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INTRODUCTION
General Navigation is divided into five main areas. It starts with the form of the earth examining direction, distance and time, and ends with looking at the latest flight management systems for in-flight navigation. The relationship of the earth with the sun is the starting point and a positional reference system is developed which allows us to measure direction, distance and time difference. The next area is the Direct Reading Compass and magnetism. Compasses and Magnetism are covered in detail in Instruments. Charts is the next area covered looking at the Mercator, Lamberts Conical and Polar Stereographic charts in detail. For the purposes of JAA examinations orthomorphic and conformal charts are taken as being the same type of chart. Correct use of aeronautical charts for the accurate establishing of aircraft position is essential for safe navigation. The triangle of velocities is the next area looked at with its solution by navigational computer being closely examined. In-flight navigation is the final area and it includes navigation in the climb and descent looking at rates of climb/descent and average speeds, and navigation in the cruise with track correction and revision of estimated time of arrival over a point.

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
060 00 00 00	**NAVIGATION**						
061 00 00 00	**GENERAL NAVIGATION**						
061 01 00 00	**BASICS OF NAVIGATION**						
061 01 01 00	**The solar system**						
061 01 01 01	**Earth's orbit, seasons and apparent movement of the sun**						
LO	State that the solar system consists of the Sun, and a number of planets of which the Earth is one, and a large number of asteroids and comets.	x	x	x	x	x	
LO	State that Kepler's first law explains that the planets revolve in elliptical orbits with the Sun at one focus. Each planet has its orbital period.	x	x	x	x	x	
LO	State that Kepler's second law explains the variation in the speed of a planet in its orbit. Each planet revolves so that its radius vector sweeps out equal areas in equal intervals of time.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State that the highest speed of the Earth in its orbit is when the Earth is closest to the Sun. (perihelion)	x	x	x	x	x	
LO	State that the lowest speed of the Earth in its orbit is when the Earth is furthest away from the Sun. (aphelion)	x	x	x	x	x	
LO	Explain in which direction the earth rotates on its axis.	x	x	x	x	x	
LO	Explain that the axis of rotation of the earth is inclined to its orbital path around the sun at an angle of about 66,5°	x	x	x	x	x	
LO	Define the term “Ecliptic” and “plane of the Ecliptic”. The ecliptic is the apparent path of sun around the earth. The plane of the ecliptic is inclined to the plane of the equator at an angle of approximately 23,5 degrees. The inclination of the polar axis to the plane of the ecliptic is the reason for the seasons.	x	x	x	x	x	
LO	Explain that the Earth completes one orbit around the Sun in approximately 365,25 days.	x	x	x	x	x	
LO	Describe the effect of the inclination of the Earth’s rotation axis to the plane of its orbit around the Sun, being the seasons and variation of sunrise and sunset with latitude and time of the year.	x	x	x	x	x	
LO	Define the term’s “apparent sun” and “mean sun” and state their relationship.	x	x	x	x	x	
LO	Define the celestial equator. It is the projection of the earth’s equator onto the celestial sphere.	x	x	x	x	x	
LO	Define the term declination. Declination is the angular distance of a celestial body north or south of the celestial equator.	x	x	x	x	x	
LO	State that the mean sun is conceived to move eastward along the celestial equator at a rate that provides a uniform measure of time equal to the average time reckoned from the true sun.	x	x	x	x	x	
LO	Define the polar circles, the tropic of Cancer and the tropic of Capricorn.	x	x	x	x	x	
LO	Explain summer and winter solstice.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the terms spring and autumn equinox.	x	x	x	x	x	
LO	Explain at which time of the year the duration of daylight changes at the highest rate.	x	x	x	x	x	
LO	Explain the relationship between the declination of the sun, latitude and the period of daylight.	x	x	x	x	x	
LO	State that perihelion occurs early January and aphelion occurs early July.	x	x	x	x	x	
LO	Illustrate the position of the Earth relative to the Sun with respect to the seasons and months of the year.	x	x	x	x	x	
LO	Define zenith. The point on the sky vertically overhead an observer.	x	x	x	x	x	
061 01 02 00	**The earth**						
061 01 02 01	**Great circle, small circle, rhumb line**						
LO	State that the earth is not a true sphere. It is flattened slightly at the poles. The value for flattening is 1/298.	x	x	x	x	x	
LO	Given the earth flattening and either the semi-major or semi-minor axis in NM/km. Calculate the distance of the other axis.	x	x	x	x	x	
LO	State that the Earth may be described as an “ellipsoid” or “oblate spheroid”.	x	x	x	x	x	
LO	Explain that the Equator has its plane perpendicular to the Earth’s axis and divides the earth into the northern and southern hemisphere	x	x	x	x	x	
LO	Given that the distance of the circumference of the earth is 40000 km or approximately 21600 NM. Calculate approximate earth diameter or earth radius.	x	x	x	x	x	
LO	Define a great circle in relation to the surface of a sphere.	x	x	x	x	x	
