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CALCULATING, GRAPHING & INTERPRETING POSITION, VELOCITY & ACCELERATION VALUES

The following set of questions considers methods of describing and recording the changes in the horizontal motion of a sprinter who is taking part in a 100 m running race. The race is run along the straight of a running track from the start to the finish line with no changes in direction.

12 *Answer*

Using the data in Table 2 work out the time the runner took for each of the 10 m intervals, and record them in Column 3 of Table 2.

Table 2 Times recorded for a 100 m sprint at 10 m intervals.

Col 1 Position from Start (m)	Col 2 Cumulative Time (s)	Col 3 Time for 10 m Intervals (s)	Col 4 Average Velocity ($m \cdot s^{-1}$)
0	0.00	_____	_____
10	1.66	_____	_____
20	2.84	_____	_____
30	3.88	_____	_____
40	5.00	_____	_____
50	5.95	_____	_____
60	6.97	_____	_____
70	7.93	_____	_____
80	8.97	_____	_____
90	10.07	_____	_____
100	11.19	_____	_____

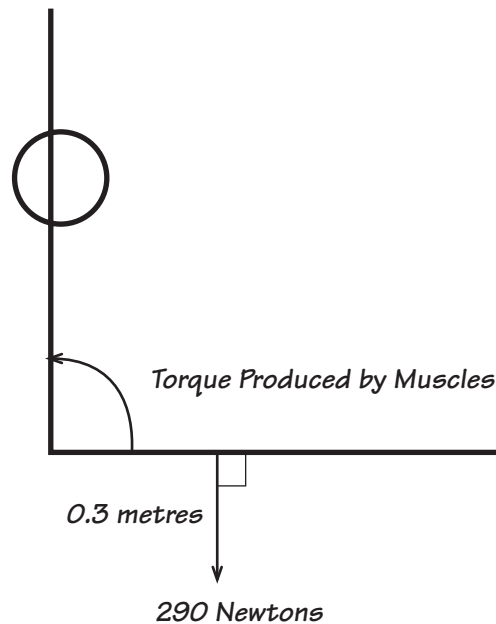
MOMENTS/TORQUES

The purpose of this set of tasks is to consider the concept of torque and moments. The questions involve examples from situations where the torque generating forces are both within the body, and external to the body.

124 **Answer**

Figure 11 represents someone hanging from the wall bars in a 'half lever' position, with the top and bottom halves of the body perpendicular to one another.

Figure 11 Force and moment arm acting in a half lever.



What is the size of the turning effect (torque) being produced by the muscles crossing across the front of the hip joint?

Note that any counter influence of tension in muscle acting across the posterior side of the hip joint are ignored, and the hip is assumed to be the pivot.

Figure 21 A series of stick figures representing stages in the take off phase of a vertical jump (Figures shown 1/10 second intervals).

