NIFA REGIONAL SAFECON 2006
Manual Flight Computer Accuracy

Explanations

Note to competitor:
This will offer some basic help in solving the problems on the test. There is often more than one way to correctly solve any given problem. You will simply be offered one possible method or direction to help you find the solution. Although a calculator was used to help with the explanations, all answers can be correctly found with accurate use of a manual flight computer.

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1. Basic off-course problem.
   Degrees to parallel = x
   Sin(x) = 11/68
   x = 9.3°

   Rather than using sin, many manuals have you align dist off over dist flown and look above either 57.3 or the speed index. Some have a specific off-course window. Any of these techniques would get you very close to the correct answer of 9°.
   Correct Answer: B

2. Same concept as #1. Need to convert distance so they are the same.
   195 km = 105 NM
   15 SM = 13 NM
   105 – 13 = 92
   Sin(x) = 11/92
   x = 6.9°
   6.9 + 9 = 15.9 total degrees, closest to answer of 16°
   Correct Answer: D

3. Basic TSD with fuel burn.
   Plot wind dot and use TC & TAS to acquire the GS.
   GS = 141 kts.
   Convert distance to NM and combine with GS to find time.
   Time = 57.3 minutes
   Combine time & fuel flow to get fuel burn.
   Fuel = 8.2 gal
   Correct Answer: A

4. Basic radius of action problem.
   (GS out + GS back) / H = GS back / T
   H = hours (or minutes) of fuel available
   T = Time to turn
   Find the above data and plug it into the equation solving for T.
   (106 + 146) / 76 min = 146 / T
   T = 44 min. Combine your time with GS out and get the answer of 78.
   Correct Answer: B

5. Simply find the total circumference of the circle and create a ratio of the portion flown.
   Circumference of a circle = 2πr
   C = 2 x 3.14 x 27
   C = 169.6
   So, 169.6 NM is to 360° as x is to 124°
   X = 58 NM on arc
   Correct Answer: D

6. Basic wind problem to find a GS of 127 kts.
Correct Answer: C

7. Basic wind problem to find a TH of 277°
Correct Answer: D

8. Basic wind problem that gives TH instead of TC to give a GS of 110 kts.
Correct Answer: D

9. Basic wind problem to find WCA of 5°L.
Correct Answer: A

10. Basic wind problem, but TAS & GS are in mph where the answers are in knots.
Need to convert to get correct answer of 177° @ 27 kts.
Correct Answer: B

11. Basic wind problem that gives TH instead of TC to give a GS of 160 kts.
Correct Answer: D

12. Basic wind problem to find a TC of 223°.
Correct Answer: B

13. Basic wind problem, but answers are in kmph. Must convert to find answer of 232 kmph.
Correct Answer: A

14. TC with variation equals MC.
300° - 8° = 292°
Correct Answer: D

15. Take CH and remove variation & deviation to get TH. Compare TH & TC to get WCA of 11°.
Since no other info was given, must use WCA in place of crab angle.
Sin(crab) = XW Comp / TAS
Sin(11) = x / 100
x = 19
Easiest to use a manual flight computer with a "sin" scale, but can use off-course technique: Align 11° over 57.3. Look above 100 to get close to 19.
Correct Answer: A

16. Basic double-drift (or triple-drift if you like). For each TH draw a line on your computer that represents the amount of drift associated with it. After all three lines are drawn you will see that they formed a triangle. Place a dot in the exact middle of it. This dot represents the wind dot. If you only use two of the readings, you will not get the correct answer of 308 @ 22 kts. The question asks for your best estimate and it is always prudent to average more readings than less.
Correct Answer: C

17. Basic mach number problem.
Use TAS and OAT to find a mach number of .18 mach.
Correct Answer: B

18. Basic climb profile question. Find distance traveled during climb.
Subtract the altitudes to find the difference in altitude in each segment. No altimeter setting was given, so assume standard.

8,000 – 2,000 (field elevation) = 6000 ft.
18,000 – 8,000 = 10,000 ft.
29,000 – 18,000 = 11,000 ft.

6,000' / 1500 fpm = 4 min. 130 KTAS for 4 min = 8.7 NM
10,000 / 900 fpm = 11.1 min. 120 KTAS for 11.1 min = 22.2 NM

11,000 / 500 fpm = 22 min. 110 KTAS for 22 min = 40.3 NM

Add up distances to get 71.2 NM traveled during climb. This is about 3 NM short of the restricted area.
Correct Answer: A

19. Distance to station, isosceles triangle method.
You are on the 090° radial and re-center needle on 070° radial, a difference of 20°. When you left the 090° radial you changed your course by 20°. If you draw a picture you can make an isosceles triangle where two of the corners are 20°. The sides opposite these angles must be the same as well. So since you traveled 20 NM (one side) the other side must also be 20 NM. Because there is no wind you can interchange headings and courses. Answers are in SM, so convert to get 23 SM.
Correct Answer: B

20. Basic time-to-station problem.
Time (minutes) / bearing change = time-to-station / 60
5 / 13 = x / 60
Time to station = 23 minutes
You have time, use given groundspeed to find distance. GS is mph and answers are in NM, so remember to convert to get answer of 30.7 NM.
Correct Answer: A

