

GENERAL NAVIGATION • CHAPTER 32

Revision Questions

187 Questions • Tap any question to reveal the answer

Appendix Figures

Questions that reference these appendices are marked with ↑ Refer to Figure N above.

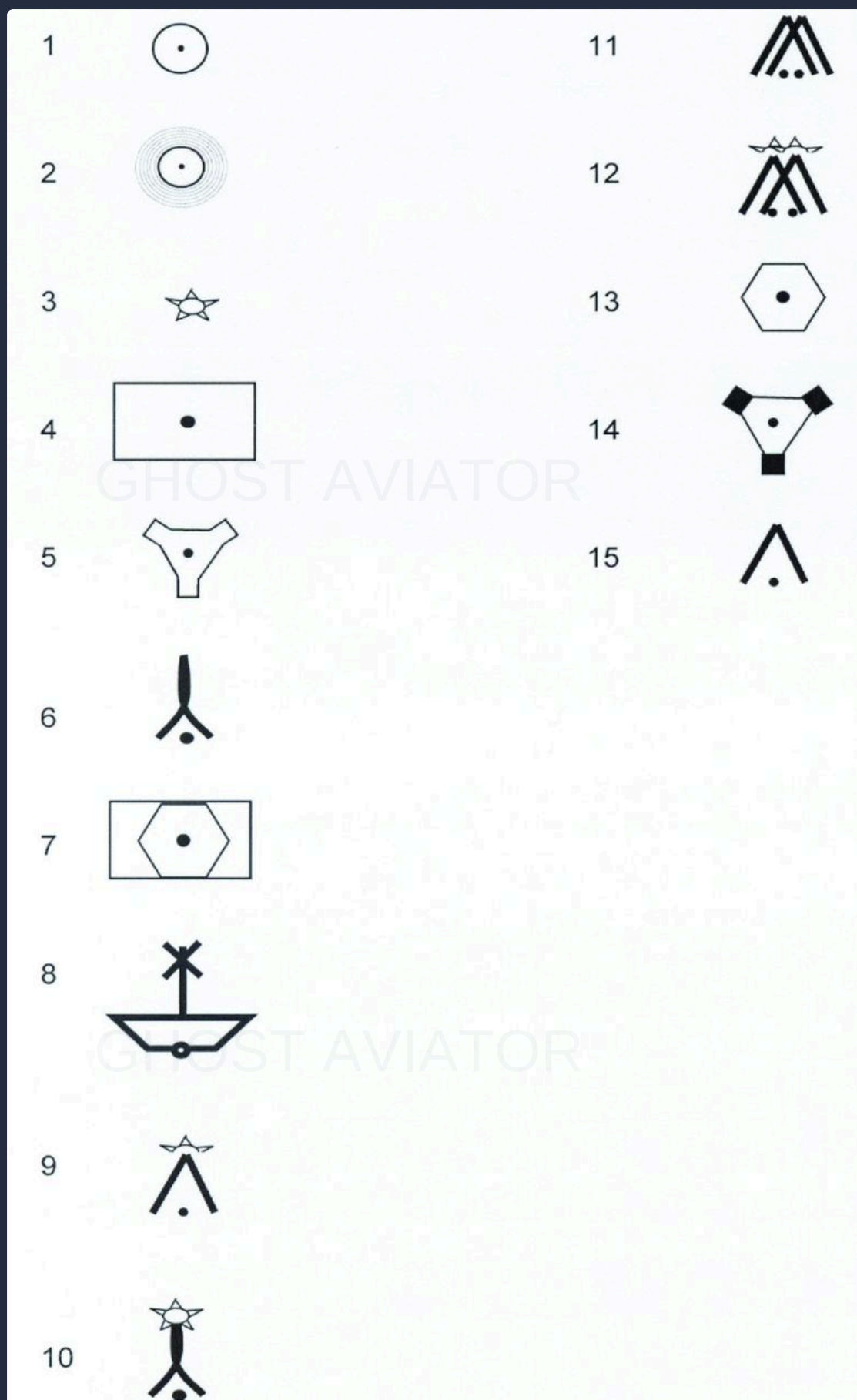


FIGURE 1 — APPENDIX A — CHART SYMBOLS REFERENCE

Appendix B to Revision Questions

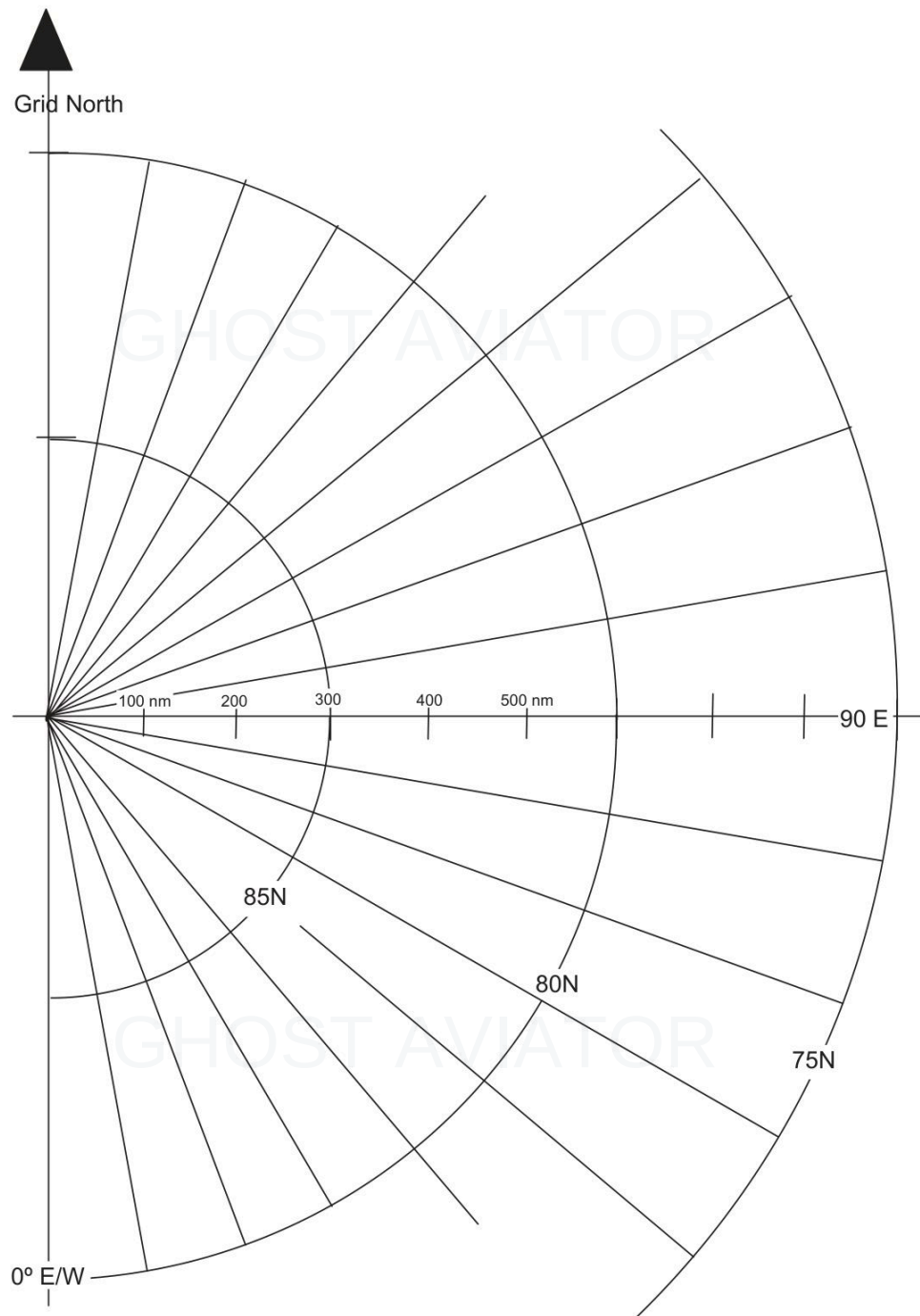


FIGURE 2 — APPENDIX B — NAVIGATION CHART

Appendix C to Revision Questions

W/V	HDG (T)	VAR	HDG (M)	POSITION FROM TO	CAS/ MACH	FL/ OAT	TAS	GS	DIST	TIME	ETA
050/40		7E		A B	210	180/-20			300		
320/50		5W		C D	175	160/-10			480		
140/60		10W		E F	M 0.82	360/-40			300		
315/70		10E		G H	M 0.78	310/-35			600		
240/30		17W		J K	150	100/-10			275		
020/60		11W		L M	M 0.84	390/-55			495		

FIGURE 3 – APPENDIX C – FLIGHT NAVIGATION LOG

Questions

- 1 Pressure Altitude is 28 000 feet, OAT = -45°C, Mach No = 0.46, W/V = 270/85, Track = 200°T. What is the drift and groundspeed?

A 18L / 252 knots

B 15R / 310 knots

C 17L / 228 knots

D 17R / 287 knots

▼ Show Answer

Correct Answer: C

A common mistake here is to set the W/V, then put 200 up at the 12 o'clock index and just read the drift and ground speed off. But that is the answer for a HEADING of 200. The question asks for a TRACK of 200. You now have to lay off for drift, which will give you a heading of 217 at the top, balanced by 17 degrees of port drift, giving a track of 200.

2 G/S = 240 knots, Distance go = 530 NM. What is time to go?

A 27 minutes

B 29 minutes

C 2 h 05 m

D 2 h 12 m

▼ Show Answer

Correct Answer: D

3 'ISA Dev = +30°C, Pressure alt = 5000 feet. What is true alt?

A 4550 feet

B 5600 feet

C 4290 feet

D 5320 feet

▼ Show Answer

Correct Answer: B

We recommend that you use the CRP-5 for true altitude problems, especially if the question gives you the actual SAT instead of ISA deviation. But if you want to use the formula, the ISA deviation is +30 degrees: True Alt = $5000 + (+30 \times 4/1000 \times 5000)$ = 5600 feet which is pretty close to answer (b).

4 Course 040°(T), TAS 120 kt, Wind speed = 30 knots. From which direction will the wind give the greatest drift?

A 220°(T)

B 230°(T)

C 235°(T)

D 245°(T)

▼ Show Answer

Correct Answer: D

You would expect the greatest drift when the wind direction makes the greatest angle with from the track or reciprocal direction (the JAA use the word 'course' to mean 'desired track'). The reciprocal track of 040° is 220° and answer (d) is the furthest from 220°.