LO	Describe the geometric properties of a great circle, including vertex.	x	x	x	x	x	
LO	Define a small circle in relation to the surface of a sphere.	x	x	x	x	x	
LO	Define a Rhumb Line. A line which cuts all meridians at the same angle	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
061 01 02 02	**Convergency, conversion angle**						
LO	Explain the term convergency of meridians between two positions.	x	x	x	x	x	
LO	Explain how the value of convergency can be determined using calculation	x	x	x	x	x	
LO	The formula to calculate convergency between two positions relatively close to each other is: Convergency = Difference of longitude × sin(mean latitude).	x	x	x	x	x	
LO	Calculate the value of convergency between two stated positions	x	x	x	x	x	
LO	Explain that the difference between great circle track and rhumb line track at a specified position is called conversion angle.	x	x	x	x	x	
LO	State that over short distances and out of polar regions the average great circle true track is approximately equal to rhumb line true track between two positions.	x	x	x	x	x	
LO	Explain how the value of conversion angle can be calculated as half the value of convergency.	x	x	x	x	x	
LO	Calculate great circle track and rhumb line track angle at specified position involving calculations of convergency and conversion angle.	x	x	x	x	x	
061 01 02 03	**Latitude, difference of latitude**						
LO	Define geographic latitude as the angle between the plane of the equator and the local plumb-line on the ellipsoid	x	x	x	x	x	
LO	Define geocentric latitude as the angle between the plane of the equator and a line from the position to the centre of the earth.	x	x	x	x	x	
LO	State that maximum difference between geographic and geocentric latitude occurs at a latitude of 45 degrees.	x	x	x	x	x	
LO	Describe a parallel of latitude as a small circle connecting all positions on the earth with the same latitude	x	x	x	x	x	
LO	Calculate difference of latitude between two given positions lat/long.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*			*Helicopter*		*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State that one-degree difference of latitude equals 60 nautical miles.	x	x	x	x	x	
LO	Convert difference of latitude to distance.	x	x	x	x	x	
LO	Calculate the mean latitude between two positions.	x	x	x	x	x	
061 01 02 04	**Longitude, difference of longitude**						
LO	Describe a meridian as a semi great circle, which runs north and south from pole to pole.	x	x	x	x	x	
LO	Explain that the meridians and their anti meridian complete a great circle.	x	x	x	x	x	
LO	State that the Greenwich meridian is also known as the Prime meridian.	x	x	x	x	x	
LO	Define longitude as the angle measured at the polar axis between the plane of the prime meridian and the local meridian.	x	x	x	x	x	
LO	Explain the Greenwich anti meridian is the maximum longitude possible, namely 180° E/W.	x	x	x	x	x	
LO	Calculate difference of longitude between two given positions lat/long.	x	x	x	x	x	
LO	Name examples of great circles on the surface of the Earth.	x	x	x	x	x	
LO	Name examples of small circles on the surface of the earth.	x	x	x	x	x	
		x	x	x	x	x	
LO	Explain the geometrical properties of a rhumb line. Parallels and meridians are special cases of rhumb lines.	x	x	x	x	x	
061 01 02 05	**Use of latitude and longitude co-ordinates to locate any specific position**						
LO	Explain that along the equator a difference of longitude of one degree equals a distance of 60 NM.	x	x	x	x	x	
LO	Explain that because the meridians converge towards the poles the distance between meridians will decrease with increase in latitude.	x	x	x	x	x	
LO	State that earth distance along a parallel of latitude is also known as departure.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Calculate the earth distance between two meridians along a parallel of latitude (departure) using the following formula: Distance = Difference of longitude × 60 × cos latitude.	x	x	x	x	x	
LO	Given a position lat/long, distances travelled north/south in NM/km and distance travelled east/west in NM/km along a parallel of latitude. Calculate new position.	x	x	x	x	x	
LO	Given two positions on same meridian (or one on the anti-meridian) calculate distance.	x	x	x	x	x	
061 01 03 00	**Time and time conversions**						
061 01 03 01	**Apparent time**						
LO	Explain the principles of zone time.	x	x	x	x	x	
LO	Explain that, because the earth rotates on it’s axis from west to east, the celestial bodies appear to revolve around the earth from east to west.	x	x	x	x	x	
LO	Define and explain the term transit. Explain that transit means that a celestial body crosses the observer’s meridian.	x	x	x	x	x	
LO	Explain that the time period a “day” is the elapsed time between two successive transits of a heavenly body.	x	x	x	x	x	
LO	Explain that the term sidereal day is time measured with reference to a fixed point on the celestial sphere.	x	x	x	x	x	
LO	State that, if the day is measured by the apparent passage of the sun the length of a day will vary.	x	x	x	x	x	
LO	Explain the reason for the variation in the length of an apparent day, being a combination of the variation in the earth orbital speed around the sun, and the inclination of the earth rotation axis to the plane of the ecliptic.	x	x	x	x	x	
