SECTION III Frame 55

Now let's talk about airspeeds. In preflight you know the indicated airspeed (IAS) you will get with normal cruise power settings. You also know from the weather forecast the expected temperature at your flight altitude therefore you can compute the True Airspeed (TAS) since it is needed for the flight plan. The computer is used to correct or change IAS TO TRUE airspeed.

Frame 63

Suppose you are flying at 8000 feet with an air temperature of 10° and the airspeed gage indicates 100 knots, what is the TAS (True Airspeed)? Set the airspeed window so that 10° is over 8000 feet (between 0-10 not the 80 at end of scale). Now locate 100 knots on the inner scale and read 115 K TAS.

Frame 71

Your answer: B. 9,300 is correct. Continue below--------

A pressure altitude of 15,000 feet and a temperature of -20° will give a density altitude of 14300 feet.

ANS: TAS

ANS: 115K

ANS: 14,300 ± 200 feet

Frame 56

IAS differs from TAS because of temperature and altitude therefore when you correct IAS to TAS you are correcting for the error caused by temp and alt.

Frame 64

Again, your flight altitude is 4,000 feet with the temperature of 0° and IAS of 210K. Set the temperature over the altitude and read 220K TAS over 210K.

Frame 72

Another use for the airspeed window is to determine the density altitude.

ANS: Temperature and Altitude.

ANS: 220K

ANS: Density

Frame 57

Look around the outer scale of the computer and you will notice the label True A. S. On the inner scale is labeled Cal. A. S. Meaning calibrated airspeed. These labels are between the number 15 and 17 on the MB-4 type computer. On other models they may be elsewhere. The scales are labeled so you won't forget to read TAS from the (outer - inner) scale.

Frame 65

Try these two. 1. Altitude = 15,000 feet
Temperature = -20°
IAS = 140
TAS = _____K

2. Altitude = 6,000 feet
Temperature = 15°
IAS = 180
TAS = _____K

Frame 73

Aircraft altimeters will show the approximate true altitude only when the altimeter setting is correct and the temperature is Standard. The pilot can control the altimeter setting but he cannot control the temperature. To calculate the true altitude when the temperature is not standard the pilot uses the computer. Look at the ALTITUDE COMPUTATION window. Rotate the disc until you see temperature values in the window. The temperature values range from +50°C to -80 °C.

ANS: Outer

ANS: 175

200

ANS: -80

Frame 58

NOTE: IAS and CAS are not the same due to instrument error, but we will use them as the same for the purpose of this program since the error, or difference, is small. For most Army Aircraft the aviator can ignore this difference between CAS and IAS.

Continue on page 25 Frame 59.

Frame 66

Sometimes you will be solving for IAS rather than TAS. The altitude and temperature set up is the same and if you will remember: IAS is on the inner scale and TAS is on the outer scale you will have no trouble with either type. Solve this:

Altitude = 6000 feet
Temperature = 15°
TAS = 150
IAS = _____

Frame 74

And the altitude figures range from minus 2000 feet to 35,000 feet.

ANS: 134

Remember to look for IAS on the inner scale.

ANS: 35,000 to 80,000

From 35,000 to 80,000 the altitude effect remains constant.

Frame 59

Next look at the computer and locate the window marked FOR AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS. The airspeed window has a temperature range from plus 50 to -80 degrees centigrade and by moving the disc you see the altitude range in the window is from minus 2000 feet to 80,000 feet.

Frame 67

While you are working with the airspeed window you should learn to solve for DENSITY ALTITUDE. Although you are solving for Density altitude you will still use the AIRSPEED window. Read the instructions under the AIRSPEED WINDOW of the computer.

Continue on page 26 frame 68.

Frame 75

The Indicated Altitude is not error free. Therefore during flight it is sometimes necessary to determine the True Altitude (corrected) so that you will not endanger your flight by flying into a mountain side or obstruction. More details on this are covered in the navigation and weather courses, but for now you will be concerned only with correcting Indicated altitude to True altitude or Corrected Altitude.

Go to page 26 frame 76.

ANS: -80 (minus 80)

80,000 feet

Frame 60

To correct airspeed for temperature and altitude error you should use the _____ window.

FRAME 68

To check yourself on following instruction, work this:

Pressure Altitude = 10,000 feet
Temperature = -10^{o}
Find Density Alt. = _____

A. 11,800 See page 27 frame 69.
(B) 9,300 See page 21 frame 71.
C. I don't get it. See page 28 frame 70.

NOTE: For computing density altitude it is very important to use the pressure altitude. This is the altitude shown by the altimeter when the setting is 29.92.