5 Required course $045^{\circ}(T)$, $W/V = 190 / 30$, $FL = 55 @ ISA$, Variation = $15^{\circ}W$. CAS = 120 knots. What is mag heading and G/S?

A $052^{\circ}(M)$ 154

B $067^{\circ}(M)$ 154

C $037^{\circ}(M)$ 154

D $037^{\circ}(M)$ 113

▼ Show Answer

Correct Answer: B

6 An aircraft flies a great circle track from $56^{\circ}N$ $070^{\circ}W$ to $62^{\circ}N$ $110^{\circ}E$. The total distance travelled is:

A 3720 NM

B 5420 NM

C 1788 NM

D 2040 NM

▼ Show Answer

Correct Answer: A

You should note that these longitudes are meridian and anti-meridian. This is the over-the-pole case.

- 7 You are flying 090°(C) heading. Deviation is 2W and Variation is 12E. Your TAS is 160 knots. You are flying the 070 radial outbound from a VOR and you have gone 14 NM in 6 minutes. What is the W/V?

A 158°(T) / 51

B 060°(T) / 50

C 340°(T) / 25

D 055°(T) / 25

▼ Show Answer

Correct Answer: A

If your compass heading is 090°(C), you can fill in the following table: T V M D. C 12E 2W So your true heading is 100. VOR radials are always magnetic, so you are flying a true track of 082. Your TAS is 160. If you have gone 14 NM in 6 min, your G/S is 140. Now use your CRP-5 as in Chapter 6.

- 8 Please refer to Appendix B (attached at back). Assume a North Polar Stereographic chart whose grid is aligned with the Greenwich meridian. An aircraft flies from the geographic North Pole for a distance of 480 NM along the 110° E meridian, then follows a grid track of 154° for a distance of 300 NM. Its position is now approximately:

↑ Refer to Figure 2 (Appendix B) above

A 78°45'N 087°E

B 70°15'N 080°E

C 79°15'N 074°E

D 80°00'N 080°E

▼ Show Answer

Correct Answer: D

This question is solved by scale drawing. Use the scale to draw a line 480 NM along the 110°E meridian from the North Pole, then plot a line 300 NM in a direction of 154°Grid .

9 The sensitivity of a direct reading magnetic compass is:

- A Inversely proportional to the horizontal component of the Earth's magnetic field.
- B Inversely proportional to the vertical and horizontal components of the Earth's magnetic field.
- C Inversely proportional to the vertical component of the Earth's magnetic field.
- D Proportional to the horizontal component of the Earth's magnetic field.

▼ Show Answer

Correct Answer: D

10 An aircraft at position $60^{\circ}\text{N } 005^{\circ}\text{W}$ tracks $090^{\circ}(\text{T})$ for 315 km. On completion of the flight the longitude will be:

- A $010^{\circ}40'\text{W}$
- B $000^{\circ}15'\text{E}$
- C $000^{\circ}40'\text{E}$
- D $002^{\circ}10'\text{W}$

▼ Show Answer

Correct Answer: C

This is a departure question. A very similar example is given in Chapter 15

11 What is the definition of magnetic variation?

- A The angle between the direction indicated by a compass and Magnetic North.
- B The angle between True North and Compass North.
- C The angle between Magnetic North and True North.
- D The angle between Magnetic Heading and Magnetic North.

▼ Show Answer

Correct Answer: C

12 At the magnetic equator:

- A Dip is zero
- B Variation is always maximum
- C Deviation is zero
- D The isogonal is an agonic line

▼ Show Answer

Correct Answer: A

13 Which of these is a correct statement about the Earth's magnetic field?

- A It has no effect on aircraft deviation.
- B The angle of dip is the angle between the vertical and the total magnetic force.
- C It may be temporary, transient, or permanent.
- D It acts as though there is a large blue magnetic pole in Northern Canada

▼ Show Answer

Correct Answer: D

14 Where is a compass most effective?

- A About midway between the equator and the Magnetic North Pole
- B In the region of the magnetic South Pole
- C In the region of the magnetic North Pole
- D On the geographic equator

▼ Show Answer

Correct Answer: A

15 The value of variation:

- A is zero at the magnetic equator
- B cannot exceed 180°

C has a maximum value of 45° E or 45° W

D cannot exceed 180°

▼ Show Answer

Correct Answer: **B**

16 Grivation is the combination of

A Variation and Deviation

B Deviation and the Agonic value

C Variation and Grid Convergence

D Grid Convergence and Deviation

▼ Show Answer

Correct Answer: **C**

17 An aircraft leaves at 0900UTC on a 250 NM journey with a planned ground speed of 115 knots. After 74 NM the aircraft is 1.5 minutes behind the planned schedule. What is the revised ETA at the destination?

A 1100

B 1110

C 1115

D 1054

▼ Show Answer

Correct Answer: C

74 NM @ the planned G/S of 115 knots = 38.6 min
250 NM @ the planned G/S of 115 knots = 130.4 min
After 74 NM, the actual elapsed time = 40.1 min
Therefore the flight time for 250 NM at the revised G/S = $130.4 \times 40.1 / 38.6$
This comes to 135 min.
0900UTC + 135 min = 1115UTC

18 A B C 30 NM 20 NM ATA A is 1010. ETA B is 1030. ETA C is 1043. ATA B is 1027. What is revised ETA C?

A 1040

B 1043

C 1038

D 1036

▼ Show Answer

Correct Answer: C

ETA B and ETA C are not relevant. You fly 30 NM in 17 min. How long will it take you to fly the remaining 20 NM at the same ground speed?

19 Isogrivs are lines that connect positions that have:

A the same grivation

B the same variation

C 0°(M)agnetic dip

D the same horizontal magnetic field strength

▼ Show Answer

Correct Answer: **A**

20 What is the average magnetic track and distance between WTD NDB (5211.3N 00705.0W) and FOY NDB (5234.0N 00911.7W)? - use your Jeppesen E(LO)1 Track Dist

A 294 76

B 286 76

C 294 81

D 286 81

▼ Show Answer

Correct Answer: **C**

Plotting question. Solve by measurement on the chart.

21 A useful method of a pilot resolving, on a visual flight, any uncertainty in the aircraft's position is to maintain visual contact with the ground and:

A set heading towards a line feature such as a coastline, river or motorway

B fly the reverse of the heading being flown prior to becoming uncertain until a pinpoint is obtained

C fly expanding circles until a pinpoint is obtained

D fly reverse headings and associated timings until the point of departure is reached

▼ Show Answer

Correct Answer: A

22 An aircraft is at FL140 with an IAS of 210 and a true OAT of -5°C . The wind component is -35 knots. When the aircraft is at 150 NM from a reporting point, ATC request the crew to lose 5 minutes by the time they get to the beacon. How much do they need to reduce IAS?

A 15 knots

B 25 knots

C 30 knots

D 20 knots

▼ Show Answer

Correct Answer: D

Find the present TAS, apply the wind and get the present G/S (230 knots) 150 NM @ 230 kt G/S is 39 min. You need to arrive 5 minutes later, so your new time to go is 44 min. The new required G/S will be 150 NM in 44 min, which is 205 kt G/S The wind should not change, so the new required TAS will be 240 Then either use FL140/ -5°C in the airspeed window to convert the TAS to 190 kt CAS, or put the old TAS (264) against the old IAS (210), then against 240 TAS, you will see 190. 210 to 190 is a 20 knot reduction in IAS (strictly CAS, but the PEC should not change much in 20 knots). Answer (d).

23 X Y Z 30 NM 20 NM ATA X is 1420. ETA Y is 1447. ATA Y is 1450. What is new ETA Z?

A 1503

B 1508

C 1510

D 1512

▼ Show Answer

Correct Answer: C

ETA Y is irrelevant. If it takes you 30 minutes to cover 30 NM, it will take you a further 20 minutes to cover the remaining 20 NM at the same ground speed.

24 Given: Airport elevation is 1000 feet. QNH is 988 hPa What is the approximate airport pressure altitude?

A 320

B 1680

C -320

D 680

▼ Show Answer

Correct Answer: B

The QNH is 988 hPa. The datum for Pressure Altitude is 1013 hPa, which is 25 hPa greater. Using 27 feet to one hPa, this equates to a distance of 675 feet. A greater static pressure occurs at a lower pressure level. Therefore the 1013 hPa pressure level is below sea level by 675 feet. The airport is 1000 feet above sea level, which means that it is 1675 feet above the 1013 hPa pressure level.

25 An aircraft starts at position 0410S 17822W and heads true north for 2950 NM, then turns 90 degrees right, and maintains a rhumb line track for 314 kilometres.

What is its final position?

- A 5500N 17422W
- B 4500N 17422W
- C 5500N 17738E
- D 4500N 17738E

▼ Show Answer

Correct Answer: B

The aircraft flies 2950 NM N, which takes it to 4500N 17822W. Now convert 314 km to NM and then use the departure formula.

26 You are heading 080°(T) when you get a range and bearing fix from your AWR on

- A headland at 185 NM 30° left of the nose. What true bearing do you plot on the chart? / 050 from the headland, using the headland's meridian
- B 050 from the headland, using the aircraft's meridian
- C 230 from the headland, using the headland's meridian
- D 230 from the headland, using the aircraft's meridian

▼ Show Answer

Correct Answer: D

The true bearing from you TO the headland is 050°(T). However, you are going to have to plot FROM the headland to the aircraft (the headland is on your map – the aircraft's position is not!) The aircraft's heading has been measured relative to the direction of True North at the aircraft's position. If there is significant chart convergence between the aircraft's position and the headland's position, the direction

of True North will be different at the headland. We must therefore plot the reciprocal bearing using the aircraft's meridian paralleled through the headland's position.

27 By what amount must you change your rate of descent given a 10 knot decrease in headwind on a 3° glide slope?

A 50 feet per minute increase

B 30 feet per minute increase

C 50 feet per minute decrease

D 30 feet per minute decrease

▼ Show Answer

Correct Answer: A

GHOST AVIATOR

28 You are on a heading of 105° (C), deviation 3° E. WTD NDB (5211.3N 00705.0W) bears 013° R, CRK VOR (5150.4N 00829.7W) QDM is 211° . What is your position? (Use Jeppesen E(LO)1)

A 5245N 00757W

B 5217N 00745W

C 5412N 00639W

D 5228N 00802W

▼ Show Answer

Correct Answer: D

Plotting question. Solve by measurement on the chart.