LO	Illustrate that, since both the direction of rotation of the earth around its axis, and its orbital rotation around the sun are the same, the earth must rotate through more than 360° to produce successive transits.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State that the period between two successive transits of the sun is called an apparent solar day and that the time based on this is called apparent time.	x	x	x	x	x	
LO	State that in order to have a constant measurement of time, which will still have the solar day as a basis, the average length of an apparent solar day is taken. This average day is called the mean solar day. It is divided into 24 hours of mean time.	x	x	x	x	x	
LO	State that the mean sun is a fictitious sun orbiting along the plane of the equator at a constant angular velocity that provides a uniform measure of time.	x	x	x	x	x	
LO	State that the time between two successive transits of the mean sun over a meridian is constant.	x	x	x	x	x	
LO	Explain that the difference between apparent time and mean time is defined as the “equation of time”.	x	x	x	x	x	
LO	State that the time of orbital revolution of the earth in one year around the sun is approximately 365 ¼ calendar days.	x	x	x	x	x	
LO	State that the calendar year is 365 days and every 4th year a leap year with 366 days and 3 leap years are suppressed every 4 centuries.	x	x	x	x	x	
LO	State that time can also be measured in arc since, in one day of mean solar time, the mean sun is imagined to travel in a complete circle round the earth, a motion of 360° in 24 hours.	x	x	x	x	x	
LO	Illustrate the relationship between time and arc along the equator.	x	x	x	x	x	
LO	Deduce conversion values for arc to time and visa-versa.	x	x	x	x	x	
061 01 03 02	**UTC**						
LO	State that the Greenwich meridian is selected as standard meridian, and that LMT at the Greenwich meridian is equal to Greenwich mean time (GMT).	x	x	x	x	x	
LO	State that UTC is based on atomic time and GMT on earth rotation but in practice they are considered as the same.	x	x	x	x	x	
LO	State that the conversion factor between LMT and UTC is Arc (Change of longitude) converted to time.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Convert arc to time.	x	x	x	x	x	
LO	Convert time to arc.	x	x	x	x	x	
LO	Convert between UTC and LMT.	x	x	x	x	x	
061 01 03 03	**LMT**						
LO	State that the beginning of the local mean day at any location is when the mean sun is in transit with the anti meridian. This is known as midnight or 0000 hours LMT.	x	x	x	x	x	
LO	State that when the mean sun is in transit with the location’s meridian it is noon or 1200 hours LMT.	x	x	x	x	x	
LO	State that the LMT at locations at different longitudes vary by an amount corresponding to the change in longitude.						
061 01 03 04	**Standard times**						
LO	State that standard time is the time used by a particular country (or part of country) determined by the government of that particular country.	x	x	x	x	x	
LO	State that some countries use summer time (daylight saving time)	x	x	x	x	x	
LO	State that conversion from UTC to standard time and visa versa is usually done using extracts from the air almanac published in appropriate documents.	x	x	x	x	x	
LO	Given appropriate documents convert from UTC to ST of a specific country and from ST of a specific country to UTC.	x	x	x	x	x	
061 01 03 05	**Dateline**						
LO	Explain the effect on the LMT when approaching the 180° meridian line from either side.	x	x	x	x	x	
LO	State that the dateline does not follow exactly the 180° E/W meridian	x	x	x	x	x	
LO	Explain that when crossing the anti meridian of Greenwich, one day is lost or gained depending on direction of travel.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State that the date line is the actual place where the change is made and, although mainly at the 180° meridian, there are some slight divergences in order to avoid countries being divided by the date line.	x	x	x	x	x	
LO	State that when calculating times, the date line is automatically taken into account by doing all conversions via UTC.	x	x	x	x	x	
LO	Calculate conversions of LMT and GMT/UTC and ST for cases involving the international date line.	x	x	x	x	x	
061 01 03 06	**Determination of sunrise, sunset and civil twilight**						
LO	State that SR or SS is when the sun's upper edge is at the observer's horizon. State how atmospheric refraction affects this apparent sighting.	x	x	x	x	x	
LO	Explain that SR and SS occur at different times on the same meridian depending on the latitude for a given day.	x	x	x	x	x	
LO	Explain that SR will occur earlier and SS occurs later with increase in altitude.	x	x	x	x	x	
LO	State that the times for SR and SS given in the air almanac are calculated for the Greenwich meridian.	x	x	x	x	x	
LO	Explain that at the spring and autumn equinox SR and SS occurs approximately at the same time at all latitudes.	x	x	x	x	x	
LO	State that, except in high latitudes, the times of SR and SS at any place changes only a little each day. So for all places of the same latitude, SR or SS will occur at approximately the same LMT.	x	x	x	x	x	
LO	State that the reason for the variation of the duration of daylight and night throughout the year is the inclination of the earth rotation axis to the ecliptic.	x	x	x	x	x	
LO	State that SR and SS times are tabulated against specified dates and latitudes.	x	x	x	x	x	
LO	State that at equator SR is always close to 0600 LMT and SS close to 1800 LMT (within 15 minutes).	x	x	x	x	x	
