ATAR course examination, 2020

Question/Answer booklet

AVIATION

Please place your student identification label in this box

WA student number: In figures ☐☐ ☐☐☐ ☐☐☐

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	30	30	120	124	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 2020: 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.

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.

See next page

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.

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1.   An aircraft is travelling at a true airspeed (TAS) of 143 knots and has a tailwind of 7 knots. Assuming no instrumentation errors, at what distance apart should 10 minute markers be placed on a chart?

    (a)   15 nm
    (b)   20 nm
    (c)   25 nm
    (d)   30 nm

2.   The adverse effects of gravity-induced loss of consciousness (G-LOC) can be **most** effectively reduced by

    (a)   human centrifuge training.
    (b)   improved aircraft stability.
    (c)   sitting upright.
    (d)   high-altitude training.

3.   An AIRMET (AIRmen's METeorological information) is a report that provides information regarding

    (a)   improving conditions not included in the Graphical Area Forecast.
    (b)   deteriorating conditions not included in the Graphical Area Forecast.
    (c)   any changes to the Graphical Area Forecast.
    (d)   an update to any meteorological forecast that is current.

4.   The **most** significant factor in limiting further development of composite materials in aviation is

    (a)   regulation.
    (b)   inferiority to aluminium.
    (c)   lack of strength.
    (d)   cost.

See next page

5. A pilot holding a Class 1 medical certificate increases their Civil Aviation Safety Authority (CASA) approved medication dosage for a period of 10 days. According to CASA regulations, what action **must** be taken by this pilot?

   (a) no further action is required
   (b) no action is required if this lasts for less than 30 days
   (c) report the change in medication to a Designated Aviation Medical Examiner (DAME) within 5 days
   (d) report the change in medication to CASA immediately

6. Propellers are generally feathered to

   (a) increase engine performance.
   (b) reduce RPM.
   (c) increase drag.
   (d) reduce drag.

7. The bucket-thrust reverser system generally operates using

   (a) hydraulic power and reverse cold exhaust stream.
   (b) hydraulic power and reverse hot exhaust stream.
   (c) electric power and reverse cold exhaust stream.
   (d) electric power and reverse hot exhaust stream.

8. Decelerating an aircraft on an easterly or westerly heading will result in the aircraft's magnetic compass indicating a turn to the

   (a) north.
   (b) south.
   (c) left.
   (d) right.

9. The **most** significant factor in limiting the future development of unmanned aerial vehicle (UAV) technology is

   (a) airspace and other aircraft.
   (b) cost and UAV size.
   (c) payload capacity.
   (d) licensing requirements.

10. For maximum endurance, an aircraft is flown at

    (a) high altitude and maximum power.
    (b) high altitude and minimum power.
    (c) low altitude and maximum power.
    (d) low altitude and minimum power.

11. The **most** significant effect on an aircraft's operations caused by a dust devil is

(a)   reduced visibility.
(b)   increased hail.
(c)   change in aircraft performance.
(d)   increased rain frequency.

12. Piston-engine performance reduces with altitude due to

(a)   increased air density.
(b)   decreased air density.
(c)   greater airspeed.
(d)   reduced airspeed.

13. The design feature **most** likely to be incorporated into a supersonic aircraft is a

(a)   delta wing.
(b)   swept wing.
(c)   turbojet engine.
(d)   turbofan engine.

14. In an aircraft with a constant speed propeller, the throttle controls the

(a)   tachometer.
(b)   manifold pressure.
(c)   exhaust gas temperature.
(d)   cylinder head temperature.

15. When winter occurs in the Southern Hemisphere, the Earth's geographic North Pole is

(a)   vertical to the plane of rotation around the Sun.
(b)   tilted away from the Sun.
(c)   tilted toward the Sun.
(d)   toward 90° from the Sun.

16. The airspeed limitation Va indicates the

(a)   turbulence penetration speed.
(b)   maximum manoeuvring speed.
(c)   flap operating speed.
(d)   normal operating speed.

17. Actual time interval is the

     (a)   time difference between time zones.
     (b)   actual time at a future position.
     (c)   planned time to fly between locations.
     (d)   time taken to fly between locations.

18. The **main** advantage of the head-up display (HUD) is the

     (a)   easy access to information.
     (b)   limitless information.
     (c)   cost.
     (d)   coloured display.

19. A pilot is only licensed for daytime visual flight rules (VFR) flying. When planning a flight that is landing near the end of daylight, this pilot will **not** need to consider

     (a)   aerodrome lighting.
     (b)   terrain.
     (c)   cloud.
     (d)   rain.