29 The airport at 5211N 00706W is: (use Jeppesen E(LO)1)

A Kerry

B Cork

C Shannon

D Waterford

▼ Show Answer

Correct Answer: D

Plotting question. Solve by measurement on the chart.

30 In which months is the difference between apparent noon and mean noon the greatest?

A November and February

B January and July

C March and September

D June and December

▼ Show Answer

Correct Answer: A

31 5 hours 20 minutes and 20 seconds time difference is equivalent to which change of longitude?

A $81^{\circ}30'$

B $78^{\circ}15'$

C $79^{\circ}10'$

D $80^{\circ}05'$

▼ Show Answer

Correct Answer: D

Multiply by 15° per hour. The easiest way of dealing with minutes and seconds is by using the DMS function of a scientific calculator.

32 The main reason that day and night, throughout the year, have different durations is due to the:

- A Earth's rotation
- B relative speed of the Sun along the ecliptic
- C inclination of the ecliptic to the Equator
- D gravitational effect of the Sun and the Moon on the speed of rotation of the Earth

▼ Show Answer

Correct Answer: C

The combination of the inclination of the ecliptic to the Equator and the orbit of the Earth round the Sun produces a constantly changing declination. The length of the hours of daylight at a given latitude varies with the declination of the Sun.

33 A Lambert's Conical conformal chart has standard parallels at 63N and 41N. What is the convergence factor?

- A .891
- B .788
- C .656
- D .707

▼ Show Answer

Correct Answer: B

On a Lambert chart, the Parallel of Origin is midway between the 2 Standard Parallels. The 'constant of the cone' is simply another term for the sine of the parallel of origin.

34 On a chart, 90.74 km is represented by 7.0 centimetres. What is the scale?

A $1 / 700\,000$

B $1 / 2\,015\,396$

C $1 / 1\,296\,400$

D $1 / 1\,156\,600$

▼ Show Answer

Correct Answer: C

See Example 1 in Chapter 16, which is the same type of question.

35 On a direct Mercator chart, great circles are shown as:

A Curves convex to the nearer pole

B Straight lines

C Rhumb lines

D Curves concave to the nearer pole

▼ Show Answer

Correct Answer: A

36 The scale on a Lambert's conformal conic chart

- A is constant along a meridian of longitude
- B is constant along a parallel of latitude
- C varies slightly as a function of latitude and longitude
- D is constant across the whole map

▼ Show Answer

Correct Answer: B

The scale on a Lambert chart alters as latitude changes but, for a fixed latitude (i.e. along a parallel of latitude), it remains constant.

37 Please refer to Appendix A. What is the symbol for a DME?

↑ Refer to Figure 1 (Appendix A) above

- A 9
- B 10
- C 12
- D 4

▼ Show Answer

Correct Answer: D

38 Reference Jeppesen E(LO)1, position 5211N 00706W, which of the following denotes all the symbols?

A military airport, ILS, NDB

B civil airport, VOR, ILS

C military airport, VOR, ILS

D civil airport, ILS, NDB

▼ Show Answer

Correct Answer: D

The Jeppesen conventions differ slightly from the ICAO ones. The key is given in the introduction to the Jeppesen Student Pilots' Manual.

39 Heading is $156^{\circ}(T)$, TAS is 320 knots, W/V is 130/45 and the Variation is $10^{\circ}W$. What is your magnetic track?

A 170

B 150

C 160

D 222

▼ Show Answer

Correct Answer: A

40 You are heading $345^{\circ}(M)$, the variation is $20^{\circ}E$, and you take a radar bearing of 30° left of the nose from an island. What bearing do you plot from the island?

A $160^{\circ}(T)$

B 155°(T)

C 140°(T)

D 180°(T)

▼ Show Answer

Correct Answer: B

Apply 20°E variation to 345°(M) to get 005°(T). 30° left of this is a true bearing of 335°(T) from you TO the headland. However, you are going to have to plot FROM the headland to the aircraft (the headland is on your map – the aircraft's position is not!) You therefore plot the reciprocal of 155°(T).

41 Your pressure altitude is FL55, the QNH is 998, and the SAT is +30°(C). What is density altitude?

A 6980 feet

B 7750 feet

C 8620 feet

D 10 020 feet

▼ Show Answer

Correct Answer: C

As per the reply to Q3.

42 On a particular take-off, you can accept up to 10 knots tailwind. The runway QDM is 047, the variation is 17°E and the ATIS gives the wind direction as 210. What is the maximum wind strength you can accept?

A 18 knots

B 4 knots

C 8 knots

D 11 knots

▼ Show Answer

Correct Answer: D

43 The agonic line:

A is midway between the magnetic North and South poles

B follows the geographic equator

C is the shorter distance between the respective True and Magnetic North and South poles

D indicates zero variation

▼ Show Answer

Correct Answer: D

44 On a 5% glide slope your groundspeed is 150 kt. What should be your rate of descent to maintain the glide slope?

A 750 feet/min

B 450 feet/min

C 900 feet/min

D 650 feet/min

▼ Show Answer

Correct Answer: A

A 5% glide slope means that for every 100 knots you go forward horizontally, you go down 5 knots vertically. 5% of your forward speed of 150 is 7.5 knots vertically. Convert this to feet per min and you will see that option (a) is the nearest

45 At 65 NM from a VOR you commence a descent from FL330 in order to arrive over the VOR at FL80. Your mean ground speed in the descent is 240 knots. What rate of descent is required?

A 1540 feet/min

B 1630 feet/min

C 1270 feet/min

D 1830 feet/min

▼ Show Answer

Correct Answer: A

65 NM @ 240 knots will take 16.25 minutes. I need to lose 25 000 feet, also in 16.25 minutes. The required ROD is $25\,000/16.25 = 1540$ feet per minute.

46 On the Jeppesen E(LO)1 chart, what are the symbols at Sligo (5354.8N 00849.1W)?

A VOR, NDB, DME, compulsory reporting point

B civil airport, NDB, DME, compulsory reporting point

C civil airport, VOR, DME, non-compulsory reporting point

D VOR, NDB, DME, non-compulsory reporting point

▼ Show Answer

Correct Answer: **B**

The Jeppesen conventions differ slightly from the ICAO ones. The key is given in the introduction to the Jeppesen Student Pilots' Manual.

47 In which month does aphelion occur?

A January

B March

C July

D November

▼ Show Answer

Correct Answer: **C**

48 What is the highest latitude listed below at which the Sun will rise above the horizon and set every day?

A 68°N

B 66°N

C 62°N

D 72°N

▼ Show Answer

Correct Answer: B

The lowest latitude at which there is at least one day a year without a Sunset (Mid-summer Day) and one day a year without a Sunrise (Mid-winter Day) is the Arctic Circle (which is $66\frac{1}{2}^{\circ}\text{N}$). Therefore the Sun will rise and set every day at 62N and 66N. The higher of these two is 66N.

49 The pressure alt is 29 000 feet and the SAT is -55°(C) . What is density altitude?

A 27 500 feet

B 26 000 feet

C 30 000 feet

D 31 000 feet

▼ Show Answer

Correct Answer: A

(Pressure alt + (ISA dev $\times$ 120) gives 27 560; CRP5 gives 27 000)

50 What is the UTC time of Sunrise in Vancouver, British Columbia, Canada (49N 123 30W) on the 6th December? (In the exam, tables were supplied. The answers given below are based on the tables in your Gen Nav notes).

A 2324 UTC

B 0724 UTC

C 1552 UTC

D 0738 UTC

▼ Show Answer

Correct Answer: C

Look up the LMT of Sunrise at 49N on the 6th December. There is 3 minutes change between the 4th Dec and the 7th Dec. So, interpolating, the times at 50N and 45N are 0742 and 0723 respectively. That is a difference of 19 minutes. One-fifth of that is about 4 minutes, so the LMT of Sunrise at 49N on the 6th December is 0738. Now set it out in a table: LMT sunrise at Vancouver 6 Dec 07 LMT Arc/time 123° 30'W (long. west, UTC best) - +08 - UTC 6 Dec 15 UTC Day Hour Minute Time To calculate arc/time, enter the degrees and minutes in DMS format into your calculator and divide by 15.

51 How does scale change on a normal Mercator chart?

- A** Expands as the cosine of the latitude
- B** Expands directly with the secant of the latitude
- C** Correct on the standard parallels, expands outside them, contracts within them
- D** Expands as the secant of the E/W great circle distance

▼ Show Answer

Correct Answer: B

52 You are on an ILS 3-degree glide slope which passes over the runway threshold at 50 feet. Your DME range is 25 NM from the threshold. What is your height above the runway threshold elevation? (Use the 1 in 60 rule and 6000 feet = 1 nautical mile)

- A** 7450 feet

B [Option not in source]

C 6450 feet

D 7550 feet / 8010 feet

■ **Instructor's Note:** Source formatting error — one or more options appear duplicated or missing in the original text. Options shown as extracted; verify against printed copy.

▼ Show Answer

Correct Answer: A

This is just the 1 in 60 rule. A 3-degree glide path gives you 300 feet per nautical mile. 25 NM @ 300 feet per NM is 7500 feet. That would be for a touch-down at zero feet at the runway threshold. However, height over the threshold is 50 feet, which has to be added.

53 When it is 0600 Standard Time in Queensland, Australia, what is the Standard Time in Hawaii, USA? (Disregard Summer Time)

A 0200 ST

B 0600 ST

C 1000 ST

D 1200 ST

▼ Show Answer

Correct Answer: C

As always, use a table: Standard Time at Queensland Today 00 ST STD (long. east, UTC least) - -10 00 - UTC Yesterday 00 UTC STD (long. west, UTC best) - -10 00 - Standard Time at Hawaii Yesterday 1000 00 ST Hour Minute Time Day

54 Please refer to Appendix A. Which of the following is the symbol for an exceptionally high (over 1000 feet AGL) unlit obstruction?

↑ Refer to Figure 1 (Appendix A) above

A 6

B 9

C 10

D 15

▼ Show Answer

Correct Answer: A

55 You are flying at a True Mach No. of .82 in a SAT of -45°(C) . At 1000 hours you are 100 NM from the POL DME and your ETA at POL is 1012. ATC ask you to slow down to be at POL at 1016. What should your new TMN be if you reduce speed at 100 NM distance to go?

A M .76

B M .72

C M .68

D M .61

▼ Show Answer

Correct Answer: D

56 The relative bearing to a beacon is 090°R . Three minutes later, at a ground speed of 180 knots, it has changed to 135°R . What was the distance of the closest point of approach of the aircraft to the beacon?

