9.2 Ready, set, go!

Remember

1. *v* = *d/t* where *v* = average speed, *d* = distance travelled and *t* = time taken.
2. Average speed is a measure of how quickly distance is covered, whereas average velocity is a measure of how quickly position relative to the starting point changes. They are different because you can travel a distance without changing your final position. For example, while running one complete lap around a running track in 60 seconds you travel a distance of 400 metres but your position relative to the start has not changed. Your average speed is 400 m ÷ 60 s = 6.7 m/s but your average velocity is zero. A non-zero velocity must include direction, just as a change in position must.
3. The gradient of a distance–time graph is equal to the speed.
4. (a) 50 times per second (b) 0.02 seconds
5. Electronic detectors are embedded into the road surface in each lane of traffic. As vehicles travel over these detectors, they trigger the emission of radio waves that, when reflected back, allows the speed of each vehicle to be measured. If the speed of the vehicle exceeds the legal limit then a digital picture is taken of the offending vehicle.

Using data

1. (a) *v* = 3200 m ÷ 200 s = 16 m/s
2. *v* = 2500 m ÷ 180 s = 13.9 m/s ≈14 m/s
3. *v* = 2 km ÷ (3/60) h = 40 km/h
4. *v* = 16 km ÷ 0.5 h = 32 km/h
5. (a) 180 hours (7.5 days)
6. 18 days
7. (a) 24 cm
8. 1440 cm (14.4 m)
9. (a) 1.47 m/s
10. 1.43 m/s due north
11. zero
12. Second interval: 4.2 cm/0.1 s = 42 cm/s

Third interval: 5.6 cm/0.1 s = 56 cm/s

Think

1. Responses may vary. Example: It is more important to measure instantaneous speed because it must be established if a driver is over the speed limit at a particular moment in time.
2. The object is travelling at a constant speed.
3. Ticker tape drawings should show the spaces between the dots becoming smaller over time.
4. Ticker tape drawings should show the spaces between the dots becoming larger over time.