8MA0 Unit Test

Mechanics – Quantities and Units

Time allowed: 45 minutes

Centre:

Name:

Teacher:

Question	Points	Score
1	3	
2	12	
3	15	
4	8	
5	12	
Total:	50	

How I can achieve better:

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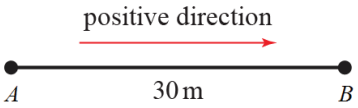
1. A person runs across a field from point A to point B with a speed of 5.3 ms^{-1} and then runs back from point B to point A with a speed of 4.8 ms^{-1}.



Taking the positive direction as shown in the diagram, state the person's

(a) 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

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 ms^{-1}. [3]

Total: 12

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 resistance negligible. [1]

Total: 15

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 $\mathbf{i}$. [4]

Total: 8

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

   (a) Find the speed of the puck. [3]

   (b) Find the angle of direction of motion the puck makes with the unit vector $\mathbf{j}$. [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: 12