Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2012

Question/Answer Booklet

AVIATION
Stage 3

Please place your student identification label in this box

Student Number: In figures | | | | | | | | |

In words ______________________________

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Time allowed for this paper
Reading time before commencing work: ten minutes
Working time for paper: two and a half hours

Materials required/recommended for this paper
To be provided by the supervisor
This Question/Answer Booklet
Multiple-choice Answer Sheet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction tape/fluid, eraser, ruler, highlighters
Special items: non-programmable calculators approved for use in the WACE examinations, navigation plotter (or ruler and protractor), flight computer

Important note to candidates
No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Ref: 12-014

Structure of the examination

The Aviation examination comprises a written examination worth 80 per cent of the total examination score and a practical examination worth 20 per cent of the total examination score.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of total exam
Section One: Multiple-choice	20	20	30	20	16
Section Two: Short answer	20	20	120	110	64
				Total	80

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2012*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Section Two: Write answers in this Question/Answer Booklet.

3. Working or reasoning should be shown clearly when calculating or estimating answers.

4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Section One: Multiple-choice **16% (20 Marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

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1. At which of the following levels of the atmosphere is the temperature most likely to be at approximately –57°C?

(a) bottom of ionosphere
(b) top of ionosphere
(c) top of stratosphere
(d) top of troposphere

2. Which cloud type would best describe a 1400 feet deep layer that an aircraft encounters at a height of about 15 000 feet?

(a) cirrostratus
(b) altocumulus
(c) altostratus
(d) stratocumulus

3. When air masses of different temperatures and densities come together, their boundary is called a

(a) trough.
(b) cyclone.
(c) front.
(d) convergence zone.

4. Which one of the following provides the actual wind speed and direction at an airport?

(a) METAR
(b) TTF
(c) ARFOR
(d) TAF

5. The World Aeronautical Chart (WAC) has a scale of

(a) 500 000:1.
(b) 1 000 000:1.
(c) 250 000:1.
(d) 100 000:1.

6. Isogonals are

   (a) imaginary lines connecting points on the Earth's surface of the same longitudinal value.
   (b) lines of zero magnetic variation.
   (c) lines connecting places of equal magnetic variation.
   (d) lines connecting places of equal magnetic dip.

7. The common link between sea breezes, katabatic winds and anabatic winds is that they are all

   (a) light winds.
   (b) local winds.
   (c) cool winds.
   (d) dry winds.

8. A Lambert Conformal Conic Projection is a chart in which

   (a) a straight line approximates a great circle.
   (b) straight lines cannot be represented.
   (c) a straight line approximates a rhumb line.
   (d) rhumb lines are equal to great circles.

9. According to a Civil Aviation Advisory Publication, the recommended fixed fuel reserve for a piston engine aircraft with a fuel flow of 36 litres/hour would be

   (a) 45 litres.
   (b) 18 litres.
   (c) 27 litres.
   (d) 60 litres.

10. When supersonic airflow changes direction while flowing over the upper surface of a wing, it

    (a) increases in pressure.
    (b) increases in density.
    (c) decreases in temperature.
    (d) decreases in speed.

11. At an aerodrome with an elevation of 900 ft, OAT 25°C and a QNH of 1002 hPa, the Pressure Height would be closest to

    (a) 570 ft.
    (b) 1230 ft.
    (c) 2670 ft.
    (d) 1290 ft.

12. CAS is

(a) TAS corrected for wind.
(b) IAS corrected for density.
(c) GS corrected for density, position and instrument error.
(d) IAS corrected for position and instrument error.

13. When a helicopter is carrying out an autorotation, the energy to drive the rotor blades comes from

(a) upwards airflow through the rotor.
(b) ground effect.
(c) transverse flow.
(d) Coriolis effect.

14. The theoretical range of a VOR signal

(a) may be increased by positioning the receiver on the lowest elevation available.
(b) may be increased by setting the VOR to utilise the reflection of the signals from a nearby sloping mountain range.
(c) may be increased by positioning the transmitter on the highest terrain available.
(d) cannot be increased, as it relies on frequency phase shift only.

15. When landing, even in nil-wind conditions, the simpler types of helicopters are usually observed to touch down first on the skid on one side, before settling onto both. This action is designed to counteract

(a) transverse flow effect.
(b) rotor drift.
(c) Coriolis effect.
(d) dissymmetry of lift.

16. Below are four statements about night vision in humans. Which of these statements are correct?

(i) Night vision is enabled by the rods of the retina.
(ii) There are no colours in night vision.
(iii) People whose bodies are deficient in vitamin A have poor night vision.
(iv) Night vision prevents objects from being seen if viewed directly.

(a) (i), (ii) and (iv) only
(b) (ii) and (iii) only
(c) (ii), (iii) and (iv) only
(d) (i), (ii), (iii) and (iv)

17. An aircraft needs to descend from FL125 to arrive overhead a Mean Sea Level aerodrome at 1500 ft AGL. Given a constant ground speed of 150 knots and descent rate of 500 fpm, how far from the aerodrome must the descent commence?

