, N-1), (B, N-2), (C, N-3).

28. Assume that the *Airplane Flight Manual* lists the following airspeeds for a light twin-engine airplane:

	Both engines operating (m.p.h.)	One engine out (m.p.h.)
Best rate-of-climb speed	150	100
Best angle-of-climb speed	80	95
V <sub>MC</sub> (minimum control speed)	—	87

If one engine of this light twin becomes inoperative during flight, the pilot will lose altitude at the slowest rate, or gain altitude as quickly as possible if he establishes an airspeed of—

- 1- 87 m.p.h.
- 2- 95 m.p.h.
- 3- 100 m.p.h.
- 4- 150 m.p.h.

29. You are demonstrating to your student, who is working toward a commercial pilot certificate, the use of the VOR as an aid to navigation on a cross-country flight. You are approaching the VOR station from the east and are north of the 090° radial; the course (omni-bearing) selector is set to 270°; and your omnireceiver indications are as depicted in illustration "OR-3" (Figure 9 in the Appendix). You make a 180° turn to the right to an easterly heading. The omnireceiver indication which the student will see in this new position will be approximately the same as illustration—

- 1- OR-1.
- 2- OR-2.
- 3- OR-3.
- 4- OR-4.

NOTE: Aircraft positions "A" and "B" in Figure 9 in the Appendix represent the situation.)

30. Which of the following should you stress as the PRIMARY objective during all student stall instruction and practice?
- 1- Learning to view stalls without apprehension or concern since it is easy to avoid or recover from them.
  - 2- Learning the difference between power-on and power-off stalls.
  - 3- Learning how to duplicate situations that produce the stall.
  - 4- Learning to recognize the onset of incipient stalls and to respond immediately with effective avoidance or recovery procedures.

### ANSWERS TO SAMPLE TEST ITEMS

<i>Item</i>	<i>Answer</i>	<i>Item</i>	<i>Answer</i>
1	4	16	4
2	4	17	3
3	3	18	1
4	2	19	1
5	1	20	2
6	3	21	2
7	2	22	2
8	3	23	1
9	4	24	2
10	1	25	4
11	3	26	4
12	2	27	3
13	2	28	3
14	4	29	3
15	3	30	4



## ANALYSIS OF ANSWERS TO SAMPLE TEST ITEMS

Item	Answer	Item	Answer		
1	(4)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "The procedure and elements mastered in each step should be identified in demonstrating the performance of the subsequent step . . . each lesson should also require the student to recall and apply previous learning . . . a maneuver which incorporates the elements used in the preceding maneuver and extends their application or associates them with other flight elements provides much more effective training than does a maneuver which is completely foreign to the preceding maneuvers."	6	(3)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "A student whose slow progress is found to be due to lack of confidence should be assigned subgoals which can be achieved easily."
2	(4)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "Teaching success depends more upon lesson planning than it does on presentation, personality, flying ability, or experience."	7	(2)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "For such a student the good instructor will continually raise the standard of performance for each lesson, demanding a greater effort from the student."
3	(3)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "Negative motivations . . . are not characteristically as effective in promoting efficient learning as are positive motivations."	8	(3)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, ". . . it was soon recognized that students trained in this manner are more precise in their flight maneuvers and operations . . . the performance he obtains from an airplane increases noticeably . . . integrated flight instruction provides the student with the ability to control an airplane in flight for limited periods under favorable circumstances . . . this ability could save the pilot's life and those of his passengers . . ."
4	(2)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "Worries and emotional upsets which result from the course at hand can be remedied. Such occurrences are usually evidence of inadequacies on the part of the course or of the instructor concerned."	9	(4)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "Communication at the understanding level goes far beyond the receipt of information; ideas must be comprehended. Understanding is a higher type of communication than is the mere acquisition of facts. To be effective, however, the flight instructor must go beyond this level of communication. Effective communication requires that information be provided in such a way that it affects the behavior of the student."
5	(1)	The <i>Flight Instructor's Handbook</i> , AC 61-16A, states, "The flight instructor's first step in teaching is to gain the student's confidence."			

## Item Answer

- 10 (1) The *Flight Instructor's Handbook*, AC 61-16A, states, "Negative self-concepts inhibit the perceptual processes by introducing psychological barriers which tend to keep the student from receiving them and then perceiving what the instructor intends. They may even inhibit the ability to properly implement that which is perceived. That is, they affect unfavorably the 'ability to do.' Learners who view themselves positively, on the other hand, are less defensive. . . ."
- 11 (3) The *Flight Instructor's Handbook*, AC 61-16A, points out that ". . . they are valuable only as aids to good instruction; and none has yet been devised which successfully eliminated the need for an instructor."
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## Item Answer

- is impossible. They are (1) preparation, (2) explanation and demonstration, (3) trial and practice, and (4) review and evaluation."
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- 19 (1) In any ground track maneuver in which a constant radius of turn is to be maintained, the angle of bank should be directly proportional to the groundspeed. The faster the groundspeed, the steeper the bank; the slower the groundspeed, the shallower the bank. The *Flight Training Handbook* states, "The steepest bank will be the point at which the groundspeed is highest." In "S" turns across the road, this point will be when entering the turn on the downwind side. This

Item Answer

assumes that the wind direction is perpendicular to the road and the airplane is going directly downwind with a groundspeed greater than at any other point in the maneuver. This same rule would apply to constant radius turns about a point.

The *Flight Training Handbook* further states, "Throughout the maneuver (turns about a point), the bank required at any given position is proportional to the groundspeed; the faster the groundspeed, the steeper the bank; the slower the groundspeed, the shallower the bank . . . it follows then that the steepest bank is required when the airplane is headed directly downwind. . . ."

- 20 (2) "P" factor and crosswinds certainly play a part in the problems of directional control on takeoffs, but an understanding of these factors will not in itself correct the difficulties involved if the student does not have a clear concept of the *use of controls* and *how their effectiveness changes* with speed. The same thing is true in regard to repeated demonstrations. Therefore, alternate response 2 is the correct answer. (See *Flight Training Handbook*.)

- 21 (2) The *Flight Instructor's Handbook*, AC 61-16A, states, "It is possible for the wing to pass through the air at a high angle of attack when the airplane descends in a level flight attitude. Conversely, the angle of attack may be near zero in a steep dive." If, through analysis we can accept the validity of this statement, then we can perceive that when using low-power settings and slow speed, it will also be necessary to use a high angle of attack in order to maintain a

Item Answer

constant altitude. (See *Flight Training Handbook* and Exam-O-Gram No. 28.)

- 22 (2) The *Flight Training Handbook* states, "Since the headings throughout the turn vary from downwind to directly into the wind, the groundspeed will never be constant when there is a wind. This may result in variations in the pivotal altitude throughout the eight." A careful study of the material presented in the *Flight Training Handbook* will clarify the fact that, in the performance of pylon 8's in a stiff breeze, ". . . the average pivotal altitude will be slightly lower . . ." than when flying at the same airspeed in calm or light winds.

- 23 (1) The *Flight Training Handbook* defines a spin as an aggravated stall that results in autorotation. It also states that "Care must be taken to completely stall the airplane; otherwise it may not spin and the only result will be a skidding spiral of increasing speed. If such a maneuver results, it is useless to continue in the hope of eventually spinning the airplane . . . Any tendency to relax on the controls after the spin is in progress will result in a sloppy spin and in many cases will completely stop the spin."

- 24 (2) The airplane is descending in a turn to the right. The descent is confirmed by:
- The nose down indication on the gyro-horizon.
  - The decreasing altitude as indicated on the altimeter.
  - The down trend indicated by the vertical speed indicator.
  - The increasing airspeed as shown by the airspeed indicator.

The right turn is confirmed by:

- a. The turn needle of the turn-and-slip indicator.
- b. The bank to the right as indicated by the attitude of the wings in relation to the horizon on the gyro-horizon. On most gyro-horizons in use with light airplanes today, the degree of bank index at the top of the instrument moves OPPOSITE to the direction of bank and turn. (See *Flight Training Handbook* and *Pilot's Handbook of Aeronautical Knowledge*.)

- 25 (4) In determining the takeoff distances at Airport "A," locate the "1,900 lb. - 15 m.p.h." row on the Takeoff Data Chart, Figure 15 in the Appendix. Follow this row to the "At sea level and 59° F. - Clear 50' obstacle" column where you read 675 ft. Since the temperature at Airport "A" is 25° above standard, this distance will have to be increased by 10% (see Note at bottom of chart). Ten percent of 675 is 68 ft.; 675 plus 68 feet gives a total takeoff distance at Airport "A" of 743 ft. In computing the takeoff distance at Airport "B," locate the "2,200 lb. - zero m.p.h. wind" row; 6,250 ft. - 36½° F. falls halfway between the "5,000 ft. and 41° F. column" and the "7,500 ft. and 32° F. column." Therefore, you will have to interpolate between the values found in these two columns. Follow the selected row out to these two columns ("to clear 50' obstacle" portions) where you read 1,995 ft. and 2,495 ft. The distance halfway between these two distances is 2,245 ft. The takeoff distance at Airport "B" is 2,245 ft., 743 ft. at Airport "A." (See *Pilot's Handbook of Aeronautical Knowledge*.)

