



ATAR course examination, 2024

Question/Answer booklet

AVIATION

Please place your student identification label in this box

WA student number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes

Working time: 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 fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination, 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 material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of the examination

The Aviation ATAR course examination consists of a written component and a practical (performance) component.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of written examination
Section One Multiple-choice	20	20	30	20	20
Section Two Short answer	28	28	120	145	80
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2024: Part II Examinations*. 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. Do not use erasable or gel pens. 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 your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. Working or reasoning should be shown clearly when calculating or estimating answers.
4. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Section One: Multiple-choice**20% (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. Do not use erasable or gel pens. 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.

1. An aircraft travels 62 nautical miles (nm) in 34 minutes. How far apart should the 10 minute markers be placed on the chart?
 - (a) 20 nm
 - (b) 18 nm
 - (c) 19 nm
 - (d) 17 nm

2. Automatic Dependent Surveillance Broadcast (ADSB) requires a transponder capable of what mode of operation? Mode
 - (a) S
 - (b) A
 - (c) C
 - (d) ADSB

3. Aircraft design manoeuvring speed is indicated by which 'V' code?
 - (a) Vd
 - (b) Vs
 - (c) Vr
 - (d) Va

4. An aircraft travels 98 nautical miles (nm) at a speed of 147 kts and consumes 27.2 US gallons of fuel. What is the fuel consumption per hour in US gallons?
 - (a) 39
 - (b) 41
 - (c) 42
 - (d) 43

5. By setting 1013.2 hPa on the subscale, an altimeter will indicate the
 - (a) density height.
 - (b) pressure height.
 - (c) airfield elevation.
 - (d) aircraft's true altitude.

See next page

6. Select the correct statement regarding superchargers.
- (a) Driven directly by the engine, some engine power is lost in running the supercharger, typically used in aircraft above 250 hp.
 - (b) Driven by the exhaust gases, some engine power is gained in running the supercharger, typically used in aircraft above 250 hp.
 - (c) Driven by the exhaust gases, some engine power is lost in running the supercharger, typically used in aircraft below 250 hp.
 - (d) Driven directly by the engine, some engine power is gained in running the supercharger, typically used in aircraft above 250 hp.
7. Given a pressure height of 3000 ft and an airfield elevation of 2760 ft, the local QNH is
- (a) 1013 hPa.
 - (b) 1021 hPa.
 - (c) 1005 hPa.
 - (d) impossible to tell.
8. The manifold pressure gauge measures the air pressure in the inlet manifold. What units does it display?
- (a) litres per hour
 - (b) foot pounds per square inch
 - (c) cubic centimetres
 - (d) inches of mercury
9. When entering the climb in an aircraft fitted with a constant speed unit, the correct order of operation is to
- (a) decrease mixture, decrease RPM, increase manifold pressure.
 - (b) increase mixture, increase RPM, decrease manifold pressure.
 - (c) decrease mixture, increase RPM, increase manifold pressure.
 - (d) increase mixture, increase RPM, increase manifold pressure.
10. A pilot is taking off in a single engine aircraft with a clockwise rotating propeller, as seen from the pilot's seat. In nil wind conditions, to maintain the runway centreline during the ground roll, the pilot will need to apply
- (a) left rudder input.
 - (b) right rudder input.
 - (c) nose up trim.
 - (d) left roll input.
11. Defects in the cabin heating system of a single engine light aircraft are **most** likely to produce which debilitating problem for a pilot?
- (a) decompression sickness
 - (b) histotoxic hypoxia
 - (c) hyperventilation
 - (d) hypemic hypoxia

12. According to Civil Aviation Safety Authority (CASA) regulations, what is the minimum time from completing alcohol consumption to operating an aircraft and the maximum blood alcohol content (BAC) allowed?
- (a) 8 hours and 0.05% BAC
 - (b) 10 hours and 0.02% BAC
 - (c) 8 hours and 0.02% BAC
 - (d) 10 hours and 0.05% BAC
13. In a sustained positive 4G manoeuvre, the first stage leading to gravity-induced loss of conscious (G-LOC) will affect the
- (a) lower eyelids.
 - (b) peripheral vision.
 - (c) cochlear.
 - (d) semi-circular canals.
14. Considering a typical light twin aircraft, which of the following applies? Throttle lever controls the amount of
- (a) air, pitch lever controls the tension on the speeder spring, mixture lever controls the amount of fuel entering the system.
 - (b) fuel entering the system, pitch lever controls the amount of air, mixture lever controls the tension on the speeder spring.
 - (c) air, pitch lever controls the amount of fuel entering the system, mixture lever controls the amount of tension on the speeder spring.
 - (d) tension on the speeder spring, pitch lever controls the amount of air, mixture lever controls the amount of fuel entering the system.
15. In what way does Newton's Third Law of Motion apply to a modern turbine engine?
- (a) Once moving, the engine allows the aircraft to maintain a constant speed and direction during level flight, due to a lack of external forces.
 - (b) The propulsion force is equal to the mass multiplied by the acceleration.
 - (c) By compressing the air in the intake, the engine generates a forward force, which creates a reaction force that propels the aircraft forward.
 - (d) By expelling hot gases backward, the engine generates forward thrust, which demonstrates action and reaction forces.
16. Reverse thrust is typically used in which of the following scenarios?
- (a) landing in marginal weather (dry runway)
 - (b) when a shorter landing is required
 - (c) to lessen aircraft noise impact
 - (d) to reduce engine wear