A 45 NM

B 18 NM

C 9 NM

D 3 NM

▼ Show Answer

Correct Answer: C

57 Ground speed is 540 knots. 72 NM to go. What is time to go?

A 8 min

B 9 min

C 18 min

D 12 min

▼ Show Answer

Correct Answer: A

58 An aircraft at position $2700\text{N } 17000\text{W}$ travels 3000 km on a track of $180^{\circ}(\text{T})$, then 3000 km on a track of $090^{\circ}(\text{T})$, then 3000 km on a track of $000^{\circ}(\text{T})$, then 3000 km on

A track of $270^{\circ}(T)$. What is its final position? / 2700N 17318W

B 0000N/S 17000W

C 2700N 17000W

D 2700N 14300W

▼ Show Answer

Correct Answer: A

The first leg takes it down to the Equator at 170W, the second leg takes it to the Equator at 143W, the third leg takes it to 27N 143W and you then work out the change of longitude of 1620 NM due west departure at 27N, which is $30^{\circ}18' W$, i.e. 17318W. However, you do not need to do the full calculation. You should realize that a departure of 3000 km will give a greater change of longitude at 27N than it will at the Equator. Therefore, the answer must be at 27N, but WEST of the 170W meridian. There is only one option which fits.

59 On the Jeppesen E(LO)1, Baldonnel (5318.0N 00626.9W) is 91 NM DME, Galway (5318.1N 00856.5W) is 50 NM DME. What is your position?

A 5242N 00827W

B 5230N 00834W

C 5255N 00819W

D 5219N 00809W

▼ Show Answer

Correct Answer: B

Plotting question. Solve by measurement on the chart.

60 An aircraft at FL370 is required to commence descent at 120 NM from a VOR and to cross the facility at FL130. If the mean GS for the descent is 288 kt, the minimum rate of descent required is:

A 920 ft/min

B 890 ft/min

C 860 ft/min

D 960 ft/min

▼ Show Answer

Correct Answer: D

You have 120 NM horizontal distance to travel at 288 knots. This will take 25 minutes. You need to lose 24 000 feet in 25 minutes, which is 960 feet per minute.

61 You are homing to overhead a VORTAC and will descend from 7500 QNH to be 1000 AMSL by 6 NM DME. Your ground speed is 156 knots and the ROD will be 1000 feet/min. At what range from the VORTAC do you commence the descent?

A 22.9 NM

B 15.8 NM

C 16.9 NM

D 30.2 NM

▼ Show Answer

Correct Answer: A

You need to lose 6500 feet at a rate of descent of 1000 feet per minute. This will take 6.5 minutes. Flying for this time at a ground speed of 156 knots gives a distance of

16.9 NM. However, this is 6 NM before the DME, so the total distance to start the descent is 22.9 NM.

62 A rhumb line is:

- A the vertex of a conformal polyformic projection / straight line on a Lambert's conformal chart / line on the Earth which cuts all meridians at the same angle
- B *[Option not in source]*
- C *[Option not in source]*
- D the shortest distance between two points on the Earth's surface

🚩 **Instructor's Note:** Source formatting error — one or more options appear duplicated or missing in the original text. Options shown as extracted; verify against printed copy.

▼ Show Answer

Correct Answer: C

63 You fly from 49N to 58N along the 180 E/W meridian. What is the distance in kilometres?

- A 540 km
- B 804 km
- C 1222 km
- D 1000 km

▼ Show Answer

Correct Answer: D

This is a 9-degree change of latitude. You could work this out as 540 NM and then convert it to km, but there is a quicker way. 90 degrees of change of latitude is 10 000 km (see pages 28/29, so a 9 degree change of latitude will be 1000 km.

64 On a particular direct Mercator wall chart, 'the full length of the parallel of latitude at 53N is 133 cm long. What is the scale of the chart at 30S?

A 1: 30 000 000

B 1: 18 000 000

C 1: 21 000 000

D 1: 26 000 000

▼ **Show Answer**

Correct Answer: D

The thing to realize is that on a Mercator chart, meridians are drawn as parallel lines. Therefore the total length of the 53N parallel of latitude will be 133 cm as will be the length of the 30S parallel of latitude. So now find the departure from 180E to 180W at 30S. $\text{Dep} = \text{ch.long} \times \cos 30 = 360 \times 60 \times \cos 30 = 18\,706 \text{ NM}$ You now have a simple scale problem. The Chart length is 133 cm, the Earth Distance is 18 706. This gives you a scale of approximately 1:26 million.

65 What is the highest latitude on the Earth at which the Sun can be vertically overhead?

A $23\frac{1}{2}^\circ$

B $66\frac{1}{2}^\circ$

C 45°

D 90°

▼ Show Answer

Correct Answer: **A**

The Sun would be at its Zenith.

66 Track = 090°(T), TAS = 460 knots, W/V = 360°(T) / 100, Variation = 12°E, Deviation = -2. What is compass heading and ground speed?

A 079° 470 knots

B 067° 450 knots

C 068° 460 knots

D 070° 455 knots

▼ Show Answer

Correct Answer: **B**

Find the true heading in the normal way, then apply variation and deviation. First, check that you have balanced the drift. When deviation is given as East or West then you use the DEVIATION EAST COMPASS LEAST RULE. However, deviation (not variation, only deviation) is sometimes quoted as plus or minus-. In this case the rule is that deviation is what you apply to the compass to get magnetic (not the other way round). So EAST deviation is plus and WEST deviation is minus.

67 Please refer to Appendix A. What symbol is used to show multi unlit obstacles on a map/chart?

↑ Refer to Figure 1 (Appendix A) above

A 5

B 7

C 13

D 11

▼ Show Answer

Correct Answer: **D**

68 The angle between True North and Magnetic North is known as:

A deviation

B dip

C alignment error

D variation

▼ Show Answer

Correct Answer: **D**

69 An aircraft is at 10°N and is flying North at 444 km/hour. After 3 hours the latitude is:

A 10°S

B 02°S

C 22°N

D 00°N/S

▼ Show Answer

Correct Answer: **C**

3×444 is 1332 km. Divide by 1.852 to get 719.2 NM. This has obviously been approximated to 720 to give 12° change of latitude, which takes us to latitude 02°S .

70 Given that: A is $\text{N}55^\circ \text{E/W } 000^\circ$ B is $\text{N}54^\circ \text{E } 010^\circ$, If the average true course of the great circle is $100^\circ(\text{T})$, the true course of the rhumb line at point A is:

A 096°

B 107°

C 104°

D 100°

▼ Show Answer

Correct Answer: **D**

The average great circle track is the rhumb line track.

71 The circumference of the Earth is approximately:

A 40 000 NM

B 10 800 NM

C 5400 NM

D 21 600 NM

▼ Show Answer

Correct Answer: D

You should remember that the distance from the Equator to a Pole is 5400 NM (90° change of latitude $\times$ 60 NM per degree). So the Earth's circumference is 4×5400 , which is 21 600 NM. Alternatively, multiply 360° (a meridian plus the associated anti-meridian) by 60.

72 The angle between the plane of the Equator and the plane of the Ecliptic is:

A 66.5°

B 23.5°

C 25.3°

D 65.6°

▼ Show Answer

Correct Answer: B

73 Position A is at 70S 030W, position B is 70S 060E. What is the great circle track of B from A, measured at A?

A $132^\circ(\text{T})$

B $048^\circ(\text{T})$

C $090^\circ(\text{T})$

D $228^\circ(\text{T})$

▼ Show Answer

Correct Answer: A

The rhumb line track from 70S to 70S is along a parallel of latitude, so it will be 090(T). However, the great circle track will 'cut the corner' and take the shortest route. This will be to the south of 090(T). Draw it out on a Lambert's style projection, or try it on a globe. The conversion angle will be 42 degrees, so this makes the initial great circle track 132(T).

74 The value of magnetic variation on a chart changes with time. This is due to:

- A Movement of the magnetic poles, causing an increase
- B Increase in the magnetic field, causing an increase
- C Reduction in the compass deviation, causing a decrease
- D Movement of the magnetic poles, which can cause either an increase or a decrease

▼ Show Answer

Correct Answer: D

GHOST AVIATOR

75 Isogonal lines converge as follows:

- A At the North Magnetic Pole
- B At the North and South Magnetic and both Geographical Poles
- C At the North and South Magnetic Poles
- D At the Magnetic equator.

▼ Show Answer

Correct Answer: B

76 Position A is 55N 30W. Position B is 54N 20W. The great circle track from A to B, measured at A, is $100^{\circ}(T)$. What is the rhumb line bearing from A to B?

- A $104^{\circ}(T)$
- B $090^{\circ}(T)$
- C $100^{\circ}(T)$
- D $284^{\circ}(T)$

▼ Show Answer

Correct Answer: A

77 An aircraft departs a point 0400N 17000W and flies 240 NM South, followed by 240 NM East, then 240 NM North, then 240 NM West. What is its final position?

- A 0400N 17000W

B 0600S 17000W

C 0400N 170°35.9'W

D 0400N 170°01.8'W

▼ Show Answer

Correct Answer: **C**

6°S is a greater value of latitude than 4°N. Therefore, for a given departure, you get a greater change of longitude eastwards. When you come back to 4°N again, 600 NM does not take you so far westwards. So you will finish up east of where you started.

78 At 1000 hours an aircraft is on the 310 radial from a VOR/DME, at 40 nautical miles range. At 1015 the radial and range are 040/40 NM. What is the aircraft's track and ground speed?

A 080° / 226 knots

B 085° / 226 knots

C 080° / 56 knots

D 085° / 90 knots

▼ Show Answer

Correct Answer: **B**

79 A straight line is drawn on a North Polar Stereographic chart joining Point A (7000N 06000W) to Point B (7000N 06000E). What is the initial track direction (going eastwards) of the line at A ?

A 090°(T)

B 030°(T)

C 120°(T)

D 330°(T)

▼ Show Answer

Correct Answer: B

80 What is the maximum possible value of Dip Angle at either Pole?

A 66°

B 180°

C 90°

D 45°

▼ Show Answer

Correct Answer: C

81 Given: Magnetic heading 311° Drift is 10° left Relative bearing of NDB 270 What is the magnetic bearing of the NDB measured from the aircraft?

