ATAR PHYSICS
UNIT 1 – Motion and Forces
TEST 1 2020

Student Name:

_____

Teacher: JRM   PCW   CJO   SA
(Please circle)

Time allowed for this paper
Working time for paper: **40 minutes.**

Instructions to candidates:

- You must include **all** working to be awarded full marks for a question.
- Answers shall be expressed to 3 significant figures unless otherwise instructed.
- Marks will be deducted for incorrect or absent units.
- **No** graphics calculators are permitted – scientific calculators only.

Mark:	/ 37
=	%

Question 1   **(10 marks)**

A villain falls from a stationary helicopter at an altitude of 1250 m. After 3.00 seconds the villain attempts to shoot the helicopter. The bullet misses and reaches a vertical height of 2210 m above the ground. Air resistance can be ignored.

(a)   Calculate how far the villain falls in the 3.00 seconds.

                                                                                   (3 marks)

(b)   Calculate the velocity of the villain when he attempts to shoot the helicopter.

                                                                                   (2 marks)

(c)   Calculate the initial velocity of the bullet, relative to the villain, as it leaves the gun barrel.

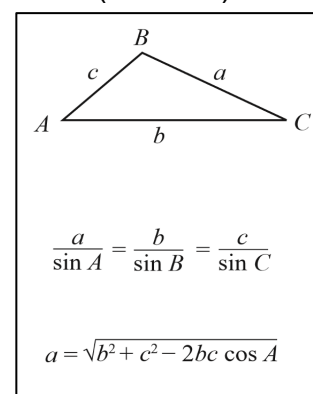   **(5 marks)**

Question 2 **(8 marks)**

A ship is sailing north 50.0º east at 12.0 knots relative to the water and there is a current of 6.50 knots flowing **from** north 30.0º west

(a)   Draw a clearly labelled vector diagram of the ship's motion showing the relationship between the vectors provided and the ship's motion relative to Earth.

(2 marks)

(b)   Calculate the velocity of the ship relative to the surface of the Earth. The following expressions for triangle ABC shown may be used to assist.

(3 marks)

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
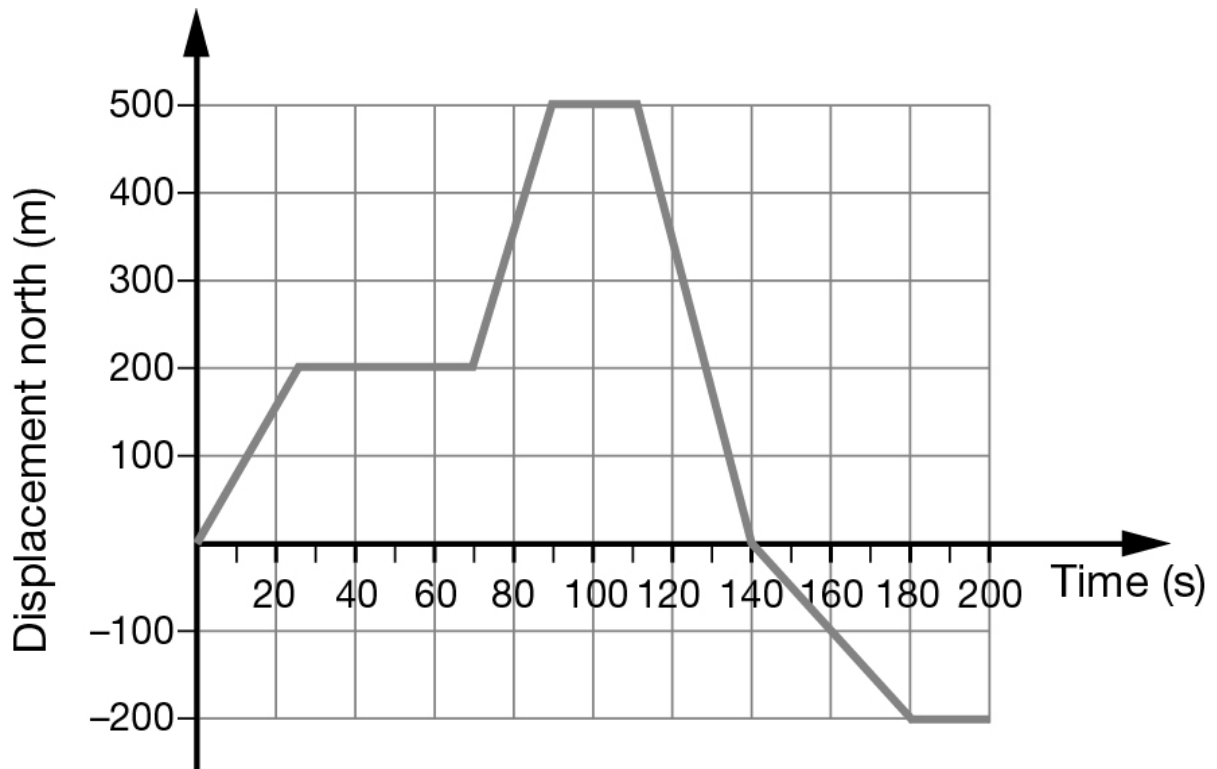
$$a = \sqrt{b^2 + c^2 - 2bc \cos A}$$