- 26 (4) The *Flight Training Handbook*, AC 61-21 explains that direction and velocity of the wind are important factors during any landing and particularly in a forced landing, since they affect the gliding distance of the airplane over the ground, the flight path over the ground during the approach, the groundspeed at which the airplane touches the ground, and the distance which the airplane will roll after the landing.
- 27 (3) The rate-of-turn of an airplane is directly proportional to the angle of bank and inversely proportional to the true airspeed. Therefore, as the angle of bank increases, the rate-of-turn increases, and as the airspeed increases, the rate-of-turn decreases. The angle of bank is the same for all three airplanes. Therefore, the rate of turn will depend upon the airspeed. Since Airplane "A" has the lowest airspeed, its rate-of-turn will be the greatest; Airplane "C" is flying at the highest airspeed, so its rate-of-turn will be the least; and the rate-of-turn for Airplane "B" will fall somewhere between that of "A" and "C." (See "Standard Rate, Level Turns" in *Flight Training Handbook*.)
- 28 (3) If one engine of a light twin-engine airplane becomes inoperative, the pilot will be able to gain altitude at the best rate or lose altitude at the slowest rate if he maintains the best single-engine rate-of-climb speed. The *Flight Training Handbook* states that "The engine-out best rate-of-climb speed is found in the Airplane Flight Manual . . . it is the airspeed which results in the greatest increase in altitude in a unit of time."

*Item Answer*

- 29 (3) The indications on the TO-FROM indicator and the LEFT-RIGHT needle are dependent *only* upon the setting of the omnibearing selector and your position relative to the VOR station. The indications are not dependent on the heading of the aircraft with respect to the VOR station. Therefore, regardless of the heading to which aircraft "A" turns, the TO-FROM indicator and the LEFT-RIGHT needle will not change their indications as long as the omnibearing selector setting remains constant and the aircraft remains north of the 090° radial and east of the 360° radial. The *Flight Training Handbook* states, "The vertical or

*Item Answer*

- deviation needle shows the position of the aircraft without any reference to its heading . . . the VOR bearing selector and the TO-FROM indicator always show correctly the position of the airplane in relation to the station, regardless of the heading of the airplane." Also refer to the *Pilot's Handbook of Aeronautical Knowledge*.
- 30 (4) *The Flight Training Handbook*, AC 61-21, states, "The student pilot should understand during all stall instruction and practice that the objective is to learn to recognize incipient stalls and respond immediately with effective recovery procedures."

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**APPENDIX**



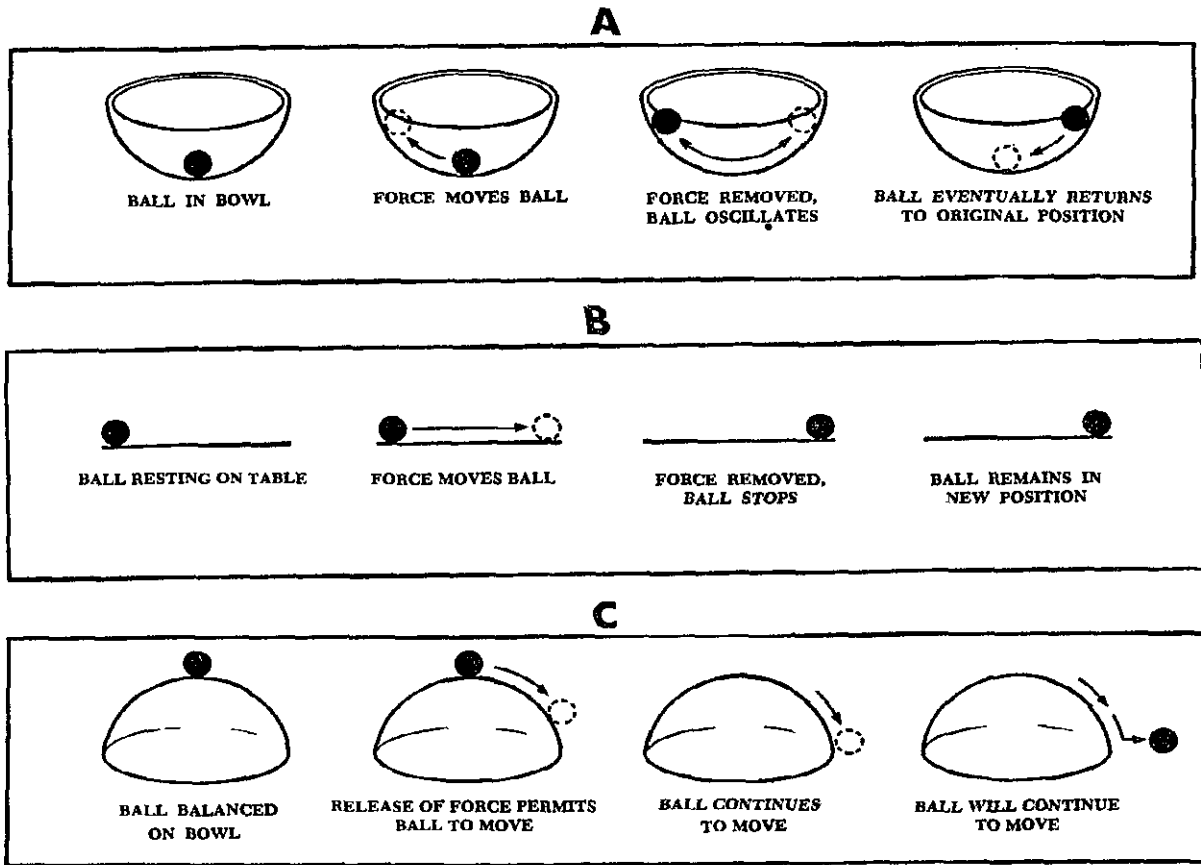


FIGURE 1. Types of stability.

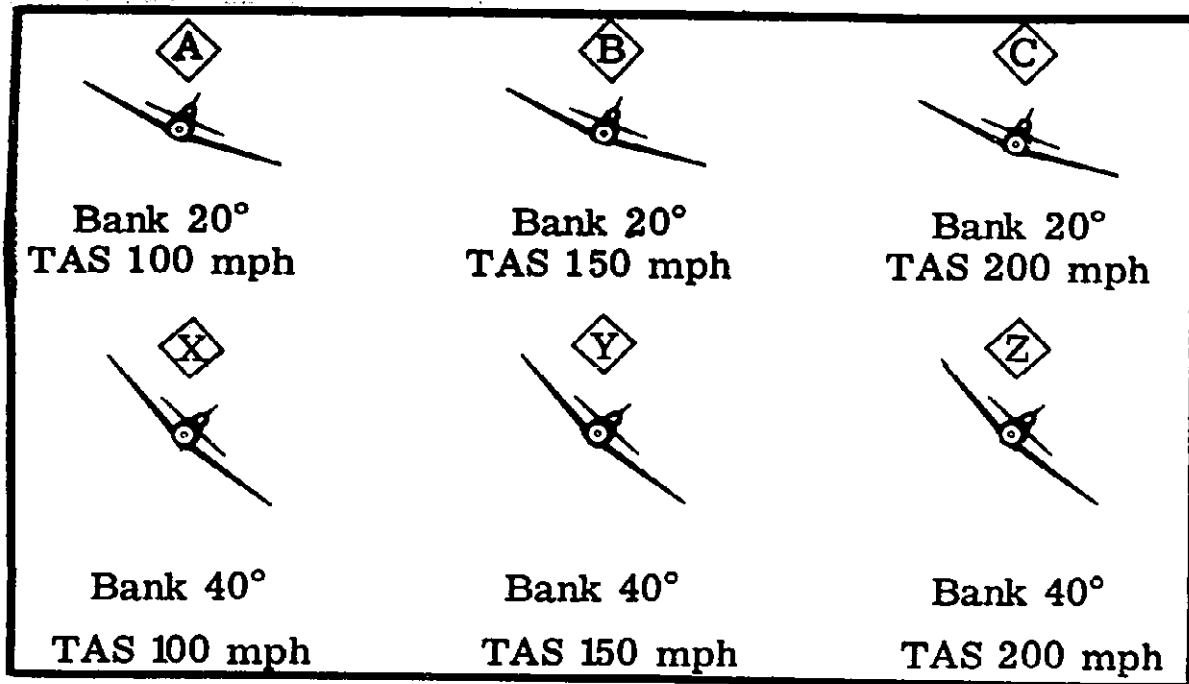


FIGURE 2. Bank vs. airspeed.