20. A VFR pilot conducting a flight tracking 080° M should plan to cruise at

     (a)   6000 ft.
     (b)   6500 ft
     (c)   7000 ft.
     (d)   7500 ft.

End of Section One

Section Two: Short answer **80% (124 Marks)**

This section has **30** 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 **(2 marks)**

Given the following data:
- airfield elevation 715 ft
- QNH 1025 hPa
- OAT 27 °C,

calculate airfield pressure height. Show **all** workings.

Question 22 **(2 marks)**

Given the following data:
- airfield pressure height 1500 ft
- QNH 1016 hPa
- OAT 16 °C,

calculate airfield density altitude. Show **all** workings.

Question 23 **(3 marks)**

Colour blindness can cause problems for pilots as a result of their inability to determine particular colours. List **three** instances of such problems.

One: _____

_____

Two: _____

_____

Three: _____

_____

Question 24 **(4 marks)**

A pilot has a required flight track of 040° T and is flying at a true airspeed (TAS) of 155 kt. The aircraft is experiencing a wind of 080° T/22 kt. Using a flight computer, complete the following table.

Drift angle	Direction of drift	Required heading	Groundspeed

Question 25 **(2 marks)**

Given an exact time of 1429 Local Mean Time (LMT) and a position of 20° 45′ S 125° 25′ E, use the Conversion of Arc to Time chart on the next page to convert the LMT to the Coordinated Universal Time (UTC), correct to the nearest second.

_____

_____

_____

_____

See next page

CONVERSION OF ARC TO TIME											
DEGREES						MINUTES					
	Time			Time			Time			Time	
Long Deg	Hours Min	Sec	Long Deg	Hours Min	Sec	Long Min	Min	Sec	Long Min	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

See next page

Question 26 **(5 marks)**

An aircraft is flying within coverage of the Automated Dependent Surveillance Broadcast (ADSB), primary and secondary surveillance radars. Describe how the aircraft interacts with each form of radar for Air Traffic Control (ATC) to identify the aircraft's position.

(a) ADSB (1 mark)

_____

_____

_____

(b) primary surveillance radar (2 marks)

_____

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_____

_____

(c) secondary surveillance radar (2 marks)

_____

_____

_____

_____

_____

See next page

Question 27   **(3 marks)**

An aircraft designer wants to develop the most laterally-stable aircraft possible. Name **three** features that would need to be included in the design.

One: _____

_____

Two: _____

_____

Three: _____

_____

Question 28   **(2 marks)**

Unconventional control surfaces can be designed for multiple purposes on aircraft. Stabilators are common on high-performance aircraft to assist with controllability. Describe the purpose and operation of stabilators on an aircraft.

_____

_____

_____

_____

_____

Question 29   **(4 marks)**

Data from the Australian Transport Safety Bureau indicate that, in 2017, the most common form of accident or serious incident in general aviation was terrain collision. Identify **two** possible reasons for terrain collision and state why each is specific to general aviation.

Reason for terrain collision	Why this is specific to general aviation
One:	
Two:	

Question 30 **(7 marks)**

Consider the following meteorological information.

TAF YPPH 271111Z 2712/2818
07025G35KT 9999 -SHRA SCT050
FM280300 05018G28KT 9999 -SHRA SCT030
BECMG 2807/2809 33012KT 9999 NSW SCT030
FM281200 27010KT 9999 SCT018
TEMPO 2816/2818 2000 DZ BKN008 BKN020
PROB30 INTER 2712/2806 VRB25G45KT 4000 TSRA SCT015 FEW050CB
RMK FM271200 SEV TURB BLW 5000FT TL280200
FM280200 MOD TURB BLW 5000FT TL280400
T 24 25 24 24 Q 1008 1008 1007 1006

TTF SPECI YPPH 271200Z 09027G39KT 9999 -TSRA FEW050 SCT125 FEW120CB
24/18 Q1008
RMK RF00.0/004.8
FM1300 07020G35KT 9999 -SHRA SCT050
INTER 1200/1400 07030G45KT 4000 TSRA SCT015 SCT050CB
FM1200 SEV TURB BLW 5000FT

(a)   What do the initials 'NSW' stand for?   (1 mark)

_____

(b)   Use the meteorological information above to determine each of the following:

    (i)   forecast QNH at 1800Z on the 27th   (1 mark)

_____

    (ii)   dewpoint temperature at 1200Z   (1 mark)

_____

    (iii)   actual wind at 1200Z   (1 mark)

_____

    (iv)   when drizzle is forecast and for how long   (2 marks)

_____

_____

    (v)   period of validity of the TAF.   (1 mark)

_____

See next page

Question 31 (2 marks)

A pilot is flying from A to B in a twin-engined aircraft (not centreline thrust). The right engine suffers complete power loss, requiring the pilot to apply left rudder force. The pilot decides to use the rudder trim to reduce the excess rudder pedal force. Draw a diagram to demonstrate the operation of a moveable rudder trim tab in this scenario.