(a) 33 nm
(b) 55 nm
(c) 62.5 nm
(d) 22 nm

18. Which one of the statements below is correct?

(a) Air can only enter the lungs if its pressure is lower than that of the air already in them.
(b) Air enters the lungs because downward movement of the diaphragm sucks it in.
(c) Air can only enter the lungs if its pressure is higher than that of the air already in them.
(d) Air enters the lungs because upward movement of the diaphragm sucks it in.

19. Which one of the following symptoms is **not** indicative of hypoxia?

(a) dizziness
(b) muscular spasms
(c) increased rate of breathing
(d) blueness of the lips

20. A diver who takes a flight in an unpressurised aircraft after having been deep scuba diving on the previous day is at risk of suffering decompression sickness while flying. A common symptom of decompression sickness is

(a) development of pain in knees and elbows.
(b) dizziness.
(c) rapid heartbeat.
(d) tingling sensations in the finger joints.

End of Section One

Section Two: Short answer **64% (110 Marks)**

This section has **20** questions. Answer **all** questions. Write your answers in the spaces provided.

A spare page is included at the end of this booklet. It can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 120 minutes.

Question 21 **(6 marks)**

Given a pressure altitude of 1000 feet, an outside air temperature of ISA +25ºC, a ground speed of 150 knots, a head wind of 20 knots and a fuel flow of 80 litres per hour,

(a) calculate the Density Height using a formula. Show your workings. (2 marks)

Density Height = ____________________

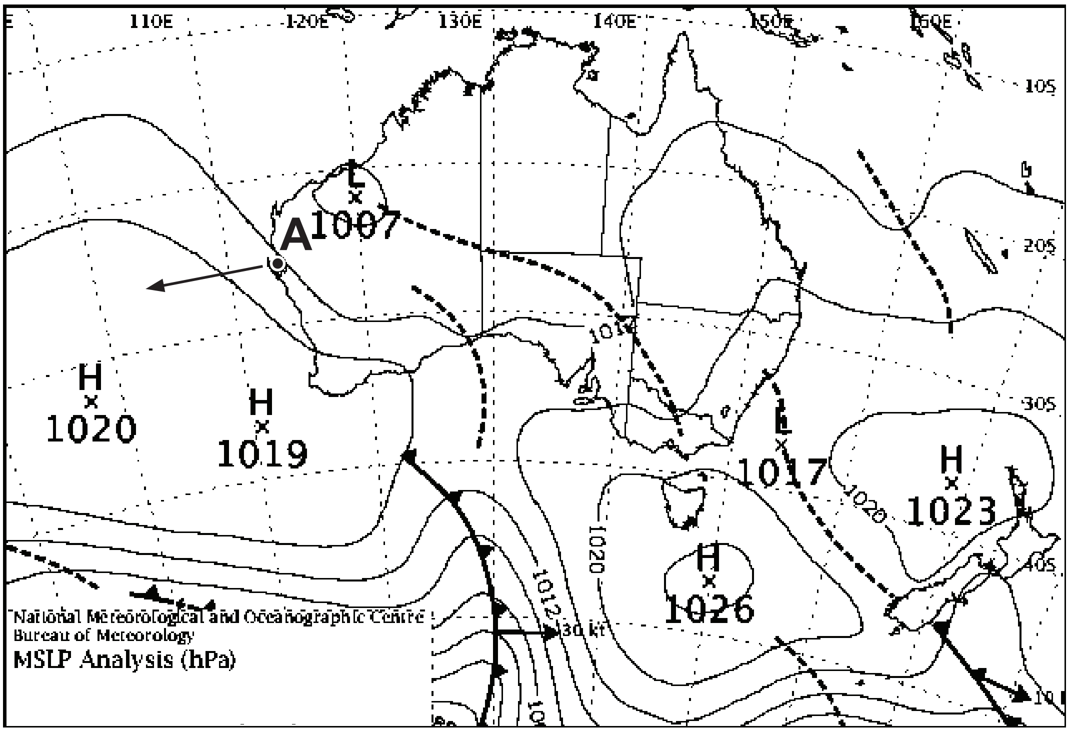
(b) calculate the distance covered after 37 minutes of flight using your flight computer. (1 mark)

Distance covered = ____________________

(c) determine the Calibrated Air Speed (CAS) using your flight computer. To support your answer, show how you calculated the True Air Speed. (3 marks)

Calibrated air speed = ____________________

Question 22 **(5 marks)**



Use the information contained in the above synoptic chart to answer the following questions.

(a) Which feature dominates the weather along the 130°E meridian south of the Australian continent? (1 mark)

(b) What meteorological feature is indicated by the dotted line stretching from the north-west region of Australia to Victoria? (1 mark)

(c) Of which of the four seasons is this weather chart most typical? (1 mark)

(d) An aircraft is at point A heading in the direction shown at 3000 feet. Will the aircraft experience any drift, and if so, will the drift be to the left or right? Assume that winds are the same from the surface to 5000 feet. (2 marks)

Question 23 **(5 marks)**

Examine the information below and extract from it the answers to the questions.

