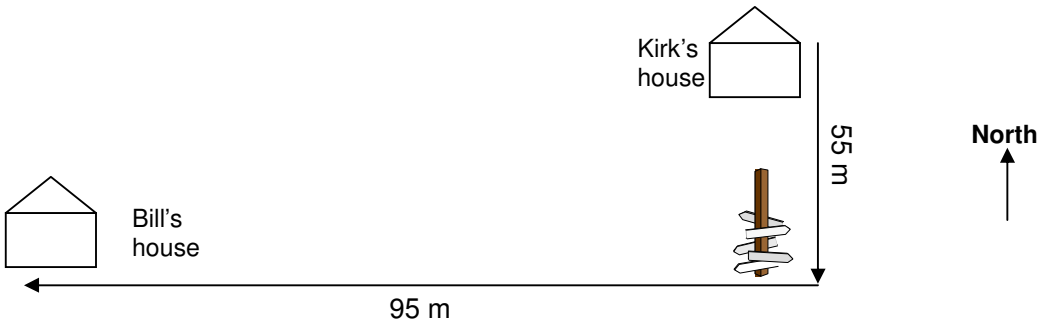
Unit 2 Physics
Kinematics Test **Name:_____**

Use g = 10 ms^{-2} for all questions, where appropriate
Total = 48 Marks

The following information refers to Questions 1 to 3
Kirk walks to his friend Bill's house using the path shown in the following diagram.



1. What is the size of Kirk's **distance** travelled to get to Bill's house? (to the nearest metre)
   55 + 95 = 150m

(2 marks)

2. What is size of Kirk's **displacement** from his home? (to the nearest metre)
   $55^2 + 95^2 = 109.77$m

(2 marks)

3. If it takes Kirk 2 ½ minutes to walk to Bill's house, what is his average speed (in metres per second)?
   150 / (60 * 2.5) = 1 m/s

(2 marks)

4. A car is travelling at a constant speed of 23 ms^{-1}. The driver takes 0.4 s to read the speedometer. How far does the car travel in this time?
   23 * 0.4 = 9.2m

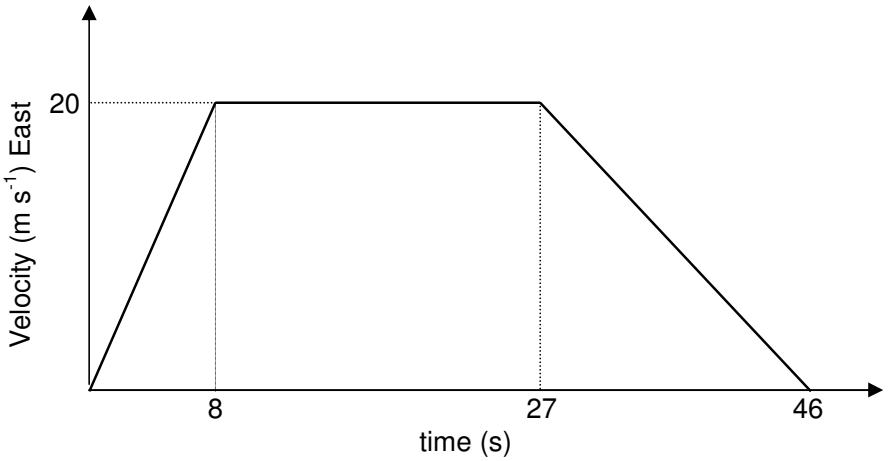
(2 marks)

5. The express train from Melbourne to Sydney travels at 108 kmh^{-1} (30 ms^{-1}). When the brakes are applied, it will travel 900 m before it stops.
   What is the size of the train's average acceleration?

   $V^2 = u^2 + 2ax$
   $0 = 900 - 2*900*a$
   $a = 0.5$m/s^2

(2 marks)

The following velocity time graph refers to Questions 6 - 8.
This graph displays the velocity of a car travelling on Canterbury road.



6. What was the initial acceleration of the vehicle (in ms^{-2})? Give your answer as a vector

20 / 8 = 2.5m/s^2 East

(2 marks)

7. What was the change in displacement of the car over the 46 seconds? Give your answer as a vector

AREA UNDER THE GRAPH = 10*8 + 20 * 19 + 10 * 19
= 80 + 380 + 190 = 650m East

(3 marks)

8. What was the average speed of the car over the 46 seconds?

650m / 46 seconds = 14.13 m/s

(2 marks)

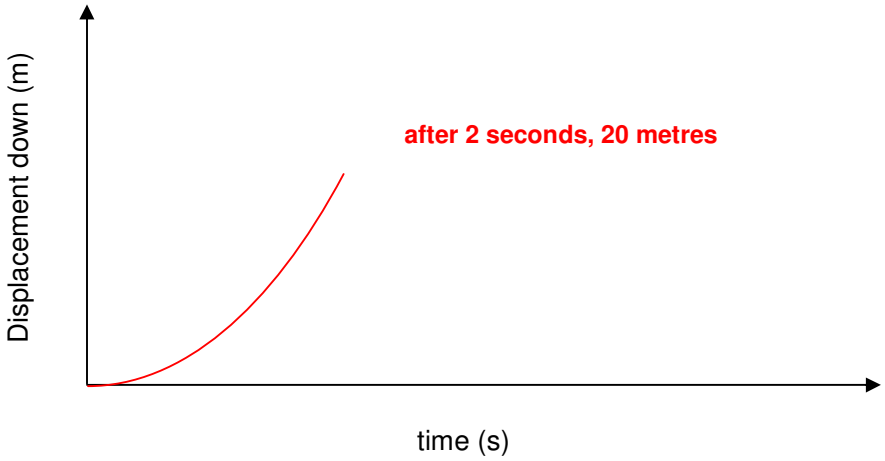
9. Explain, using appropriate examples the difference between a **vector** and a **scalar** quantity.

