

- M1.** (a) distance is a scalar and displacement is a vector
or
distance has magnitude only, displacement has magnitude and direction 1
- (b) 37.5 km
accept any value between 37.0 and 38.0 inclusive 1
- 062° or N62°E
accept 62° to the right of the vertical 1
- accept an angle in the range 60° – 64°*
accept the angle correctly measured and marked on the diagram
- (c) train changes direction so velocity changes 1
- acceleration is the rate of change of velocity 1
- (d) number of squares below line = 17
accept any number between 16 and 18 inclusive 1
- each square represents 500 m 1
- distance = number of squares × value of each square correctly calculated – 8500 m 1

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- M2.(a)** (i) 9.5
accept ± 1 mm 1
- 10.5 1
- (ii) 9.5
ecf from (a)(i) 1
- (iii) 190
20 \times (a)(ii) ecf 1
- (iv) medium
ecf from (a)(iii) 1
- (b) (i) any **two** from:
- position of ball before release
 - same angle **or** height of runway
 - same ball
 - same strip of grass
- 2
- (ii) long
or
longer than in part (a)
or
uneven
do not allow reference to speed 1

- (c) (i) as humidity increases mean distance decreases
accept speed for distance

1

- (ii) $71 \times 180 = 12780$
 $79 \times 162 = 12798$
 $87 \times 147 = 12789$

all three calculations correct with a valid conclusion gains 3 marks

or

find k from $R = k / d$

all three calculations correct gains 2 marks

or

$$87 / 71 \times 147 = 180.1 \sim 180$$

$$87 / 79 \times 147 = 161.9 \sim 162$$

two calculations correct with a valid conclusion gains 2 marks

conclusion based on calculation

one correct calculation of k gains 1 mark

3

- (iii) only three readings **or** small range for humidity
accept not enough readings
accept data from Internet could be unreliable
ignore reference to repeats

1

- (d) distance is a scalar **or** has no direction **or** has magnitude only
allow measurements from diagram of distance and displacement

1

displacement is a vector **or** has direction

1

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M3. (a) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

or $\frac{10}{4}$

*gains 1 mark
do not penalise if both of these present
but 'change in' omitted from formula*

but
2.5

gains 2 marks

unit m/s² **or** metres per second squared

or metres per second per second

or ms⁻²
for 1 mark

3

(b) *evidence* of using area under graph or distance average speed × time
or

$10 \times 4 \times \frac{1}{2}$

gains 1 mark

but
20

gains 2 marks

units metres / m⁻²
for 1 mark

3

(c) force = mass × acceleration **or** 75 × 25
gains 1 mark

but
1875

gains 2 marks

**NB Correct unit to be credited even if numerical answer wrong or absent.*

2

[8]