EN 122 ASSIGNMENT 2

Instructions: Attempt all questions. Maximum mark (/ 45).

Date issued: Thursday, 08th August, 2019

Date due: Thursday, 15th August, 2019 (before 4:06 pm)

Question One

A daring 510-N swimmer dives off a cliff with a running horizontal leap, as shown in Fig. 1. What must her minimum speed be just as she leaves the top of the cliff so that she will miss the ledge at the bottom, which is 1.75 m wide and 9.00 m below the top of the cliff? (**8 marks**)
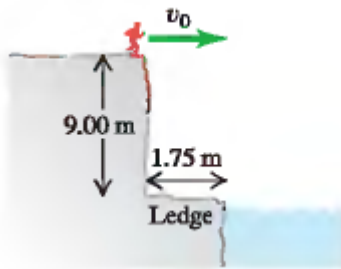

Figure 1

Question Two

A rocket is fired at an angle from the top of a tower of height h_o = 50.0 m. Because of the design of the engines, its position coordinates are of the form $x(t) = A + Bt^2$ and $y(t) = C + Dt^3$ where A, B, C, and D, are constants. Furthermore, the acceleration of the rocket 1.00 s after firing is $\mathbf{a}$ = (4.00$\mathbf{i}$ + 3.00$\mathbf{j}$) m/s^2. Take the origin of coordinates to be at the base of the tower. (a) Find the constants A, B, C, and D, including their SI units. (b) At the instant after the rocket is fired, what are its acceleration vector and its velocity? (c) What are the x- and y-components of the rocket's velocity 10.0 s after it is fired, and how fast is it moving? (d) What is the position vector of the rocket 10.0 s after it is fired? (**15 marks**)

Question Three

A horizontal wire holds a solid uniform ball of mass m in place on a tilted ramp that rises 35^0 above the horizontal. The surface of this ramp is perfectly smooth, and the wire is directed away from the center of the ball (Fig. 2). (a) Draw a free-body diagram for the ball. (b) How hard does the surface of the ramp push on the ball? (c) What is the tension in the wire? (**12 marks**)

Figure 2

Question Four

A bowling ball weighing 71.2 N is attached to the ceiling by a 3.80-m rope. The ball is pulled to one side and released; it then swings back and forth as a pendulum. As the rope swings through the vertical, the speed of the bowling ball is 4.20 m/s. (a) What is the acceleration of the bowling ball, in magnitude and direction, at this instant? (b) What is the tension in the rope at this instant? **(10 marks)**