A 221°

B 208°

C 211°

D 180°

▼ Show Answer

Correct Answer: A

82 The initial straight track from A(75N 60E) to B(75N 60W) on a Polar Stereographic chart is:

A 030°

B 360°

C [Option not in source]

D 060° / 330°

■ **Instructor's Note:** Source formatting error — one or more options appear duplicated or missing in the original text. Options shown as extracted; verify against printed copy.

▼ Show Answer

Correct Answer: D

83 Given: Runway direction 083°(M), Surface W/V 035/35 kt. Calculate the effective crosswind component.

A 24 kt

B 26 kt

C 31 kt

D 34 kt

▼ Show Answer

Correct Answer: **B**

CRP-5

84 Given: For take-off an aircraft requires a headwind component of at least 10 kt and has a cross-wind limit of 35 kt. The angle between the wind direction and the runway is 45° . Calculate the maximum and minimum allowable wind speeds.

A 15 kt and 50 kt

B 15 kt and 43 kt

C 12 kt and 38 kt

D 18 kt and 50 kt

▼ Show Answer

Correct Answer: **A**

85 What is the weight in kilograms of 380 US Gallons at a Specific Gravity of 0.78?

A 1123

B 2470

C 5434

D 543

▼ Show Answer

Correct Answer: A

Either use the CRP-5 or remember that there are 5 imperial gallons to 6 US.gal and the imp.gal to litres conversion is 4.55. Then multiply by .78 to get the weight in kg, i.e. $380 \times 5/6 \times 4.55 \times .78 = 1123.85$ It is probably easier with the CRP-5.

86 You leave A to fly to B, 475 NM away, at 1000 hours. Your ETA at B is 1130. At 1040, you are 190 NM from A. What ground speed is required to arrive on time at B?

A 342 knots

B 330 knots

C 317 knots

D 360 knots

▼ Show Answer

Correct Answer: A

Distance still remaining = $475 - 190 = 285$ NM. Time to go = $1130 - 1040 = 50$ min

87 What is the aircraft position in lat and long given the following (use Jeppesen chart E(LO)1): CRN (5318N 00857W) 18 DME SHA (5243N 00853W) 20 DME Heading 270(M) Both ranges DME increasing

A 5201N 00908W

B 5301N 00908W

C 5302N 00843W

D 5203N 00843W

▼ Show Answer

Correct Answer: **B**

Plotting question. Solve by measurement on the chart. An explanation of the point about 'both DME distances decreasing' is given in the Plotting chapter.

88 What is the NDB frequency and ident at 5211N 00932W? - Use E(LO)1)

- A Kerry NDB - 113MHz and KER
- B Cork NDB - 343KHz and OC
- C Waterford NDB - 368MHz and WTD
- D Kerry NDB - 334KHz and KER

▼ Show Answer

Correct Answer: **D**

The Jeppesen conventions differ slightly from the ICAO ones. The key is given in the introduction to the Jeppesen Student Pilots' Manual.

89 What is the mean magnetic track and distance from the BAL VOR (5318N 00627W) to CFN NDB (5502N 00820W)? - (use E(LO)1)

- A 335° 125
- B 148° 125
- C 328° 134
- D 148° 134

▼ Show Answer

Correct Answer: **A**

Plotting question. Solve by measurement on the chart.

90 You are at position 5340N 00800W. What is the QDR from the SHA VOR (5243N 00853W)? - (Use E(LO)1)

A 217

B 037

C 209

D 029

▼ Show Answer

Correct Answer: **B**

Plotting question. Solve by measurement on the chart.

91 Your radial from the SHA VOR (5243N 00853W) is 120°(M). From the CRK VOR (5151N 00830W), the radial is 033°(M). What is your position? - (use E(LO)1)

A 5230N 00820W

B 5240N 00821W

C 5220N 00821W

D 5230N 00800W

▼ Show Answer

Correct Answer: **D**

Plotting question. Solve by measurement on the chart.

92 Which of the following differences in latitude will give the biggest difference in the initial great circle track and the mean great circle track between two points separated by 10° change of longitude?

A 60N and 60S

B 60N and 60N

C 30S and 30N

D 30S and 25S

▼ Show Answer

Correct Answer: B

The mean great circle is the same as the rhumb line track. The question is asking which pairs of latitudes will give the greatest difference between great circle and rhumb line track, i.e. which will give the greatest conversion angle? The ca formula is $\frac{1}{2} \text{ ch. long } \sin \text{ mean lat.}$ If you keep the $\frac{1}{2} \text{ ch. long}$ constant for all cases, then you are asking which pairs of latitudes will give you the greatest sine mean lat.

93 An aircraft is at 5530N 03613W, where the variation is 15W. It is tuned to a VOR located at 5330N 03613W, where the variation is 12W. What VOR radial is the aircraft on?

A 348

B 012

C 165

D 015

▼ Show Answer

Correct Answer: B

The longitudes are the same so, from the given lats and longs, the true bearing of the aircraft from the VOR is 000/360. For VOR, you take the variation at the VOR, because the bearing is measured at the beacon. (For an ADF bearing, it would be the variation at the aircraft, because that is where the variation is measured).

94 The wind velocity is 359/25. An aircraft is heading 180 at a TAS of 198 knots. (All directions are True). What is its track and ground speed?

A 179 223

B 179 220

C 180 220

D 180 223

▼ Show Answer

Correct Answer: D

The air vector is 5 times as long as the wind vector, so the direction will be nearer 180 than 179. Try drawing the triangle of velocities out as a diagram.

95 An aircraft's compass must be swung:

A If the aircraft has been in the hangar for a long time and has been moved several times.

B If the aircraft has been subjected to hammering.

C Every maintenance inspection

D After a change of theatre of operations at the same magnetic latitude.

▼ Show Answer

Correct Answer: **B**

96 Civil Twilight occurs between:

A Sunset and 6° below the horizon

B 6° and 12° below the horizon

C 12° and 18° below the horizon

D Sunrise and Sunset

▼ Show Answer

Correct Answer: **A**

GHOST AVIATOR

97 What is the dip angle at the North Magnetic Pole?

A 0°

B 90°

C 180°

D 64°

▼ Show Answer

Correct Answer: B

98 What is a line of equal gravitation?

A An isocline

B An isogonal

C An isogriv

D An isovar

▼ Show Answer

Correct Answer: C

99 What is the reason for seasonal changes in climate?

A Because the Earth's spin axis is inclined to the plane of its orbit round the Sun

B Because the distance between the Earth and the Sun varies over a year

- C** Because the Earth's orbital speed round the Sun varies according to the time of the year
- D** Because of the difference between the Tropical Year and the Calendar Year

▼ Show Answer

Correct Answer: A

The combination of the inclination of the ecliptic to the Equator and the orbit of the Earth round the Sun produces a constantly changing declination. The predominant cause of the seasons is the inclination (tilt) of the Earth.

100 The aircraft position is at 5330N 00800W. The VORs are tuned to Shannon (SHA, 5243N 00853W) and Connaught (CON, 5355N 00849W). Which radials will be indicated? SHA. CON

- A** 033 130
- B** 221 318
- C** 042 138
- D** 213 310

▼ Show Answer

Correct Answer: C

Radials radiate. That is what the word means. In other words they are, by definition, the magnetic bearing FROM the VOR. On the VOR in the aircraft you have a needle with 2 ends. The sharp end points to the VOR and is the QDM, or mag track to the VOR and the other end points to the QDR, or radial, which is the mag bearing from the VOR.

101 You are on the 205 radial from the Shannon VOR (SHA, 5243N 00853W) and on the 317 radial from Cork VOR (CRK, 5150N 00830W). What is the aircraft position?

A 5205N 00915W

B 5215N 00917W

C 5118N 00913W

D 5210N 00909W

▼ Show Answer

Correct Answer: D

Plotting question. Solve by measurement on the chart.

102 What is the radial and DME distance from Connaught VOR/DME (CON, 5355N 00849W) to overhead Abbey Shrile aerodrome (5336N 00739W)?

A 304 47 NM

B 124 47 NM

C 296 46 NM

D 116 46 NM

▼ Show Answer

Correct Answer: B

Plotting question. Solve by measurement on the chart.

103 What is the average magnetic track and distance between Kerry NDB (KER, 5211N 00932W) and CarNMore NDB (CRN, 5318N 00856W)?

A 025 70 NM

B 197 71 NM

C 017 70 NM

D 205 71 NM

▼ Show Answer

Correct Answer: A

Plotting question. Solve by measurement on the chart.

104 What is the approximate course (T) and distance between Waterford NDB (WTD, 5212N 00705W) and Sligo NDB (SLG, 5417N 00836W)?

A 344 139 NM

B 164 138 NM

C 156 136 NM

D 336 137 NM

▼ Show Answer

Correct Answer: D

Plotting question. Solve by measurement on the chart.

105 What is the rhumb line track from A (4500N 01000W) to B (4830N 00500W)?

A 045°T

B 030°T

C 225°T

D 150°T

▼ Show Answer

Correct Answer: A

106 What is the effect on the Mach number and TAS in an aircraft that is climbing with constant CAS?

A Mach number decreases; TAS decreases

B Mach number increases; TAS remains constant

C Mach number increases; TAS increases

D Mach number remains constant; TAS increases

▼ Show Answer

Correct Answer: C

As the air becomes less dense, the aircraft has to fly faster through it (TAS) to experience the same dynamic pressure (CAS). So the TAS is increasing, which means that the Mach No. would also increase even if there were no temperature change. However, in addition, temperature normally decreases with increasing altitude. This means that the speed of sound will decrease so, for a given TAS, the Mach No. will increase, giving an additional effect.

107 Please refer to Appendix A. What is the chart symbol for a lightship?

↑ Refer to Figure 1 (Appendix A) above

A 6

B 8

C 9

D 12

▼ Show Answer

Correct Answer: B

108 Given: Track 198° , Heading 184° , TAS 427 kt and GS 453kt, what are the W/V and Drift Angle?

A $280^\circ/110\text{kt}$ and 14°P

B $087^\circ/109\text{kt}$ and 14°S

C $116^\circ/110\text{kt}$ and 14°S

D $294^\circ/110\text{kt}$ and 14°P

▼ Show Answer

Correct Answer: B

109 An aircraft is on the 025 radial from Shannon VOR (SHA, 5243N 00853W) at 49 DME. What is its position?

A 5329N 00930W

B 5239N 00830W

C 5229N 00930W

D 5329N 00830W

▼ Show Answer

Correct Answer: D

Plotting question. Solve by measurement on the chart.

