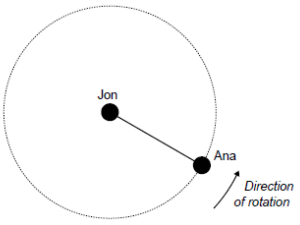
Mechanics – Choosing the right equation ANSWERS

(Where needed, use g = 9.8 ms^{-2})

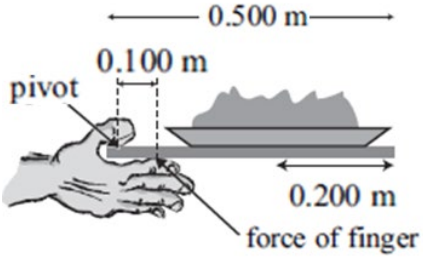
For the following questions, which set of equations would help you best? Once you have found the correct equation, solve the problem.

A	B
$v = \frac{\Delta d}{\Delta t}$ $a = \frac{\Delta v}{\Delta t}$ $v_f = v_i + at$ $d = v_i t + \frac{1}{2}at^2$ $d = \frac{v_i + v_f}{2}t$ $v_f^2 = v_i^2 + 2ad$	$a_c = \frac{v^2}{r}$ $F = ma$ $\tau = Fd$ $F = -kx$
C	**D**
$F_c = \frac{mv^2}{r}$ $p = mv$ $\Delta p = F\Delta t$	$E_p = \frac{1}{2}kx^2$ $E_k = \frac{1}{2}mv^2$ $\Delta E_p = mg\Delta h$ $W = Fd$ $P = \frac{W}{t}$

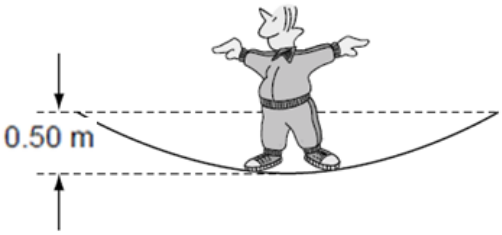
1. Ana and Jon are now practising ice skating routines. In a skating move, Jon spins Ana around in a horizontal circle. Ana has a mass of 55 kg. If the radius of the circle is 0.95 m and the tension force in Jon's arm is 5.00 x 10^2 N, calculate the speed with which Ana is travelling around the circle. **C**



2. Harry carries his tray of food to his cafeteria table for lunch. The uniform tray is 0.500 m long and has a mass of 0.20 kg. It holds a 0.40 kg plate of food where the centre of the plate is 0.200 m from the right-hand edge. Calculate the weight (force of gravity) of the plate of food and tray. **B**



3. In order to gain the necessary height to perform a certain move, Henry has stretched the mat downwards by 0.50 m. The spring constant of the mat is 3500 Nm^{-1}. Calculate the size of the force supplied by the mat when stretched by this amount. **B**

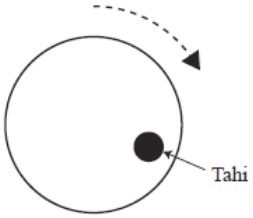


4. Ernie is pushing a lawn mower with a horizontal force of 22 N, as shown. Calculate the power produced by Ernie when he accelerates the mower through a distance of 4.0 m in 3.0 seconds. Give the correct **units** for your answer. **D**

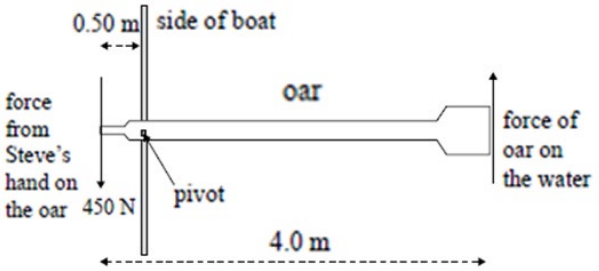
5. Ana runs a 400 m race around the school track. At the start of the race, Ana accelerates to a speed of 6.0 ms^{-1} during the first 2.2 seconds. Calculate her acceleration, assuming it is constant. **A**

6. Ana and Jon are now practising ice skating routines. Jon (mass 75 kg) skates at 6.0 ms^{-1} towards Ana (mass 55 kg) who is standing still on the frictionless ice. Jon collides with Ana and they move off together in the same straight line that Jon was moving before the collision. Calculate the speed of the skaters after the collision. **C**

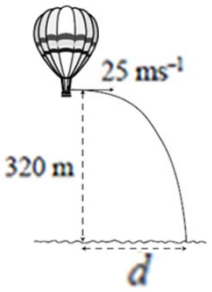
7. Tahi and Rua are at the playground. Tahi is sitting on a merry-go-round that is spinning clockwise. He is 3.0 m from the centre and has a speed of 1.5 ms^{-1}. Calculate the size of his acceleration. **B**



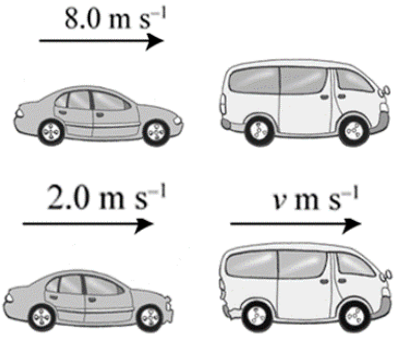
8. Steve is in a rowing race. The oar is 4.0 m long. Steve's hand is 0.50 m from the pivot. During a warm-up, Steve exerts a force of 450 N on the oar. Calculate the size of the force that the oar exerts on the water. **B**



9. A hot air balloon is hovering in a stationary position, 320 m above the sea. One of the passengers throws a tennis ball with a speed of 25 ms^{-1} in a horizontal direction. Assuming that it was a calm day with no wind, calculate the horizontal distance d from the balloon to where the ball lands in the sea. **A**



10. Marama is driving her car home after her event, when she collides with a stationary van. Assume there are no outside horizontal forces acting during the collision. The mass of the car is 950 kg and the mass of the van 1700 kg. The car is travelling at 8.0 ms^{-1} before the collision and 2.0 ms^{-1} immediately after the collision. Calculate the size and direction of the car's momentum change. **C**



Full answers

	A, B, C or D?	Equation	Answer
1	C	$F_c = \frac{mv^2}{r}$	
2	B	$F = ma \quad \tau = Fd$	
3	B	$F = -kx$	
4	D	$W = Fd \qquad P = \frac{W}{t}$	
5	A	$d = v_i t + \frac{1}{2}at^2$	
6	C	$p = mv$	
7	B	$a_c = \frac{v^2}{r}$	
8	B	$\tau = Fd$	
9	A	$d = v_i t + \frac{1}{2}at^2$	
10	C	$p = mv$	