Frame 76

There are several ways by which altitude is computed. When you have the altimeter set for the current pressure setting - it will read Indicated Altitude. The altitude window on your computer calls for Pressure Altitude. But except as noted above in Frame 68 - we will ignore the difference between Indicated Altitude and Pressure Altitude.

So if you wish to compute your approximate True Altitude, just look at your altimeter and use that altitude figure on your computer.

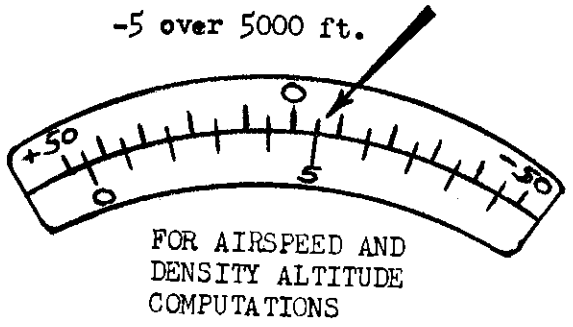
Go to page 27 and frame 77.

ANS: Airspeed

Frame 61

During preflight planning you select 5000 feet as the flight altitude. The temperature at 5000 feet is expected to be minus (-) 5 degrees. You plan to cruise at an IAS of 80 knots, what TAS will you put on the flight plan? You now use the computer to find TAS.

Set your computer like this:



Continue on page 28 frame 62.

Frame 69

Your Answer: A. 11,800

You are following instructions O. K., but the temperature is (-) 10 degrees. Now go back to page 26 and use -10° on the computer.

Frame 77

Let's use the Altitude Window.

With a free air temperature of 10°C at an altitude of 8000 feet, what is the true altitude? Set the 8000 under 10 in the window (notice each mark represents 2000 feet). Read the answer on the outer scale over 80 (8000) on the inner scale. Do you read 8300? Correct

ANS: Yes.

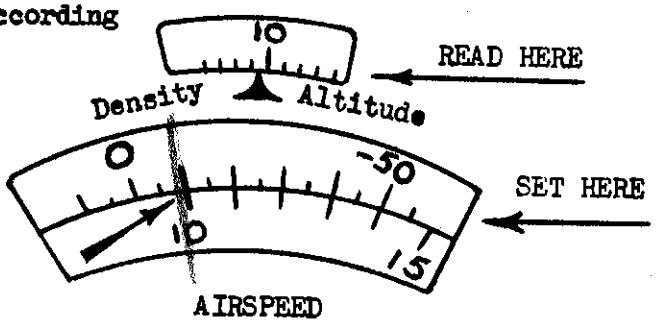
Frame 62

Now look at 80 on the inner scale and read the TAS from the outer scale directly over 80 on the inner scale. In this case the TAS is 94.5 K.

Frame 70

Your answer: C. I don't get it.

O. K. Set your computer according to this diagram:



Go to page 21 frame 71

Frame 78

Therefore 8300 is the true or corrected altitude. Now suppose the temperature to be -10° at 8000 feet, find the corrected or true altitude. Set 8000 under minus 10° and read 7900 feet, true altitude.

ANS: 85 knots

Return to page 21 frame 63.

ANS: 7750

Continue on page 29 frame 79

From the previous problems you see that the corrected altitude can be more or less than the pressure altitude depending on the temperature.

Try These: A. Pressure Altitude = 12,000 ft
Temperature = 0°
Corrected Alt. = 12,400 ft

B. Pressure Alt. = 7,000 ft.
Temperature = 5°
Corrected Alt. = 7400 ft

NOW TAKE THE TEST BELOW

TEST NO. 3

1. DISTANCE CONVERSION

	Nautical Miles	Statute Miles	Kilometers
a.	45		
b.		150	
c.			200

2. TIME - RATE - DISTANCE:

a. Find the time required to travel 78 nm at a GS of 96K. _____

b. Find the GS if a distance of 35 nm is covered in 19 min. _____

c. Find the time to travel 14 nm at a GS of 120K. _____

d. What is the distance traveled in 1 hr + 10 min at a GS of 90K? _____

e. Find GS if it takes 2 hrs + 15 min to travel 264 nm. _____

f. Find the distance traveled in 47 min at a GS of 147K. _____

3. FUEL PROBLEMS:

a. Find the fuel required to fly 3 hrs + 10 min if the consumption rate is 14 gal per hour. _____

b. If 21 gal of fuel is used in 2 hrs + 20 min, what is the rate of consumption? _____

c. Find the time required to use 57 gal at a consumption rate of 17 gal per hour. _____