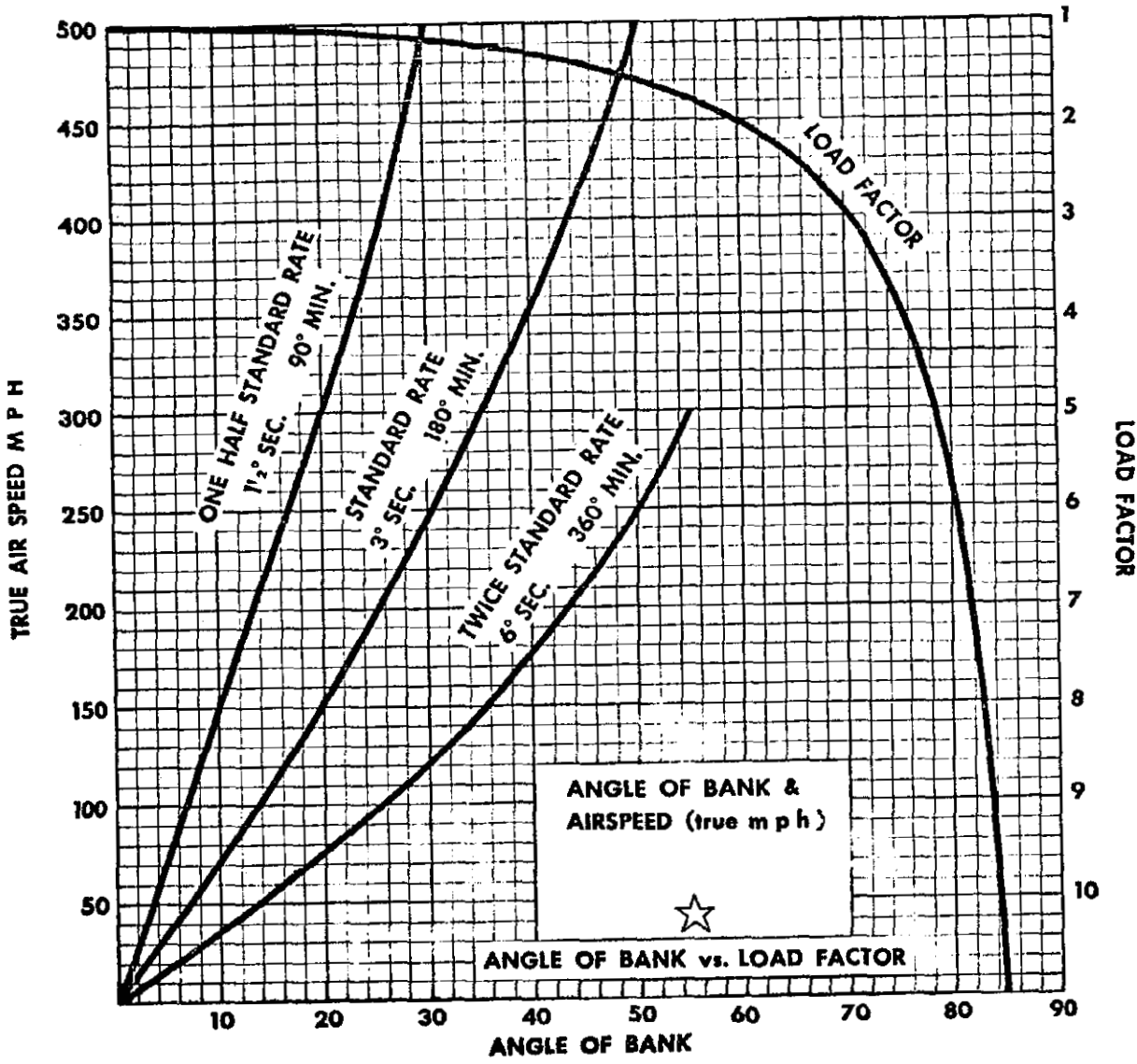


FIGURE 3. Load factors in turns.

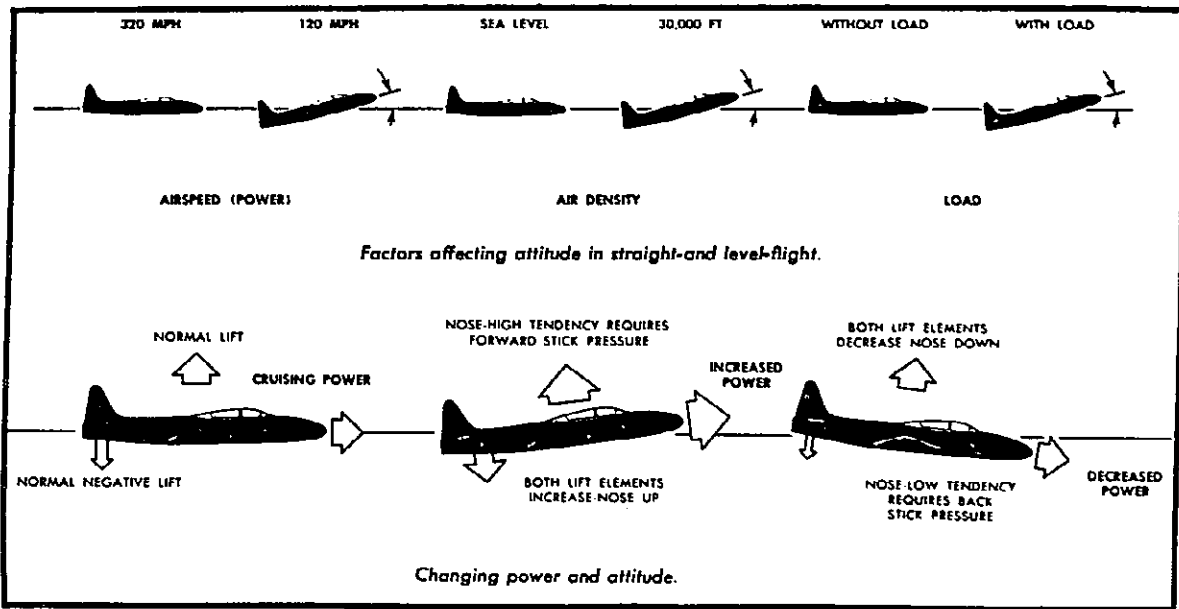


FIGURE 4. Aerodynamics—power and pitch attitude.

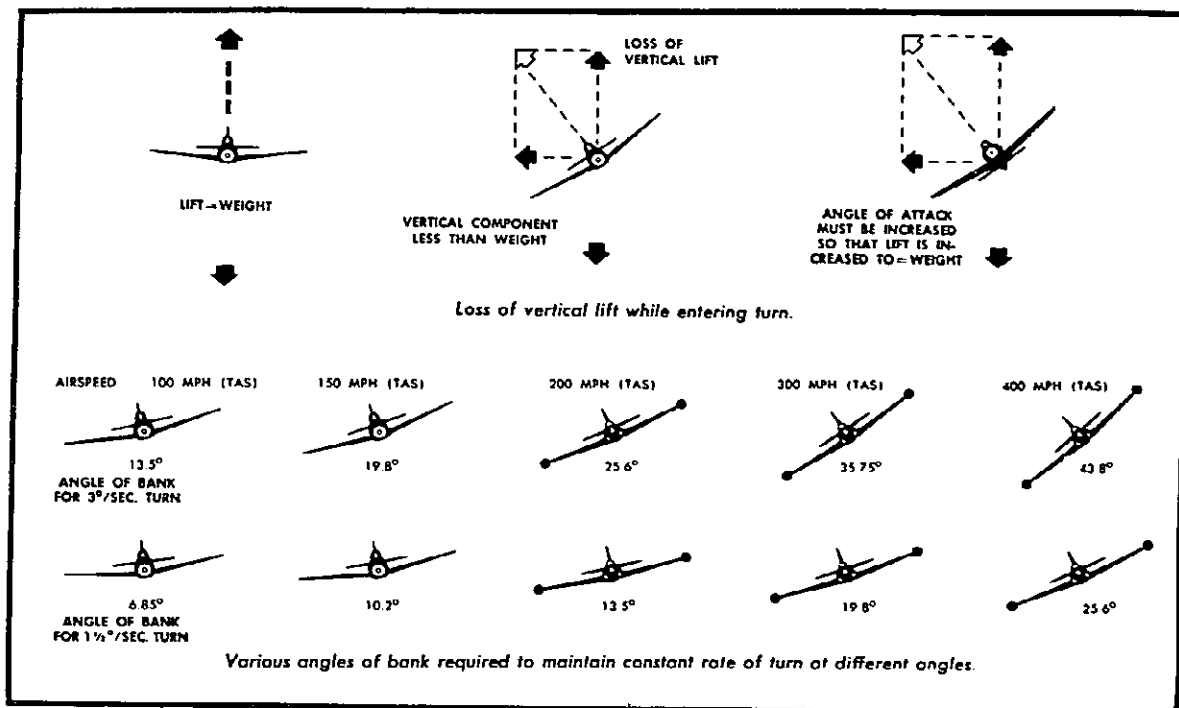


FIGURE 5. Aerodynamics—turning.