21. Simply asks for the time you calculated in problem #20.
Correct Answer: C

22. Basic equal time point problem.
Find GS out (if you were to continue) and GS back (if you were to turn back).
Basic wind solution to find groundspeeds, but TAS not given. You must use the CAS, PA and OAT to find TAS of 152 kts (if you use a computer and method that takes into account compressibility, the speeds are slow enough that the answer will be the same). Remember to use your altimeter setting to compute PA, which is 500 ft. higher than cruising altitude. Using given winds with your TAS, find the groundspeeds.
T = D / S
Since time will be same, we can re-write:
Dist back / GS back = Dist out / GS out
Let's say dist to return = x and dist to continue = 110 – x

x / 168 = (110 – x) / 136
136x = 18480 – 168x
304x = 18480
x = 60.8 NM, making the choice of 61 NM the correct one.
Distance to return from ETP is the distance from KDAY.
Correct Answer: C

23. Simply use your GS out of 136 kts with the distance of 110 NM to find time of 48.5 min.
Use this time with given fuel burn rate to find a burn of 9.7 gal.
Correct Answer: B

24. Basic time-to-station problem.
Time (minutes) / bearing change = time-to-station / 60
0.78 min / 8 = x / 60
x = 5.85 min or 5 min 51 seconds
Correct Answer: B

25. Using a computer with a navigation grid, align 283° at the TC index and mark a dot 40 units up. Next align 037° at the TC index and mark a dot 35 units up. Turn the marked disc until the line formed between the two dots is vertical or horizontal so you can read the grid units to measure the distance between them. Measure the units between them to find the answer of 63 NM.
Correct Answer: A

26. Subtract field elevation to get altitude climbing of 7,250 ft. Convert TAS to knots.
Use equation fpm / fpnm = GS in kts / 60

Use winds to find GS. Runways are magnetic, so MH is 150°. Find GS of 54 kts.
So, fpm / 350 = 54 / 60
Answer is 315 fpm.
Remember, assigned heading is runway heading. This is not your course.
Correct Answer: B

27. Basic wind problem using given data.
Correct Answer: D

28. Altitude climbed is 7,250 ft. at 315 fpm.
7,250 / 315 = 23 minutes
Combine with GS of 54 kts to arrive at 20.7 NM
Correct Answer: C

29. Basic true altitude problem.
Correct Answer: D

30. Using a computer with a temp rise window, you will find that 315 KTAS is aligned with a temp rise of 13 C°.
Correct Answer: C

31. Using a computer that can take into account compressibility, align CAS with PA to find mach #.
Correct Answer: C

32. 1.8 km / 25 sec = .072 km per second
3281 feet per km
.072 x 3281 = 236 fps
Correct Answer: A

33. Basic weight & balance problem.
This explanation will use manual flight computer figures, not calculator.
Make all weights the same units. We will use pounds. Multiply each by its station to find moment.

Nose Gear: 170 x 15 = 2550
Left Main: 1430 x 90 = 128000
Right Main: 1320 x 90 = 119000

Add weights and moments. Total Moment / Total Weight = CG (in same units as stations)
249550 / 2920 = 85
CG is 85". Convert to centimeters.
85 x 2.54 = 217 cm
If you use a calculator through the entire problem you will get 217.533
Correct Answer: C

34. TEMAC is the trailing edge of the mean aerodynamic chord.
LEMAC is the leading edge of the mean aerodynamic chord.
CG can be stated by how far back from LEMAC it is in a percentage of total MAC length.
TEMAC minus 37" gives you a LEMAC of 77. You already calculated the CG as 85.
85 – 77 = 8
CG is 8" behind LEMAC
8 / 37 = 21.6% MAC
Correct Answer: A

35. Convert 165 meters to 541 feet and 3 SM to 2.6 NM.
So you are climbing 541 feet per 2.6 nautical miles. Divide to get 208 fpnm.
Altitude climbed is 8000 ft. divided by 18 minutes equals 444 fpm.
Fpm / fpnm = GS in knots / 60
444 / 208 = GS / 60
GS = 128 kts.
Correct Answer: D

36. Simple density altitude problem.
Accepted As Correct: 10,500 – 11,500 feet

37. Simple conversion.
Accepted As Correct: 490 – 493 kilometers

38. Convert liters to pounds, then pounds to kilograms.
Accepted As Correct: 367 – 373 kilograms

39. Convert 26 gph to 98.4 liters per hour. Divide by 60 minutes to get 1.64 lpm.
Accepted As Correct: 1.60 – 1.68 lpm

40. Divide 300 by 4 quarts per gallon to get 75 gal. Multiply 75 x 8.35 = 626 lbs. Convert to 284 kg.
Accepted As Correct: 282 – 286 kilograms

41. Altimeter settings can be given in millibars or hectopascals, which have a 1 to 1 conversion.
Correct Answer: 1026.1 hPa (exactly)

42. 113 kmph x 1000 meters (per km) / 3600 seconds (per hour) to get 31.4 m/s.
Accepted As Correct: 31.20 – 31.60 m/s

43. Refer to calculator side. Note 538 on outside scale. Turn inside scale until the same number appears under 538 and over the 10 of the inside scale. This alignment occurs twice on the scale, opposite each other: 23.2 and 7.3. Pick the one that makes sense for the given number. 20 x 20 = 400, so you know it's slightly more than 20, hence 23.2. If you were asked the square root of 53.8 the answer would be 7.3. If you were asked the square root of 5380 the answer would be 73. It alternates as the decimal moves.
Accepted As Correct: 23.1 – 23.3

44. Simple temperature conversion.
Accepted As Correct: 38.5°C – 39.5°C

45. 5616 / 60 = 93.6 hours / 24 = 3.90 days
Accepted As Correct: 3.80 – 4.00 days