4. AIRSPEED COMPUTATIONS

	ALT.	TEMP	IAS	TAS
a.	3000	+10	80k	
b.	4500	-15	110k	
c.	4500	+15	110k	
d.	8000	+5		108K

5. ALTITUDE COMPUTATIONS

	I.ALT.	TEMP.	T. ALT.
a.	9000	-15	8,600
b.	3000	+10	3200
c.	7000	+ 5	7000
d.	4500	0	4400

Ans: A. 12,400

B. 7,100

---

1. a. 52 -- 83

   b. 130 -- 240

   c. 109 -- 125

2. a. 49

   b. 110

   c. 7

   d. 105

   e. 118

   f. 115

3. a. 44.5

   b. 9.0

   c. 3 + 20

4. a. 84

   b. 113

   c. 120

   d. 95

5. a. 8600

   b. 3010

   c. 7100

   d. 4400

Continue on page 30 frame 80.

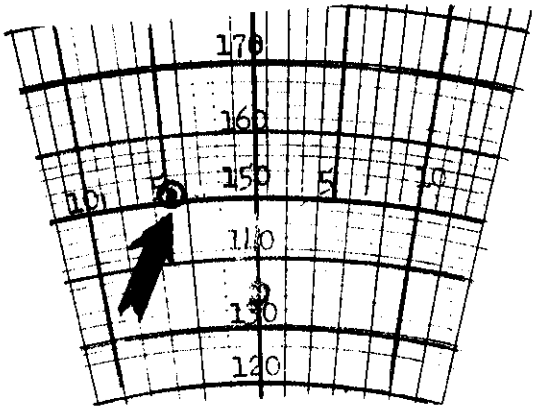
SECTION IV Frame 80

Now that you have the computer side under your belt turn the computer over and insert the grid card. Place the card in the same position as shown in the diagram. (Figure 2) page 43.

Go to page 31 frame 81.

Frame 91

Don't stop yet, you must now slide the grid card up or down until the TAS ARC (150K) comes under the wind dot, for example: ⟶



After doing this you should be careful and not allow the plotting disc or grid to move while reading the answers.

Go to page 31 frame 92.

Frame 102

Let's vary the problem slightly. "You must fly the next leg of your flight at a GS of 85K in order to reach a controlled check point at the correct time. Therefore you must find the TAS that will produce this GS with a given wind condition". For example: Wind = 210°/30K
TC = 170°
GS = 85K
Find TH _____ & TAS_____

First plot the wind - oops! Erase the old wind dot. Second - TC up top. Third- Now the difference, since you know GS put it under the grommet. The TAS arc now falls under the wind dot.
Fourth - Read TH (as before) _____ and TAS_____(Read under ⊙).

ANS: 170 + 10 = 180 TH

TAS 110K

Frame 81

Notice the labeled parts of the diagram. The center line on the sliding grid passes directly under the _____ index and the small circle in the center of the disc is called the _____.

Frame 92

Notice the wind dot (•). It is now 5° _____ of
(left - right)
the Center Line.

Frame 103

With a wind of 140°/20K and a GS of 90K and a course of 95°, what TH and TAS will you have? TH _____ TAS _____

ANS: True

Grommet

ANS: left.

ANS: TH 103°

TAS 106k

Frame 82

The maximum speed arc on this side of the sliding grid is _____.

A. 270 See page 33 frame 83.

B. 800 See page 34 frame 84.

Frame 93

Notice the grid card. The vertical center line represents your TC and the diverging lines on each side represents the TH lines. Also notice on the top half (above 150) of the card one diverging line represents 1 degree but on the bottom half one line represents _____ degrees.

Frame 104

Remember you can now work with six factors:

1. Wind direction.
2. Wind speed.
3. TC (or track -TR).
4. GS.
5. TH.
6. TAS.

Suppose on another leg of your flight you were unable to get an accurate forecast wind or the wind may have changed. Under this situation you solve for the new wind (in-flight wind). Try this type solution next.

NOTE: Four of the above factors must be known in order to solve for wind direction and speed.

Go to page 33 frame 105.

ANS: 2°

FRAME 83

Your Answer: A. 270.

Correct. Continue on page 35, Frame 85.