110 An island is observed to be 15° (T) to the left. The aircraft heading is 120° (M), variation 17° (W). The bearing ($^\circ$ T) from the aircraft to the island is:

A 268

B 302

C 088

D 122

▼ Show Answer

Correct Answer: C

Apply 17° W variation to 120° (M) to get 103° (T) heading. The island is 15° (T) to the left, which makes the true bearing TO the island 088° (T).

111 An aircraft is flying around the Earth eastwards along the 60° N parallel of latitude at a ground speed of 360 knots. At what ground speed would another aircraft have to fly eastwards along the Equator to fly once round the Earth in the same journey time?

A 600 knots

B 240 knots

C 720 knots

D 120 knots

▼ Show Answer

Correct Answer: C

This is a departure problem. In one hour, the aircraft covers 360 NM. The departure formula is: Departure = change of longitude (minutes) $\times$ cosine latitude 360 NM = change of longitude (minutes) $\times$ cosine 60 (which is 0.5) Change of longitude = 720 minutes. At the Equator, 720 minutes = 720 NM, which also has to be covered in one hour.

112 If it is 0700 hours Standard Time in Kuwait, what is the Standard Time in Algeria?

A 0500 hours

B 0900 hours

C 1200 hours

D 0300 hours

▼ Show Answer

Correct Answer: A

As always, use a table: Standard Time at Kuwait Today 00 ST STD (long. east, UTC least) - -3 00 - UTC Today 00 UTC STD (long. east, UTC least) +1 00 - Standard Time at Algeria Today 0500 00 ST Hour Minute Time Day

113 If variation is East, then:

- A True North is West of Magnetic North
- B Compass North is West of Magnetic North
- C True North is East of Magnetic North
- D Magnetic North is West of Compass North

▼ Show Answer

Correct Answer: A

114 At what latitude does the maximum difference between geodetic and geocentric latitude occur?

- A 0°
- B 45°
- C 60°
- D 90°

▼ Show Answer

Correct Answer: B

115 At what times of the year does the length of the hours of daylight change most rapidly?

- A Spring Equinox and Autumn Equinox

B Summer Solstice and Winter Solstice

C Spring Equinox and Summer Solstice

D Autumn Equinox and Winter Solstice

▼ Show Answer

Correct Answer: **A**

116 Given: Aircraft height = 2500 feet, ILS GP angle = 3° , at what approximate distance from the threshold can you expect to intercept the glide-path?

A 8.0 NM

B 14.5 NM

C 13.1 NM

D 7.0 NM

▼ Show Answer

Correct Answer: **A**

This is just the 1 in 60 rule. A 3-degree glide path gives you 300 feet per nautical mile. Divide 2500 feet by 300 feet and the answer is just over 8 nautical miles.

117 Convert 80 metres/sec into knots.

A 155 knots

B 55 knots

C 160 knots

D 16 knots

▼ Show Answer

Correct Answer: A

To convert metres into NM, divide by 1852. This gives you NM per second. Now multiply by 60×60 to convert to NM per hour, i.e. $\text{knots} \times 3600/1852 = 155 \text{ knots}$

118 The chart that is generally used for navigation in polar areas is based on a:

A Direct Mercator Projection

B Gnomonic projection

C Lambert conformal projection

D Stereographic projection

▼ Show Answer

Correct Answer: D

Polar navigation can be (and often is) carried out on a Polar Stereographic, a Transverse Mercator or an Oblique Mercator, in fact, but the JAA consider Polar Stereographic to be the preferred answer.

119 Which of the following conversions from True to Compass is the correct one? T V M D. C

A 130 2W 132 -1 131

B 130 2E 132 -1 133

C 130 2W 132 -1 133

D 130 2E 132 -1 131

▼ Show Answer

Correct Answer: **C**

120 Your position is 5833N 17400W. You fly exactly 6 NM westwards. What is your new position?

A 5833N 17411.5W

B 5833N 17355W

C 5833N 17340W

D 5833N 17348.5W

▼ Show Answer

Correct Answer: **A**

This is a departure problem. The departure formula is: Departure = change of longitude (minutes) $\times$ cosine latitude
 $6 \text{ NM} = \text{change of longitude (minutes)} \times \cos 58^\circ 33'$
Change of longitude = $6 / .5218 = 11.5$ minutes (westwards) from 174°00'W

121 TAS = 240 knots. Track is 180°(T). The relative bearing from an NDB is 315(R) at 1410. At 1420 the bearing has changed to 270(R). What is your distance from the NDB at 1420?

A 40 NM

B 50 NM

C 60 NM

D 70 NM

▼ Show Answer

Correct Answer: **A**

This is covered in detail in the 'General Navigation Problems' Chapter. The numbers are different but the principle is the same. If the question does not give you any wind information, you can only assume that $TAS = G/S$.

122 Given: True Track = 352 Variation = 11W Deviation = - 5 Drift = 8°R What is Heading (C)?

A 078°(C)

B 346°(C)

C 000°(C)

D 025°(C)

▼ Show Answer

Correct Answer: **C**

Do not forget that a deviation of -5° is equivalent to 5°W.

123 What is the radial and DME distance from CRK VOR (5151N 00830W) to position 5220N 00910W?

A 322(M) 39 NM

B 330(M) 41 NM

C 330(M) 39 NM

D 322(M) 41 NM

▼ Show Answer

Correct Answer: **C**

Plotting question. Solve by measurement on the chart.

124 What is the radial and DME distance from SHA VOR (5243N 00853W) to Birr airport (5304N 00755W)?

A 068(M) 42 NM

B 060(M) 40 NM

C 068(M) 40 NM

D 060(M) 42 NM

▼ Show Answer

Correct Answer: **A**

Plotting question. Solve by measurement on the chart.

125 What is the lat and long of the SHA VOR (5243N 00853W) 239(M)/36 NM radial/range?

A 5215N 00930W

B 5220N 00937W

C 5212N 00930W

D 5212N 00915W

▼ Show Answer

Correct Answer: **B**

Plotting question. Solve by measurement on the chart.

126 A Lambert conformal conic chart has a constant of the cone of 0.80. A straight line course drawn on this chart from A (53°N 004°W) to B is 080° at A; course at B is 092°. What is the longitude of B?

A 019°E

B 008°E

C 009°36'E

D 011°E

▼ Show Answer

Correct Answer: **D**

'Constant of the cone' is just another term for 'sine of the parallel of origin'. Chart convergence = change of longitude $\times$ sin parallel of origin 12° = change of longitude $\times$ 0.80 Change of longitude = 15° 15° eastwards from 004°W is 011°E.

127 An aircraft at position 0000N/S 16327W flies a track of 225°(T) for 70 NM. What is its new position?

A 0049N 16238W

B 0049S 16238W

C 0049N 16416W

D 0049S 16416W

▼ Show Answer

Correct Answer: **D**

Resolve 70 NM along a track of 225 into their change of latitude and change of longitude, i.e. $70 \sin 45$ and $70 \cos 45$. This gives 49 NM south and 49 NM west. As you are at the Equator, you can take the 49 NM west as 49 min change of longitude - you do not need the departure formula. So the final position is 49 min south and 48 min west of the original position.

128 On a Polar Stereographic map, a straight line is drawn from position A (70N 102W) to position B (80N 006E). The point of highest latitude along this line occurs at longitude 035W. What is the straight-line track angle from B to A, measured at B?

A 023°(T)

B 077°(T)

C 229°(T)

D 131°(T)

▼ Show Answer

Correct Answer: **D**

129 Given that the value of ellipticity of the Earth is $1/297$ and that the semi-major axis of the Earth, measured at the axis of the Equator is 6378.4 km, what is the semi-minor axis of the Earth measured at the axis of the Poles?

A 6399.9 km

B 6367.0 km

C 6378.4 km

D 6356.9 km

▼ Show Answer

Correct Answer: D

The only problem with this question is the language, not the concept. The question is telling us that the polar diameter and the equatorial diameter of the Earth are in the ratio 296:297. The 'semi-major axis of the Earth, measured at the axis of the Equator' is simply half the equatorial diameter and the 'semi-minor axis of the Earth measured at the axis of the Poles' is half the Polar diameter. We need to find half the Polar diameter, or the Polar radius. $\text{Polar radius} / 6378.4 = 296 / 297$ So Polar radius = 6356.9 km Alternatively, you could remember from page 3 that the Polar diameter is 43 km shorter than the equatorial diameter. So the radius or semi-diameter will be 21.5 km shorter. $6378.4 - 21.5 = 6356.9$ km. Either method gives you the right answer.

GHOST AVIATOR

130 On a chart, meridians at 45N are shown every 10 degrees apart. This is shown on the chart by a distance of 14 cm. What is the scale?

A 1: 2 000 000

B 1: 4 000 000

C 1: 5 000 000

D 1: 5 600 000

▼ Show Answer

Correct Answer: D

This is a combination of a departure and a representative fraction (scale) problem.

Departure = change of longitude $\times$ cos latitude = 10° ($\times 60$, to get minutes) $\times 0.7071 = 424.3$ NM
Scale = Chart Length / Earth Distance = $14 \text{ cm} / (424.3 \times 1852 \times 100) = 1 / 5.6 \text{ Million (approx)}$, which is closest to (d).

131 Please refer to Appendix A. Which is the symbol for a NDB?

↑ Refer to Figure 1 (Appendix A) above

A 4

B 5

C 2

D 14

▼ Show Answer

Correct Answer: C

132 How do rhumb lines (with the exception of meridians) appear on a Polar Stereographic chart?

A concave to the nearer pole

B convex to the nearer pole

C ellipses round the pole

D straight lines

▼ Show Answer

Correct Answer: A

133 Please refer to Appendix A. What does symbol 9 represent?

↑ Refer to Figure 1 (Appendix A) above

A lit obstacle

B lighthouse

C VRP

D aeronautical ground light

▼ Show Answer

Correct Answer: A

134 What is the chart convergence factor on a Polar Stereographic chart?

A 0

B 1.0

C 0.866

D 0.5

▼ Show Answer

Correct Answer: **B**

135 At 0422 you are 185 NM from a VOR at FL370. You need to descend at a mean descent rate of 1800'/min to be at FL80 overhead the VOR. Your ground speed in the level cruise is currently 320 knots. In the descent your mean G/S will be 232 knots. What is the latest time to commence descent?