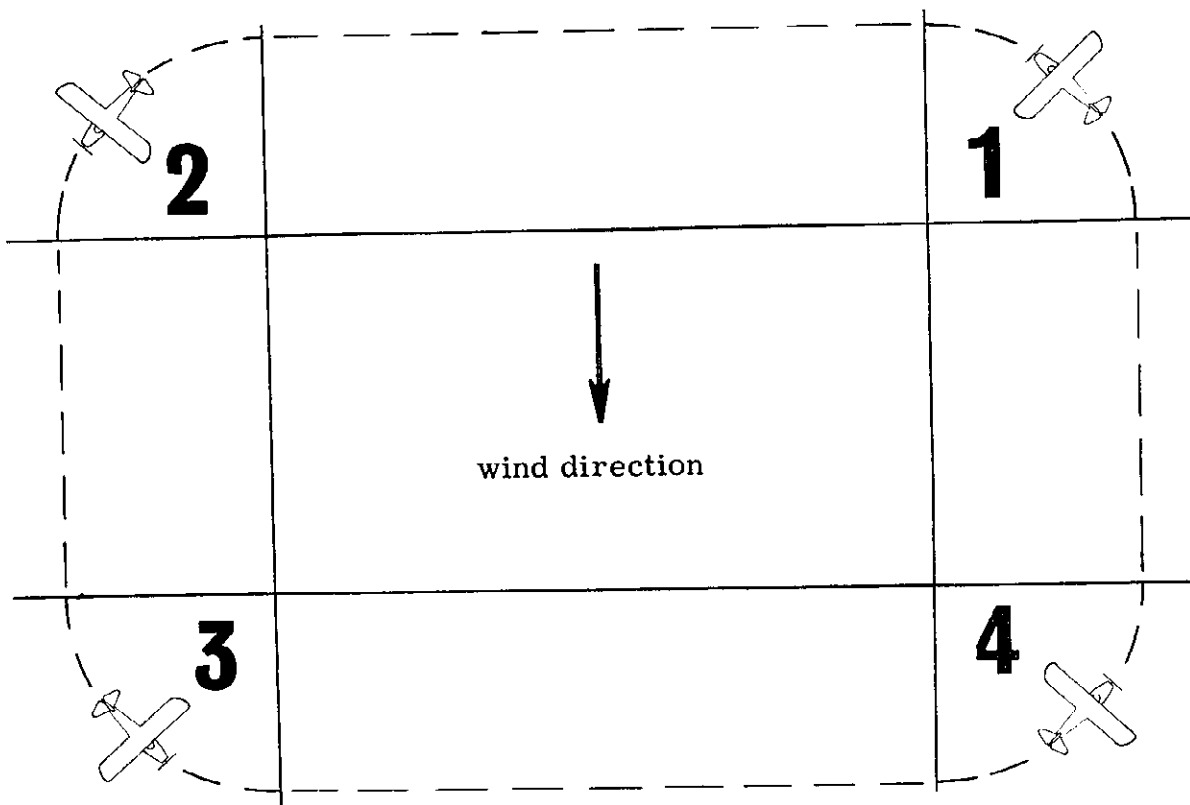


FIGURE 6. Rectangular course.

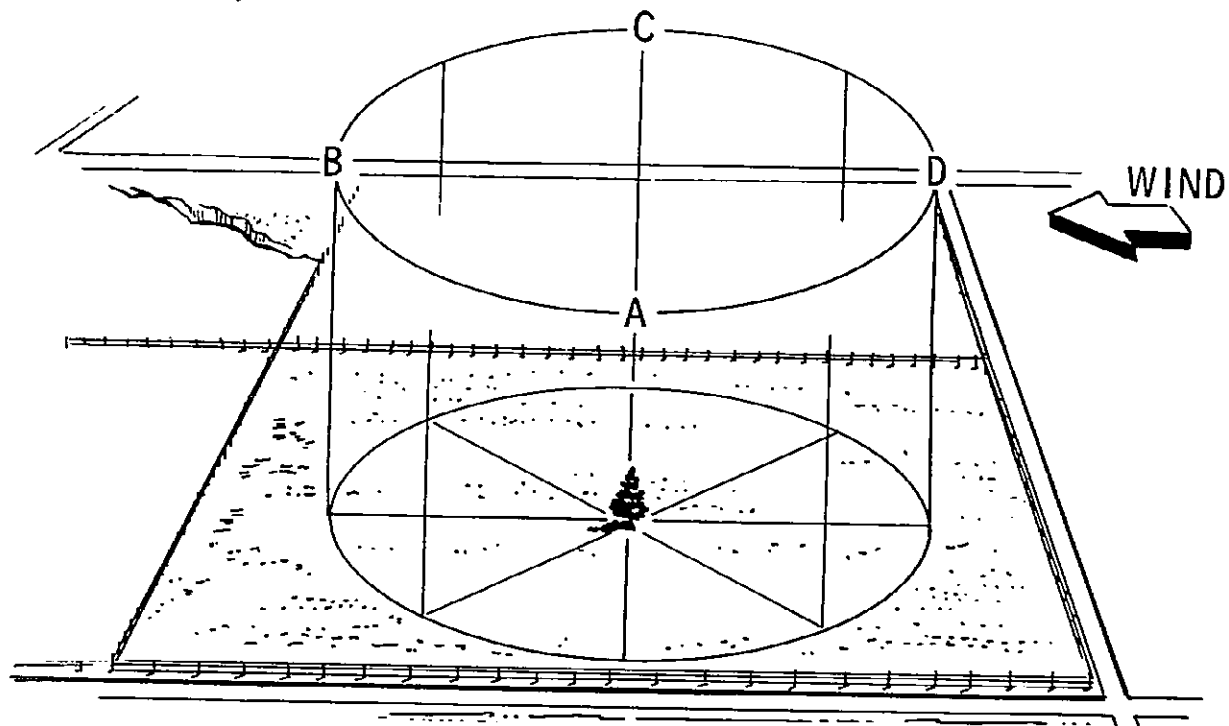


FIGURE 7. Turns about a point.

