

See back cover for an English translation of this cover

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90940M



909405



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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Tohua tēnei pouaka mēnā  
KĀORE koe i tuhi kōrero ki  
tēnei pukapuka

## Pūtaiao, Kaupae 1, 2022

### 90940M Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa.	Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa, kia hōhonu.	Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa, kia tōtōpū.

Tirohia kia kitea ai e ōrite ana te Tau Ākonga ā-Motu kei tō puka whakauru ki te tau kei runga i tēnei whārangi.

**Me whakamātau koe i ngā tūmahi KATOĀ kei roto i tēnei pukapuka.**

Tirohia kia kitea ai kei a koe te Pukapuka Rauemi L1–MSCIE.

Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2–23 i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (X). Ka poroa pea taua wāhanga ka mākahia ana te pukapuka nei.

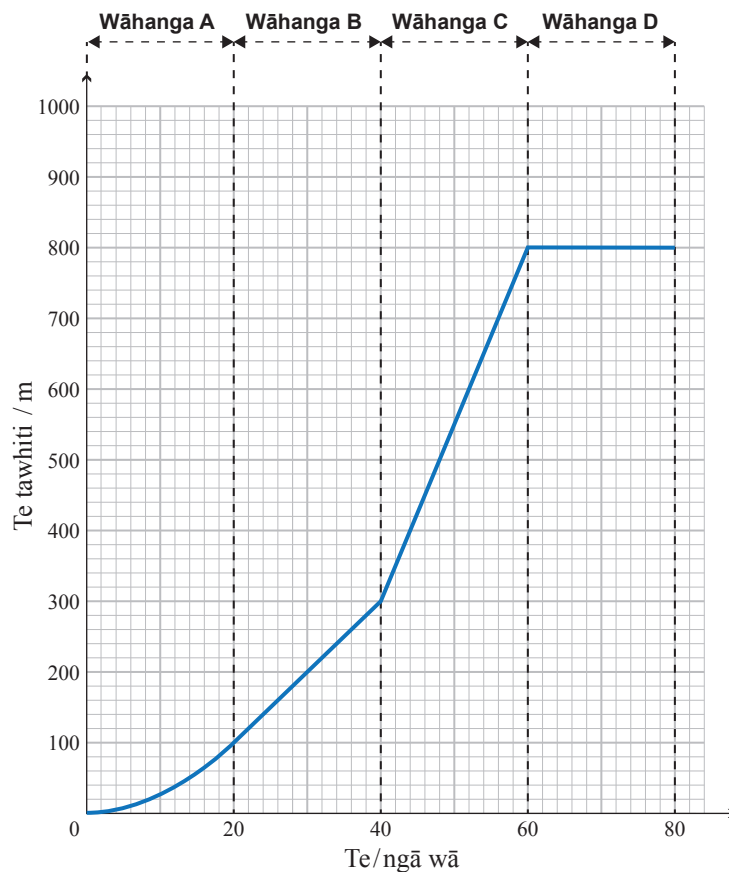
**HOATU TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

## TE TŪMAHI TUATAHI: HE WAKA I TE KAPU O AMERIKA



Te mātāpuna: <https://resources.stuff.co.nz/content/dam/images/4/y/r/2/z/n/image.related.StuffLandscapeSixteenByNine.1420x800.220eds.png/1613834074445.jpg>

Kei raro nei tētahi kauwhata **tawhiti-wā** mō tētahi waka i te Kapu o Amerika e tere ana i te Whanga o Waitematā.



(a) Whakaahuatia te nekehanga o te waka i ngā wāhanga e whā.