Frame 94

You have now solved the problem but reading the correct answer requires some thought. How many degrees left of center line is the wind dot now? _____

Frame 105

Problem: You have been flying a Track*(TR) of 330° with a TH of 340. The TAS has been 120 k and you determine the GS to be 100K. What wind have you encountered? First summarize the problem by listing the known factors, (See next frame, page 34).

* Track (TR) is the actual path over the ground. TC is the intended path over the ground. For wind solution use TR since you don't always fly where you intended because of wind.

ANS: 5

Frame 84

Your answer: B. 800

You missed a curve - return to page 30 and follow the instructions.

Frame 95

Therefore your true heading (TH) will be 5 degrees left of the true course. With a TC of 310° under the true index, the wind dot represents a TH of (310 minus 5) _____ degrees.

Frame 106

Known factors: TR = 330° (use the same as TC)

GS = 100K

TH = 340°

TAS = 120K

Find Wind = _____

We can't plot wind first this time so place the TR under the true index; GS goes under the grommet - put it there. Now the old head (yours) must be used. The TH (340) will be _____ of the centerline.
(left - right)

ANS: 305°

ANS: **Right**

Frame 85

In planning a flight and during a flight you must know the ground-speed (GS) of the aircraft.

For Dead Reckoning (DR) navigation you also must know the heading (true and magnetic) to fly. You can compute these values on the wind face.

Go to page 36 frame 86.

Frame 96

Now to verify your answer look at the fixed scale labeled Drift Left - Drift Right at top of computer. Since your wind dot ⊙ is left 5°, read on the drift left scale under 5°. What do you read?

_____

Frame 107

Right is right. OK, locate the heading line 10° right of center line. You are ready to make the wind dot but where, make a reasonable guess. _____

ANS: 305

ANS: Where the heading line and the TAS Arc (120) cross.

Frame 86

In order to compute ground speed (GS) and heading (let's use true heading -TH) you must know: True Course - (Measured on nav. chart.) Wind Direction - (From Weather Forecast); Wind Speed-(From Weather Forecast); True Airspeed - Computed from IAS, Alt. & Temp.

Go to page 37 frame 87.

Frame 97

Good! By reading 305° from the "drift left scale", you double checked your answer and used the computer as it should be.

But wait, you still must read the groundspeed (GS). With TAS under the wind dot ⊙ the GS will be under the grommet. Your GS is _____.

Frame 108

Sure the wind dot has always been located where the TAS ARC and the TH line cross, put it there. Now you are ready to find the answer. Rotate the plotting disc until the wind dot is on the centerline above the grommet. Read under the true index the wind direction of _____.

ANS: 135

ANS: 20°

Frame 87

NOTE: In this program you will work with true values rather than magnetic values, for example, true course (TC), true heading (TG), true wind, etc. By applying magnetic variation to the true values you can obtain magnetic values. Since this program does not attempt to cover this aspect of navigation we will continue to use True Values although magnetic values can be solved with this computer in the same manner.

Continue on page 38, frame 88.

Frame 98

Sure that is a long process and to summarize a few of the main points complete the following statements.

1. The wind was plotted first by placing the wind direction under the _____ _____ and plotting the wind speed from the grommet up.

2. The TC was placed under the _____ _____.

3. The TAS was placed under the _____ _____.

4. The GS was read under the _____.

5. The wind correction (in degrees) was determined by the angular displacement of the wind dot _____ degrees left of the _____. This determines TH.

Frame 109

Don't move anything, read the wind speed, as the difference from the grommet up to the wind dot. In this case _____.

ANS: 1. True index

2. True index

3. wind dot.

4. Grommet

5. 5° Centerline (TC)

ANS: 27K.

Frame 88

For example: Solve for TH and GS using the information below: Wind = 270°/20k; True course = 310°; TAS = 150k. First you should plot the wind on the computer disc. Rotate the plotting disc until the wind direction is under the True index. In this case _____ degrees will be under the True index.

Frame 99

You need to practice a few of these TH and GS problems so try this one. NOTE: Erase the old wind dot before starting a new problem.

Wind = 095°/30k; TC = 060°; TAS = 120k. Find TH and GS.

Step one - plot the wind direction under the true index, count the wind speed from the grommet up and place the wind dot.

Step two - place TC under the true index.

Step three - place TAS under the wind dot.

That's it, now read TH _____ and GS _____.

Frame 110

You did it right - wind 020/27k

Review wind solution:

1. TR placed under _____ _____.
2. GS placed under _____ _____.
3. Wind dot placed where TH and _____ are cross.
4. Read wind direction under _____.
5. Read wind speed from grommet up to _____.