LO	Calculate examples of SR and SS at mean sea level in LMT, ST or UTC, given SR and SS tables, latitudes and longitude of the place in question and the date.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Given sunrise or sunset time in UTC or ST for a given position, calculate sunrise or sunset for another position on the same latitude in UTC or ST.	x	x	x	x	x	
LO	Explain the meaning of the term twilight	x	x	x	x	x	
LO	Define duration of evening civil twilight, The time from sunset to the time when the centre of the sun is 6° below the horizon	x	x	x	x	x	
LO	Define the duration of morning civil twilight. The fime from when the centre of the sun is 6° below the horizon to the time of sunrise	x	x	x	x	x	
LO	State that the beginning of morning civil twilight and the end of evening civil twilight has been tabulated in UTC, valid for the prime meridian, with latitude and date as the entering argument. It may be taken to be LMT for any other meridian	x	x	x	x	x	
LO	Calculate examples of twilight in UTC and ST given a twilight table, latitude and longitude of the place in question and the date.	x	x	x	x	x	
LO	Determine the duration of morning and evening civil twilight	x	x	x	x	x	
LO	Explain the effect of declination and latitude on the duration of twilight.	x	x	x	x	x	
061 01 04 00	**Directions**						
061 01 04 01	**True north**						
LO	State that all meridians run in north-south direction and the true north direction is along any meridian towards the geographic north pole.	x	x	x	x	x	
LO	State that true directions are measured clockwise as an angle in degrees from true north (TN).	x	x	x	x	x	
061 01 04 02	**Terrestrial magnetism: Magnetic North, Inclination and Variation**						
LO	State that a freely suspended compass needle will turn to the direction of the local magnetic field. The direction of the horizontal component of this field is the direction of magnetic north (MN).	x	x	x	x	x	
LO	State that the magnetic poles do not coincide with the geographic poles.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State that the magnetic variation varies as a function of time due to the movement of the northern magnetic pole.	x	x	x	x	x	
LO	Define magnetic dip or inclination. The angle between the horizontal and the total component of the magnetic field.	x	x	x	x	x	
LO	State that the angle of inclination at the magnetic poles is 90°.	x	x	x	x	x	
LO	Explain that the accuracy of the compass depends on the strength of the horizontal component of the earth's magnetic field	x	x	x	x	x	
LO	State that, in the polar areas, the horizontal component of the earth's magnetic field is too weak to permit the use of a magnetic compass.	x	x	x	x	x	
061 01 04 03	**Compass deviation, Compass North**						
LO	State that, in a direct reading compass, the magnetic element will align along a magnetic field. This direction is called compass north (CN) and is the direction 000° on the compass rose. The field is the resultant of the earth's magnetic field and the magnetic field of the aircraft	x	x	x	x	x	
LO	State that the effect of the aircraft magnetism on the compass changes with different headings, as well as different latitudes.	x	x	x	x	x	
LO	State that the angle between magnetic north and compass north is called deviation (DEV) and is given in degrees east (+ or E) or west (- or W) of magnetic north.	x	x	x	x	x	
061 01 04 04	**Isogonals, relationship between true and magnetic**						
LO	State that the angle between the true north and magnetic north is called variation (VAR) being measured in degrees east (+ or E) or west (- or W) of true north.	x	x	x	x	x	
LO	Define an isogonal line. A line joining positions of equal variation.	x	x	x	x	x	
LO	Convert between compass, magnetic and true directions.	x	x	x	x	x	
061 01 04 05	**Gridlines, isogrives**						

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the purpose of a Grid north (GN) based on a suitable meridian on a polar stereographic chart. (reference or datum meridian).	x		x	x		
LO	Explain that the gridlines or the grid meridians are drawn on the chart parallel to the reference meridian.	x	x	x	x	x	
LO	State that the angle between the grid north (GN) and true north (TN) is called grid convergence being measured in degrees east (+ or E) if GN is west of TN or west (- or W) if GN is East of TN.	x	x	x	x	x	
LO	State that the angle between the grid north (GN) and magnetic north (MN) is called grivation (griv) being measured in degrees east (+ or E) or west (- or W) of grid north.	x	x	x	x	x	
LO	State that a line joining points, which have the same grivation is called an isogriv.	x	x	x	x	x	
LO	convert between compass, magnetic, true and grid directions.	x	x	x	x	x	
061 01 05 00	**Distance**						
061 01 05 01	**Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres, feet**	**x**	**x**	**x**	**x**	**x**	
LO	Define the nautical mile. A distance being equal to 1,852 km.	x	x	x	x	x	
LO	In map/charts distance between two positions is measured along a meridian at mean latitude, where one minute of latitude presents 1 NM.	x	x	x	x	x	
LO	State that when dealing with heights and altitudes the unit used is metres or feet subject to the choice of individual states.	x	x	x	x	x	
061 01 05 02	**Conversion from one unit to another**						
LO	Convert between the following units: nautical miles (NM), statute miles (SM), kilometres (km), metres (m) and feet (ft).	x	x	x	x	x	
061 01 05 03	**Relationship between nautical miles and minutes of latitude and minutes of longitude**						