Question 32 (4 marks)

A pilot is flying in cloud without a visual horizon. The aircraft's wings are banked approximately 15 degrees to the right for a moderate period of time. The pilot then corrects this by way of an abrupt aileron input, returning the aircraft to straight and level flight using the artificial horizon as guidance.

(a) Describe the sensations likely to be perceived by this pilot in Instrument Meteorological Conditions (IMC), immediately before and after the correction. (2 marks)

(b) How would the sensations be different from those in part (a) for the pilot in Visual Meteorological Conditions (VMC)? (2 marks)

See next page

Question 33 **(2 marks)**

Using a flight computer, determine each of the following.

(a)   If an aircraft is travelling at 147 kt, how many minutes will it take to travel 500 nm?

(1 mark)

_____

_____

(b)   If an aircraft uses 38 litres per hour and has total usable fuel of 140 litres, how long will it be before it runs out of fuel? (1 mark)

_____

_____

Question 34 **(4 marks)**

Carbon monoxide poisoning will have a significant effect on pilots and passengers during flight.

(a)   How is carbon monoxide poisoning most likely to occur in a light aircraft? (1 mark)

_____

_____

A pilot experiences carbon monoxide poisoning.

(b)   Identify **three** symptoms of carbon monoxide poisoning you would observe in the pilot at different stages. (3 marks)

One: _____

Two: _____

Three: _____

Question 35 **(2 marks)**

Use the chart on the next page to calculate the End of Daylight time (LMT) on 17 January for the position 20° 45′ S 125° 25′ E. Show **all** workings.

_____

_____

End of Daylight Southern Hemisphere
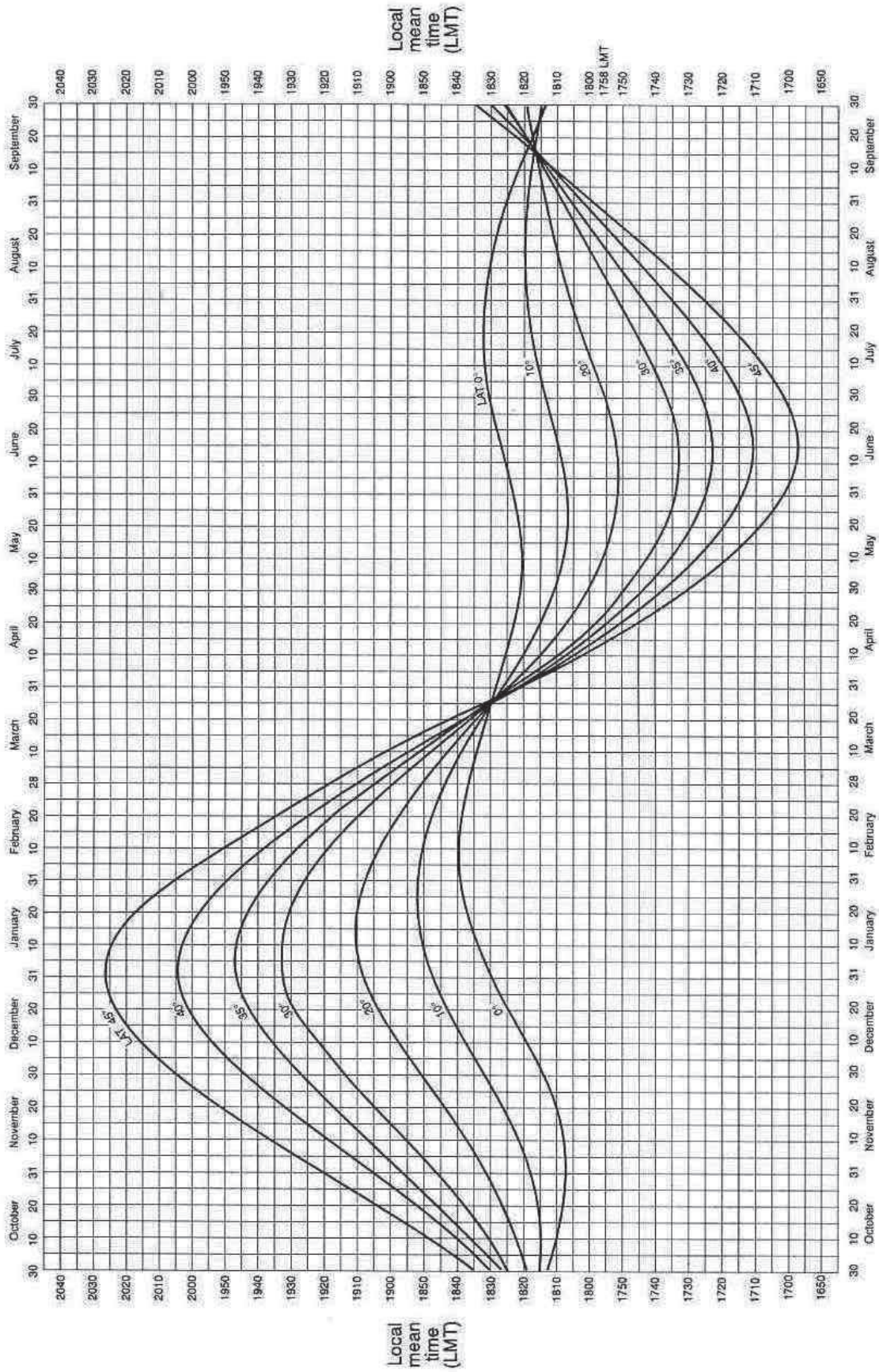
Question 36 **(4 marks)**