MORUYA (YMRY)
TAF AMD YMRY 180646Z 1807/1820
13008KT 9999 LIGHT SHOWERS OF RAIN SCT020 BKN030
BECMG 1809/1810 VRB05KT 9999 LIGHT SHOWERS OF RAIN BKN012
PROB30 1812/1814 2000 MIST
PROB30 1814/1820 0500 FOG
T 23 22 21 20 Q 1018 1016 1017 1018

(a) For how many hours is the TAF valid? (1 mark)

(b) What is the forecast cloud base at 1030 UTC? (1 mark)

(c) What is the lowest visibility that has been predicted during the period of the forecast? (1 mark)

(d) What is the expected wind direction between 0900 UTC and 1000 UTC? (1 mark)

(e) What altimeter subscale setting would be used for an aircraft arriving at YMRY at 1100 UTC? (1 mark)

Question 24 **(5 marks)**

During aerobatic flight the pilot experiences various changes in the forces acting on his body. These are commonly described as ‘G’ forces.

As these G forces increase, their effect on the pilot’s vision increases.

(a) Explain why G forces affect vision. (2 marks)

(b) Describe the progressive effects on the pilot as the G forces increase. (3 marks)

G force experienced	Effect on pilot
4–5 G	
6–7 G	
8 G and above.	

Question 25 **(10 marks)**

Unmanned Aerial Vehicles (UAVs) are now used throughout the world to carry out both civil and military tasks that 10 years ago could only be accomplished by piloted aircraft.

(a) Describe **two (2)** military and **two (2)** civil tasks that are ideally suited to UAV operations. Comment on how UAVs are superior to manned aircraft in these circumstances. (6 marks)

Military task one:

Military task two:

Civil task one:

Civil task two:

(b) There are circumstances in which either manned or unmanned aircraft can be used, but currently only manned aircraft are permitted. Identify **two (2)** such circumstances and explain each. (4 marks)

Circumstance one:

Circumstance two:

Question 26 **(6 marks)**

Given the following conditions, calculate the cloud top, dew point and freezing level within the cloud.

- Condensation level is 4000 ft
- Initial temperature of surface air is 20°C
- Initial temperature of rising air is 21°C

ELR = 4°/1000 ft to 3000 ft
2°/1000 ft from 3000 ft to 6000 ft
1°/1000 ft from 6000 ft upward

(Calculations may be done in the space below.)

(a) Cloud top: ______________________ (2 marks)

(b) Dew point: ______________________ (2 marks)

(c) Freezing level in cloud: ______________________ (2 marks)

Question 27 **(3 marks)**

A private VFR flight is being planned direct from Dubbo to Young. The relevant flight information is as follows. There are no alternate airport requirements for the flight.

TAS	120 knots
Headwind	15 knots
Fuel flow	38 litres/hour
Taxi reserve	10 litres
Fixed reserve	45 minutes
Flight time	70 minutes
Holding fuel required	10 minutes
Fuel quantity on board prior to taxi	180 litres

Determine the fuel quantity required to be on board prior to taxi by completing the following fuel table. Ignore any climb fuel considerations. Show any workings here.

Fuel Calculation	**Time**	**Litres**
Climb		
Cruise		
Alternate		
Sub-total		
Variable reserve		
Fixed reserve		
Holding		
Taxi		
Fuel required		
Fuel margin		
Endurance		
From		

Minimum fuel quantity required: ____________________

Question 28 **(5 marks)**

An aircraft with a TAS of 180 knots is tracking 250°M and is being affected by a wind 225°M/20 kt. Calculate the following using your flight computer where necessary.

(a) Drift angle and direction. (2 marks)

(b) Ground speed. (2 marks)

(c) The true track, given that the magnetic variation is 5°E. (1 mark)

This space has been left blank intentionally

Question 29 **(5 marks)**

(a) If an airliner is cruising at a speed of Mach 0.8, at an altitude where the speed of sound is 580 knots, what is its TAS? (1 mark)

(b) For high speed subsonic flight (such as in jet airliners) the aerofoils are designed in such a way as to have high critical Mach numbers that enable them to fly as fast as possible before the air over any part reaches Mach 1.

Use diagrams to illustrate the comparison between the cross section of a conventional, or slower, subsonic wing with that of a high speed subsonic wing. (2 marks)

conventional subsonic wing

high speed subsonic wing

Question 29 (continued)

(c) Using a diagram, explain how sweepback on the wing of an airliner assists the wing to have a high critical Mach number. (2 marks)

Question 30 **(3 marks)**

A potentially hazardous event may occur during take-off from a dark country airstrip on a moonless night. Pilots often experience a sensation that the aircraft has begun to pitch and climb too steeply. An inexperienced pilot may, in these circumstances, respond to this sensation by pushing the control column forward. The sensation then ceases, but the aircraft strikes the ground. However, if the pilot ignores the sensation and maintains the climb attitude, the sensation will cease within a few seconds and the aircraft will continue to climb away safely.

