E6-B Computer Questions – Examples (Revised 2008-05-01 21:15)

I will explain questions 1, 2; 9, 11, 12; 21; 27; 31; 35; 38; 41; and provide comments about question 44.

NOTE: The following abbreviations are used.

SM	-	Statute Miles	TAS	-	True Airspeed
MPH	-	Miles Per Hour	IAS	-	Indicated Airspeed
NM	-	Nautical Miles	GS	-	Ground Speed
KTS	-	Knots	GPH	-	Gallons Per Hour
TH	-	True Heading	PA	-	Pressure Altitude
TC	-	True Course	C	-	Centigrade
CH	-	Compass Heading	WCA	-	Wind Correction Angle
CC	-	Compass Course	CAS	-	Calibrated Airspeed

NOTE: The photographs in this document do not necessarily match the questions being addressed; however they do illustrate the concept.

Some computers are slightly different that the one shown herein. Use the instructions provided with your computer if needed.

Written Originally by Dale Kuhns
Inherted on 2007-04-15 and revised by Godfrey D. Watson

CONVERSIONS

1. 45 SM is 39 NM

   Use the naut. stat. arrows on the front outer scale to convert between nautical miles and statute miles. Place 45 (middle scale) below the stat. arrow; read 39 below the naut. arrow.

2. 105 nautical miles per hour is 121 statute miles per hour

   Use the naut. stat. arrows on the front outer scale to convert between nautical miles and statute miles. Place 105 (middle scale) below the naut. arrow; read 121 below the stat. arrow.

Figure 1 SM-NM Conversion—100 SM is 87 NM
(Note: this is a different example than above.)

TIME, RATE, DISTANCE

Answers do not have to be perfect but should be reasonable close.

Remember:

a. Be sure to decide on the units you choose to use and make units the same before starting. For example, if you prefer to work in nautical miles (knots and NM) then convert MPH and SM before doing the problem. If you prefer to work in statue miles (MPH and SM) then convert KTS and NM before starting. How to do this is shown above.
b. Time is always on the inner scale (middle and inner). The other item is on the outer scale.
c. If you have a rate (MPH, knots, GPH) point the 60-index to it, then the time will be on the inner scale and the other item (miles or gallons) will be on the outer scale directly above the time.
d. Be sure to include the units (SM, NM, gal, MPH, KTS, GPH, etc.) in your answers.

9. You have a rate so start with the 60-index. Set INDEX (inner scale) to 114 on outer scale; read approximately 175 on outer scale above 1:32 on inner scale.

   Because you are working with statue miles, your distance is in statue miles (SM).

11. You have a rate so start with the 60-index. Set INDEX (inner scale) to 133 on outer scale; read 37 minutes on inner (middle) scale below 82 on inner scale.

12. Here you have a time and a distance, but no rate. You need to find the rate. Since time is always on the inner scale, the other item (distance in this case) must be on the outer scale.

    Place 57 directly above 32 minutes. The 60-index will point to the rate.

    You are working in nautical miles so your rate is nautical miles per hour (knots).

15. Notice that this problem has speed in statute miles and distance in nautical miles; one must be converted so that the units match. We did this problem or similar problem in class. You have a rate, so point your 60 INDEX to the rate, then read the TIME on inner scale below the DISTANCE on outer scale.

	TIME	SPEED		DISTANCE
9.	1:32	114 MPH		**175 SM**
11.	**:37**	133 MPH		82 SM
12.	:32	**107 KTS**		57 NM
15.	**2:25**	152 MPH	**132 KTS**	(**368 SM**) 320 NM

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FUEL CONSUMPTION

Answers do not have to be perfect but should be reasonable close.

Fuel problems are exactly like the Time-Speed-Distance problems except you are consuming fuel (gallons) instead of miles.