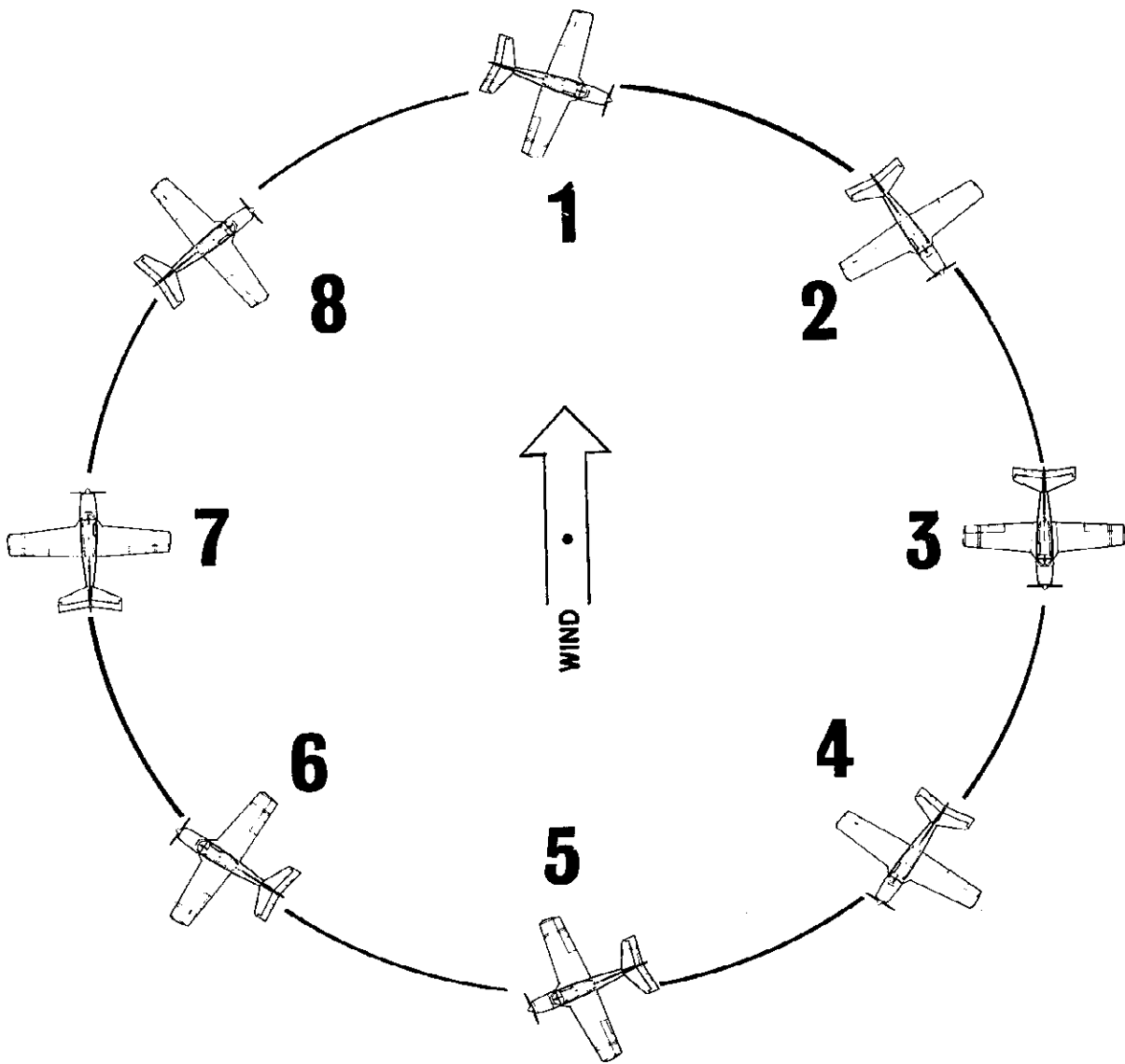
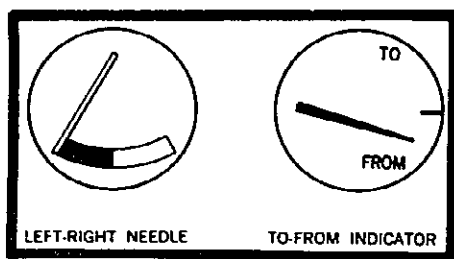
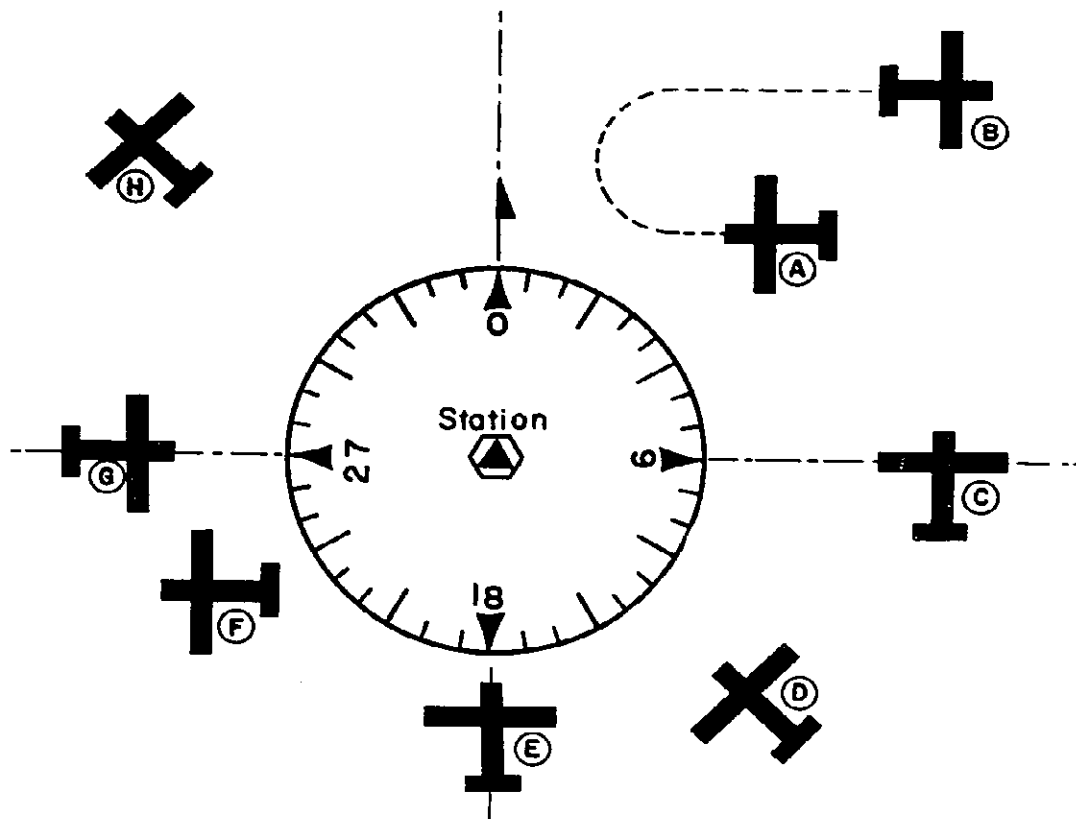
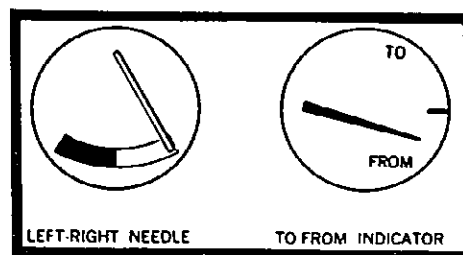


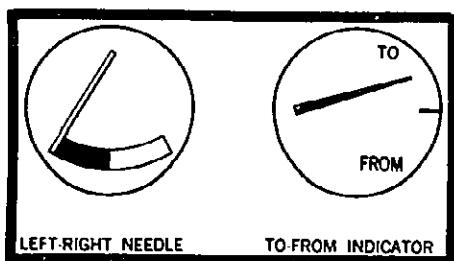
FIGURE 8. Turns about a point.



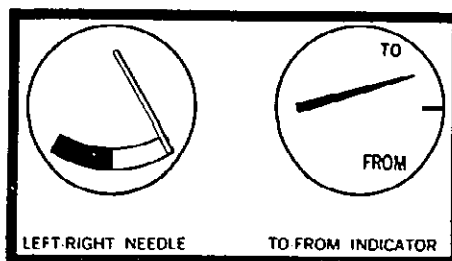
OR-1



OR-2



OR-3



OR-4

FIGURE 9. VOR orientation and omnireceiver indications.



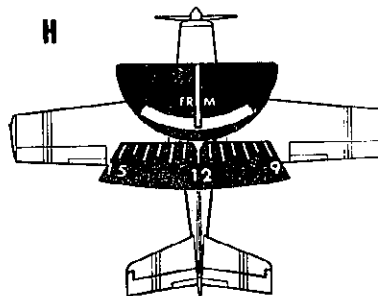
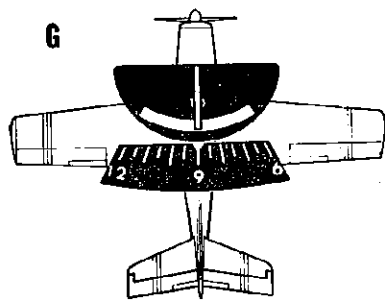
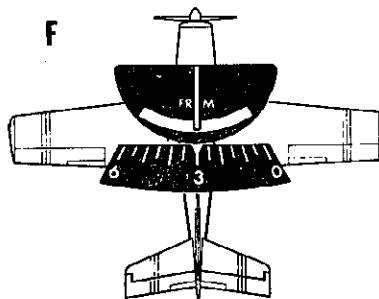
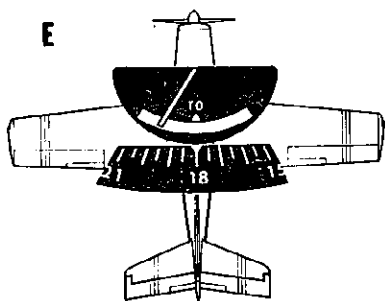
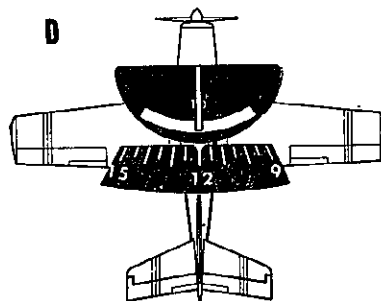
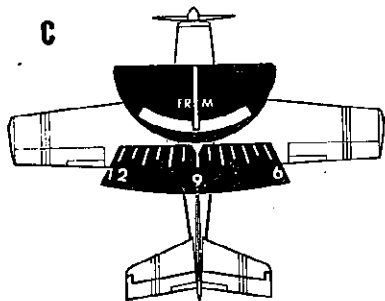
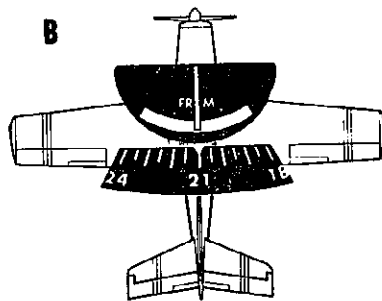
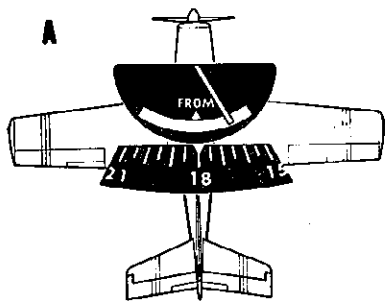