LO	State that horizontal distances are calculated in metres, kilometres and nautical miles.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Given two positions or latitude/longitude difference, calculate the distance	x	x	x	x	x	
LO	Given two positions on the same latitude and distance between the two positions in km or NM, calculate difference of longitude between the two positions.	x	x	x	x	x	
LO	Flying a rhumb line true track of 090, 180, 270 and 360 degrees given an initial geographical position, flight time and ground speed, calculate new geographic position.	x	x	x	x	x	
061 02 00 00	**MAGNETISM AND COMPASSES**						
061 02 01 00	**Knowledge of the principles of the direct reading (standby) compass**						
061 02 01 01	**The use of this compass**						
LO	Direct reading compass (DRC):	x	x	x	x	x	
LO	Interpret the indications on a DRC, given an indication on the compass, deviation or deviation table and variation.	x	x	x	x	x	
061 02 01 02	**Serviceability tests**						
LO	State the pre-flight serviceability check of the DRC, such as: general condition check indication is within limits	x	x	x	x	x	
LO	State that the serviceability test consists of comparing the DRC indication to another reference (e.g.other compass system or runway direction)	x	x	x	x	x	
LO	State that the compass should be checked when carrying magnetic freight or freight with a large ferrous metal content	x	x	x	x	x	
061 02 01 03	**Situations requiring a compass swing**						

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	State occurrences when a compass swing may be required: if transferred to another base involving a large change in latitude. major changes in aircraft equipment. aircraft hit by lightning. aircraft parked in same direction for long period of time. when a new compass is fitted. at any time when the compass or recorded deviation is suspect. When specified in the aircraft maintenance schedule	x	x	x	x	x	
061 03 00 00	**CHARTS**						
061 03 01 00	**General properties of miscellaneous types of projections**						
LO	Define the term conformal. At any given point on the chart distortions (as a result of the projection) in east-west direction must be the same as in north-south direction. The meridians and parallels must cut each other at right angles.	x	x	x	x	x	
LO	State that on a conformal chart the angles measured on the chart are the same as on the earth.	x	x	x	x	x	
LO	State that different chart projections are used, depending on the application and area of use involved.	x	x	x	x	x	
LO	State that all charts, although they have been developed mathematically, are designated as projections.	x	x	x	x	x	
LO	State that the following projection surfaces are used when projecting charts: - plane - cylindrical - conical	x	x	x	x	x	
LO	Define the scale of a chart. The ratio of the chart length compared to the earth distance that it represents.	x	x	x	x	x	
LO	Use the scale of a chart to calculate particular distances.	x	x	x	x	x	
LO	Calculate scale given chart length and earth distance.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define the term chart convergency. The angle between two given meridians on the chart	x	x	x	x	x	
LO	Define parallel of origin. The parallel where the projection surface touches the surface of the reduced earth.	x	x	x	x	x	
061 03 01 01	**Direct Mercator**						
LO	State that the Direct Mercator is a cylindrical projection. The parallel of origin is the Equator.	x	x	x	x	x	
LO	State that the convergency on the chart is 0°.	x	x	x	x	x	
LO	State that the scale increases with increasing distance from the Equator.	x	x	x	x	x	
LO	State that on a Direct Mercator, scale at any latitude = scale at the Equator x secant latitude (1/cosine latitude)	x	x	x	x	x	
LO	Given the scale at one latitude, calculate the scale at different latitudes.	x	x	x	x	x	
LO	Given a chart length at one latitude, show that it represents a different earth distance at other latitudes.	x	x	x	x	x	
061 03 01 02	**Lambert conformal conic**						
LO	State that the Lambert conformal chart is based on a conical projection. Only Lambert conformal charts mathematically produced with two standard parallels will be considered.	x	x	x	x	x	
LO	Define the term standard parallel. The latitudes where the cone cuts the reduced earth.	x	x	x	x	x	
LO	State that at the parallel of origin earth convergency is equal to chart convergency.	x	x	x	x	x	
LO	State that the parallel of origin is close to the mean latitude between the standard parallels.	x	x	x	x	x	
LO	Explain the scale variation throughout the charts as follows: - The scale indicated on the chart will be correct at the standard parallels. - The scale will increase away from the parallel of origin. - The scale within the standard parallels differs by less than 1% from the scale stated on the chart	x	x	x	x	x	
LO	Define the term constant of cone/convergency factor. The ratio between the top angle of the unfolded cone and 360°, or sine of the parallel of origin.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Chart convergency = Difference of longitude × constant of cone	x	x	x	x	x	
LO	Given appropriate data calculate initial, final or rhumb line tracks between two positions (lat/long).	x	x	x	x	x	
LO	Given two positions (lat/long) and information to determine convergency between the two positions, calculate the parallel of origin.	x	x	x	x	x	
LO	Given a Lambert chart determine the parallel of origin, or constant of cone.	x	x	x	x	x	
