

VICTORIA

UNIVERSITY OF WELLINGTON

TE WHARE WĀNANGA
O TE ŪPOKO O TE IKA A MĀUI



ENGR142 2018, 2nd Trimester

Lecturers: B. Ruck, F. Natali, and C. Hollitt

Assignment 1

Due date: 11:59 PM, Thursday 26th July, 2018

Problem 1: Kinematics problems

(5 Marks)

- (a) An airplane starts at rest and accelerates down a runway at 3.20 ms^{-2} for 30 s until it finally lifts off the ground. Determine the distance traveled before takeoff.
- (b) An apple falls from a tree and travels 4 m to the ground. The acceleration due to gravity has magnitude 9.8 ms^{-2} . Use two different methods *based only on kinematic equations* to find the speed of the apple when it hits the ground.

Problem 2: Vertical stone throw

(5 Marks)

A stone is thrown upwards at a speed of 20 ms^{-1} from the top of a building of height 50 m. The stone narrowly misses the building on the way down and continues on to hit the ground below. Determine:

- (a) The total time taken before the stone hits the ground.
- (b) The time taken for the stone to reach the top of its flight.

Problem 3: Undersea drama

(5 Marks)

A shark travelling through the water at 5 ms^{-1} sees a tasty-looking fish swimming past at -3 ms^{-1} (i.e., the fish is swimming in the opposite direction). At the moment they pass each other the shark begins using its swimming prowess to accelerate at -6 ms^{-2} , so that it slows down, turns around, and starts moving towards the fish. The fish is 10 m from a reef which will provide safety (i.e., the reef is at $x = -10 \text{ m}$). Will the fish reach the reef before the shark catches it? Show your working.

Problem 4: Olympic sprinter

(5 Marks)

A sprinter running a 100 metre race accelerates for the first 4 seconds before travelling the rest of the race at constant speed. She starts from rest and completes the race in a time of 11 seconds.

- (a) What was her acceleration over the first 4 seconds?
- (b) Draw graphs of displacement vs. time and velocity vs. time for the sprinter.