Tailwheel aircraft tend to loop in certain circumstances when operating on the ground. With the aid of the diagram below, explain the phenomenon of ground loop for an aircraft landing with a strong wind from its starboard side.

_____

_____

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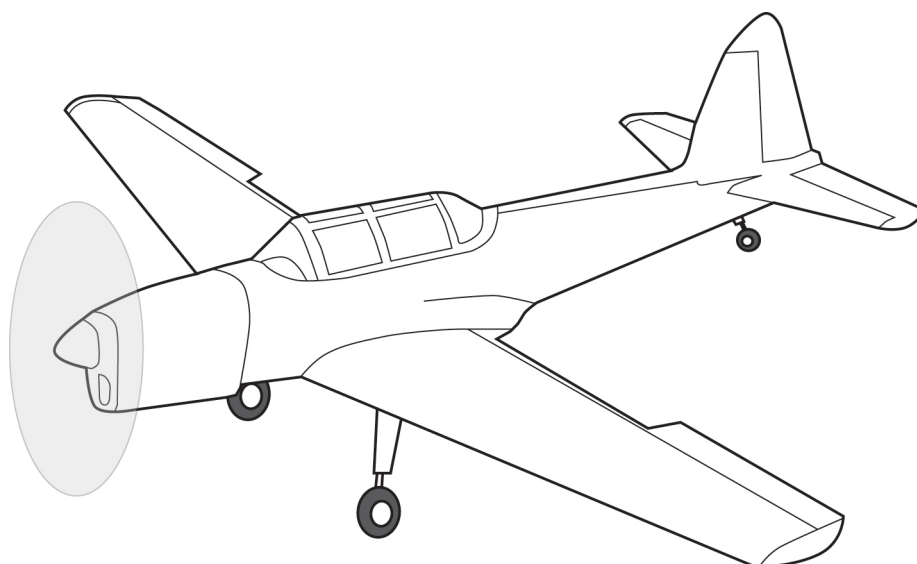
Question 37 **(3 marks)**

Antihistamines are commonly used to control a variety of conditions, including allergic reactions. State **three** possible negative effects of using antihistamines for a pilot.

One: _____

Two: _____

Three: _____

See next page

Question 38 **(2 marks)**

A Piper Cherokee is conducting a 60° angle of bank turn. Steep turns can have a significant effect on aircraft performance, so it is important to know the extent of this effect. State the load factor and the increase in stall speed of the aircraft.

_____

_____

_____

_____

Question 39 **(2 marks)**

An aircraft is being flown to become established on the Instrument Landing System (ILS). Explain the frequency bands received from the ILS ground antennae and their role as part of this system.

_____

_____

_____

_____

Question 40 **(3 marks)**

Superchargers are used to increase the performance of piston engines at higher altitudes. Explain the operation of a supercharger on a piston engine.

_____

_____

_____

_____

_____

_____

See next page

Question 41 (11 marks)

Using the information table below and the Take-off and Performance charts provided on pages 19–21, complete the following question parts that relate to a proposed flight in a Piper PA-32RT-300T Turbo Lance from Alpha to Bravo.