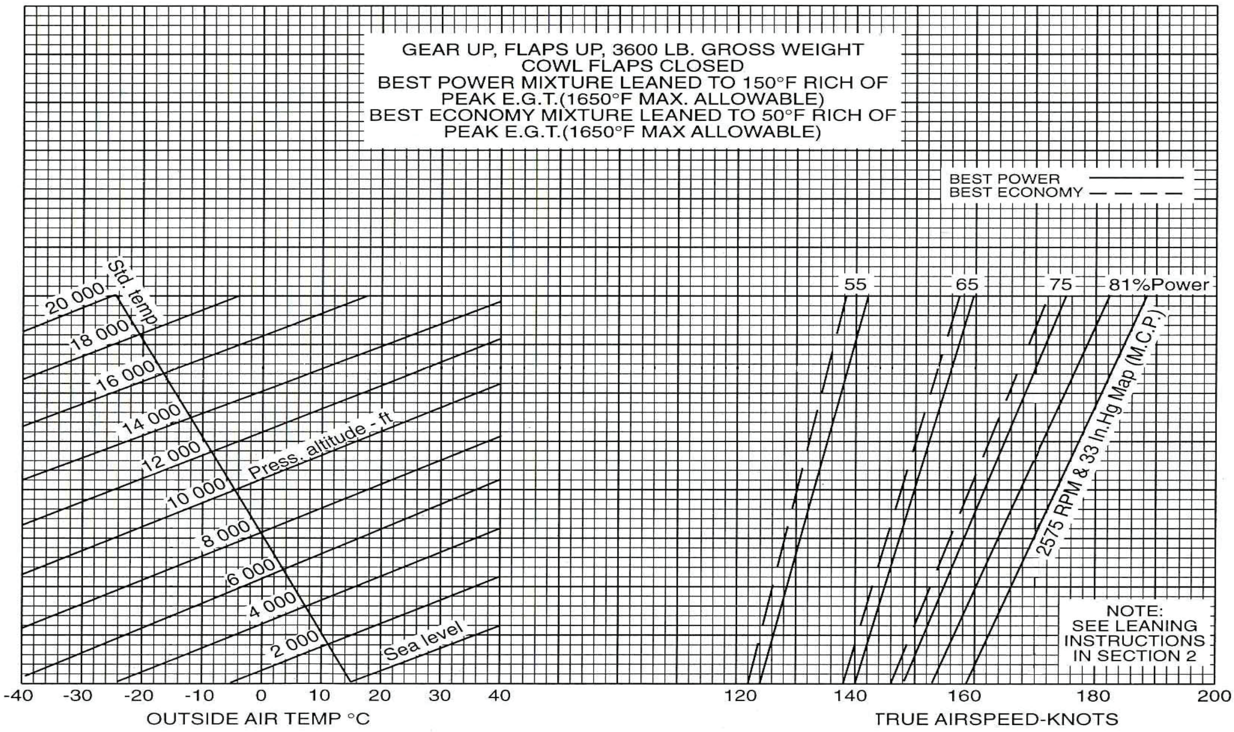
With the aid of a diagram, explain how the pilot's otolith organs have been involved in producing this illusion.

Question 31 **(4 marks)**

Using the PA-32RT Cruise Performance Chart below, determine the TAS for the following cruise configurations. Show your workings on the chart below.

(a) Best Economy 55% at a Pressure Height of 6000 ft and ISA (2 marks)

(b) Best Power 75% at a Pressure Height of 8000 ft and ISA+10° (2 marks)



Question 32 **(2 marks)**

Almost all pilots who have normal vision when they are young find that when they reach about 40 years of age they begin to find it difficult to focus clearly on objects that are close to them (for example, books, maps or instruments in the cockpit).

(a) What is the clinical name given to this eye condition? (1 mark)

(b) What change has occurred in the eyes to cause this problem? (1 mark)

Question 33 **(5 marks)**

A conventional helicopter has both a main rotor and a tail rotor.

(a) With the aid of a sketch, explain why the tail rotor is necessary. (2 marks)

Question 33 (continued)

(b) How would the pilot of a conventional helicopter type know immediately if the tail rotor had detached from the aircraft in cruise flight? (1 mark)

(c) What must be the pilot's instant response under the above circumstance? (1 mark)