(c)   If the captain wanted to sail due East calculate the direction he should face, relative to the water, assuming no change in speed through the water.

(3 marks)

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Question 3 **(9 marks)**

The graph below shows the displacement of Jimmy riding a mountain bike over a period of 200 s.
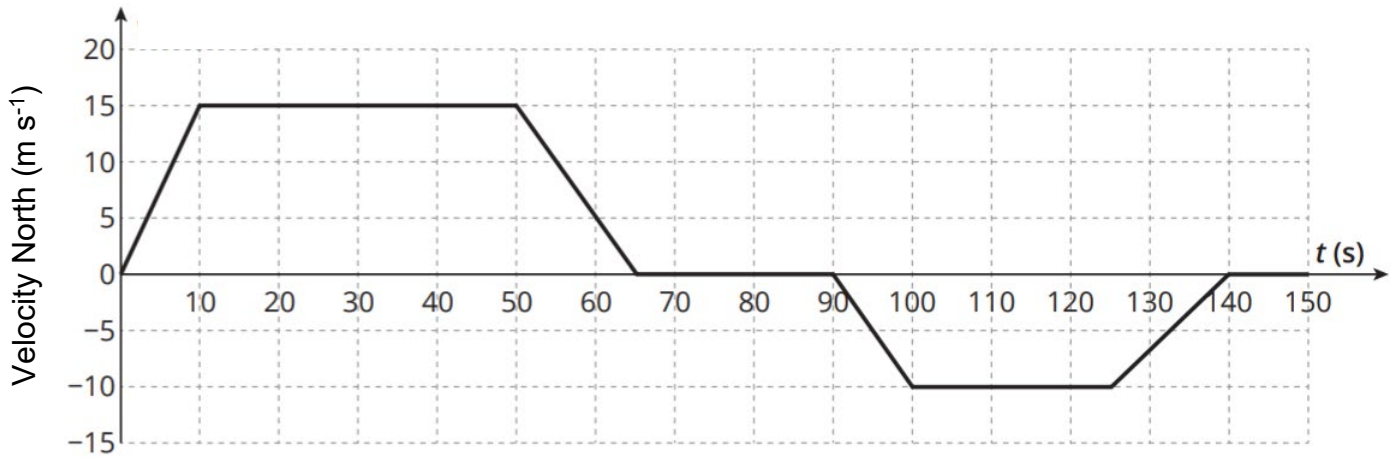

(a)   Calculate the total distance covered by Jimmy.

(1 marks)

(b)   Calculate the average velocity of the rider over the 200 second period.

(2 marks)

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Robbie rides his mountain bike from the same point and at the same time as Jimmy. Robbie's ride is shown below:

(c)   Calculate the total distance covered by Robbie for the time period shown.