17. An aircraft designer wants to fit a more powerful engine to an aircraft. Which of the following design changes to the propeller allow it to absorb the extra power?
- (a) longer blades, thinner blades, fewer blades
 - (b) shorter blades, thinner blades, more blades
 - (c) similar length blades, wider blades, more blades
 - (d) shorter blades, wider blades, fewer blades
18. Gravity-induced loss of consciousness (G-LOC) is **most** likely to occur when
- (a) flying straight and level.
 - (b) turning an aircraft at low speed.
 - (c) pulling out of a dive at high speed.
 - (d) wearing a pressure suit.
19. The effect alcohol has on the body is to
- (a) increase the amount of blood in the body.
 - (b) increase the oxygen in the brain.
 - (c) act as a laxative.
 - (d) act as a depressant.
20. A form of spatial disorientation may occur in flight when there is a loss of visual reference during forward acceleration and the pilot feels that the aircraft is pitching up. Which of the following organs creates this illusion?
- (a) saccules
 - (b) cochlea
 - (c) utricles
 - (d) semi-circular canals

End of Section One

See next page

Section Two: Short answer**80% (145 Marks)**

This section has **28** questions. Answer **all** questions. Write your answers in the spaces provided. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 120 minutes.

Question 21**(4 marks)**

Knowing the correct pressure height and density height is critical when calculating aircraft performance.

(a) Calculate airfield pressure height using the following data:

- airfield elevation 1700 ft above mean sea level (AMSL)
- OAT 19 °C
- QNH 1019 hPa.

Show all workings.

(2 marks)

(b) Calculate airfield density height using the following factors:

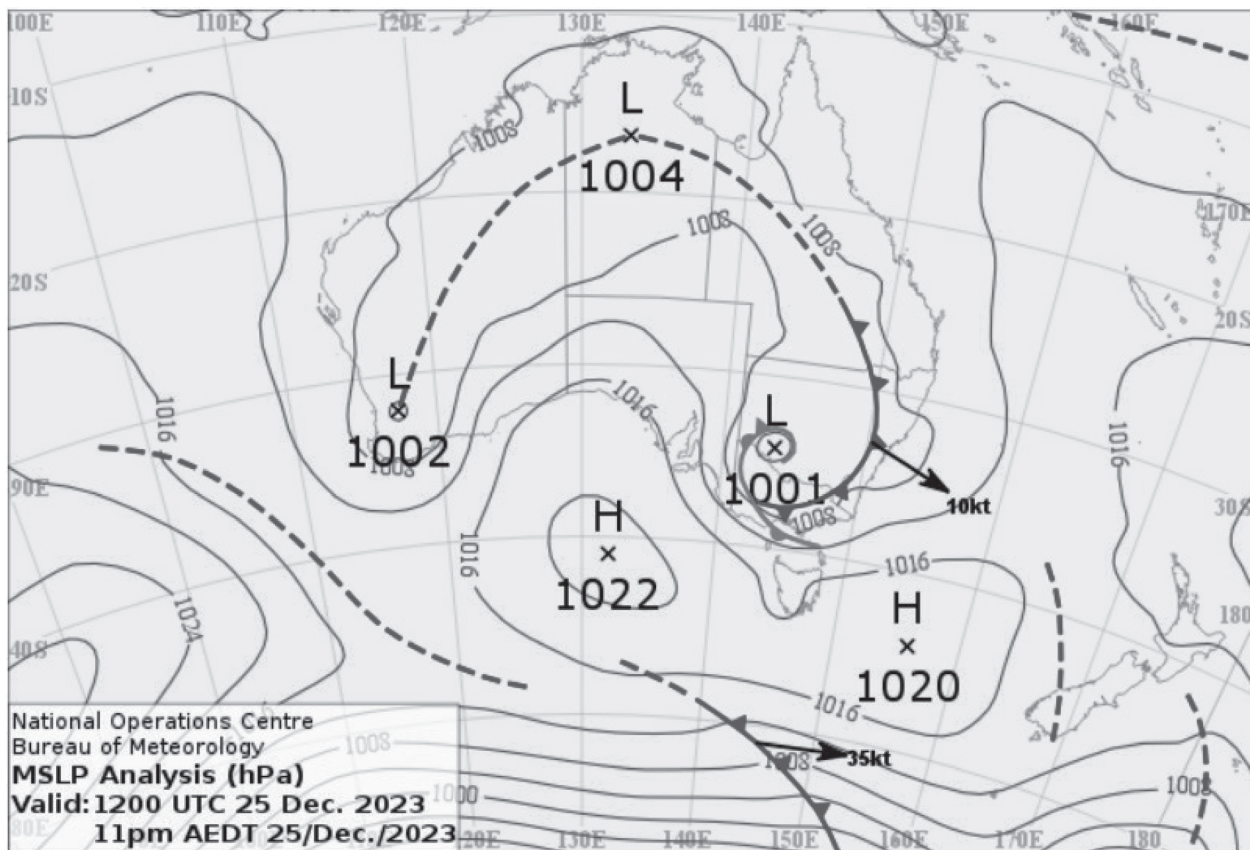
- airfield pressure height 3500 ft
- OAT 5 °C.