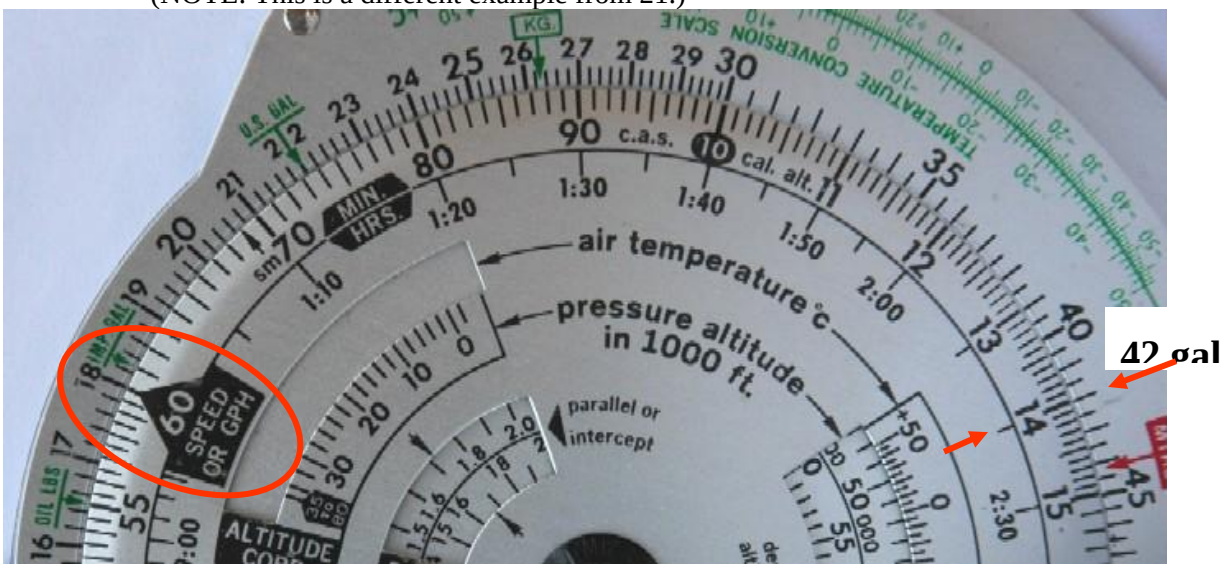
21. 38 gallons of fuel used in 1 hour 57 minutes.
This is similar to number 12 above.

Here you have a time and gallons, but no rate. You need to find the rate. Since time is always on the inner scale, the other item (gallons in this case) must be on the outer scale.

Place 38 directly above 1:57 (117 minutes). As usual, the 60-index points to the rate.

21.	38 gal. fuel used in 1:57		____19.5_ GPH

Figure 2—18 gallons in 1 hour = 27 gallons in 1:30 = 36 gallons in 2 hours = 42 gallons in 2:20
(NOTE: This is a different example from 21.)



TRUE AIRSPEED

27. Using the Airspeed Correction window on the computer.
Set 7000 feet below 0 degrees centigrade.
Read TAS 144 on outer scale adjacent to CAS 130 on inner (middle) scale.
(Note—density altitude is ~7,000 feet but not specifically asked for in this problem.)

Instructions are provided on face of computer. Degrees must be in centigrade.

	ALTITUDE	TEMP	IAS	TAS
27.	7000'	0° C	130 kts	**144 KTS**

Figure 3a Density—Pressure Altitude 5,000', Temperature -15°C, Density Altitude ~2,700'
(NOTE: This is a different example from 27.)