Conditions	Alpha	Bravo	En route	
Pressure height	750 ft	2500 ft	Distance	430 nm
Runway surface	Short wet grass	Long dry grass	Pressure altitude	6500 ft
Runway slope	1% up	Nil	Fuel flow	13.7 gph
Take-off weight	1470 kg		Headwind	5 kt
Temperature	27 °C	25 °C	OAT	7 °C
Wind	10 kt headwind	5 kt headwind	TAS	150 kt

(a)   Determine the minimum take-off distance required at Alpha. Show **all** workings clearly on the appropriate chart(s). (2 marks)

_____

_____

(b)   Determine climb, cruise and descent data to complete the table below to find the total:
   • flight time
   • flight fuel required (excluding reserves, taxi and unusable fuel).

Ignore all winds in the climb and descent. Show **all** workings clearly on the appropriate chart(s). (9 marks)

	Climb	Cruise	Descent	Total
Fuel (gal)				
Time (min)				
Distance (nm)				430 nm

See next page

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

Zero flap setting

Take-off distance available ~ metres

Take-off weight ~ kg

Ambient wind component ~ kt

HEAD   TAIL

Slope ~ percent

DOWN   UP

Reference line

Surface

Long wet grass
Short wet or long dry grass
Short dry grass
Hard sealed surface

Reference line

Airfield pressure height ~ feet

Shade temperature ~ °C
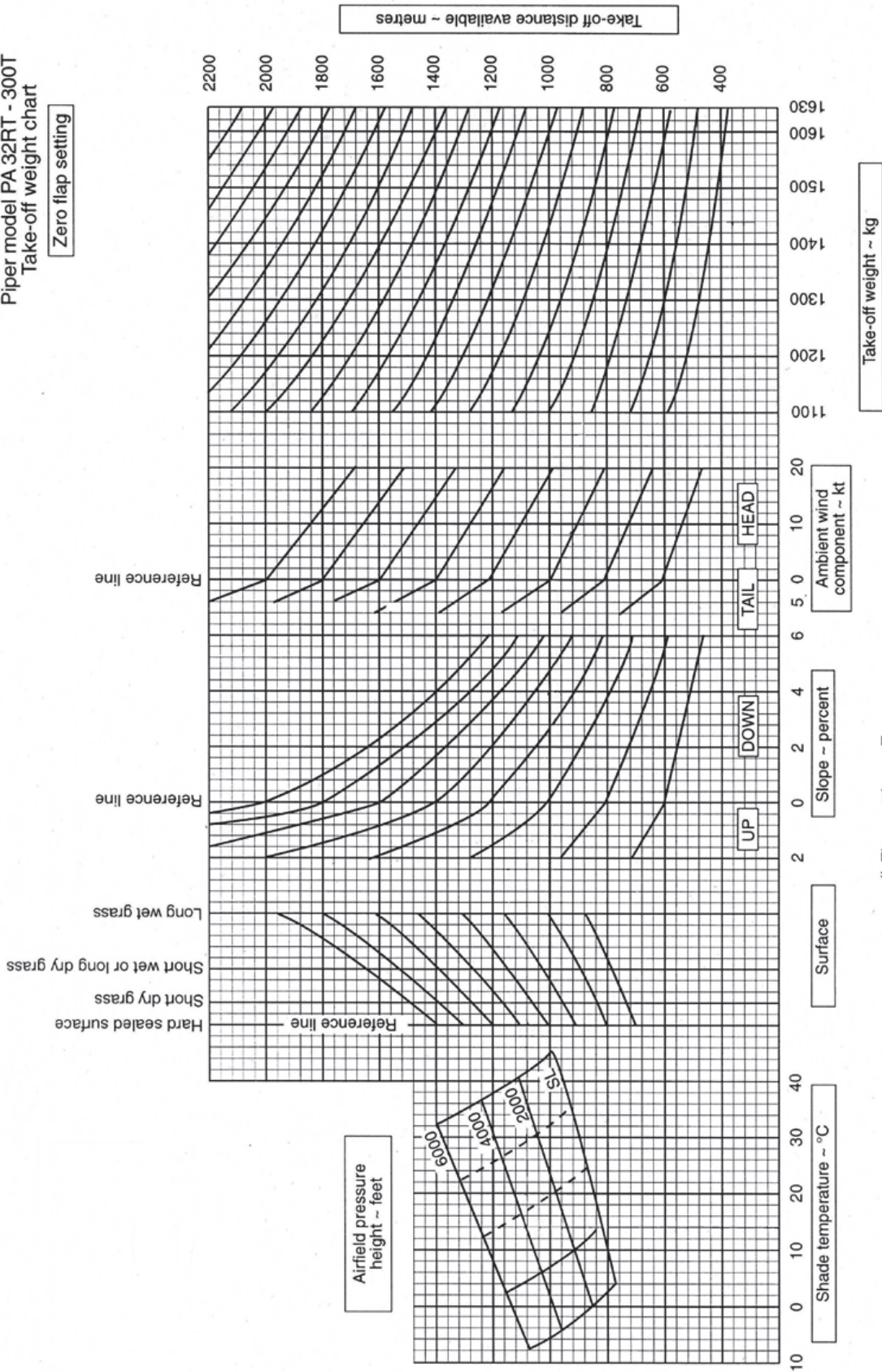
|| Flap setting ~ Zero
Take-off safety speed 78 kt IAS
Power setting ~ Take-off
~ RPM 2700
|| Chart distance factor 1:15

