11 PHYSICS ATAR
ASSIGNMENT 2: EQUATIONS OF MOTION

NAME: _____ **DUE DATE:** _____ **TOTAL:** ___/44

1. During an air race, a competitor leaves the start point and flies at 1.80×10^2 kmh^{-1} due south for 20.0 minutes to reach a small town (A). She then turns to a heading of S 40.0° W and maintains 1.60×10^2 kmh^{-1} for 15.0 minutes to reach town B.

   (a) What distance has the competitor covered from the starting point?

   (2)

   (b) What is the displacement of the plane?

   (3)

   (c) Determine the following.

      (i) The average speed for the entire journey.

      (2)

(ii) The average velocity for the entire journey.

(2)

2. A boy kicks a football vertically upwards from 1.00 m above the ground at 18.0 ms^{-1}. It rises to its highest point and then falls down, just getting caught on a branch 5.50 m above the ground. (Ignore any sideways movement that has taken place.)

(a) How long is the ball in flight?

(3)

(b) What is the maximum height to which it rises?

(3)

(c) What is its velocity as it strikes the branch?

(2)

(d) Draw the following graphs (with suitable scales) for this motion.

(i) acceleration - time

(2)

(ii) velocity - time

(2)

(iii) displacement - time

(2)

3. A car moves off from a standing start with a uniform acceleration. It reaches 20.0 ms^{-1} after 8.00 s before maintaining its speed for another 15.0 s. As it approaches a set of lights, it brakes uniformly to 8.00 ms^{-1} over 12.0 s before accelerating uniformly again (as the light turned green) to 18.0 ms^{-1} in 10.0 s. It maintains this speed for 20.0 s before decelerating uniformly to a stop (at a stop sign) over the next 7.00 s.
(Assume the movement has occurred on a straight road.)

(a) Draw a velocity - time graph for the entire motion.

(3)

(b) Calculate:

(i) the acceleration at the start of the motion.

(2)

(ii) the deceleration as the car approached the second set of lights.

(2)

(c) From the graph, determine the displacement of the car over the entire motion.

(4)

4. A river 3.00×10^2 m wide flows at 5.00 ms^{-1}. A person in a boat that can travel at 12.0 ms^{-1} in still water wants to reach a jetty 2.00×10^2 m upstream on the opposite bank.

(a) Draw a vector diagram showing this situation.

(2)

(b) Determine the angle to the bank upstream that the boat must head in order to reach the jetty.

(4)

(c) How long does it take for the boat to reach the jetty?

(4)