LO	Given constant of cone or parallel of origin, great circle track at one position and great circle track at another position, calculate difference of longitude between the two positions.	x	x	x	x	x	
061 03 01 03	**Polar stereographic**						
LO	State that the Polar Stereographic projection is based on a plane projection, the parallel of origin is the pole.	x		x	x		
LO	State that chart convergency = difference of longitude.	x		x	x		
LO	State that the scale is increasing with increasing distance from the Pole.	x		x	x		
LO	Given two positions (lat/long), rhumb line true track or initial/final great circle true track, calculate the missing track angles.	x		x	x		
LO	Calculate the chart scale at a specific latitude when difference of longitude and chart distance along the parallel of longitude are given.	x		x	x		
061 03 02 00	**The representation of meridians, parallels, great circles and rhumb lines**						
061 03 02 01	**Direct Mercator**						
LO	State that meridians are straight parallel lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are straight lines parallel to the equator.	x	x	x	x	x	
LO	State that a straight line on the chart is a rhumb line.	x	x	x	x	x	
LO	State that the great circle is a line convex to the nearest pole.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	For great circle track angle calculations over short distances, the conversion angle may be calculated by the formula: $\text{Conversion angle} = ½ \times \text{difference of longitude} \times \sin \text{mean latitude}.$	x	x	x	x	x	
LO	Given rhumb line true track between two positions (lat/long), calculate initial or final great circle true track.	x	x	x	x	x	
061 03 02 02	**Lambert conformal conic**						
LO	State that meridians are straight lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are arcs of concentric circles.	x	x	x	x	x	
LO	State that great circles are curved lines concave towards the parallels of origin.	x	x	x	x	x	
LO	State that for short distances the great circle is approximately a straight line.	x	x	x	x	x	
061 03 02 03	**Polar stereographic**						
LO	State that meridians are straight lines radiating from the pole, which cut parallels of latitudes at right angles.	x		x	x		
LO	State that parallels of latitude are concentric circles, and distance apart increasing away from the pole.	x		x	x		
LO	State that great circles are approximately straight lines close to the pole. The exact great circle being concave to the pole.	x		x	x		
061 03 03 00	**The use of current aeronautical charts**						
061 03 03 01	**Plotting positions**						
LO	Enter position on a chart using range and bearing from a VOR DME station, and derive geographical coordinates.	x	x	x	x	x	x
LO	Enter positions on a chart using geographical coordinates and derive tracks and distances.	x	x	x	x	x	x
LO	Plot DME ranges on an aeronautical chart and derive geographical coordinates.	x	x	x	x	x	x

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the methods used to provide information on chart scale. Use the chart scales stated and be aware of the limitations of the stated scale for each projection.	x	x	x	x	x	x
061 03 03 02	**Methods of indicating scale and relief**						
LO	Describe methods of representing relief and demonstrate the ability to interpret data.	x	x	x	x	x	x
061 03 03 03	**Conventional signs**						
LO	Interpret conventional signs and symbols on ICAO and other most frequently used charts.	x	x	x	x	x	x
061 03 03 02	**Measuring tracks and distances**						
LO	Given two positions measure the track and the distance between them	x	x	x	x	x	x
061 03 03 03	**Plotting bearings**						
LO	Resolve bearings of a NDB station for plotting on an aeronautical chart.	x	x	x	x	x	x
LO	Resolve radials from VOR stations for plotting on an aeronautical chart.	x	x	x	x	x	x
061 04 00 00	**DEAD RECKONING NAVIGATION (DR)**						
061 04 01 00	**Basis of dead reckoning**						
LO	Explain the triangle of velocities, e.g. true heading/TAS, W/V and true track/GS.	x	x	x	x	x	
061 04 01 01	**Track**						
LO	Explain the concept of vectors including adding together or splitting in two directions.	x	x	x	x	x	
061 04 01 02	**Heading (compass, magnetic, true, grid)**						
LO	Calculate (compass, magnetic, true, grid) heading given appropriate data.	x	x	x	x	x	
061 04 01 03	**Wind velocity**						
LO	Calculate wind velocity given appropriate data.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
061 04 01 04	**Airspeed (IAS, CAS, TAS, Mach number)**						
LO	Calculate TAS from IAS/CAS and Mach number given appropriate data.	x	x	x	x	x	
061 04 01 05	**Groundspeed**						
LO	Calculate groundspeed given appropriate data.	x	x	x	x	x	
061 04 01 06	**ETA**						
LO	Calculate ETA, flying time from distance and GS.	x	x	x	x	x	
LO	Calculate revised directional data for heading, track, course and W/V, e.g. true, magnetic, compass and grid given appropriate data.	x	x	x	x	x	
061 04 01 07	**Drift, wind correction angle**						
LO	Calculate Drift, wind correction angle given appropriate data.	x	x	x	x	x	
061 04 02 00	**Use of the navigational computer**						
061 04 02 01	**Speed**						
LO	Given appropriate data determine speed	x	x	x	x	x	x
061 04 02 02	**Time**						
LO	Given appropriate data determine time	x	x	x	x	x	x
061 04 02 03	**Distance**						
LO	Given appropriate data determine distance	x	x	x	x	x	x
061 04 02 04	**Fuel consumption**						
LO	Calculation of fuel used/fuel flow/flying time.	x	x	x	x	x	x
061 04 02 05	**Conversions**						

