Edexcel AS Mathematics Kinematics
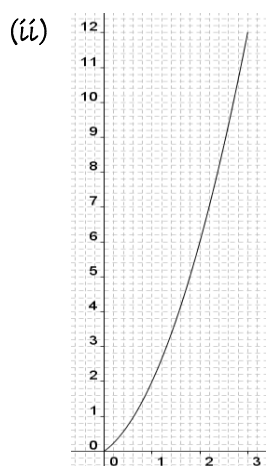
Section 1: Displacement and distance
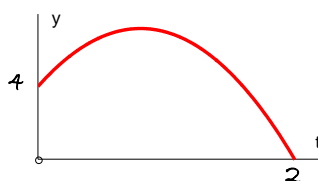
Solutions to Exercise level 2

1. (i) | | |
    |---|---|
    | $t = 0$ | $x = 0$ |
    | $t = 0.5$ | $x = 0.75$ |
    | $t = 1$ | $x = 2$ |
    | $t = 1.5$ | $x = 3.75$ |
    | $t = 2$ | $x = 6$ |
    | $t = 2.5$ | $x = 8.75$ |
    | $t = 3$ | $x = 12$ |

    (ii)

    (iii) 8.16 m

2. (i) $y = 8t - 5t^2 + 4$

t	0	0.2	0.6	1.0	1.4	1.8	2
y	4	5.4	7	7	5.4	2.2	0

    (ii)

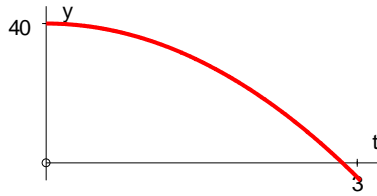 | t | 0 | 0.2 | 0.6 | 1.0 | 1.4 | 1.8 | 2 |
    |---|---|-----|-----|-----|-----|-----|---|
    | Displacement | 0 | 1.4 | 3 | 3 | 1.4 | -1.8 | -4 |

    (iii) By symmetry the greatest height is when t = 0.8

    Greatest height $= 8 \times 0.8 - 5 \times 0.8^2 + 4 = 7.2$

    Total distance travelled = (7.2 – 4) + 7.2 = 10.4 metres.

3. (i) $y = 40 - 4.9t^2$

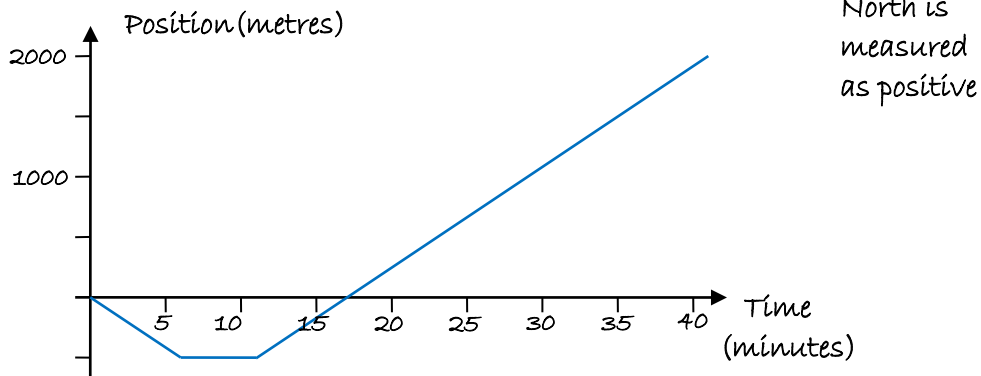| t	0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.0
y	40	39.2	36.4	32.9	27.5	20.4	11.8	1.6	-4.1

(ii) Between t = 2.8 and t = 3.0, the stone hits the water.

4. (i) Time taken to shop $= \dfrac{distance}{speed} = \dfrac{0.5}{5} = 0.1$ hours = 6 minutes

Time in shop = 5 minutes

Time taken from shop to school $= \dfrac{2.5}{5} = 0.5$ hours = 30 minutes.
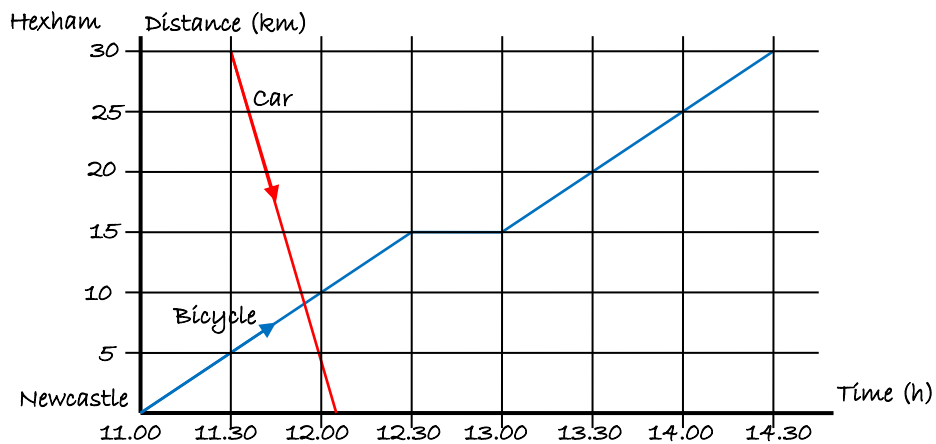