A 0437

B 0441

C 0445

D 0451

▼ Show Answer

Correct Answer: **C**

There are 2 parts to this profile. You are going to continue to fly at FL370 until the top of descent, and then descend to FL80. The question is asking for the ETA for top of descent. From FL370 to FL80 is 29 000 feet. At 1800 feet per minute, that is 16.1 minutes. Your mean ground speed in the descent is 232 knots so, for 16.1 min, that is 62 NM in the descent. Your total distance to run is 185 NM. If there are 62 NM in the descent, the high level distance to top of descent is 123 NM. 123 NM @ your level ground speed of 320 is 23 min. Add 23 to 0422 to get 0445.

136 Given: Heading 165(M), Variation 25W, Drift 10°R, G/S 360 knots. At 'A' your relative bearing to an NDB is 325R. Five minutes later, at 'B', the relative bearing is 280(R). What is the true bearing and distance from 'B' to the NDB?

A 060°(T) 40 NM

B 105°(T) 30 NM

C 060°(T) 30 NM

D 105°(T) 40 NM

▼ Show Answer

Correct Answer: C

True heading is 140, true track is 150. Relative bearing at A is 35° left of the nose, ie a true bearing of 105 to the NDB. At B, the NDB is 80 left of the nose, true bearing to the NDB is 060. So you now have 3 lines. A track line of 150, and a bearing from A of 105 and a bearing from B of 060. This gives a right angles isosceles triangle, with the 2 short sides being 30 NM long (5 minutes at 360 knots G/S). Draw it out and it become obvious.

137 What is the diameter of the Earth?

A 40 000 km

B 12 732 km

C 21 600 km

D 6366 km

▼ Show Answer

Correct Answer: B

You are not supposed to remember the diameter of the Earth. But you should know that the circumference of the Earth is 40 000 km. Circumference = $2 \pi r$ (or πd). So divide 40 000 km by π .

138 An aircraft flies 100 stat.m in 20 minutes. How long does it take to fly 215 NM?

A 50 min

B 37 min

C 57 min

D 42 min

▼ Show Answer

Correct Answer: A

Use the CRP-5.

139 What is the duration of civil twilight?

A From the moment when the centre of the Sun is on the sensible horizon until the centre reaches a depression angle of 6° from the sensible horizon.

B From the moment when the tip of the Sun disappears below the sensible horizon until the centre reaches a depression angle of 6° from the sensible horizon.

C From the moment when the centre of the Sun is on the visual horizon until the centre reaches a depression angle of 6° from the sensible horizon.

D From the moment when the tip of the Sun disappears below the visual horizon until the centre reaches a depression angle of 6° from the sensible horizon.

▼ Show Answer

Correct Answer: **D**

- 140 Please refer to Appendix B (or your Jeppesen E(LO)1). From the Connaught (CON, 5355N 00849W) VOR / DME, you plot a radial of 048°(M) and a range of 22 NM. What is the aircraft position?

↑ Refer to Figure 2 (Appendix B) above

A 5410N 00844W

B 5350N 00821W

C 5407N 00837W

D 5411N 00824W

▼ Show Answer

Correct Answer: **D**

Plotting question. Solve by measurement on the chart.

- 141 What is the shortest distance between Point 'A' (3543N 00841E) and Point 'B' (5417N 17119W)?

A 5400 NM

B 6318 NM

C 6557 NM

D 6000 NM

▼ Show Answer

Correct Answer: **A**

Plotting question. Solve by measurement on the chart.

142 On a conformal chart, the standard parallels are $41^{\circ} 20'N$ and $11^{\circ} 40'N$. What is the constant of the cone?

A .660

B .202

C .446

D .895

▼ Show Answer

Correct Answer: **C**

On a Lambert chart, the parallel of origin is midway between the 2 Standard Parallels, which in this case is $26^{\circ}30'$. $\sin 26^{\circ}30'$ is 0.446.

143 Given: Runway direction $083^{\circ}(M)$, Surface W/V $045/35$ kt. Calculate the effective headwind component.

A 29 kt

B 27 kt

C 31 kt

D 34 kt

▼ Show Answer

Correct Answer: **A**

144 Given: TAS=375 Trk=335°(T) W/V=340°(T)/50 What is heading and Ground speed?

A 335°(T) 322

B 335°(T) 318

C 336°(T) 326

D 333°(T) 326

▼ Show Answer

Correct Answer: C

145 Lines of latitude on a chart are always:

A Great circles

B Small circles except for the Equator

C Vertices

D Meridians

▼ Show Answer

Correct Answer: B

146 On a Lambert chart, the convergence factor is .78585. What is the parallel of tangency?

A 51°02'

B 51°36'

C 51°15'

D 51°48'

▼ Show Answer

Correct Answer: D

The 'constant of the cone' is the sine of the parallel of origin (or tangency). Simply use your calculator to find the arc sine of 0.78585. Use the DMS button if you need to convert the answer from degrees and decimal degrees to degrees and minutes.

147 On a Lambert's chart the constant of the cone is 0.80. A is at 53N 04W. You plan to fly to B. The initial Lambert's chart straight-line track is 070(T) and the rhumb line track from A to B is 080(T). What is the longitude of B?

A 021E

B 034W

C 011E

D 015E

▼ Show Answer

Correct Answer: A

The 'constant of the cone' is another term for the sine of the parallel of origin. The initial straight-line track is 070 and the mean is 080. Therefore half chart

convergence is 10 degrees, so the chart convergence between A and B is 20 degrees.
Chart convergence = change of longitude $\times$ sine parallel of origin Therefore change of longitude = chart convergence/sin parallel of origin Change of longitude = $20/.8 = 25$ degrees. 25 degrees east of 004W is 021E.

148 On which chart projection is it not possible to show the North Pole?

- A Direct Mercator
- B Lambert's
- C Transverse Mercator
- D Polar Stereographic

▼ Show Answer

Correct Answer: A

The North Pole is in the hole at the end of the cylinder.

149 You are at FL150 and the SAT is -5°(C) . You are over an airport with an elevation of 720 feet. The QNH is 1003. Assume 27 feet = 1 hPa. What is your true height?

- A 14 300 feet
- B 15 300 feet
- C 14 700 feet
- D 15 600 feet

▼ Show Answer

Correct Answer: C

(The correct answer is 14 610, but 14 700 was the nearest option).

150 What is the formula for conversion angle?

- A Change of longitude $\times$ Sine latitude
- B Change of longitude / 2 $\times$ Sine mean longitude
- C Change of longitude / 2 $\times$ Sine mean latitude
- D Change of longitude $\times$ Cosine latitude

▼ Show Answer

Correct Answer: C

151 On the Polar Stereographic projection, a great circle appears as:

- A straight line / curve which becomes more near to a straight line as the latitude increases / curve convex to the nearer pole
- B *[Option not in source]*
- C *[Option not in source]*
- D a curve which can be concave or convex to the nearer pole, depending on the latitude

► **Instructor's Note:** Source formatting error — one or more options appear duplicated or missing in the original text. Options shown as extracted; verify against printed copy.

▼ Show Answer

Correct Answer: **B**

152 An aircraft departs Guam (13N 145E) at 2300 Standard Time on 30th April local date. Flight time to Los Angeles, California, USA (34N 118W) is 11 hours 15 minutes. What is the California Standard Time and local date of arrival? Assume Summer Time is being kept.

A 1715 ST 30 Apr

B 1215 ST 01 May

C 1315 ST 01 May

D 1615 ST 30 Apr

▼ Show Answer

Correct Answer: **A**

As always, use a table: Standard Time at Guam 30 Apr 00 ST STD (long east, UTC least) -10 00 UTC 30 Apr 00 UTC Flight Time +11 UTC arrival at Los Angeles 01 May 00 UTC STD (long west, UTC best) -8 00 Standard Time at LA 30 Apr 16* ST Hour Minute Time Day * But California Summer Time rules apply. Add an hour to get 1715.

153 What rate of descent is required to maintain a 3.5° glide slope at a ground speed of 150 knots?

A 850 fpm

B 800 fpm

C 600 fpm

D 875 fpm

▼ Show Answer

Correct Answer: **D**

154 What is the meaning of the term 'standard time'?

- A It is another term for UTC
- B It is the time zone system applicable only in the USA.
- C It is an expression for local mean time.
- D It is the time set by the legal authorities for a country or part of a country.

▼ Show Answer

Correct Answer: **D**

155 On 27 Feb at 52°S 040°E Sunrise is at 0243UTC. On the same day at 52°S 035°W the time of Sunrise is:

- A 0743 UTC
- B 0243 UTC
- C 2143 UTC
- D 0543 UTC.

▼ Show Answer

Correct Answer: **A**

The change in longitude between 040°E and 035°W is 75°. The Earth rotates at 15° per hour, so this is equivalent to 5 hours of time. The Earth rotates eastwards, so a westerly longitude will have a later UTC Sunrise time.

156 A compass swing is performed in order to correct for:

- A acceleration
- B deviation
- C variation
- D aperiodicity

▼ Show Answer

Correct Answer: B

157 Isogonals are lines of equal:

- A compass deviation
- B magnetic variation
- C wind velocity
- D pressure

▼ Show Answer

Correct Answer: B

158 On a direct Mercator chart, a rhumb line appears as a:

- A small circle concave to the nearer pole
- B straight line
- C curve convex to the nearer pole
- D spiral curve

▼ Show Answer

Correct Answer: B

159 Given: IAS 120 kt FL80 OAT +20°C What is the TAS?

- A 141 kt
- B 102 kt
- C 120 kt
- D 132 kt

▼ Show Answer

Correct Answer: A

160 The distance between two waypoints is 200 NM. To calculate compass heading the pilot used 2°E magnetic variation instead of 2°W. Assuming that the forecast W/V applied, what will the off track distance be at the second waypoint?

- A 14 NM

B 7 NM

C 0 NM

D 21 NM

▼ Show Answer

Correct Answer: A

This is just the one in sixty rule. The variation is 4° in error. For each 60 NM between waypoints, the aircraft will be 4 NM off track. $\text{Dist off} = \frac{\times 200}{60} = 13\frac{1}{3} \text{ NM}$

161 Given: True course 300° Drift 8°R Variation 10°W Deviation -4° Calculate the compass heading.

A 322°

B 306°

C 278°

D 294°

▼ Show Answer

Correct Answer: B

The JAA use the term 'course' to mean 'desired track'. If the drift is 8° starboard, the true heading is 292°(T). With 10°W variation, this is 302°(M). Negative deviation must be applied to the compass to give magnetic heading, so the compass heading is 306°(M). In other words, -4° deviation is the same as 4°W.