Show all workings.

(2 marks)

Question 22

(4 marks)



Using the synoptic chart supplied, identify the:

- (a) meaning of the symbol ■■■■■■■■■■. (1 mark)

- (b) meaning of the symbol ●●●●. (1 mark)

- (c) meaning of the symbol ●▲●▲. (1 mark)

- (d) forecast QNH at position 20°S 155°E. (1 mark)

See next page

Question 23**(3 marks)**

The ageing of general aviation aircraft is a significant issue in the industry. Identify **three** impacts resulting from the ageing general aviation fleet.

One: _____

Two: _____

Three: _____

Question 24**(4 marks)**

Local mean time (LMT) changes depending on an aircraft's position globally. Explain how time is considered globally, particularly in relation to LMT.

Question 25

(8 marks)

Weather reports utilised in aviation are vital for flight safety. Identify the type and purpose of the following aviation weather forecasts based on their abbreviations:

(a) TAF (2 marks)

Type: _____

Purpose: _____

(b) GAF (2 marks)

Type: _____

Purpose: _____

(c) SIG WX (2 marks)

Type: _____

Purpose: _____

(d) GPWT (2 marks)

Type: _____

Purpose: _____

Question 26**(4 marks)**

Developing knowledge of weather patterns is vital in assisting flight planning. Describe the weather conditions most commonly experienced across southern Australia during winter.

Question 27**(4 marks)**

When flying for maximum range on a given amount of fuel, the aircraft must be configured appropriately. Explain why the aircraft should be flown at the best lift over drag ratio.

Question 28

(8 marks)

Understanding weather phenomena and their impact on aircraft is vital for the pilot in command of an aircraft. For the following weather phenomena, identify the most common cause and the nature of the hazard for aircraft operations.

- (a) Microburst (2 marks)

Cause: _____

Hazard: _____

- (b) Turbulence (2 marks)

Cause: _____

Hazard: _____

- (c) Dust devil (2 marks)

Cause: _____

Hazard: _____

- (d) Tropical cyclone (2 marks)

Cause: _____

Hazard: _____

Question 29**(6 marks)**

The instrument landing system (ILS) is an important navigation aid which helps pilots navigate their aircraft to a runway. The ILS consists of various components, including the glide slope. Describe the function, principle of operation and limitations of the glide slope portion of the ILS.

(a) Function (2 marks)

(b) Principle of operation (2 marks)

(c) Limitations (2 marks)

Question 30

(2 marks)

Calculate the required compass heading to be flown, given the following information:

- true track 031°T
- variation 3°E.

Show all workings.

DEVIATION CARD					
FOR					
N	30	60	E	120	150
STEER					
N	32	60	88	118	148
FOR					
S	210	240	W	300	330
STEER					
S	212	240	272	302	330

Question 31

(7 marks)

One way to ensure the safety of an aircraft and its occupants is to ensure that it is loaded correctly within its design weight and balance limits.

- (a) Complete the table below for a Piper PA-32RT-300T aircraft to show the weight, position of the centre of gravity and moment at zero fuel weight. Round calculations to one decimal place. (4 marks)

Position	Weight (lbs)	Arm (in)	Moment (lbs/in)
Aircraft	2335.9		195 105
Front	362	85.50	
Centre	67	118.1	
Rear	343	155.7	
Forward baggage	15	42	
Aft baggage	15	178.7	
Zero fuel weight			

An aircraft has a take-off weight (TOW) of 3472.9 lbs and a centre of gravity (CG) position 36.77 inches aft of the datum. The CG limits are between 33 inches and 37 inches aft of the datum. The maximum permissible TOW is 3600 lbs.

