Flying by Numbers – Worksheet

1. Rearrange the Lift formula to make the wing area the subject.

2. An aircraft designer is designing a small jet. It needs to have a lift of 24,000 kg and a cruising speed of 100 m s\(^{-1}\) at an altitude where the air density is 0.5 kg m\(^{-3}\). The coefficient of lift will be 0.3. Calculate the minimum wing area that the new jet will need.

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3. Rearrange the Lift formula to make the velocity the subject.

4. An aircraft has a mass of 69,120 kg, a wing area of 80 m\(^2\) and a coefficient of lift of 0.2. Calculate the velocity needed to achieve level flight at an altitude where the air density is 0.6 kg m\(^{-3}\). (hint: for level flight, lift = weight)

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5. An aircraft with a mass of 147,300 kg is flying at an altitude of 5000 m. It has a coefficient of lift of 0.2 and the surface area of the wings is 200 m². Calculate the velocity needed for level flight.

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6. A Boeing 777 is flying at an altitude of 10,000 m at a velocity of 240 m s⁻¹. Assuming that the aircraft is at the maximum take-off weight, determine the angle of attack necessary for it to maintain level flight.

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Flying by Numbers – Answers

1. \[ s = \frac{2L}{(d \times v^2 \times C_L)} \]

2. \[ 32 \text{ m}^2 \]

3. \[ v = \sqrt{\frac{2L}{(d \times s \times C_L)}} \]

4. \[ 120 \text{ m s}^{-1} \]

5. \[ 100 \text{ m s}^{-1} \]

6. (Approximately) -2 degrees.