162 Given: True track 180° Drift 8°R Compass Heading 195° Deviation -2° Calculate the variation.

A 21°W

B 25°W

C 5°W

D 9°W

▼ Show Answer

Correct Answer: A

If the compass heading is 195C, apply -2 degrees deviation to get 193 Mag heading. If you have a True Track of 180 and 8 degrees starboard drift, the true heading must be 172(T). With a heading of 172(T) and 195(M), you have 21 degrees West variation.

163 Given the following: Magnetic heading: 060° Magnetic variation: 8°W Drift angle: 4° right What is the true track?

A 064°

B 056°

C 072°

D 048°

▼ Show Answer

Correct Answer: B

Apply 8°W variation to 060°(M) to get 052°(T). With 4° starboard drift, the true track is 056°(T).

164 Given: W/V 262/90 kt, Track 234° and TAS 305 kt, what are the Heading and Groundspeed?

A 226° and 224 kt

B 252° and 214 kt

C 242° and 224 kt

D 250° and 224 kt

▼ Show Answer

Correct Answer: C

165 Given: Half way between two reporting points the navigation log gives the following information: TAS 360 kt W/V 330°/80 kt Compass heading 237° Deviation on this heading -5° Variation 19°W What is the average ground speed for this leg?

A 403 kt

B 354 kt

C 373 kt

D 360 kt

▼ Show Answer

Correct Answer: A

166 (For this question use Appendix C) Complete line 5 of the 'FLIGHT NAVIGATION LOG', position 'J' to 'K'. What is the HDG°(M) and ETA?

↑ Refer to Figure 3 (Appendix C) above

A HDG 337° - ETA 1422 UTC

B HDG 320° - ETA 1412 UTC

C HDG 337° - ETA 1322 UTC

D HDG 320° - ETA 1432 UTC

▼ Show Answer

Correct Answer: A

167 During a low level flight 2 parallel roads are crossed at right angles by an aircraft. The time between these roads can be used to check the aircraft:

A track

B drift

C ground speed

D heading

▼ Show Answer

Correct Answer: C

Ground speed is the only of these options which depends on time difference.

168 The angle between the true great circle track and the true rhumb line track joining the following points: A (60S 165W) and B (60S 177E) at the place of departure A, is:

A 9°

B 15.6°

C 5.2°

D 7.8°

▼ Show Answer

Correct Answer: D

This is a conversion angle problem: Conversion angle = $\frac{1}{2}$ change of longitude $\times$ sine latitude = $\frac{1}{2} \times \times 0.866 = 7.8^\circ$

169 Which of the following indicates an advisory airspace (ADA) boundary?

A [Chart symbol — see printed exam paper]

B [Chart symbol — see printed exam paper]

C [Chart symbol — see printed exam paper]

D [Chart symbol — see printed exam paper]

■ **Instructor's Note:** Options for this question are visual chart symbols that cannot be reproduced as text. Refer to the printed examination paper or syllabus chart legend.

▼ Show Answer

Correct Answer: C

170 Given the following: True track: 192° Magnetic variation: 7°E Drift angle: 5° left
What is the magnetic heading required to maintain the given track?

A 180°

B 190°

C 194°

D 204°

▼ Show Answer

Correct Answer: B

$192^{\circ}(T) + 7E \text{ Var} = 185^{\circ}(M)$ ag Track. With 5° of left drift, you need to aim off $5^{\circ}(T)$ to the right, onto a Mag heading of $190^{\circ}(M)$.

171 Given: A Polar Stereographic chart whose grid is aligned with the zero meridian. Grid track 344° , longitude $115^{\circ}00'W$, calculate the true course. (Assume N hemisphere).

A 099°

B 279°

C 049°

D 229°

▼ Show Answer

Correct Answer: D

The datum meridian is Greenwich, so the aircraft is 115° West of the datum in the Northern hemisphere. Therefore convergence is $115^{\circ}E$. Convergence East – True Least. So True track will be 115 degrees less than Grid Track. $344^{\circ}(G) - 115^{\circ}(C)onvergence = 229^{\circ}(T)$.

172 The rhumb line distance between points A ($60^{\circ}00'N$ $002^{\circ}30'E$) and B ($60^{\circ}00'N$ $007^{\circ}30'W$) is:

A 300 NM

B 450 NM

C 600 NM

D 150 NM

▼ Show Answer

Correct Answer: A

Rhumb line distance between 2 points at the same latitude is the Departure.
Departure = change of longitude (in minutes) $\times$ cos latitude = $10^\circ \times 60$ (to get minutes) $\times$ cos $60^\circ = 600 \times 0.5 = 300$ NM

173 Given: TAS = 485 kt, OAT = ISA +10°C, FL410. Calculate the Mach Number.

A 0.87

B 0.825

C 0.90

D 0.85

▼ Show Answer

Correct Answer: B

Do not forget that ISA at FL410 is still -56.5°(C) , even though you are higher than 36 090 feet pressure alt. So the SAT is -46.5°(C) . Use the CRP-5.

174 Fuel flow per hr is 22 US.gal, total fuel on board is 83 imp.gal. What is the endurance?

A 2 hr 15 min

B 4 hr 32 min

C 3 hr 12 min

D 3 hr 53 min

▼ Show Answer

Correct Answer: B

Convert 22 US.gal per hour to imperial gallons on the CRP-5. The answer is about 18.3 imp.gal/hour. Then use either the CRP-5 or your calculator to get the total endurance.

175 Given: Position A is 60N 020W, Position B is 60N 021W, and Position C is 59N 020W, what are, respectively, the distances from A to B and from A to C?

A 60 NM and 30 NM

B 30 NM and 60 NM

C 52 NM and 60 NM

D 60 NM and 52 NM

▼ Show Answer

Correct Answer: B

A and B are at the same latitude but different longitudes. So it is a departure problem. Departure = change of longitude (in minutes) $\times$ cosine latitude
Departure = $1 \times 60 \times \cos 60 = 30$ NM
A and C are at different latitudes but the same longitude. So it is a simple change of latitude problem. One degree is 60 NM.

176 Given: FL350, Mach 0.80, OAT -55°C, calculate values for TAS and local speed of sound?

A 461 kt, LSS 296 kt

B 461 kt, LSS 576 kt

C 237 kt, LSS 296 kt

D 490 kt, LSS 461 kt

▼ Show Answer

Correct Answer: B

Use the CRP-5.

177 How many nautical miles are travelled in 1 minute 45 seconds at a ground speed of 135 knots?

A 2.36

B 3.25

C 39.0

D 3.94

▼ Show Answer

Correct Answer: D

$135 \times 1.75/60 = 3.94$

178 The distance A to B is 90 NM in a straight line. You are 60 NM from A when you fix your position 4 NM to the left of track. What correction do you need to make to arrive at B?

A 4°

B 8°

C 12°

D 10°

▼ Show Answer

Correct Answer: C

You need 4° right to correct for track error angle and parallel track. Then, with 60 NM gone, there are 30 NM to go. Four NM off in 30 gives a closing angle of 8°. Total change = 12° right.

179 A Great Circle crosses the Equator at longitude 030°W. The direction of the GC at Equator is 035°(T). An aircraft following this Great Circle will reach its highest latitude (N or S) at position:

A 35S 120W

B 55S 060E

C 35N 120W

D 55N 060E

▼ Show Answer

Correct Answer: D

180 The heading is 299° (G). Magnetic variation is 90° W and chart convergence is 55° W. What is magnetic heading?

A 154° (M)

B 084° (M)

C 264° (M)

D 334° (M)

▼ Show Answer

Correct Answer: B

181 The orbit of the Earth round the Sun is elliptical. An ellipse has 2 foci. Which of the following is a correct statement?

A The Earth is positioned at one of the foci.

B The Sun is positioned at the mid-point of the 2 foci.

C The Sun is positioned at one of the foci.

D The Earth is positioned at the mid-point of the 2 foci.

▼ Show Answer

Correct Answer: C

182 An aircraft homing to a VOR/DME loses 2500 feet in 11.1 NM change of DME range. What is the gradient of the slope?

A 4.1%

B 3.5%

C 3.9%

D 3.7%

▼ Show Answer

Correct Answer: D

183 An aircraft at position 8500N 02000E flies a rhumb line track of 075°(T). What will be its path over the Earth?

A The shortest route to a destination

B A spiral path leading towards the North Pole

C A great circle route continuing over the pole and then southwards over the other side

D An increasing track angle

▼ Show Answer

Correct Answer: B

184 Given: For take-off an aircraft requires a headwind component of at least 15 kt and has a cross-wind limit of 35 kt. The angle between the wind direction and the runway is 60°. Calculate the maximum and minimum allowable wind speeds.

A 30 kt and 40 kt

B 15 kt and 43 kt

C 12 kt and 38 kt

D 18 kt and 50 kt

▼ Show Answer

Correct Answer: **A**

185 An aircraft is cruising at FL350, Temp -50°C and is told to descend to FL80, Temp -10°C . If the IAS for the descent was 188 kt, what would be the appropriate TAS?

A 260 kt

B 188 kt

C 335 kt

D 224 kt

▼ Show Answer

Correct Answer: **A**

To calculate the TAS for the descent you need to have the mean altitude and mean temperature with the IAS. Mean altitude is 21 500 ft and mean temperature is -30°C .

186 An aircraft has to climb from FL50 -10°C to FL260 -25°C . The IAS for the climb is 180 kt and the WC is +30 kt. If the ROC is 900 ft/min, how many miles will the climb take?

A 96 NM

B 106 NM

C 83 NM

D 120 NM

▼ Show Answer

Correct Answer: B

For a climb the TAS is calculated using the 2/3 change in altitude and temperature. 2/3 altitude is 21 000 ft and temperature is -20°C so the TAS is 242 kt. GS is 272 kt and the time is 23.3 min

187 An aircraft is flying at FL200, the OAT is 0°C. When the actual air pressure on an airfield at MSL is placed on the subscale of the altimeter the indicated altitude is 19 300 ft. What is the aircraft's True Altitude?

A 17 300 ft

B 19 300 ft

C 20 000 ft

D 21 300 ft

▼ Show Answer

Correct Answer: D

ISA Dev = +25°C, Temperature Correction = $4 \text{ ft} \times 20 \times +25 = 2000 \text{ ft}$. TA = IA + Temp Corr = $19\,300 + 2000 = 21\,300 \text{ ft}$