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Conversion between kilograms/ pounds/litres/U.S. gallons/Imp. Gallons.	x	x	x	x	x	x
LO	Conversion of distances. Kilometres/Nautical miles/Statute miles.	x	x	x	x	x	x
LO	Conversion of distances. Feet/metres.	x	x	x	x	x	x
LO	Conversion of volumes and weight of fuel using density in mass per unit volume	x	x	x	x	x	x
061 04 02 06	**Airspeed**						
LO	Calculation of air speed problems including IAS/EAS/CAS/TAS/ and Mach number, given appropriate data	x	x	x	x	x	x
061 04 02 07	**Wind velocity**						
LO	Given appropriate data determine Wind velocity	x	x	x	x	x	x
061 04 02 08	**True altitude**						
LO	Given appropriate data determine true altitude / indicated altitude / density altitude	x	x	x	x	x	x
061 04 03 00	**The triangle of velocities**						
LO	Solve problems to determine: Heading Groundspeed Wind direction and speed Track/course Drift angle/wind correction angle Head/tail/cross wind components.	x	x	x	x	x	x
061 04 04 00	**Determination of DR position**						
061 04 04 01	**Confirmation of flight progress (DR)**						
LO	Describe the role and purpose of DR navigation.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Demonstrate mental DR techniques:	x	x	x	x	x	
LO	Define speed factor. Speed divided by 60, used for mental flight path calculations.	x	x	x	x	x	
LO	Calculate head/tailwind component.	x	x	x	x	x	
LO	Calculate wind correction angle (WCA) using the formula: $WCA = \frac{XWC \text{ (cross wind component)}}{SF \text{ (speed factor)}}$	x	x	x	x	x	
LO	Distance, speed and time calculations.	x	x	x	x	x	
LO	Demonstrate DR position graphically and by means of DR computer:	x	x	x	x	x	
LO	Given any four of the parts of the triangle of velocities, calculate the other two.	x	x	x	x	x	
LO	Apply the validity of wind triangle symbols correctly. Heading vector one arrow, track/course vector two arrows and W/V vector three arrows.	x	x	x	x	x	
061 04 04 02	**Lost procedures**						
LO	Describe course of action when lost.	x	x	x	x	x	
061 04 05 00	**Measurement of DR elements**						
061 04 05 01	**Calculation of altitude, adjustments, corrections, errors**						
	For questions involving height calculation 30ft/hpa is to be used unless another figure is specified in the question						
LO	Calculate true altitude (T ALT) given indicated altitude, airfield elevation, static air temperature (SAT)/outside air temperature (OAT) and QNH/QFE.	x	x	x	x	x	
LO	Calculate indicated altitude given true altitude (T ALT), airfield elevation, static air temperature (SAT)/outside air temperature (OAT) and QNH/QFE.	x	x	x	x	x	
LO	Calculate density altitude given pressure altitude and static air temperature (SAT)/outside air temperature (OAT).	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Calculate density altitude given, airfield elevation, static air temperature (SAT)/outside air temperature (OAT) and QNH/QFE.	x	x	x	x	x	
061 04 05 02	**Determination of temperature**						
LO	Define outside air temperature (OAT)/ static air temperature (SAT). The temperature of the surrounding air.	x	x	x	x	x	
LO	Define ram air temperature (RAT)/ total air temperature (TAT)/ IOAT indicated outside air temperature. The temperature measured by the temperature probe affected by friction and compressibility.	x	x	x	x	x	
LO	Define ram-rise. The increase of temperature at the temperature probe due to friction and compressibility.	x	x	x	x	x	
LO	RAT (TAT, IOAT) = OAT (SAT) + ram-rise.	x	x	x	x	x	
LO	Explain the difference in using OAT/SAT compared to RAT/TAT/IOAT in airspeed calculations.	x	x	x	x	x	
061 04 05 03	**Determination of appropriate speed**						
LO	Explain the relationship between IAS – CAS – EAS and TAS.	x	x	x	x	x	
LO	Calculate TAS given IAS/CAS, OAT/SAT and pressure inputs.	x	x	x	x	x	
LO	Calculate CAS given TAS, OAT/SAT and pressure inputs.	x	x	x	x	x	
061 04 05 04	**Determination of Mach number**	**x**	**x**	**x**	**x**	**x**	
LO	Calculate Mach number given TAS and OAT/SAT.	x	x	x	x	x	
061 05 00 00	**IN-FLIGHT NAVIGATION**						
061 05 01 00	**Use of visual observations and application to in-flight navigation**						
LO	Describe what is meant by the term “map reading”.	x	x	x	x	x	
LO	Define the term “visual check point”.	x	x	x	x	x	

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Discuss the general features of a visual checkpoint and give examples.	x	x	x	x	x	
LO	State that evaluating the differences between DR positions and actual position can refine the flight performance and navigation.	x	x	x	x	x	
LO	Establish fixes on navigational charts by plotting visually derived intersecting lines of position.	x	x	x	x	x	
LO	Describe the use of a single observed position line to check flight progress.	x	x	x	x	x	
LO	Describe how to prepare and align a map/chart for use in visual navigation.	x	x	x	x	x	
LO	Describe visual navigation techniques including: - Use of DR position to locate identifiable landmarks. - Identification of charted features/landmarks. - Factors affecting the selection of landmarks. - An understanding of seasonal and meteorological affects on the appearance and visibility of landmarks. - Selection of suitable landmarks. - Estimation of distance from landmarks from successive bearings. - Estimation of the distance from a landmark using an approximation of the sighting angle and the flight altitude	x	x	x	x	x	
LO	Describe the action to be taken, if there is no visual checkpoint available at a scheduled turning point.	x	x	x	x	x	