See next page

Question 41 (continued)

GEAR UP, FLAPS UP,
3600 LBS.MAXIMUM
CONTINUOUS POWER
95 KIAS, ZERO WIND

FUEL, TIME & DISTANCE TO CLIMB

OUTSIDE AIR TEMP °C

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

OUTSIDE AIR TEMP °C

FUEL, TIME & DISTANCE TO DESCEND

DISTANCE NAUTICAL MILES

TIME MIN

FUEL GAL

Std. temp

Pressure altitude - ft

Sea level
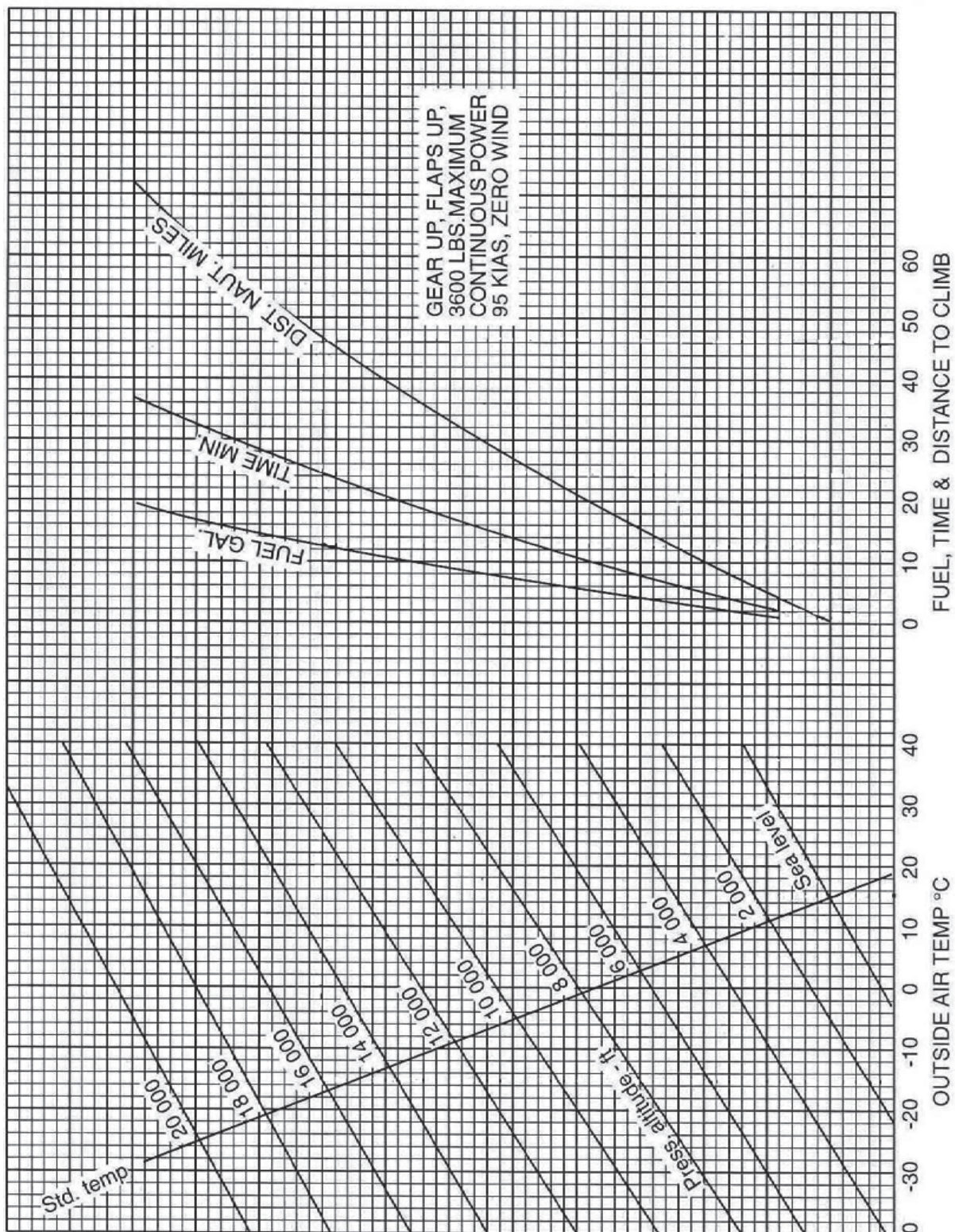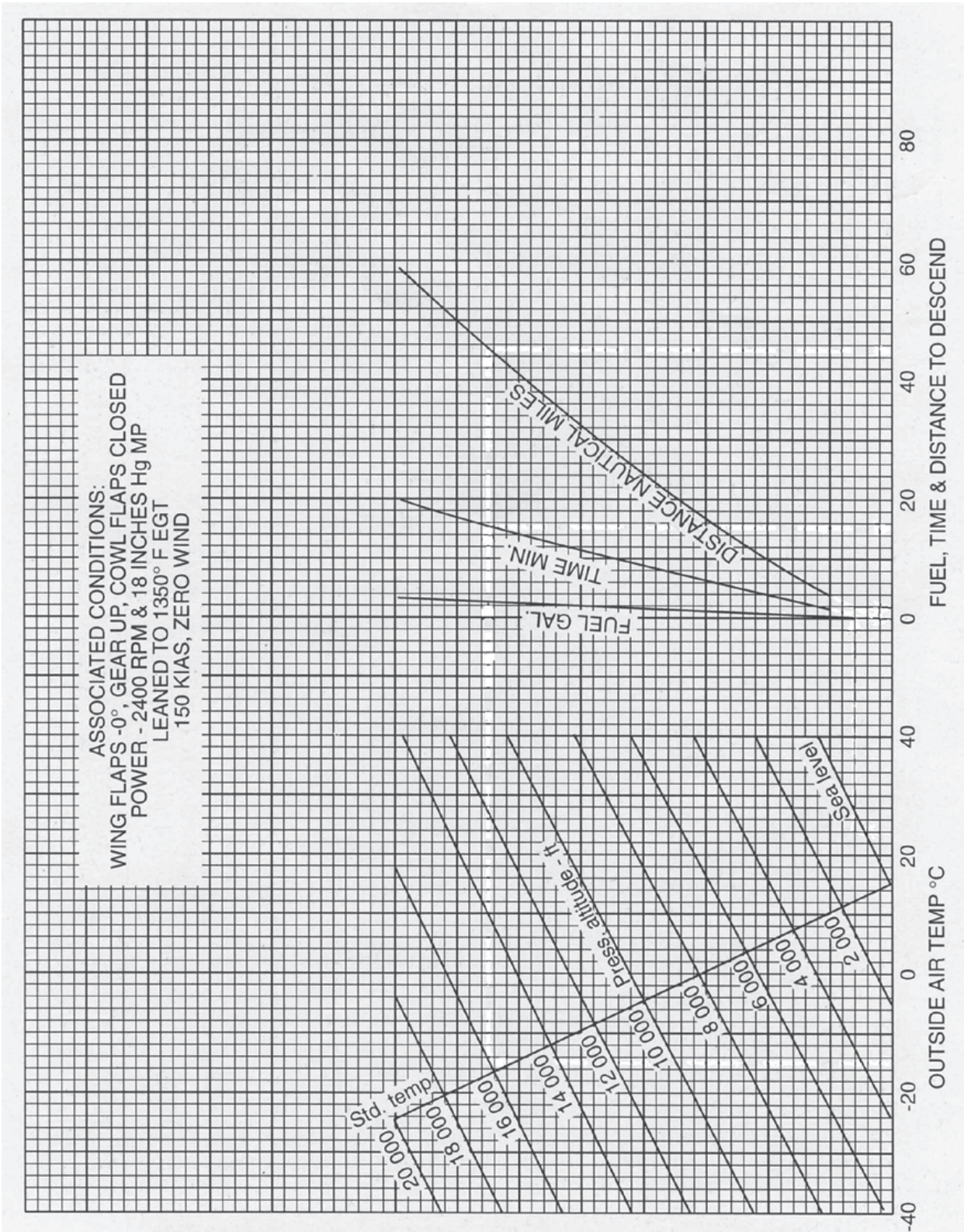
Question 42   **(8 marks)**

Synoptic charts and their correct interpretation are vital to the safety of an aircraft and its occupants.

(a)   Identify the correct meaning of the following symbols on a synoptic chart.

     (i)   ■■ ■ ■■ ■ ■ ■■   (1 mark)

     (ii)   (1 mark)

Australia has seasonal weather patterns evident each year due to the passage of the Sun and other factors. During summer, typical weather patterns are experienced across southern Australia.

(b)   Assume that southern Australia is experiencing typical weather patterns.