FIGURE 10. Omni orientation.

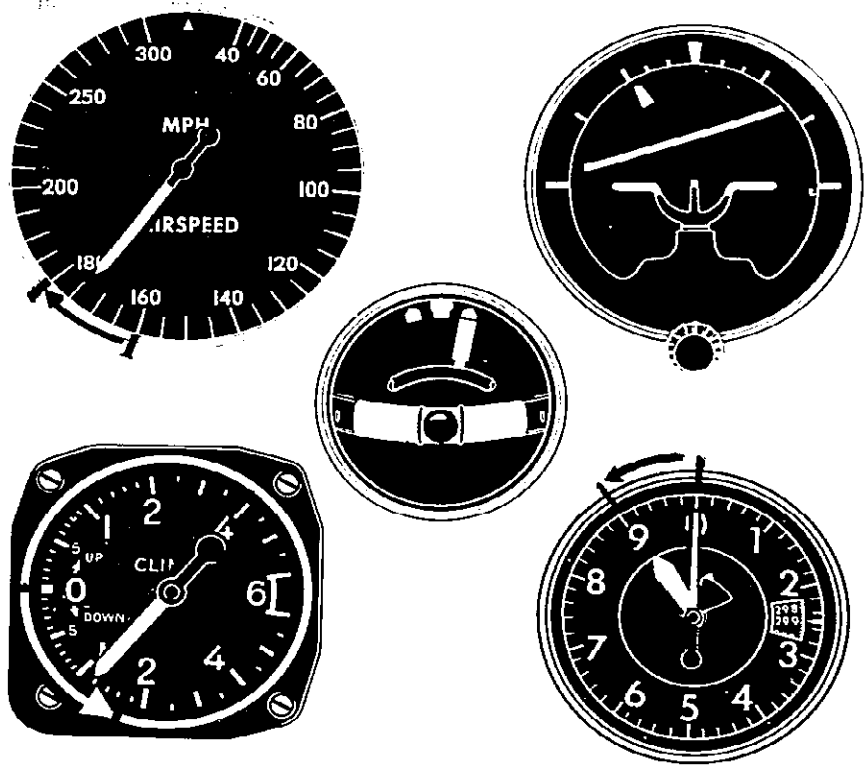
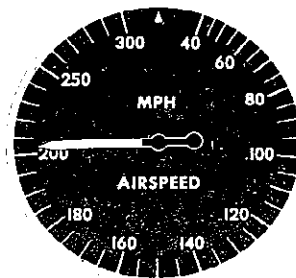
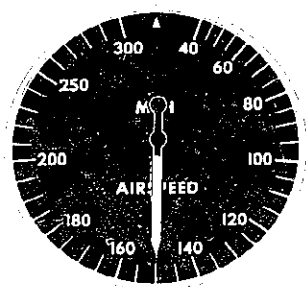
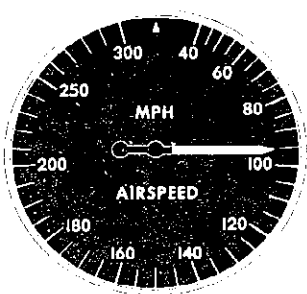
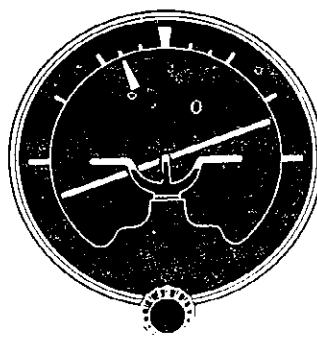
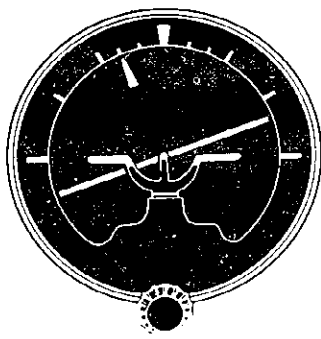
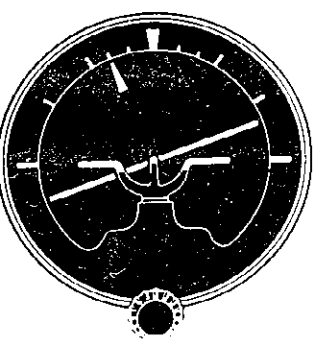


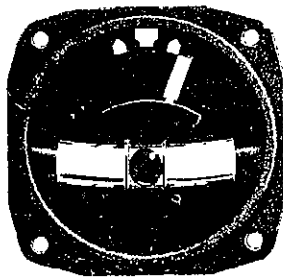
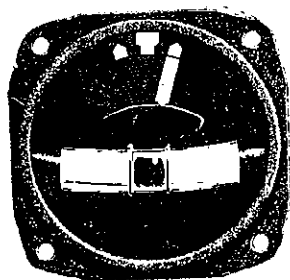
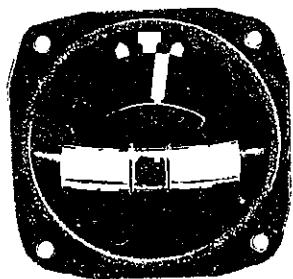
FIGURE 11. Instrument group.



A

B

C



N-1

N-2

N-3

FIGURE 12. Rates of turn vs. true airspeed.

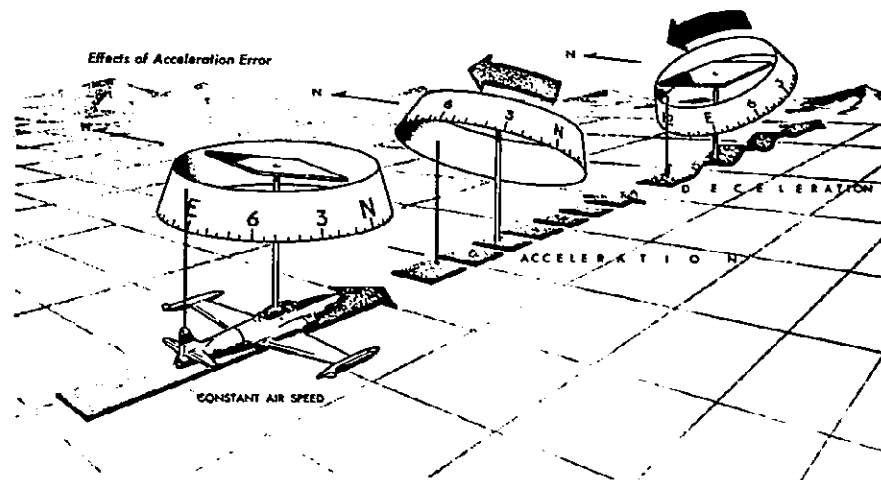
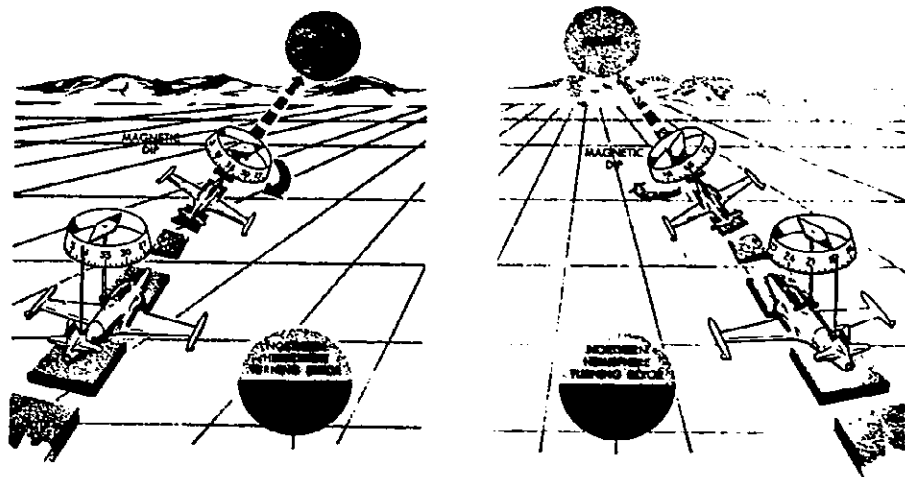


FIGURE 13. Magnetic compass errors.