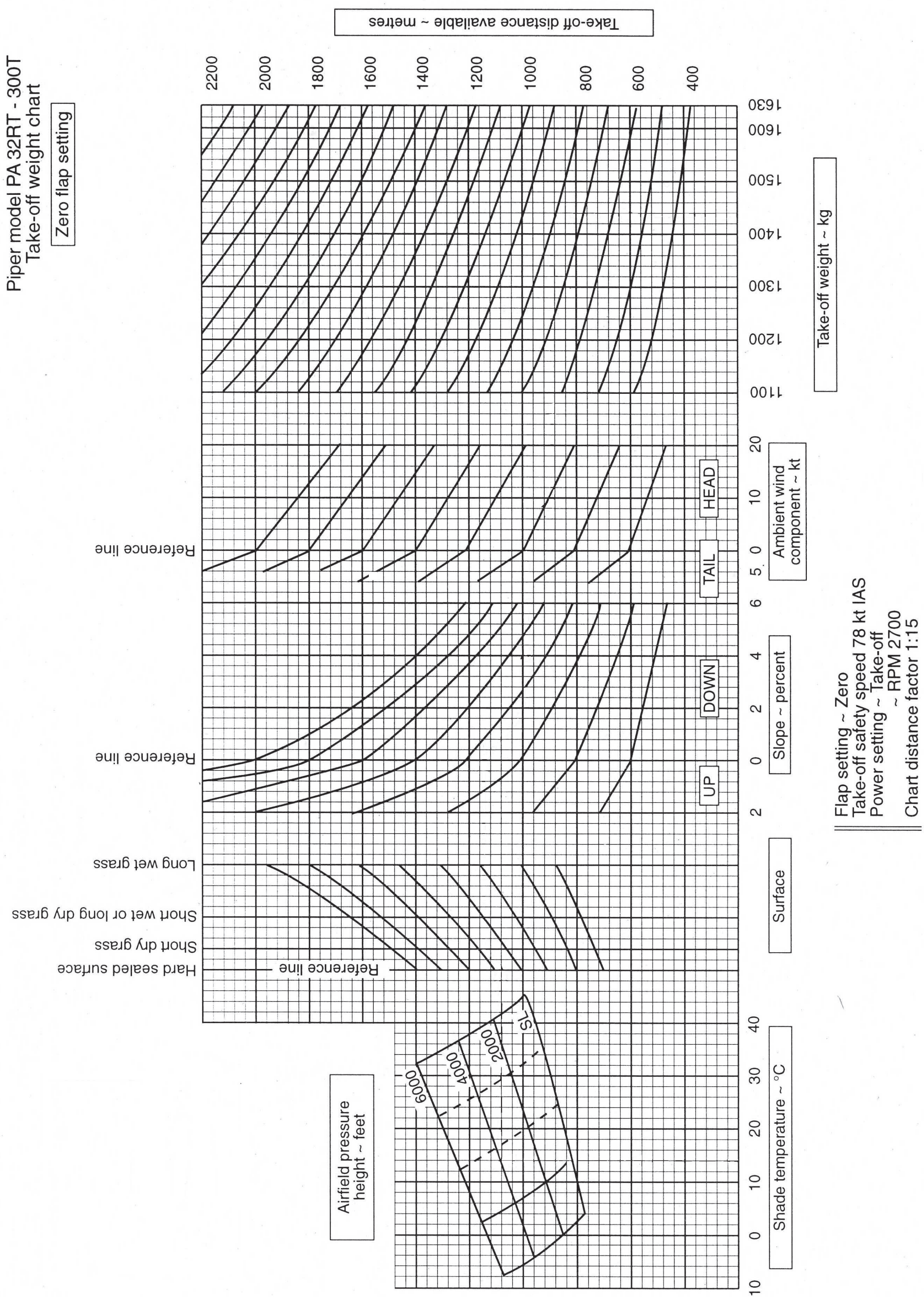
(d) Explain why a helicopter with contra-rotating rotors does not have a tail rotor. (1 mark)

Question 34 **(8 marks)**

Using the information in the tables below, and the PA-32RT performance charts, answer the following questions about a planned flight in a PA-32RT from Tottenham to Wagga Wagga, a distance of 175 nm.

Tottenham	
Pressure height	1000 feet
Temperature	40°C
Surface	hard
Slope	2% down
Wind	nil
TODA	750 m

(a) Determine the maximum take-off weight allowed at Tottenham. Show your workings on the chart on page 21. (2 marks)



Piper model PA 32RT - 300T
Take-off weight chart
Zero flap setting
Take-off distance available ~ metres
2200
2000
1800
1600
1400
1200
1000
800
600
400
1630
1600
1500
1400
1300
1200
1100
Take-off weight ~ kg
Reference line
20
10
0
5
HEAD
TAIL
Ambient wind component ~ kt
6
4
2
0
2
DOWN
UP
Slope ~ percent
Reference line
Long wet grass
Short wet or long dry grass
Short dry grass
Hard sealed surface
Reference line
Surface
Flap setting ~ Zero
Take-off safety speed 78 kt IAS
Power setting ~ Take-off
~ RPM 2700
Chart distance factor 1:15
6000
4000
2000
SL
Airfield pressure height ~ feet
40
30
20
10
0
10
Shade temperature ~ °C