North is measured as positive

(ii) Total journey time = 6 + 5 + 30 = 41 minutes.

(iii) The assumptions are that she walks at the same average speed every day, for both parts of the journey, and that she takes the same time to buy sweets every day.
The total time will not be the same every day because there will be variations in her average speed and in the time that she takes to buy the sweets.

5.

Hexham Distance (km)
30
Car
25
20
15
10
Bicycle
5
Newcastle
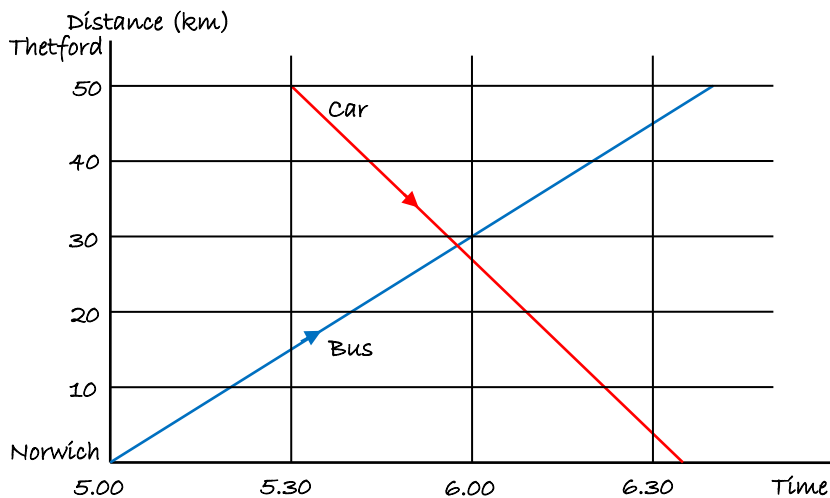Time (h)
11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30

The car and bicycle pass about 10 km from Newcastle at about 11.55 a.m.

The assumption that both the car and the bicycle maintained a steady speed for the whole journey is unrealistic.

6. (i)

Distance (km)
Thetford
50
Car
40
30
20
Bus
10
Norwich
5.00   5.30   6.00   6.30   Time

(ii) They pass at approximately 5.55 p.m.

(iii) They pass about 28 km from Norwich.

(iv) The average speed doesn't give a true indication of the journey, e.g. the bus will probably make stops, and both vehicles will probably vary in their speeds at different parts of the journey.

7. (i) Total distance covered = 80 km
      Average speed = 60 km/h

Time taken for complete journey $= \dfrac{80}{60} = \dfrac{4}{3}$ hours = 80 minutes.

Distance from A to B = 40 km

Average speed from A to B = 60 km/h

Time taken from A to B $= \dfrac{40}{60} = \dfrac{2}{3}$ hours = 40 minutes.

The car stops at B for 20 minutes, so time for return journey
$= 80 - 40 - 20 = 20$ minutes

Distance from B to A = 40 km

Time from B to A = 20 minutes = $\frac{1}{3}$ hours

Average speed from B to A $= \dfrac{40}{\frac{1}{3}} = 120$ km/h

(ii) Total displacement = 0, so average velocity for whole motion = 0.

8. (i) Distance from B to C = 20 m

Time from B to C = 4 seconds

Average speed from B to C $= \dfrac{20}{4} = 5$ ms^{-1}.

(ii) Distance from A to B = 60 m

Speed from A to B = 10 ms^{-1}

Time from A to B $= \dfrac{60}{10} = 6$ seconds

Total time from A to C = 6 + 4 = 10 seconds

Total distance from A to C = 80 m

Average speed from A to C $= \dfrac{80}{10} = 8$ ms^{-1}.

(iii) Average speed for whole journey = 5 ms^{-1}.

Total distance for whole journey = 80 + 20 = 100 m

Time taken for whole journey $= \dfrac{100}{5} = 20$ seconds

Time from C to B = 20 - 10 = 10 seconds.

(iv) Object ends up at B, so total displacement for journey = 60 m

Total time for journey = 20 seconds

Average velocity $= \dfrac{60}{20} = 3$ ms^{-1}.