(3 marks)

(d)   State which rider had the greatest speed at t = 120 s. Justify your statement with appropriate calculations.
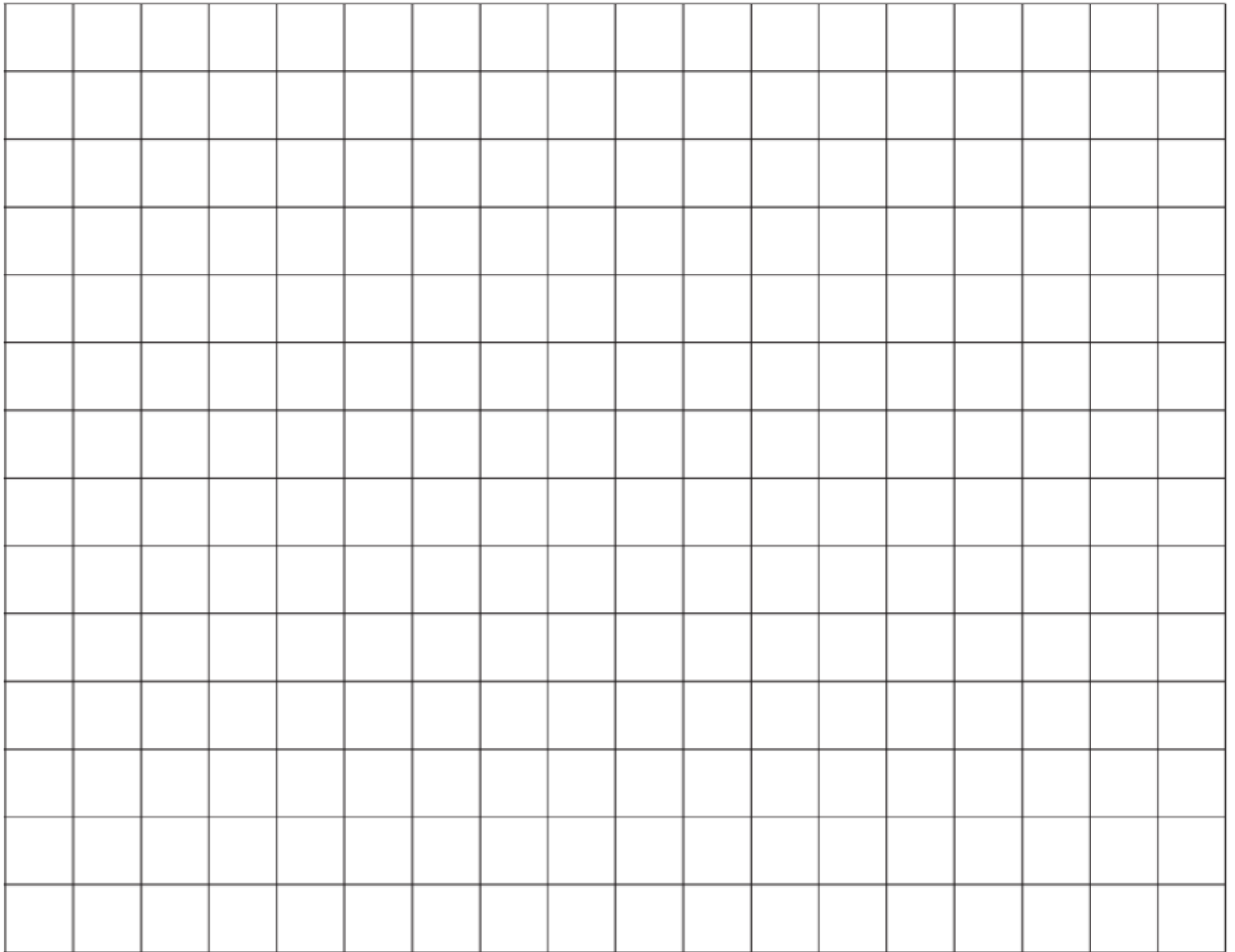
(3 marks)

Question 4   **(10 marks)**

A hungry dingo is resting under a tree when a sheep runs by at a constant speed of 8.00 m s^{-1}. At the instant the sheep passes, the dingo accelerates at a constant rate for 4.50 s until it reaches its top speed of 12.0 m s^{-1}. The dingo maintains this speed until it catches the sheep.

(a)   Sketch a velocity–time graph of both animals on the same graph below.

                                                               (3 marks)

(b)   Using the velocity-time graph, calculate how long it takes the dingo to catch the sheep.

(5 marks)

(c)   Calculate the distance the dingo travels in order to catch the sheep.

(2 marks)

END OF TEST