Oakwood Park Grammar School

MATHEMATICS DEPARTMENT
A LEVEL QUANTITIES IN MECHANICS
ASSIGNMENT

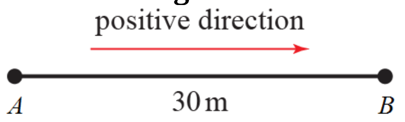
Name____________________

Target grade_____________

Answer these questions on the sheet**.** You must keep this assignment in your maths ring binder.
CALCULATORS ARE ALLOWED but **ALL** workings should be shown to gain full credit.

1. A person runs across a field from point A to point B with a speed of 5.3 m s^{-1} and then runs back from point B to point A with a speed of 4.8 m s^{-1}.

Figure 1



a Taking the positive direction as shown in the diagram, state the person's velocity when travelling from A to B,.

(1)

b velocity when travelling from B to A.

(1)

Another person runs 30 m from A in the exact opposite direction of B to a point C.

c State this person's displacement from A at the point C.

(1)

(Total 3 marks)

2. The height of a tennis ball above the ground can be modelled using the equation $h = 1.7 + 0.18x – 0.01x^2$, where h metres is the height of a tennis ball above the ground and x metres is the horizontal distance travelled.

a Find the height of the tennis ball when it is

i struck.

(2)

ii at a horizontal distance of 7 m.

(2)

To be called 'in' the tennis ball must hit the ground before it travels a horizontal distance of 25 m.

b Will the tennis ball be called 'in'?

(5)

c The tennis ball is hit with an initial speed of 2 km min^{-1}. Convert this into m s^{-1}.

(3)

(Total 3 marks)

3. The height of a pole vaulter above the ground can be modelled using the equation $h = \frac{1}{60}\left(125x - 12x^2\right)$,

where h metres is the vertical height of the pole vaulter and x metres is the horizontal distance travelled after his feet leave the ground.

a Find the horizontal distance travelled when the pole vaulter lands.

(3)

b Given that the pole vaulter is at his greatest height halfway between leaving the ground and landing, find the greatest height of the pole vaulter.

(3)

For a jump to be successful, the pole vaulter must clear a bar of height 4.9 m.

c Calculate the range of horizontal distances from the bar that the pole vaulter can leave the ground and have a successful jump.

(7)

d State the effect in this model of

i modelling the pole vaulter as a particle,

(1)

ii making air ressistance negligible.

(1)

(Total 15 marks)

4. A boat travels from *A* to *B* and then from *B* to *C*. The displacement from *A* to *B* is $(-28\mathbf{i} + 80\mathbf{j})$ m. The displacement from *B* to *C* is $(130\mathbf{i} + 15\mathbf{j})$ m.

a Find the total distance the boat travelled in moving from *A* to *C*.

(4)

b Find the angle the vector $\overrightarrow{AC}$ makes with the unit vector **i**.

(4)

(Total 8 marks)

5. An ice hockey puck is hit and initially travels with a velocity of $(14\mathbf{i} + 22\mathbf{j})$ m s^{-1}

a Find the speed of the puck.

(3)

b Find the angle of direction of motion the puck makes with the unit vector **j**.

(4)

c State the effect of modelling the ice as a smooth surface.

(1)

d A hockey puck has a density of 1.4 g cm^{-3}. Convert this into kg m^{-3}.

(4)

(Total 10 marks)

SCORE ()	PERCENTAGE	GRADE	Teacher comment including EBI

What went well	☺
Modelling in mechanics	
Understanding speed vs velocity	
Working with SI units	
Understanding vectors, magnitude and direction	
Knowing distance is magnitude of displacement	
Knowing speed is magnitude of velocity	

Student corrections completed?