(4 marks)

The following information refers to Questions 10 and 11
A ball is dropped from a 20 metre tower and hits the ground

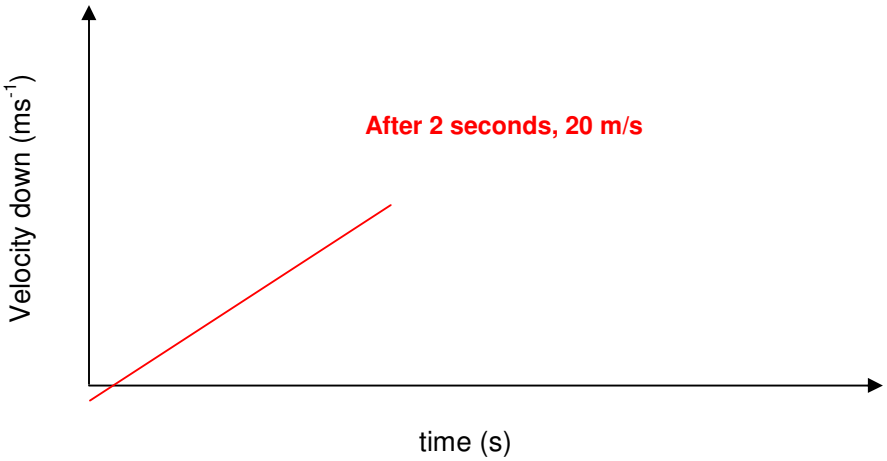
10. Taking down to be positive, draw a displacement time graph for the ball from when it is dropped until it hits the ground. (*Put the appropriate scales on the graph)*

$20 = 5t^2$
$t = 2$



(3 marks)

11. Now draw the velocity time graph for the ball from when it is dropped until it hits the ground, taking down to be positive. (*Put the appropriate scales on the graph)*



(3 marks)

The following information refers to questions 12 and 13.
An arrow is fired vertically into the air and takes 4.2 s to return to its starting position.

12. What was the initial speed of the arrow just after it left the bow?

2.1 * 10 = 21m/s

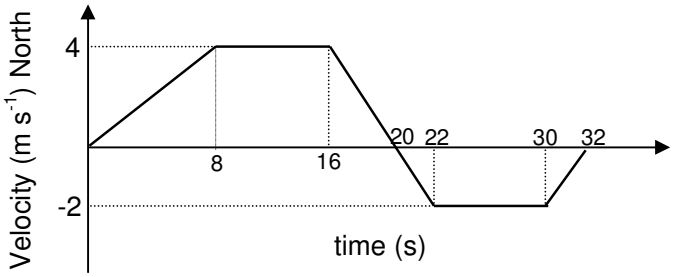
(2 marks)

13. How high did the arrow go from its starting position? (To 2 decimal places)

$X = ut + 0.5at^2$ OR
21 * 2.1 – 0.5*10*2.1*2.1 = 22.05m

(2 marks)

The graph and information below are for questions 14 – 17
The following graph represents the velocity of a remote controlled car.



14. What is the total distance travelled by the car?

2 * 8 + 4 * 8 + 2 * 4 + 1 * 2 + 8 * 2 + 1 * 2 =
16 + 32 + 8 + 2 + 16 + 2 = 76m

(2 marks)

15. What is the total displacement of the car?

2 * 8 + 4 * 8 + 2 * 4 – (1 * 2 + 8 * 2 + 1 * 2) =
16 + 32 + 8 – (2 + 16 + 2) = 56 – 20 = 36m NORTH

(2 marks)

16. What is the average velocity of the car? (Give your answer as a vector, to 2 decimal places)

36 / 32 = 1.125 = 1.13m/s NORTH

(2 marks)

17. What is the instantaneous acceleration of the car after 20 seconds? (Give size and direction)

Gradient of graph at 20 seconds is -4 / 4 = - 1 m/s^2 NORTH or 1 m/s^2 SOUTH

(3 marks)

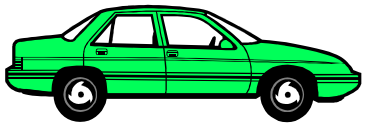
18. What is the average acceleration of the car during the first 20 seconds?

0 m/s^2

(2 marks)

The following information refers to Questions 19 and 20

Matt was driving along a road at 20 ms^{-1} when a dog ran onto the road up ahead. It took him 0.7 seconds after he saw the dog to apply the brakes (his reaction time.) Whilst the brakes were applied, he decelerated at 10 $m\ s^{-2}$ until his car came to rest.



19. What distance did Matt's car move (until the car stopped) from the moment the dog ran onto the road?

Reaction Distance 20 * 0.7 = 14m
Braking distance → 0 = 400 – 2 * 10 * x → x = 20
Total distance = 34m

(3 marks)

20. If the dog was initially 24m from Matt's car when he saw the dog, show that Matt's car would have been travelling at about 14m/s when the car reached the dog.

Reaction Distance 20 * 0.7 = 14m
Braking distance = 10m → $v^2 = 400 – 2 * 10 * 10$ → $v^2 = 200$ → v = 14.1 m/s

(3 marks)