Wāhanga A: \_\_\_\_\_

Wāhanga B: \_\_\_\_\_

Wāhanga C: \_\_\_\_\_

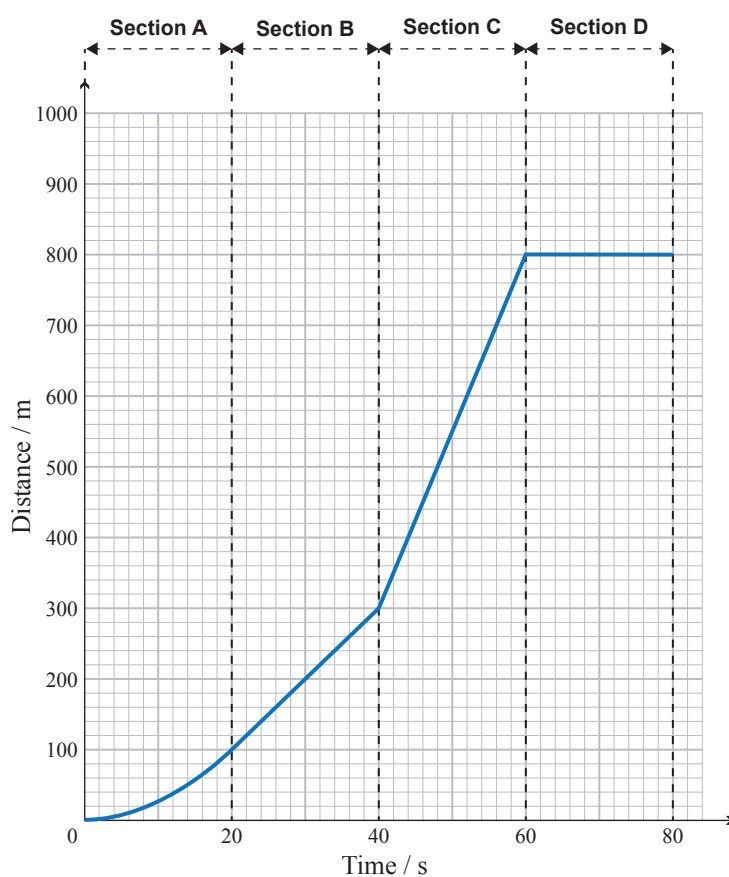
Wāhanga D: \_\_\_\_\_

## QUESTION ONE: AMERICA'S CUP BOAT



Source: <https://resources.stuff.co.nz/content/dam/images/4/y/r/2/z/n/image.related.StuffLandscapeSixteenByNine.1420x800.220eds.png/1613834074445.jpg>

Below is a **distance-time** graph for an America's Cup boat sailing across the Waitematā Harbour.



(a) Describe the motion of the boat in the four sections.

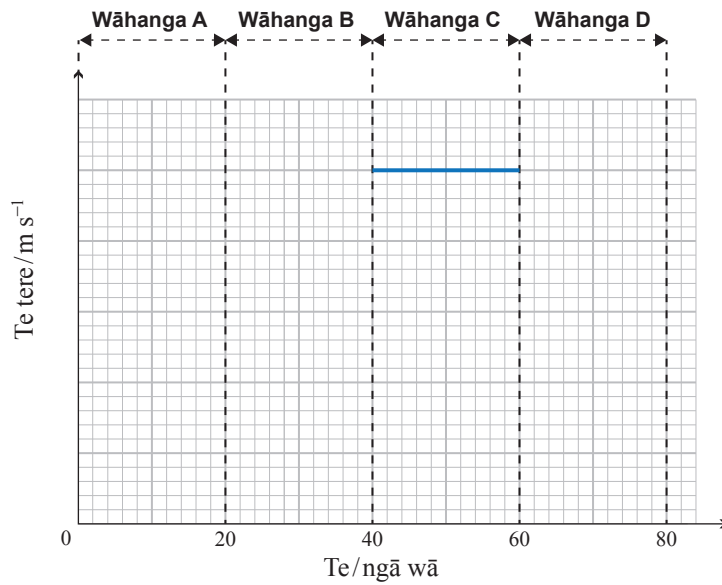
Section A: \_\_\_\_\_

Section B: \_\_\_\_\_

Section C: \_\_\_\_\_

Section D: \_\_\_\_\_

- (b) (i) I ngā tuaka i raro nei, me huahua tētahi kauwhata tere-wā mō tēnei haerenga.  
Kua oti kē te Wāhanga C māu.



*Ki te hiahia koe ki te  
tā anō i tō urupare,  
whakamahia te hoahoa  
kei te whārangi 20.*

- (ii) Tātaihia te tere o te waka i te Wāhanga B o te kauwhata.  
Tuhia ō whiriwhiringa.

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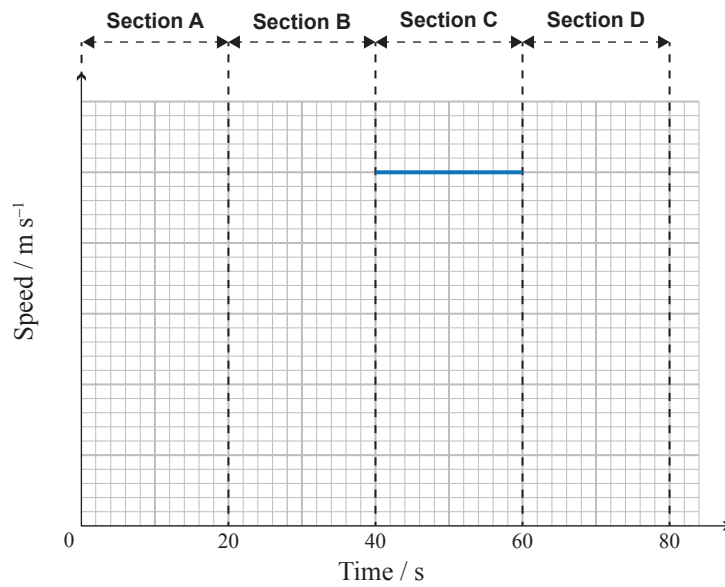


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- (b) (i) On the axes below, sketch a speed-time graph for this journey.  
Section C has been done for you.



