



AVIATION

GENERAL COURSE

Marking key for the Externally set task

Sample 2016

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Aviation

Externally set task – marking key

The Boeing 787 Dreamliner is a long-range, mid-size wide-body, twin-engine jet airliner, developed by Boeing Commercial Airplanes. Its variants seat 210 to 330 passengers. Boeing states that it is the company's most fuel-efficient airliner and the world's first major airliner to use composite materials as the primary material in the construction of its airframe. The 787 has been designed to be 20% more fuel efficient than the 767 it is to replace. The Dreamliner's distinguishing features include mostly electrical flight systems, a four-panel windshield, noise-reducing chevrons on its engine nacelles, and a smoother nose contour. It shares a common type rating with the larger 777 twinjet, allowing pilots qualified for the 777 to operate both models, due to their related design features.

The first 787 was unveiled in a roll-out ceremony on July 8, 2007. By October 2013, the 787 program had logged 982 orders from 58 customers. Average price of a 787: USD\$ 250 million.

Source: http://en.wikipedia.org/wiki/Boeing_787_Dreamliner

1. Give **three (3)** reasons why an airline executive would want to buy a Boeing Dreamliner to add to an airline fleet

Description (any three of the following)	Marks
Superior fuel efficiency	1
Chevrons on engine nacelles	1
Composite materials used in construction	1
Common type rating with 777	1
Total	3

2. For each reason stated above, provide an explanation that would justify the decision.

Description	Marks
Superior fuel efficiency means cheaper to fly and longer range (1) avoiding hubs (1)	1–2
Chevrons on engine nacelles reduce noise (1) therefore less intrusive in built up areas (1)	1–2
Composite materials are lighter/stronger (1) therefore can pressurise to lower altitude (1)	1–2
Common type rating with 777 means less time (1) and hence less money training crew (1)	1–2
Total	6

3. With the aid of a diagram, describe the process of orographic lifting to form a cloud. (3 marks)

Description	Marks
Annotated diagram to show the following: <ul style="list-style-type: none"> clouds forming as moist air is forced to rise over a mountain range indication that the air cools as it rises at the dry adiabatic lapse rate if the parcel of air reaches the dew point while ascending, then clouds will form. 	1 per annotation (maximum 3_)
Total	3

4. Complete the table of cloud types below. (5 marks)

One mark for each fully completed row.

Cloud type	Abbreviation	Level H, M, L	Description
Cirrus	Ci	High	Fine wispy 'Mare's Tails'
Altostratus	Ac	Medium	Mid level fluffy or lumpy clouds
Stratus	St	Low	Flat, layer of cloud in stable air
Cumulus	Cu	Low	Fluffy lumpy "cauliflower" cloud
Cumulonimbus	Cb	Low	Thunderstorm cloud, rain-bearing

- 5(a) What is the principle of operation of the magnetic compass? (2 marks)

Description	Marks
The Earth has a magnetic field aligned approximately North/South. The magnetic compass is basically a bar magnet suspended to rotate freely so it always points towards Magnetic North	2
Total	2

- (b) What is magnetic variation? (2 marks)

Description	Marks
Magnetic variation is the angle between True North and Magnetic North.	2
Total	2

- (c) What is magnetic deviation? (2 marks)

Description	Marks
Magnetic deviation is the deviation of the magnetic compass away from Magnetic North due to the magnetic field associated with the aircraft itself, its engine and electrical equipment.	2
Total	4

6. What are **two (2)** advantages of a turbocharged engine over a normally aspirated engine? **(4 marks)**

Description	Marks
Any two (2) of: <ul style="list-style-type: none"> • more specific power over a naturally aspirated (NA) engine. It means an engine can produce more power for its size • reuse of excess exhaust heat (it gets channeled into the turbocharger to increase boost to the engine) means the engine runs more efficiently than NA, or supercharged, engines • because a small engine can be made to produce the power of a huge NA engine, fuel economy is often better on a per kW basis. 	4 (2 per advantage)
Total	4

7. Explain how the torque reaction of the propeller causes an aircraft to yaw during the take-off run.

(5 marks)

Description	Marks
Defines 'yaw' as the tendency of the aircraft to rotate about its centre of gravity.	1
The tendency for the body to rotate results as a reaction to propeller's opposite rotation (torque reaction).	1
Rotation places additional downward force on one wheel (1)	1
Downward force on one wheel effectively acts as a brake on that wheel (1)	1
The nose of the aircraft tends to change direction, or 'yaw' (1)	1
Total	5

8. Threat and error management (TEM) is now an integral part of aircraft operations. What are **three (3)** important human TEM factors that can affect aviation safety? Explain the effect of each factor.

(6 marks)

Description (any three of the following)	Marks
Stress Pressure on pilot to meet schedule demands. Can lead to poor decision making.	1 per identification (maximum 3)
Training Insufficient training in operational procedures or new aircraft type.	
Fatigue Clear link to poor decision making.	
Communication skills Intra-cockpit and ATC communication imperative.	1 per explanation (maximum 3)
Assertiveness/judgement Pilot/co-pilot relationship has to be balanced to ensure both contribute.	
Cockpit culture Related to above. Any crew member can influence the pilot decision.	
Total	6

9. Define dihedral.

(10 marks)

With the aid of a diagram, explain the purpose of dihedral in the design of an aircraft and how it affects stability.

Description (any three of the following)	Marks
Dihedral means that the wing tips are higher than wing roots	1–2
Dihedral contributes to the lateral stability of an aircraft.	1–2
Following a lateral disturbance, an AC will begin to side-slip in the direction of the dipped wing.	1–2
Due to dihedral, the AoA of the dipped wing with the sideways airflow is greater than that of the raised wing.	1–2
This results in the dipped wing generating more lift than the raised wing and causes the wings to resume a level orientation.	1–2
Total	10