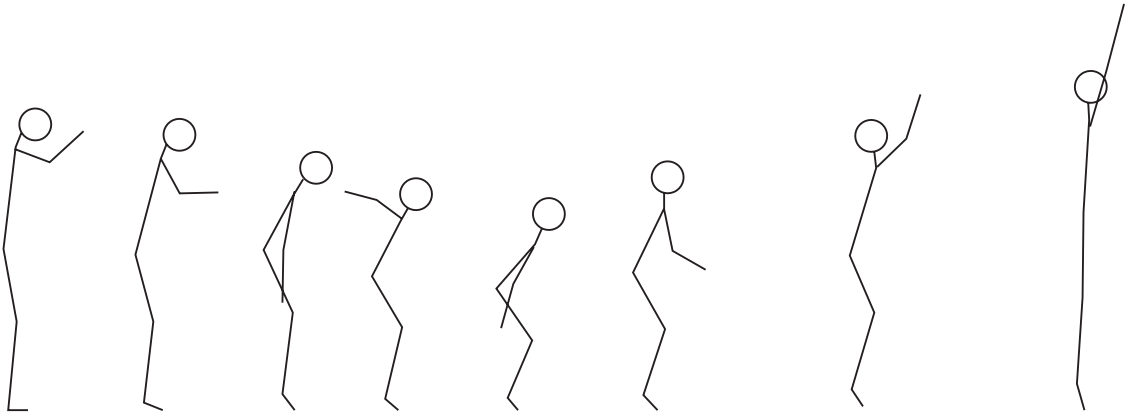
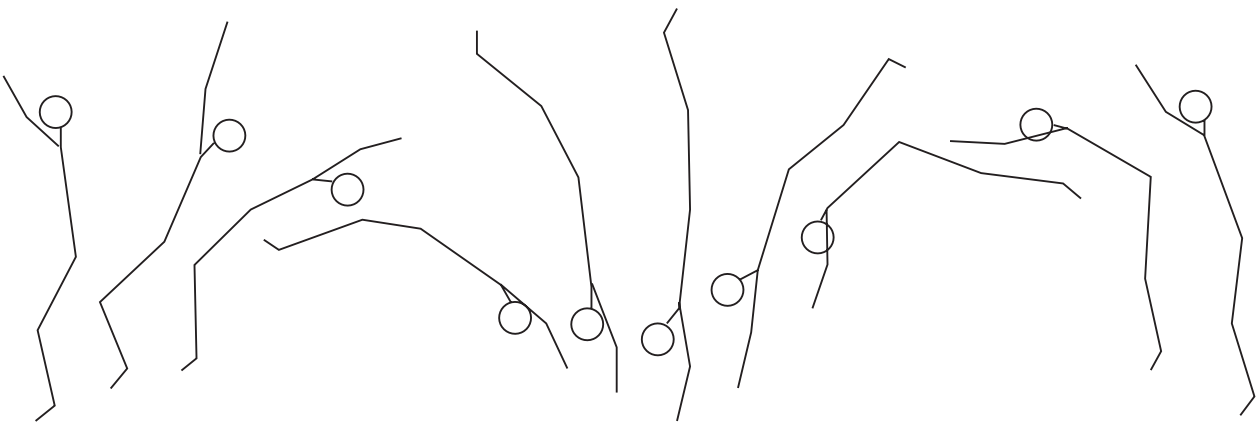
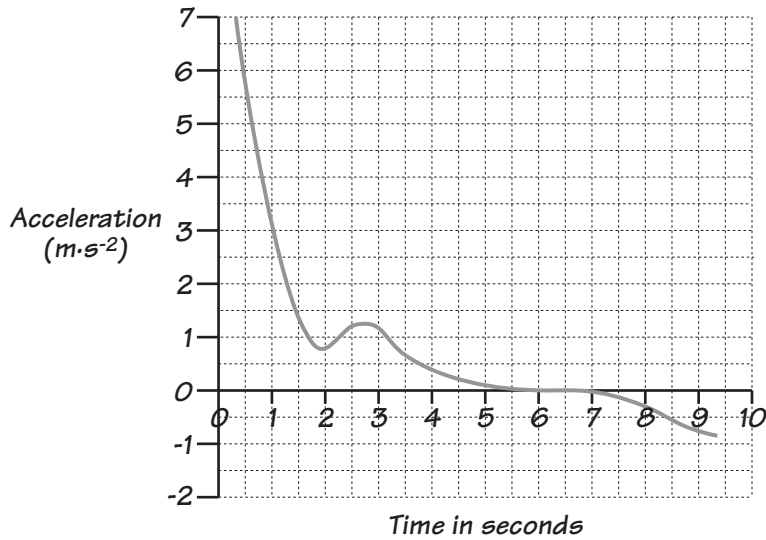


Figure 22 A series of stick figures representing stages in the take off phase of a back flic flac (Figures shown 1/12.5 second intervals).



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Figure S5 Graph of acceleration v time for the 100m sprint from data in Table S4.



As the curve is dependent on data which has been smoothed 'by eye' then variations in results can be expected. It may also be noted that in general it is difficult to obtain accurate acceleration information as the differentiation process tends to magnify the errors in the data.

27

Figure S6 Graph of position v time for the Runner.