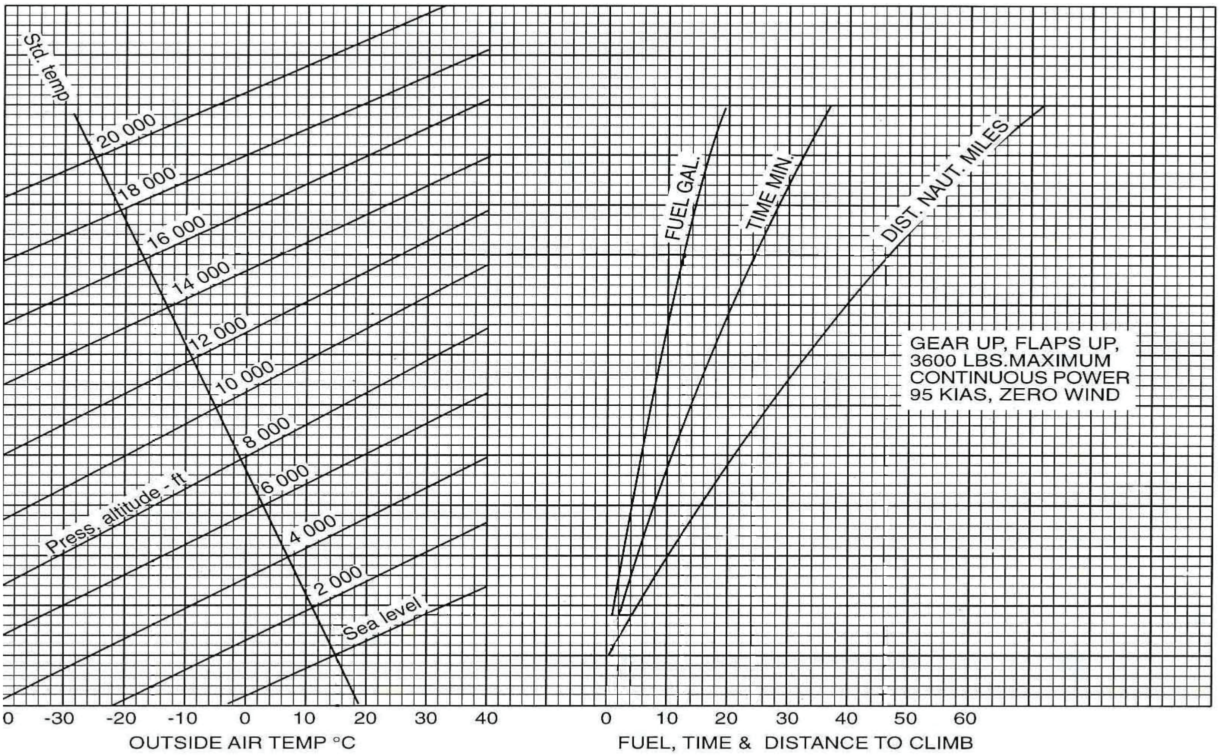
Question 34 (continued)

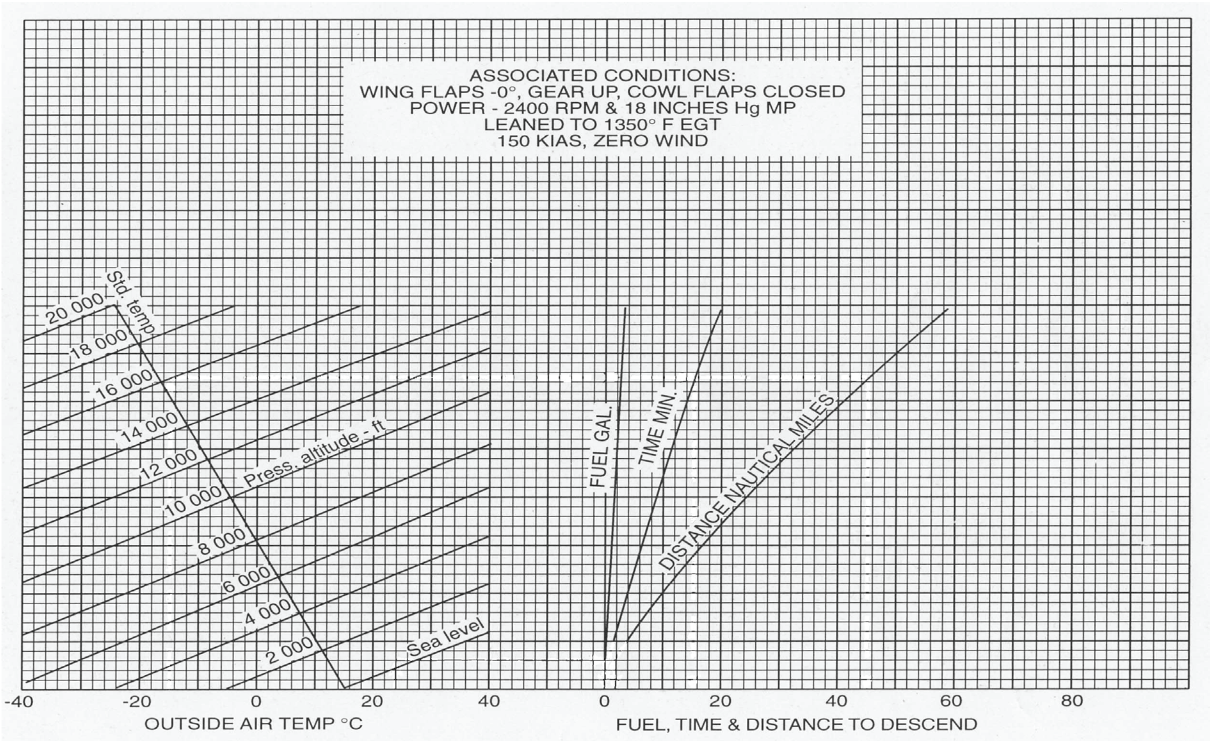
(b) Complete the table below using the following data and the supplied cruise fuel and time interval information. Do not make any allowances for reserve, taxi and unusable fuels. Show all workings. (6 marks)

Tottenham		Wagga Wagga		Cruise data	
Pressure height	1000 feet	Pressure height	750 feet	Cruising level	Alt 8500
Temperature	40°C	Temperature	35°C	OAT	+25°C
Surface	hard	Surface	hard	Fuel required	14 gallons
Slope	2% down	Slope	nil	Time interval	53 mins
Wind	nil	Wind	20 kt headwind		
TODA	750 m	LDA	1020 m		

NOTE: Use the Tottenham winds for the climb and Wagga Wagga winds for the descent.