- (b) State whether the aircraft can be brought to its maximum all up weight (MAUW) by placing the extra possible weight in the 'Forward baggage' compartment (station 42) and remain in limits. Justify your answer. (3 marks)

Question 32

(4 marks)

Explain the effects of altitude on a normally aspirated engine's performance as an aircraft climbs.

Question 33

(3 marks)

A pilot wants to maintain a true track of 127° . The planned true airspeed (TAS) is 130 kts and planned fuel burn is 35 litres per hour. Given the following wind forecast of $185^\circ T/17$ kts, calculate the following:

- (a) required heading to be flown in $^\circ T$. (1 mark)

- (b) ground speed. (1 mark)

- (c) planned fuel burn for a cruise leg of 45 nm. (1 mark)

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See next page

Question 34**(2 marks)**

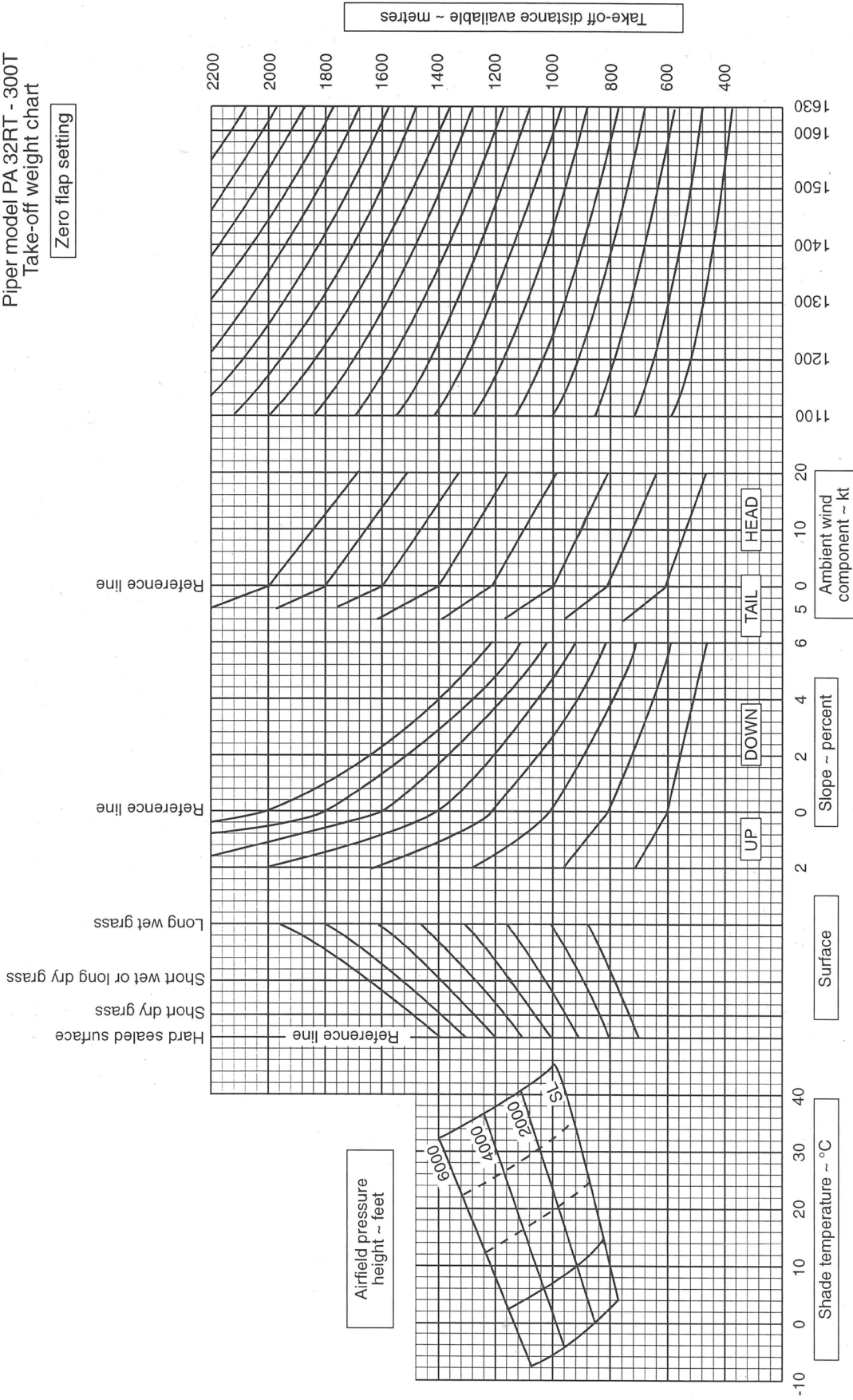
Calculate the take-off distance required using the Piper PA 32RT-300T take-off weight chart on page 19 and the following data:

- outside air temperature 28 °C
- pressure height 3000 ft
- surface short wet grass
- slope 1% down
- 7 kt headwind
- take-off weight 1440 kg.