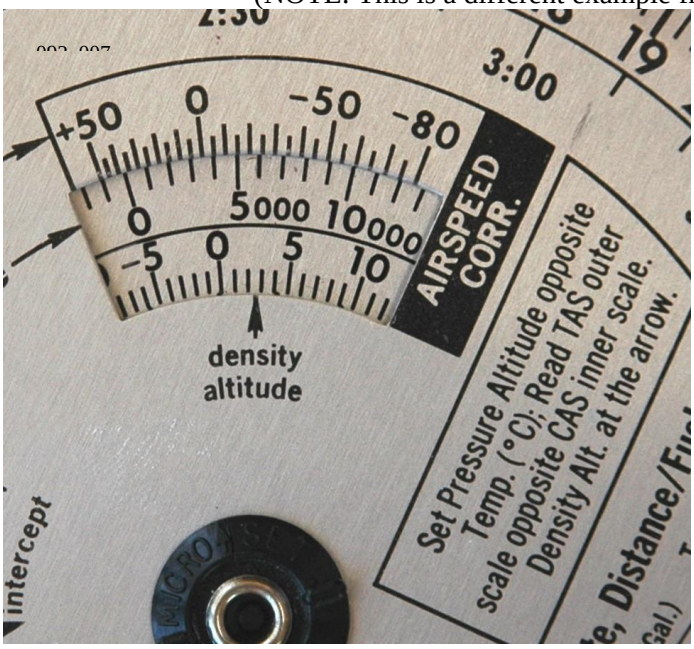


Figure 3b TAS at ~2700' Density Altitude —
90 indicated (calibrated) = 93 true, 110 indicated = 114 true, etc.

DENSITY ALTITUDE

31. Using the Airspeed Correction window on the computer.
Set 6000 feet below 10 degrees centigrade.
Read Density altitude 7000 feet at arrow.

See 27 above.
Caution—the temperature scale is backwards, positive (+) is on left and negative (–) is on right.

	ALTITUDE	TEMP	DENSITY ALTITUDE
31.	6000'	+10°C	**7000'**

GROUNDSPEED AND HEADING

These problems use the wind side of the E6-B computer. The instructions are on the computer.

Most E6B Flight Computers also have a guide written onto the computer face

(**TC ± WCA = TH ± VAR = MH ± DEV = CH**)

so if you have this on your E6B you can use it.

I suggest that you also memorize the following table as a guide.

COURSE		**WCA**	**HEADING**	
TC			**TH**	
VAR (-E +W)			**VAR (-E +W)**	
MC			**MH**	
DEV (±)			**DEV (±)**	
CC			**CH**	

35. TC – 345º
TAS – 95 MPH
Wind – 035º / 15 KTS

Convert to common units, 95 MPH = 82½ KTS and 15 KTS = 17¼ MPH.
See problem 1 for how to convert between nautical and statute.

Remember: WIND FIRST, AIRPLANE NEXT
(the instructions are on the computer)

Using nautical miles:
Step 1 (Wind)—Rotate 035° to TRUE INDEX, mark wind DOT 15 miles up from center Grommet.
Step 2 (Airplane)—Rotate 345° to TRUE INDEX and slide wind DOT over speed arc at 82½.

Step 3 Read results— **WCA 8° RIGHT** and **GS 71 KTS** (82 MPH).
Add the wind correction +8° to the 345° course to get heading of **353°** (you can avoid addition by looking below 8° on the WCA RIGHT scale and reading 353°).

35.	GIVEN:	TC – 345º TAS – (95 MPH) **82½ KTS** Wind – 035º / 15 KTS (17¼ MPH)	FIND:	TH **353°** GS **71 KTS (82 MPH)**

Using statute miles:
Step 1—Rotate 035° to TRUE INDEX and mark wind DOT 17¼ miles up from center Grommet.
Step 2—Rotate 345° to TRUE INDEX and slide your wind DOT over speed arc at 95.

Read results— **WCA 8° RIGHT** and **GS 82 MPH** (71 KTS).
Add the wind correction +8° to the 345° course to get heading of **353°** (you can avoid addition by looking below 8° on the WCA RIGHT scale and reading 353°).

FINDING WIND DIRECTION AND VELOCITY
(OPTIONAL YOU DO NOT HAVE TO DO PROBLEMS 38, 39, 40)

For these you have to work backwards (AIRPLANE FIRST, WIND NEXT). I show you how here, however, **YOU DO NOT HAVE TO DO THE "Finding Wind Direction and Velocity" PROBLEMS FOR THIS ASSIGNMENT**. Do them if you want.

