Mean Aerodynamic Chord - Exercises.

1) An aircraft's MAC is 900 mm, and the leading edge of the wing is 2000 mm aft of the aircraft datum. The CG is at 25.1% MAC. Express the centre of gravity location in mm from the datum.

2) An aircraft's MAC is 1020 mm, and the leading edge is 1900 mm aft of the datum. The CG is at 2650 mm aft of the datum. Express the CG as a percentage of MAC.

3) An aircraft's MAC is 1900, and the leading edge is 2200 mm aft of the datum. The CG is located at 2650 mm aft of the datum. Express CG as a percentage of MAC.

4) An aircraft's MAC is 1500 mm, and the leading edge is on the datum. If the CG is at 311 mm aft of the datum. Express the CG as a percentage of MAC.

5) An aircraft's MAC is 1500 mm. It CG is located at 25% MAC and 1800 mm aft of the datum. Where is the aircraft's datum in relation to the leading edge of the mean aerodynamic chord (LEMAC)?

6) Often it is necessary to remove cargo to move the CG to within the allowable limits.

   a) With the following information known about the aeroplane, if 5000 lb of cargo was removed from STN 1060", what is the new CG location relative to the MAC?

   b) Is the new CG location within the allowable CG range?

Aircraft weight	170,000 lb
MAC range	790.5" to 960.3"
CG position	27% MAC
Allowable CG range	21 – 31% MAC

Mean Aerodynamic Chord Exercise - Answers.

1) An aircraft's MAC is 900 mm, and the leading edge of the wing is 2000 mm aft of the aircraft datum. The CG is at 25.1% MAC. Express the centre of gravity location in mm from the datum.

   $\text{CG Position} = 25.1\% \text{ of } 900 \text{ mm} = 225.9 \text{ mm aft of LEMAC}$

   $\text{LEMAC is } 2000 \text{ mm aft of the datum}$

   $\therefore \text{CG position} = 2000 + 225.9 = 2225.9 \text{ mm aft of the datum}$

   ANSWER = 2225.9 mm aft of the datum

2) An aircraft's MAC is 1020 mm, and the leading edge is 1900 mm aft of the datum. The CG is at 2650 mm aft of the datum. Express the CG as a percentage of MAC.

   $\text{CG location relative to the LEMAC} = 2650 - 1900 = +750 \text{ mm (aft of LEMAC)}$

   $\text{CG position as \% of MAC} = \frac{750}{1020} * 100\% = 73.53\%$

   ANSWER = 73.5% MAC

3) An aircraft's MAC is 1900, and the leading edge is 2200 mm aft of the datum. The CG is located at 2650 mm aft of the datum. Express CG as a percentage of MAC.

   $\text{CG Location relative to LEMAC} = 2650 - 2200 = +450 \text{ mm (aft of LEMAC)}$

   $\text{CG position as \% of MAC} = \frac{450}{1900} * 100\% = 23.68\%$

   ANSWER = 23.7% MAC

4) An aircraft's MAC is 1500 mm, and the leading edge is on the datum. If the CG is at 311 mm aft of the datum. Express the CG as a percentage of MAC.

   $\text{CG position as \% of MAC} = \frac{311}{1500} * 100\% = 20.73\%$

   ANSWER = 20.7% MAC

5) An aircraft's MAC is 1500 mm. It CG is located at 25% MAC and 1800 mm aft of the datum. Where is the aircraft's datum in relation to the leading edge of the mean aerodynamic chord (LEMAC)?

   $\text{CG Position} = 25\% \text{ of } 1500 \text{ mm} = 375 \text{ mm aft of LEMAC}$

   $\text{CG Position relative to datum} = 1800 \text{ mm aft}$

   $\text{Datum Position relative to LEMAC} = 375 - 1800 = -1425 \text{ mm}$

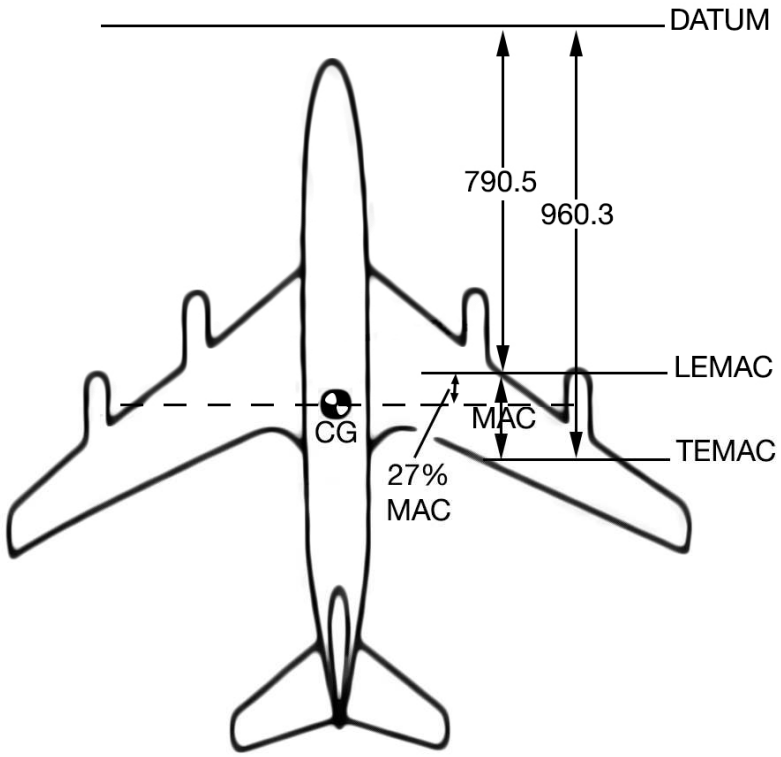
   ANSWER = Datum is 1425 mm forward of the LEMAC

6) Often it is necessary to remove cargo to move the CG to within the allowable limits.

a) With the following information known about the aeroplane, if 5000 lb of cargo was removed from STN 1060", what is the new CG location relative to the MAC?

b) Is the new CG location within the allowable CG range?

Aircraft weight	170,000 lb
MAC range	790.5" to 960.3"
CG position	27% MAC
Allowable CG range	21 – 31% MAC



$MAC = 960.3 - 790.5 \text{ mm} = 169.8 \text{ mm}$

$\text{CG position} = \text{LEMAC} + 27\% \text{ MAC}$
$= 790.5 + .27 * 169.8$
$= 836.346"$

	Weight	Arm	Moment
Aircraft	170,000	836.346	142,178,820
Removed Cargo	-5,000	1060.000	5,300,000
Aircraft after cargo removed	165,000	829.569	136,878,820

$$Amended\ CG\ position\ as\ \%\ MAC\ = \frac{829.569-790.5}{169.8} * 100\% = \frac{39.069}{169.8} * 100\% = \ 23.01\%$$

ANSWER **(a) CG position after removal of the cargo is 23.01% MAC**

(b) That is within the allowable range of 21 – 31% MAC