

A-Level Further Mathematics

Name: _____ Score: _____

-
1. A ball is thrown at $u = 20 \text{ m/s}$ at 30° . Using $\text{height} = u^2 \sin^2 \alpha / (2g)$ with $g = 10$, find the greatest height (m).
- _____
2. A uniform horizontal 4 m beam of weight 100 N is pivoted at A; an upward vertical force F at B (4 m away) balances it. Taking moments about A (weight acts at the 2 m centre), find F (N).
- _____
3. A particle moves in a circle of radius 2 m with angular speed 3 rad/s. What is its speed $v = r\omega$ (m/s)?
- _____
4. An elastic string of natural length 2 m and modulus 50 N is stretched by 0.5 m. Find the tension $T = \lambda x / L$ (N).
- _____
5. To find velocity directly as a function of position x under a position-dependent resultant force, which acceleration form is most convenient?
- ☐ dx/dt
- ☐ $x \, dx/dv$
- ☐ $v \, dv/dx$
- ☐ dv/dt
6. On a smooth horizontal plane, a 2 kg body at 3 m/s hits a stationary 1 kg body and they stick together. Find the common velocity in m/s, taking the incoming direction positive.
- _____
7. During the flight, the horizontal velocity of a projectile (ignoring air resistance):
- ☐ reverses
- ☐ increases
- ☐ stays constant
- ☐ decreases to zero
8. The moment of a force about a point is:
- ☐ force $\div$ distance
- ☐ mass $\times$ acceleration
- ☐ force $\times$ time

☐ force $\times$ perpendicular distance

9. The centripetal acceleration of a particle in circular motion points:

☐ vertically down

☐ along the velocity

☐ away from the centre

☐ toward the centre

10. By Hooke's law, the tension is proportional to the extension.

☐ True ☐ False

A-Level Further Mathematics

1. **5**

$$400 \times \sin^2 30^\circ / 20 = 400 \times 0.25 / 20 = 5 \text{ m.}$$

2. **50**

$$F \times 4 = 100 \times 2, \text{ so } F = 200/4 = 50 \text{ N.}$$

3. **6**

$$v = r\omega = 2 \times 3 = 6 \text{ m/s.}$$

4. **12.5**

$$T = 50 \times 0.5 / 2 = 12.5 \text{ N.}$$

5. **$v \, dv/dx$**

$$a = dv/dt = (dv/dx)(dx/dt) = v \, dv/dx - \text{convenient when force depends on } x.$$

6. **2**

$$6 = 3v, \text{ so } v = 2 \text{ m/s.}$$

7. **stays constant**

There is no horizontal force, so $u \cos \alpha$ is constant throughout.

8. **force $\times$ perpendicular distance**

Moment = force $\times$ perpendicular distance – the turning effect.

9. **toward the centre**

It points to the centre – that is what continually changes the direction of motion.

10. **True**

$T = (\lambda/L)x$, so tension is proportional to extension within the ideal Hookean model or a real material's proportional range. Reversible elastic behaviour alone does not guarantee proportionality.