Show all workings.

Piper model PA 32RT - 300T
Take-off weight chart

Zero flap setting



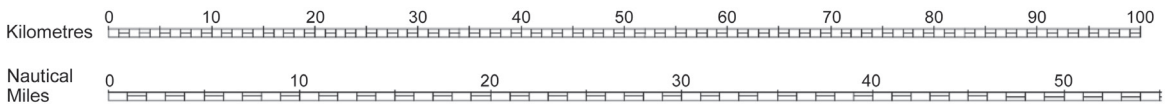
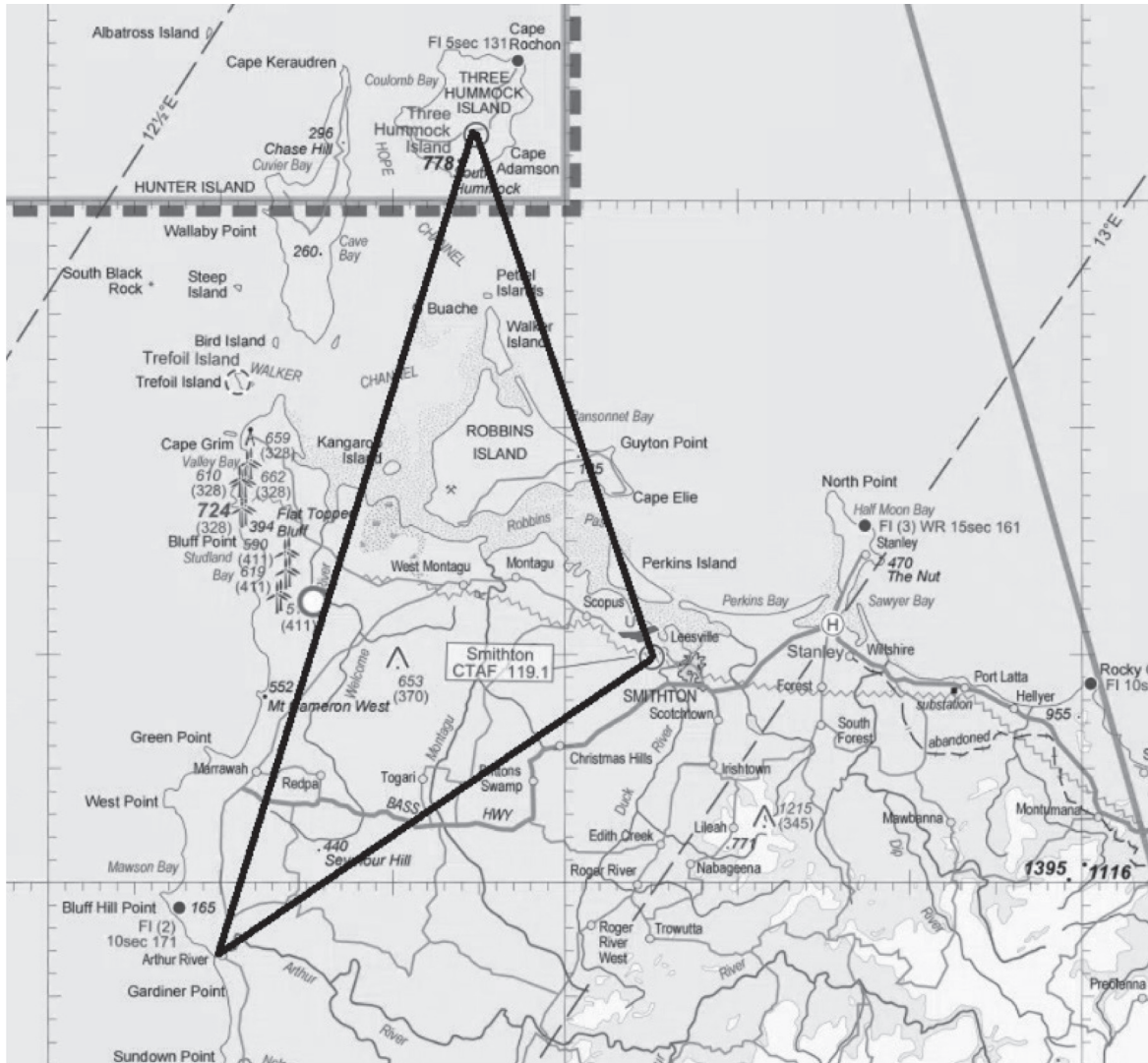
See next page

Question 35

(10 marks)

Use the chart below for a visual flight rules (VFR) flight from Smithton airport to overhead Arthur River township to Three Hummock Island airport and back to Smithton airport.