LO	Understanding the difficulties and limitations that may be encountered in map reading in some geographical areas due to nature of terrain, lack of distinctive landmarks or lack of detailed and accurate charted data.	x	x	x	x	x	
LO	State the function of contour lines on a topographical chart.	x	x	x	x	x	
LO	Indicate the role of “layer tinting” (colour gradient) in relation to the depiction of topography on a chart.	x	x	x	x	x	
LO	Using the contours shown on a chart, describe the appearance of a significant feature.	x	x	x	x	x	

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		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Understand that in areas of snow and ice from horizon to horizon and where the sky is covered with a uniform layer of clouds so that no shadows are cast, the horizon disappears, causing earth and sky to blend.	x	x	x	x	x	
061 05 02 00	**Navigation in climb and descent**						
061 05 02 01	**Average airspeed**						
LO	Average TAS used for climb problems is calculated at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	Average TAS used for descent problems is calculated at the altitude ½ of the descent altitude.	x	x	x	x	x	
061 05 02 02	**Average wind velocity**						
LO	W/V used for climb problems is W/V at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	W/V used for descent problems is W/V at the altitude ½ of the descent altitude.	x	x	x	x	x	
LO	Calculate average climb/descent GS, given TAS at various altitudes, W/V at various altitudes and true track.	x	x	x	x	x	
LO	Calculate flying time and distance during climb/descent given average rate of climb/descent and using average GS.	x	x	x	x	x	
LO	Calculate rate of descent on a given glide path angle using the following formulae Rate of descent = $\frac{\text{GS (ground speed)} \times 10}{2}$ valid for 3° glidepath $\text{Rate of descent} = \text{SF (speed factor)} \times \text{glidepath angle} \times 100$	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate rate of climb/descent in order to reach a certain position at a given altitude	x	x	x	x	x	
LO	Given speed, rate of climb/descent and altitude, calculate distance required in order to reach a position at a given altitude.	x	x	x	x	x	

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		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Given speed, distance to go and altitude to climb/descent, calculate rate of climb/descent.	x	x	x	x	x	
LO	State the effect on TAS and Mach number when climbing/descending with a constant CAS.						
061 05 02 03	**Ground speed/distance covered during climb or descent**						
LO	State that most aircraft operation manuals supply graphical material to calculate climb and descent problems.	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate rate of climb / descent in order to reach a certain position at a given altitude	x	x	x	x	x	
LO	Given speed, rate of climb / descent and altitude, calculate distance required in order to reach a certain position at a given altitude	x	x	x	x	x	
061 05 02 04	**Gradients versus rate of climb/descent**						
LO	Calculate climb/descent gradient (ft/NM, % and degrees), GS or vertical speed according to the following formulae: $\frac{\text{Ground speed (kt) x gradient (feet/NM)}}{60}$ = vertical speed (feet/min)	x	x	x	x	x	
LO	Gradient in % = altitude difference (feet) x 100 / Ground difference (feet)	x	x	x	x	x	
LO	Gradient in degrees = Arctg (altitude difference (feet) / Ground distance (feet))	x	x	x	x	x	
LO	Rate of climb/descent (feet/min) = Gradient (%) × GS (kt)	x	x	x	x	x	
LO	State that it is necessary to determine the position of the aircraft accurately before commencing descent in order to ensure safe ground clearance.	x	x	x	x	x	
061 05 03 00	**Navigation in cruising flight, use of fixes to revise navigation data**						
061 05 03 01	**Ground speed revision**						
LO	Calculate revised groundspeed to reach a waypoint at a specific time.	x	x	x	x	x	
LO	Calculate the average ground speed based on two observed fixes.	x	x	x	x	x	

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		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Calculate distance to the position passing abeam an NDB station, by timing from the position with a Relative bearing of 045/315 to the position abeam (Relative bearing 090/270).	x	x	x	x	x	
061 05 03 02	**Off-track corrections**						
LO	Calculate the track error angle given course from A to B and an of course fix, using the one in sixty rule.	x	x	x	x	x	
LO	Calculate the heading change at an off-course fix to directly reach the next waypoint using the one in sixty rule.	x	x	x	x	x	
LO	Calculate the average drift angle based upon an off-course fix observation.	x	x	x	x	x	
061 05 03 03	**Calculation of wind speed and direction**						
LO	Calculate average wind speed and direction based on two observed fixes.	x	x	x	x	x	
061 05 03 04	**ETA revisions**						
LO	Calculate ETA revisions based upon observed fixes and revised ground speed.	x	x	x	x	x	
061 05 04 00	**Flight Log**						
LO	Given relevant flight plan data calculate the missing data.	x	x	x	x	x	
LO	Enter revised navigational en-route data, for the legs concerned, into the flight log. (e.g. updated wind and ground speed and correspondingly losses or gains in time and fuel consumption).	x	x	x	x	x	
LO	Enter, in the progress of flight, at check point or turning point, the “actual time over” and the “estimated time over” for the next check point into the flight log.	x	x	x	x	x	

END