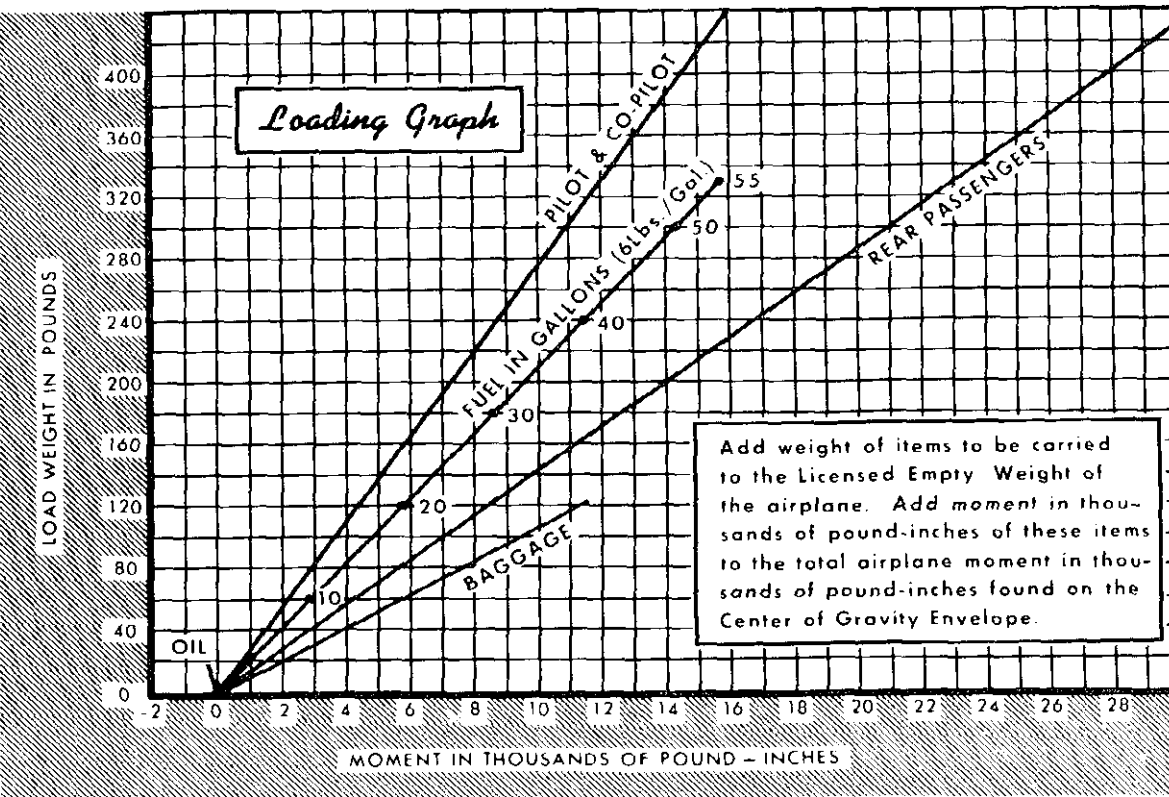
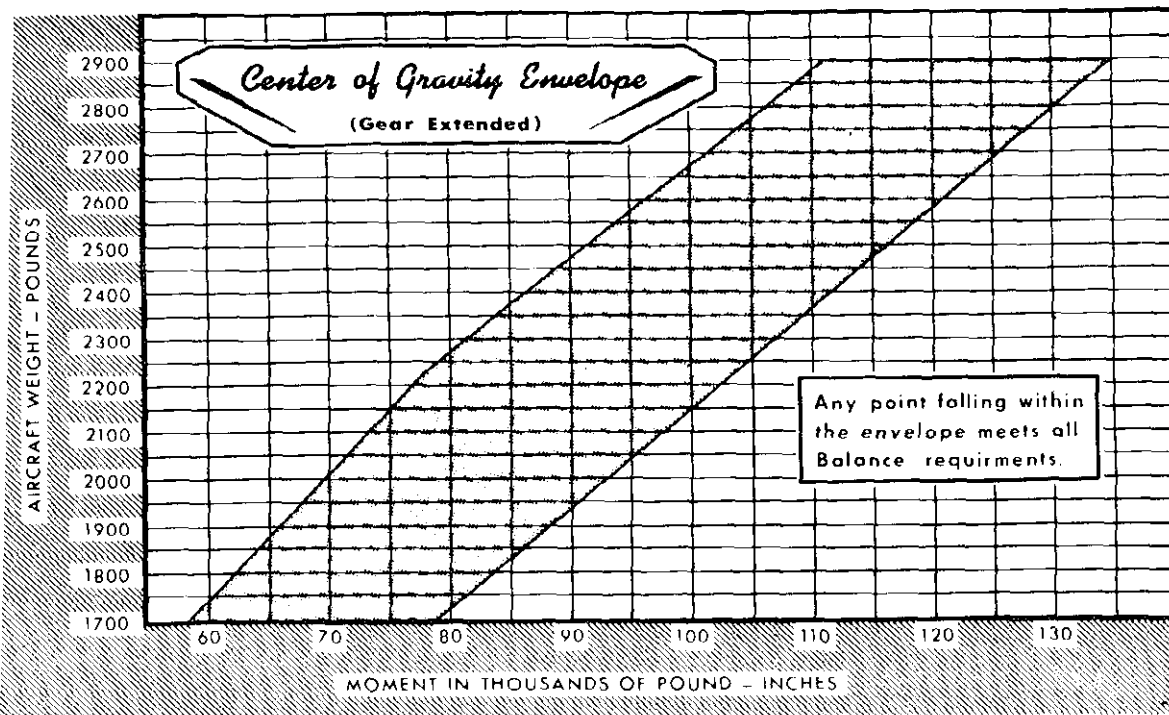


FIGURE 14. Weight and balance chart.

TAKE-OFF DATA										
TAKE-OFF DISTANCE WITH FLAPS UP FROM HARD SURFACE RUNWAY										
GROSS WEIGHT LBS.	IAS AT 50 FT.	HEAD WIND MPH	AT SEA LEVEL & 59°F		AT 2500 FT. & 50°F		AT 5000 FT. & 41°F		AT 7500 FT. & 32°F	
			GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE
1800	56	0	380	725	460	845	555	1000	680	1205
		15	315	470	265	560	330	670	415	820
		30	95	265	125	320	160	395	210	495
1900	61	0	560	1000	675	1185	820	1420	1015	1765
		15	335	675	415	805	515	980	645	1230
		30	165	400	210	490	275	610	360	785
2200	68	0	780	1370	945	1615	1155	1995	1435	2495
		15	490	945	605	1130	750	1410	950	1805
		30	280	590	330	710	425	915	560	1205

NOTE: INCREASE DISTANCE 10% FOR EACH 25°F. ABOVE STANDARD TEMPERATURE FOR PARTICULAR ALTITUDE.

CLIMB DATA												
GROSS WEIGHT LBS.	AT SEA LEVEL & 59°F			AT 5000 FT. & 41°F			AT 10000 FT. & 23°F			AT 15000 FT. & 50°F		
	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED
1600	71	1220	1.0	69	955	1.8	67	690	2.6	65	425	3.8
1900	75	940	1.0	73	710	2.1	71	475	3.3	69	245	5.2
2200	78	730	1.0	77	520	2.4	75	310	4.1	74	105	7.6

NOTE: FLAPS UP, FULL THROTTLE, AND MIXTURE LEANED FOR SMOOTH OPERATION ABOVE 5000 FT. FUEL USED INCLUDES WARM-UP AND TAKEOFF ALLOWANCE.

FIGURE 15. Performance charts.