     (i)   State the direction of weather flow.   (1 mark)

     (ii)   Identify the pressure systems.   (1 mark)

     (iii)   Describe the prevailing winds.   (2 marks)

     (iv)   Describe the visibility.   (2 marks)

See next page

Question 43   **(2 marks)**

An aircraft is established on a bearing of 315° from the NDB on a heading of 225°. Draw a diagram showing the correct positioning of the aircraft relative to the NDB and the aircraft's tracking.

Question 44   **(6 marks)**

Visual illusions can cause significant problems for pilots. For each of the following illusions, state their cause and effect and identify a way in which they can be managed.

(a)   Autokinesis   (3 marks)

Cause: _____

_____

Effect: _____

_____

Management: _____

_____

(b)   Flicker vertigo   (3 marks)

Cause: _____

_____

Effect: _____

_____

Management: _____

_____

See next page

Question 45 **(10 marks)**

(a) Helicopters have more complex systems of primary controls than fixed-wing aircraft. State the **three** controls used by helicopter pilots and what each controls. (6 marks)

Controls used by helicopter pilots	What each controls
One:	
Two:	
Three:	

(b) Use the diagram below to illustrate the four forces acting on a helicopter during a vertical descent. (4 marks)

For copyright reasons this image of a helicopter cannot be reproduced in the online version of this document

See next page

Question 46   **(4 marks)**

A VASIS is a visual aid that helps a pilot to maintain the correct approach to a runway. Complete the table below by identifying what the colours of each light array indicate about the aircraft's positioning relative to the glide slope trajectory.

Light array	Positioning
all white lights	
red lights above white lights	
white lights above red lights	
all red lights	

Question 47   **(4 marks)**

The following data apply to an aircraft flying between two points:
- distance 270 nm
- TAS 90 kt
- planned track 240° M
- heading flown 230° M.

After flying 90 nm, the aircraft has drifted 6 nm to the left of track.

(a)   Using the 1 in 60 rule, calculate the track made good. Show **all** workings.   (2 marks)

_____

_____

_____

_____

(b)   Using the 1 in 60 rule, calculate the required heading to fly directly to the intended destination. Show **all** workings.   (2 marks)

_____

_____

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Question 48 (6 marks)

An aircraft completing a 45° angle of bank turn experiences additional forces. Use the diagram below to demonstrate the forces experienced in the turn by applying the following labels:
* lift
* vertical component of lift
* weight
* apparent weight
* centripetal force
* centrifugal reaction.
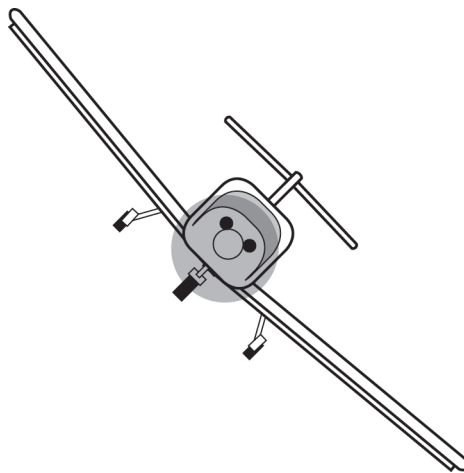
Question 49 (3 marks)

Threat and error management (TEM) is now a vital part of pilot training. Airmanship is integral to TEM and is also taught as part of flight crew training. Identify **three** elements of airmanship that a pilot in command should display.

One: _____

_____

Two: _____

_____

Three: _____

_____

See next page

Question 50 **(8 marks)**

Low-cost airline carriers (LCCs) have become more popular as a result of their cheaper fares.
Discuss how the increase in LCCs has affected the:
*   broader aviation industry
*   community
*   environment.

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End of questions

Supplementary page

Question number: _____

Supplementary page

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Supplementary page

Question number: _____

ACKNOWLEDGEMENTS

Yeo, M., Bowers, G., & Bennett, K. (2001). Fuel, time & distance to descend [Chart]. *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 171.
Not for operational purposes.

Question 45(b)   Adapted from: Federal Aviation Administration (DOT). (1973). Chapter 2. Aerodynamics of flight (Fig. 10). *Basic helicopter handbook*. Washington, D.C.: Federal Aviation Agency (DOT), p. 8. Retrieved May, 2020, from http://avstop.com/ac/basichelicopterhandbook/ch2.html

Question 48   Adapted from: Yeo, M., Bowers, G., & Bennett, K. (2001). *Fig. 7.2 manoeuvre loads* [Diagram]. *Handbook of flight* (2nd ed.). Perth: WestOne Services, p. 142.
Not for operational purposes.