- (a) Given the lowest hemispherical altitude above 3000 ft, magnetic variation of 13°E and a cruising true airspeed of 100 kt, complete the following flight plan in the table below, and use the attached scale. (5 marks)



Position	Altitude	Track (T)	Track (M)	Distance (nm)

After departing Smithton, a position fix finds you directly overhead Togari township.

- (b) Using the 1:60 rule, calculate your track error to the nearest degree. Show all workings. (2 marks)

After travelling 25 nm of a 72 nm leg on a heading of 132°M , a position fix finds you 4 nm off track to the right.

- (c) Calculate the heading change to track direct to your destination, to the nearest degree. (3 marks)

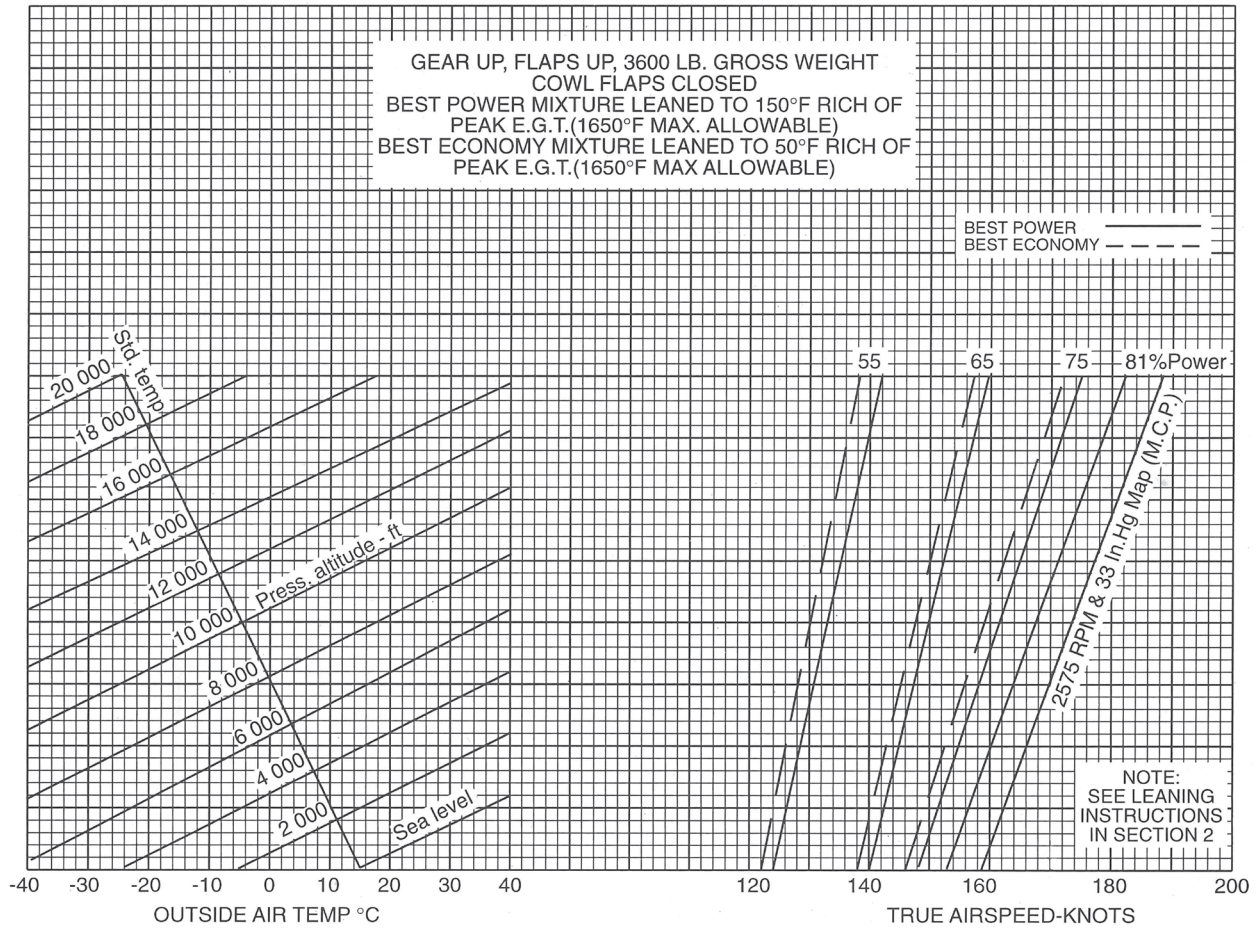
Question 36

(2 marks)

Use the performance chart below and the following data to determine the best power cruise true airspeed (TAS) and cruise power setting.