	Climb	Cruise	Descent	Total
Fuel (gallons)		14		
Time (min)		53		
Distance (nm)				175


Std. temp
20 000
18 000
16 000
14 000
12 000
10 000
8 000
6 000
4 000
2 000
Sea level
Press. altitude - ft
FUEL GAL.
TIME MIN.
DIST. NAUT. MILES
GEAR UP, FLAPS UP, 3600 LBS.MAXIMUM CONTINUOUS POWER 95 KIAS, ZERO WIND
0 -30 -20 -10 0 10 20 30 40
OUTSIDE AIR TEMP °C
0 10 20 30 40 50 60
FUEL, TIME & DISTANCE TO CLIMB


ASSOCIATED CONDITIONS:
WING FLAPS -0°, GEAR UP, COWL FLAPS CLOSED
POWER - 2400 RPM & 18 INCHES Hg MP
LEANED TO 1350° F EGT
150 KIAS, ZERO WIND
Std. temp
20 000
18 000
16 000
14 000
12 000
10 000
8 000
6 000
4 000
2 000
Sea level
Press. altitude - ft
FUEL GAL.
TIME MIN.
DISTANCE NAUTICAL MILES
-40 -20 0 20 40
OUTSIDE AIR TEMP °C
0 20 40 60 80
FUEL, TIME & DISTANCE TO DESCEND

Question 35 **(12 marks)**

An aircraft with a TAS of 140 kt departs from Grenfell at 1210 UTC maintaining a constant heading 270°M for a position 200 nm away. No allowance is made for any wind that may be blowing.

At 1240 UTC the aircraft is positively fixed by DME 80 nm from the departure airport and visual verified to be 8 nm south of its intended track.

Show **all** your workings.

(a) Using the 1 in 60 rule, calculate the track error experienced. (2 marks)

(b) Using your flight computer, determine the strength and direction (magnetic) of the wind. Show your calculation of the ground speed and the headwind or tailwind component. (4 marks)

(c) Using the 1 in 60 rule, calculate the closing angle to track to the destination. (2 marks)

(d) Calculate the change of heading and the direction of the turn needed to fly direct to the destination. (2 marks)

(e) State any effects that the proposed change of heading may have on the aircraft's ground speed. Explain your answer. (2 marks)

Question 36 **(4 marks)**

A VFR flight is being planned from Katoomba, NSW to Bathurst, NSW. The track is 296°T and the variation is 12°E. The highest terrain en route is determined to be 4474 ft and the lowest cloud base is at 9400 ft.

(a) The most appropriate hemispherical cruising level is (1 mark)

(b) Justify your answer to part (a), including the factors that you considered. (3 marks)

Question 37 **(4 marks)**

(a) From a human factors perspective, why is the barometric pressure setting used for operations in flight levels safer than the one used for flights below the transition layer? (2 marks)

(b) Until about a decade ago, the correct form of response to any air traffic control instruction in Australia was to state your call sign followed by the read-back of the critical elements of the instruction, such as altitudes. The correct response now is to read back the critical elements first, leaving the call sign until last. Which format is safer from a human factors perspective and why? (2 marks)

Question 38 **(4 marks)**

A pilot is tasked to fly a typical General Aviation aircraft fitted with a normally-aspirated internal combustion engine. For each task listed below, describe how the aircraft must be operated, with specific reference to the optimum aerodynamic configuration of the wing for the task, and the altitude to be flown.

(a) Fly the farthest distance in a given direction. (2 marks)

(b) Stay in the air for the longest possible time. (2 marks)

Question 39 **(2 marks)**

An aerodrome located at S35° 24’, E112° 15’ has had First Light calculated to be 0420 LMT. Based on the above data and using the table below, when is First Light in UTC? Show all workings.

Conversion of arc to time											
Degrees						Minutes					
Long Deg	Time		Long Deg	Time		Long Min	Time		Long Min	Time	
	Hours	Min		Hours	Min		Min	Sec		Min	Sec
110	7	20	140	9	20	0	0	00	30	2	00
111	7	24	141	9	24	1	0	04	31	2	04
112	7	28	142	9	28	2	0	08	32	2	08
113	7	32	143	9	32	3	0	12	33	2	12
114	7	36	144	9	36	4	0	16	34	2	16
115	7	40	145	9	40	5	0	20	35	2	20
116	7	44	146	9	44	6	0	24	36	2	24
117	7	48	147	9	48	7	0	28	37	2	28
118	7	52	148	9	52	8	0	32	38	2	32
119	7	56	149	9	56	9	0	36	39	2	36
120	8	00	150	10	00	10	0	40	40	2	40
121	8	04	151	10	04	11	0	44	41	2	44
122	8	08	152	10	08	12	0	48	42	2	48
123	8	12	153	10	12	13	0	52	43	2	52
124	8	16	154	10	16	14	0	56	44	2	56
125	8	20	155	10	20	15	1	00	45	3	00
126	8	24	156	10	24	16	1	04	46	3	04
127	8	28	157	10	28	17	1	08	47	3	08
128	8	32	158	10	32	18	1	12	48	3	12
129	8	36	159	10	36	19	1	16	49	3	16
130	8	40				20	1	20	50	3	20
131	8	44				21	1	24	51	3	24
132	8	48				22	1	28	52	3	28
133	8	52				23	1	32	53	3	32
134	8	56				24	1	36	54	3	36
135	9	00				25	1	40	55	3	40
136	9	04				26	1	44	56	3	44
137	9	08				27	1	48	57	3	48
138	9	12				28	1	52	58	3	52
139	9	16				29	1	56	59	3	56

First light is at: ____________________

Question 40 **(12 marks)**

Read the following account of a pilot's flight test and answer the parts of the question that follow.