You may skip this and proceed to the COMPOSITE PROBLEMS (next page).

38.	GIVEN:	TC – 080º TH – 074º TAS – 138 KTS GS – 126 KTS	FIND:	WIND **029° / 18 KTS**

Because TC + WCA = TH, then WCA = TH – TC. Therefore WCA = 074° - 080° = - 6° (6° LEFT)

With true course (TC) 080° at TRUE INDEX and Grommet at 126 KTS, mark your wind DOT at 126 KTS and 6° LEFT.

Now, place the wind DOT straight up on the center line.

Wind direction, **029°**, is under TRUE INDEX and wind velocity is **18 KTS** up from Grommet.

YOU DO NOT HAVE TO DO PROBLEMS 38, 39, 40.

COMPOSITE PROBLEMS

The composite problems combine all that you've learned for the E6-B flight computer.

It is important to do these for a good understanding. I show you one of them.

41. **GIVEN:**

TC – 235º
IAS – 120 MPH **(104 KTS)**
Wind – 340º/25 KTS
Distance – 277 NM
Fuel Consumption – 10.7 GPH
Altitude – 6000 ft.
Temperature – +10º C
TAS – **115 KTS (133 MPH)**

COURSE		WCA	HEADING	
TC	**235º**	**+12½º**	TH	**247½º**
Var			Var	
MC			MH	
Dev			Dev	
CC			CH	

FIND: TH, GS, Enroute Time, Fuel consumed.

Notice that, since I want to work in nautical miles, I have converted statue values to nautical.

SOLUTION: (with GS we can compute Enroute Time; with Enroute Time we can compute fuel.)

1. To get TH you need to add the WCA (TC ± WCA = TH). So this becomes a WIND problem using the back side of the E6-B computer.
2. Get the WIND correction and GS information (remember WIND FIRST; AIRPLANE NEXT)
   a. Wind: TRUE INDEX at 340º and mark wind DOT 25 up from Grommet.
   b. Plane: TRUE INDEX at 235º and place wind DOT over TAS.
   (Oops! We do not have a TAS; got to go get it; should have done this at beginning)
3. Using the Airspeed correction window place 6000' below +10º C. Then read **TAS, 115 KTS**, on outer scale above IAS of 104 KTS on inner (middle) scale.
4. Now that we have the TAS we can proceed with the WIND problem in 2 above.
   b. TRUE INDEX at 235º and place wind DOT over the TAS arc, 115 KTS.
   c. Read **GS 118½ KTS (137 MPH)** under center Grommet, **WCA 12½º RIGHT** under wind DOT, and **TH 247½º** below 12½º on the WCA RIGHT scale (or add 12½º to 235º).
5. For Time Enroute, you have your computed ground speed (GS) rate, 119 KTS, and you have given distance, 277 NM.
   a. On the front side of computer point the 60-index to the ground speed 119 and read the **TIME 140 minutes (2:20)** on the inner scale below 277.
6. For fuel, place 60-index at 10.7 and read **fuel 24.9** above time 2:20 (or 140 minutes) on the outer scale

ANSWER:

41.	GIVEN:	TC – 235º IAS – 120 MPH **(104 KTS)** Wind – 340º/25 KTS Distance – 277 NM Fuel Consumption – 10.7 GPH Altitude – 6000 ft. Temperature – +10º C TAS – **115 KTS**	FIND: TH **247°** GS **119 KTS (137 MPH)** Time Enroute **2:20** Fuel to reach destination **24.9**

QUESTION 44 (ASA 3549)

This is very similar to ASA question 3549, page 9-29; the climb-out is different.
You'll need to find the true airspeed.

To get the TAS, carefully point the density altitude arrow to 6000'. Read the TAS on outer scale opposite calibrated airspeed, 78 knots.

Using the TAS and the different climb-out, solve the problem as shown in the ASA text.