- cruise pressure altitude of 13 000 ft
- outside air temperature (OAT) of -12 °C
- 65% power

PA-32RT Cruise Performance Chart



TAS: _____

Cruise power setting: _____

Question 37**(5 marks)**

To relieve the force required by the pilot of a light aircraft during the climb phase, an ancillary control surface is employed.

(a) Name the ancillary control employed. (2 marks)

(b) In the space below, draw a diagram to show the position that the ancillary control surface must be in during a climb to relieve the control force required to maintain the intended attitude. Ensure that your diagram includes the:

- position of the ancillary control surface
- position of the related primary control surface
- related stabiliser that the primary control is attached to.

(3 marks)

Question 38

(7 marks)

There are many factors that affect longitudinal, lateral and directional stability.

For each of the factors described in the table below, identify whether it will affect longitudinal, lateral or directional stability.

Factor	Stability affected: <ul style="list-style-type: none"> • longitudinal • lateral or • directional.
High and low wing configurations	
Surface area of the vertical fin and rudder	
Movement in the centre of pressure	
Dihedral/anhedral	
Changes in thrust	
Distance of the fin and rudder from the centre of gravity	
Distance of horizontal stabiliser from the centre of gravity	

Question 39**(6 marks)**

Slots are high lift devices that are employed on the aerofoils of an aircraft.

- (a) Name the **two** types of wing flaps that use slots to improve their efficiency. (2 marks)

One: _____

Two: _____

- (b) Identify whether a leading-edge slot increases or decreases the stalling angle of an aerofoil. (1 mark)

- (c) State the number of degrees that a leading-edge slot can affect the stalling angle of an aerofoil. (1 mark)

- (d) Outline how slots affect the control of an aerofoil's boundary layer. (2 marks)

Question 40

(6 marks)

To hover a helicopter stationary over a fixed position, simultaneous use of all controls by the pilot is required. For the following controls, describe the movement of the associated aerodynamic surface and how it affects control of the hovering helicopter.

- (a) Cyclic pitch control (2 marks)

Movement of the associated aerodynamic surface:

How it affects control of the hovering helicopter:

- (b) Collective pitch control (2 marks)

Movement of the associated aerodynamic surface:

How it affects control of the hovering helicopter:

- (c) Anti-torque or tail rotor pedals (2 marks)

Movement of the associated aerodynamic surface:

How they affect control of the hovering helicopter:

Question 41

(7 marks)

A helicopter is transitioning from the hover to forward flight. Starting from zero knots, it continues to accelerate until it reaches its maximum speed. During the acceleration, the amount of power required changes.

- (a) Name the term given to the type of lift that causes this change in power requirements. (1 mark)

- (b) Describe the changes in the amount of power required as the helicopter moves from the hover to its maximum speed. (2 marks)

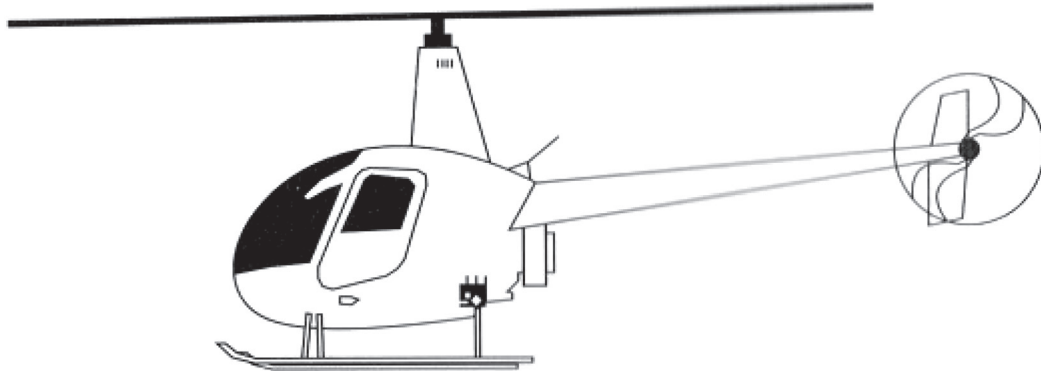
- (c) Explain why the amount of power required changes as the helicopter moves from the hover to its maximum speed. (4 marks)

Question 42

(5 marks)

A helicopter is hovering on a helipad in nil wind.