ANS: 270°

ANS: TH 68

GS 94

NOTE: The wind dot came out 8° right of the centerline therefore TC (60) plus 8 gives TH (68). By the way - your answer may not be exactly the same as ours. We won't argue about 1 or 2 degrees or knots.

ANS: 1. True index

2. Grommet

3. TAS

4. True index

5. Wind dot

Frame 89

Next move the grid card so that any heavy speed arc (for example 80, 90, 100, etc) is directly beneath the grommet. Count from the grommet up the centerline of the grid card 20 units (20 knots - wind speed) and place a small pencil dot (circle the dot so it will be easy to locate later) on the plotting disc over the centerline. You have now plotted the wind. Does your wind dot on the computer agree with the diagram in figure 3, page 43? _____
(YES NO)

Frame 100

Try another:

Wind = 020/30K
TC = 180°
TAS = 120K
Find TH _____ and GS _____

Remember plot the wind, then rotate TC under the true index and place TAS under the wind dot. Answer TH _____ and GS_____

Frame 111

Now in summary solve for the wind. Known factors:
TR = 220°
GS = 80K
TH = 230°
TAS = 95K
Find Wind _____

1st - locate TR, 2nd - place GS, 3rd - make wind dot, 4th - read the answer.

ANS: Yes

ANS: TH 175

GS 148

ANS: Wind 271°/22K

Go to page 40 and take the test (No. 4).

Frame 90

Back to the problem: Wind = 270/20K
TC = 310°
TAS = 150K

Next rotate the plotting disc until the TC (True course) is under the true index. In this case _____ degrees will be under the true index.

Frame 101

You wish to determine the heading to fly under the following conditions: TAS = 100K
TC = 165°
Wind = 240/20K
The heading will be _____ and GS _____.

TEST NO. 4
WIND FACE SIDE

1. HEADING AND GROUNDSPEED

	WIND	TC	TAS	TH	GS
a.	200/12k	192	105	____	____
b.	140/15k	320	85	____	____
c.	190/43k	267	110	____	____

2. HEADING AND TAS

	WIND	TC	GS	TH	TAS
a.	090/15k	180	90k	____	____
b.	330/20k	010	110	____	____

3. WIND COMPUTATIONS

	TR	GS	TH	TAS	WIND
a.	060	110k	075	100k	_____
b.	130	75k	115	95k	_____
c.	025	87k	033	95k	_____

ANS: 310

Return to page 30 Frame 91.

ANS: TH = 177

GS = 93

Return to page 30, frame 102.

---

1. a. 193 - 93
   b. 320 - 100
   c. 244 - 92
2. a. 171 - 91
   b. 004 - 126
3. a. 178 - 29
   b. 075 - 30
   c. 088 - 15

NOW TAKE THE COMPREHENSIVE TEST ON PAGE 42.

COMPREHENSIVE TEST

1. Convert 74 nm to sm. _____

2. What is the GS if a distance of 35nm is covered in 19 minutes? _____

3. Find the time required to fly 5.5 nm at a GS of 110k. _____

4. Find the fuel needed to fly 3 hours + 10 min with a consumption rate of 14GPH. _____

5. Find TAS when IAS is 110k at an altitude of 6500 feet and temperature of -10°. _____

6. Find True altitude when pressure altitude is 7000 ft, and temp is -12°. _____

7. Given: TC = 330°
   Wind= 270°/20k
   TAS = 90k

   Find: TH _____
   GS _____

8. Given: TC = 183°
   Wind= 150°/25k
   GS = 135k

   Find: TH _____
   TAS _____

9. Given: TR = 025°
   GS = 87k
   TH = 033°
   TAS = 95k
   Find: Wind _____°/_____K

10. Find the ETE for the following flight:

    Given: TC = 290°
    Dist= 180nm
    Wind= 270/20k
    Alt = 8000 ft.
    Temp= -(minus) 10°
    IAS = 90K

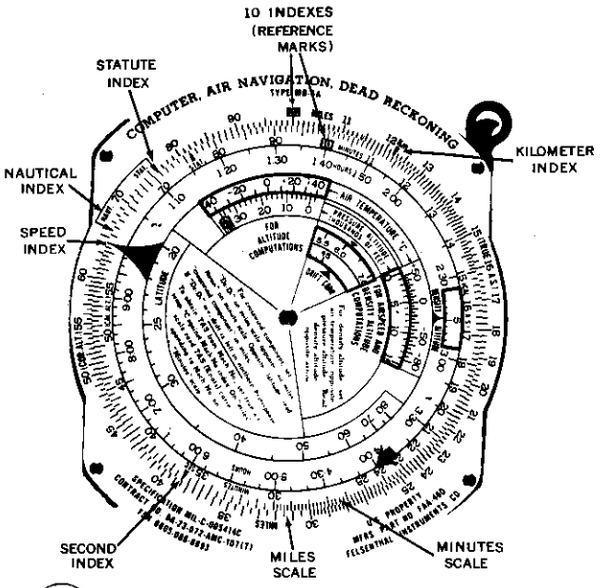
    Find: ETE = _____

ANS:

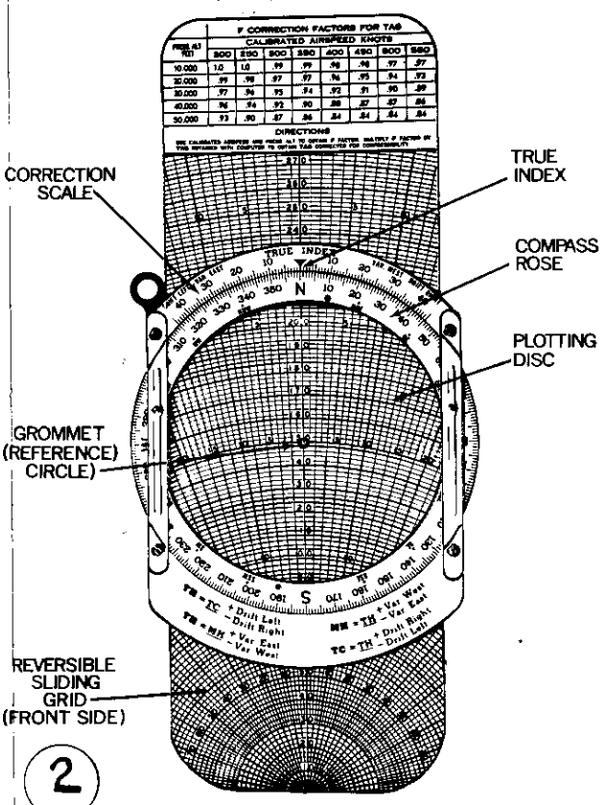
1. 85
2. 111
3. 3 min
4. 44.4
5. 119
6. 6685
7. TH = 319, GS = 79
8. TH = 178, GS = 156
9. 088/15k
10. 02 hr. and 13 min.

Frame 112

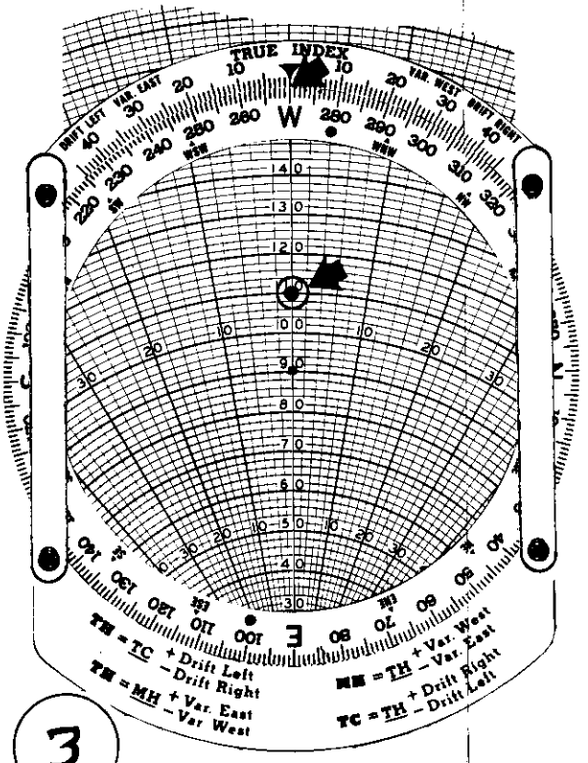
You have now learned to use the computer to solve basic navigational problems. Skill and additional use of the computer will come with further study and practice.



1



2



3

FT RUCKER 089014

(117 hed K g.s. 106?)

course 100°
TAS 110K
Wind 220°/15K

TR. 300
head 310 wind? 055 /17
TAS 90K 193°/16K
G.S 96K

Time flown 1h 23
fuel used 1000# 62#/H 1 hr 16 min
~~fuel remaining 915#~~ 85#
Time remaining ______

Press alt [illegible]
TEMP [illegible] °C
TAS [illegible] K
CAS [illegible] K