1. A ball is thrown at u = 20 m/s at 30°. Using height = $u^2\sin^2\alpha/(2g)$ with g = 10, find the greatest height (m).

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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)?

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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).

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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 ÷ distance

☐ mass × acceleration

☐ force × time

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

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1. **5**

   $400 \times \sin^2 30° \,/\, 20 = 400 \times 0.25 \,/\, 20 = 5$ m.

2. **50**

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

3. **6**

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

4. **12.5**

   $T = 50 \times 0.5 \,/\, 2 = 12.5$ N.

5. **v dv/dx**

   $a = dv/dt = (dv/dx)(dx/dt) = v\,dv/dx$ – convenient when force depends on x.

6. **2**

   $6 = 3v$, so $v = 2$ m/s.

7. **stays constant**

   There is no horizontal force, so u cos α is constant throughout.

8. **force × perpendicular distance**

   Moment = force × 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.

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