- (a) Using the diagram below, draw and label the vectors of force that would be acting on the helicopter hovering in nil wind. (4 marks)



- (b) State the relative magnitude of the forces acting on a helicopter hovering in nil wind. (1 mark)

Question 43**(6 marks)**

The ability of a pilot to see colour is an important aspect of operating an aircraft.

- (a) Name the cells in the eye that are responsible for detecting colour. (1 mark)

- (b) Identify **three** colours that the light receptors in the eye are sensitive to. (3 marks)

One: _____

Two: _____

Three: _____

- (c) State **two** primary reasons why pilots with defects in the colour detectors in the eye are barred from holding a pilot licence. (2 marks)

One: _____

Two: _____

Question 44**(3 marks)**

Aviation safety has been significantly improved by the inclusion of ergonomic considerations in the cockpit.

Name **three** methods used by aircraft manufacturers to assist aircrew to avoid the misidentification of engine controls.

One: _____

Two: _____

Three: _____

Question 45

(6 marks)

The threat and error management (TEM) model has been developed in the aviation industry as an important means of implementing crew resource management (CRM) theory.

- (a) Using the TEM model, from the perspective of a crew operating an aircraft, identify whether the situations in the table below would be categorised as a threat, error, undesirable aircraft state or countermeasure. (5 marks)

Situation	Category: <ul style="list-style-type: none"> • threat • error • undesirable aircraft state or • countermeasure.
An air traffic controller clears an aircraft to land on an occupied runway	
An aircraft is recovered after a stall warning sound	
The crew misreads a taxi sign and lines up for take-off on a runway that is not in use	
An aircraft is high and fast on an approach due to wind shear	
There is low visibility at an aerodrome	

- (b) State the reason why TEM is incorporated in flight crew training. (1 mark)

Question 46**(6 marks)**

The global navigation satellite system (GNSS) is an integral part of modern aircraft navigation systems. GPS is an example of one such system.

- (a) Outline the principle of operation of GPS. (5 marks)

- (b) State the minimum number of satellites required for three-dimensional navigation using GPS. (1 mark)

Question 47

(7 marks)

Flying after a period of scuba diving can have a negative effect on the human body due to an inhaled gas dissolving in the bloodstream.

(a) Name the gas that has the potential to have a negative effect after scuba diving. (1 mark)

(b) Name the term given to this negative effect. (1 mark)

(c) Describe the process by which the debilitating negative effect named in part (b) occurs when flying after a period of scuba diving. (4 marks)

(d) If the negative effect named in part (b) were to occur during the flight of an unpressurised aircraft, state the most effective remedy. (1 mark)

Question 48**(6 marks)**

The Asia-Pacific region airlines recorded a 283% increase in aircraft movements in March 2023 compared with 2022. Outline **two** resulting impacts on each of the following:

- (a) Aviation industry (2 marks)

One: _____

Two: _____

- (b) Community (2 marks)

One: _____

Two: _____

- (c) Environment (2 marks)

One: _____

Two: _____

ACKNOWLEDGEMENTS

- Question 22** Adapted from: Bureau of Meteorology. (2023). *MSLP Analysis (Manual) Australian Region - 1200 UTC 25/12/2023* [Chart]. Retrieved April, 2024, from <http://www.bom.gov.au/archive/charts/2023/12/IDX0102.202312251200.gif>
Used under Creative Commons Attribution 3.0 Australia licence.
- Question 34** Yeo, M., Bowers, G., & Bennett, K. (2001). Piper Model PA32RT-300T Take-off Weight Chart. *Handbook of Flight* (2nd ed.). WestOne Services, p. 147. Not for operational purposes.
- Question 35** Adapted from: Airservices Australia. (2023). *Visual Navigation Chart Launceston*. Retrieved April, 2024, from https://www.airservicesaustralia.com/aip/current/aipchart/vnc/Launceston_VNC_30NOV2023.pdf
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- Question 36** Yeo, M., Bowers, G., & Bennett, K. (2001). PA-32RT Cruise Performance Chart. *Handbook of Flight* (2nd ed.). WestOne Services, p. 170. Not for operational purposes.
- Question 42** Yeo, M., Bowers, G., & Bennett, K. (2001). [Diagram of a helicopter]. *Handbook of Flight* (2nd ed.). WestOne Services, p. 45. Not for operational purposes.
- Question 48** Information adapted from: International Air Transport Association. (2023, May 4). *Air Travel Growth Continues in March*. Retrieved July, 2024, from <https://www.iata.org/en/pressroom/2023-releases/2023-05-04-01/#:~:text=%EE%80%80Asia-Pacific%EE%80%81%20airlineshad>

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