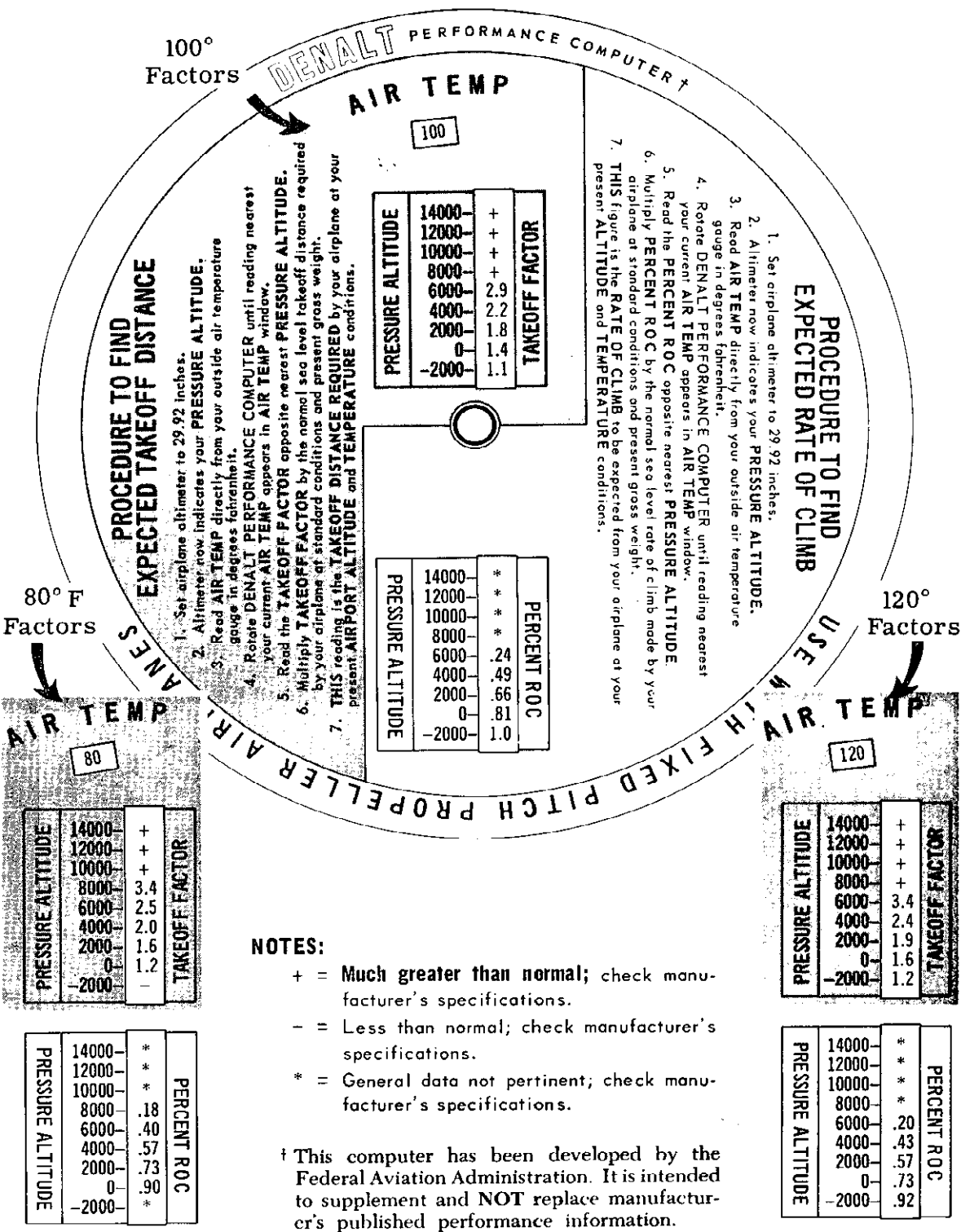
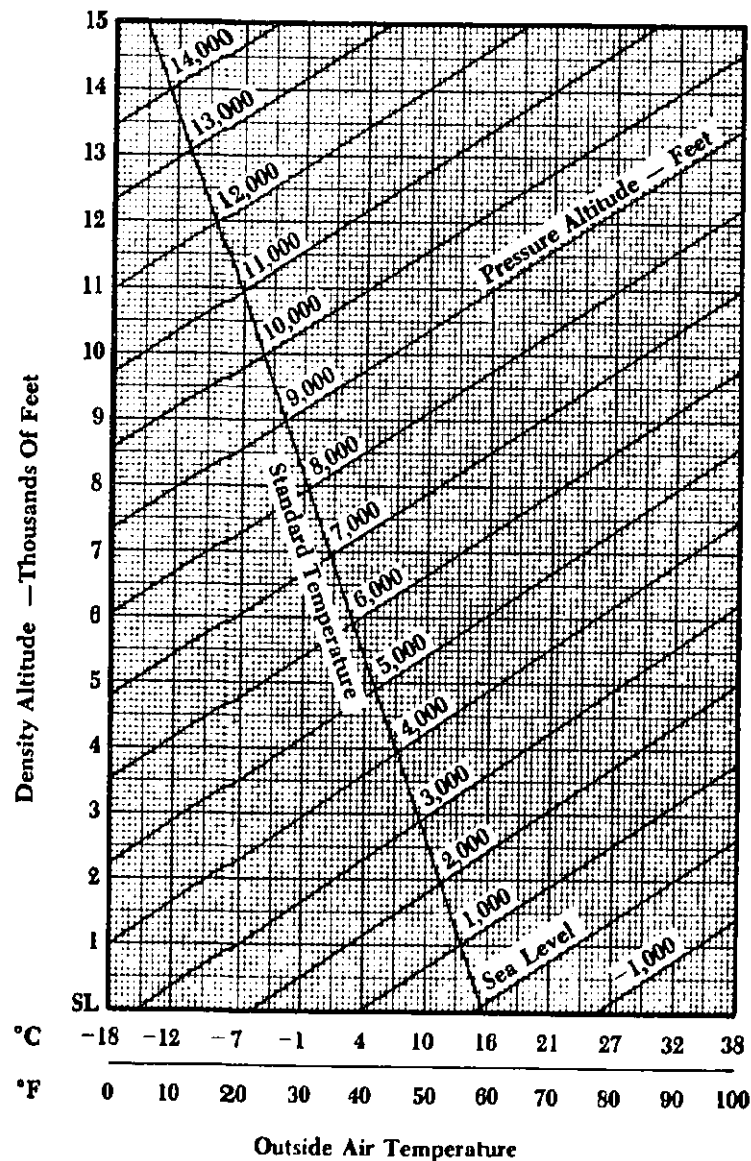


FIGURE 16. Dealt computer.



**PRESSURE ALTITUDE  
AND  
DENSITY CHART**

Altimeter Setting in Hg.	Altitude Correction For Obtaining Pressure Altitude
28.0	1,825
28.1	1,725
28.2	1,630
28.3	1,535
28.4	1,435
28.5	1,340
28.6	1,245
28.7	1,150
28.8	1,050
28.9	955
29.0	865
29.1	770
29.2	675
29.3	580
29.4	485
29.5	390
29.6	300
29.7	205
29.8	110
29.9	20
29.92	0
30.0	-75
30.1	-165
30.2	-225
30.3	-350
30.4	-440
30.5	-530
30.6	-620
30.7	-710
30.8	-805
30.9	-895
31.0	-965

FIGURE 17. Pressure altitude—density altitude.



DEPARTMENT OF TRANSPORTATION  
Federal Aviation Administration

VFR PILOT EXAM-O-GRAMS



4/72

Both VFR and IFR  
Exam-O-Grams  
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3	Use of Performance Charts - 4/66	52.	Sky Cover and Ceiling - 4/72
4	How to Obtain Proper Weather Briefing - 10/71		

In this set of Exam-O-Grams the following issues have been deleted: Nos. 1, 3, 7, 8, 9, 10, 11, 12, 13, 14, 24, 25, 30, 31, and 32. They have been discontinued since the subject areas which they cover are now adequately treated in one or more of the following FAA publications:

Pilot's Handbook of Aero. Knowledge, AC 61-23A  
Aviation Weather, AC 00-6  
Airman's Information Manual (annual subscription)  
Other pertinent FAA Advisory Circulars

Purchase from:  
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The Advisory Circular Checklist and certain free Advisory Circulars may be obtained from:

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## AIRMAN'S INFORMATION MANUAL (AIM)

The Airman's Information Manual has been designed primarily as a pilot's operational and information manual for use in the National Airspace System of the United States (unless otherwise indicated). It is divided into four basic parts, each of which may be purchased separately. Frequency of issuance, area of coverage, annual subscription costs and highlights of the contents of each part follow.

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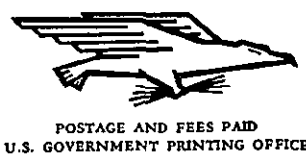
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