Steve was to conduct a flight in a twin-engine Beechcraft Baron aircraft. The purpose of this flight was to test his competence in handling the aircraft solely by using instruments. The test involved flying the aircraft as if it was in cloud for the duration of the flight and navigating it using the various radio navigation aids at the airport through the take-off, climb, cruise, descent and landing phases. Steve was aware that the CASA Approved Testing Officer (ATO) used screens in front of the windscreens to simulate being in cloud without any visual references. Steve was also aware that the ATO would include simulated 'emergency or abnormal' situations that he would be expected to manage. One of the more challenging emergencies is a simulated engine failure after take-off which was achieved by the ATO shutting off the Fuel Mixture control to one of the engines.

In the days leading up to the test, Steve took every opportunity available to fly on instruments to ensure his skills were sufficient to pass the test. He also had help from another pilot to simulate some of the emergencies that could occur so that he was confident of passing the test.

On the day of the test, the ATO advised Steve of the flight that he was to conduct and a flight plan was then lodged with AirServices. In the plan Steve indicated that the fuel on board would be only that amount required to conduct the flight plus the mandatory reserves. This action avoided the uneconomical operation of carrying excess weight. It also maximised the aircraft's single-engine climb performance which is marginal when the undercarriage is down and the propeller on the failed engine is windmilling, causing considerable drag.

After completion of the pre-flight inspection, the pilots boarded the aircraft and the ATO briefed Steve on his expectations for the flight, including his actions in the event of simulated and real emergencies. Steve then started the engines and taxied for the runway in use.

After the pre take-off checks were completed, including review of the critical drills in the event of an engine failure on take-off, Steve requested a take-off clearance. The tower controller then cleared the aircraft to line up on the runway. As Steve did this, the ATO positioned the screens that he would raise some time in the flight to obscure Steve's vision.

Shortly after take-off, the ATO raised the screens to simulate flying in cloud. Then, at about 300 feet, the right-hand engine suddenly lost all power.

Steve had been expecting this to happen at some time in the flight but was surprised that he hadn't noticed the ATO adjusting the engine controls. Both pilots looked towards each other as the realisation began to dawn that this was a real failure.

The first thoughts that went through Steve's mind were not what he was expecting from his training. What had caused the engine to fail? Could it cause the other to fail also, if, for example, the fuel had been contaminated? Would a precautionary landing be a better option even though it would probably result in injury and considerable damage to the aircraft?

Then, his training kicked in and his attention went to carrying out the required emergency actions of correctly shutting down the failed engine and feathering its propeller to reduce drag. The aircraft settled into a comfortable rate of climb and Steve advised the tower that an engine had failed and requested a priority landing. The ATO in the meantime removed the screens.

The tower cleared the aircraft to conduct a left hand circuit to land on the runway from which it had departed.

On the downwind leg of the circuit the ATO commented to Steve that he was handling the situation well but he was very close to the runway. Steve explained that he was still concerned that the other engine might fail and he wanted to be in position for a glide approach. The circuit was completed and the aircraft landed safely.

After landing, the controller, who was aware that this was a pilot test flight, asked Steve what he wanted to do for the remainder of his flight. Only then did it occur to Steve that the tower had not realised that this had been a real emergency. That also explained the lack of attendance at the runway of the Rescue and Fire-fighting service.

This flight had the potential to end in an accident, but it was completed safely.

(a) Identify and explain **three (3)** human factors that helped Steve to complete the flight safely. (6 marks)

(b) Identify and explain **two (2)** human factors involving the flight crew that threatened the safe completion of the flight. (4 marks)

(c) Identify a human factor involving the tower controller that could have influenced the outcome. Explain why, stating whether it was a positive or a negative factor. (2 marks)

End of questions

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ACKNOWLEDGEMENTS

Section Two

Question 22 Adapted from: Bureau of Meteorology. (2012). *MSLP analysis (manual) Australian region* [Chart]. Retrieved 2012, from www.bom.gov.au/australia/charts/synoptic_bw.shtml.

Question 31(b) Chart PA-32RT cruise performance from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 170. Not for operational purposes.

Question 34(a) PA-32RT take-off weight chart from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 155. Not for operational purposes.

Question 34(b) Chart PA-32RT fuel, time and distance to descend from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 171. Not for operational purposes.

Chart PA-32RT fuel, time and distance to climb performance from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 169. Not for operational purposes.

Question 39 Time-arc conversion table (Figure 9.10) from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Handbook of flight* (2nd ed.). Perth: WestOne Services, p.195. Not for operational purposes.

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