- (ii) Calculate the speed of the boat in Section B of the graph.  
Show your working.

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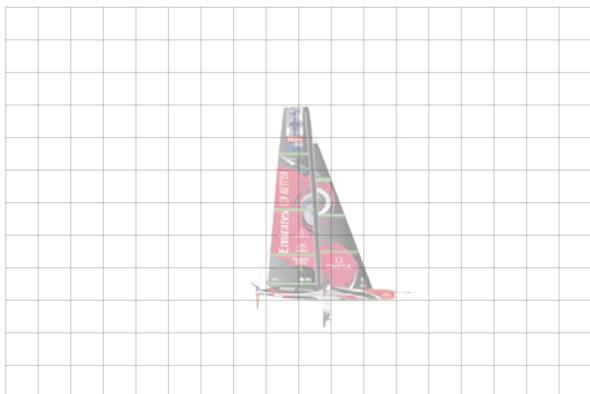
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- ## Section A



*If you need to redraw your response, use the diagrams on page 21.*

- You should consider:

- both the horizontal and vertical forces
- the size and direction of these forces
- the motion of the boat in both sections
- the net force in both sections.





## TE TŪMAHI TUARUA: TE RETI ONEPŪ I TE RĒINGA



Te mātāpuna: [www.visitboi.co.nz/wp-content/uploads/2019/05/downhill.jpg](http://www.visitboi.co.nz/wp-content/uploads/2019/05/downhill.jpg)

Ko te 25 m te teitei poutū o tētahi puke onepū. Ko te 55 kg te papatipu o Ariana me tōna papa reti onepū.

- (a) Whakamāramahia te rerekētanga o te papatipu me te taumaha o Ariana me tōna papa reti onepū.

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- (b) Ka kawea a Ariana i tōna papa reti onepū ki te taumata o tētahi puke e 25 m te teitei i te 120 hēkona.

- (i) Tātaihia te mahi i mahia rā kia piki i tēnei puke.

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- (ii) Tātaihia te kaha i pau rā i a ia kia piki i tēnei puke.

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**QUESTION TWO: SANDBOARDING AT CAPE REINGA**

Source: [www.visitboi.co.nz/wp-content/uploads/2019/05/downhill.jpg](http://www.visitboi.co.nz/wp-content/uploads/2019/05/downhill.jpg)

A sandhill has a vertical height of 25 m. Ariana and her sandboard have a mass of 55 kg.

- (a) Explain the difference between the mass and the weight of Ariana and her sandboard.

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- (b) Ariana carries her sandboard to the top of a 25 m hill in 120 seconds.

- (i) Calculate the work done to climb this hill.

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- (ii) Calculate the power that she uses to climb this hill.

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- (iii) Whakamāramahia te āhua ka taea e ia e heke ai te kaha ka pau kia piki ki te taumata o te puke.

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- (c) Ka eke a Ariana i tōna papa reti onepū mai i te taumata o te puke e 25 m te hekenga ki te pūtake.

- (i) Tātaihia te pūngao tō ā-papa e torohū ana ki a Ariana me tōna papa reti onepū i te taumata o te puke.

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- (ii) Ko te  $12 \text{ m s}^{-1}$  tōna tere i te pūtake o te puke.

Tātaihia te pūngao neke o Ariana me tōna papa reti onepū i te pūtake o te puke.

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- (iii) Whakamāramahia ngā rerekētanga o tōna pūngao tō ā-papa e torohū ana i te taumata o te puke, me tōna pūngao neke i te pūtake o te puke.

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- (iii) Explain how she could lower the power output required to climb to the top of the hill.

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- (c) Ariana rides her sandboard from the top of the 25 m hill to the bottom.

- (i) Calculate the gravitational potential energy of Ariana and her sandboard at the top of the hill.

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- (ii) Her speed at the bottom of the hill is  $12 \text{ m s}^{-1}$ .

Calculate the kinetic energy of Ariana and her sandboard at the bottom of the hill.

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- (iii) Explain the differences between her gravitational potential energy at the top of the hill, and her kinetic energy at the bottom of the hill.

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## TE TŪMAHI TUATORU: HE PUKE POUPOU



Te mātāpuna: <https://carfromjapan.com/wp-content/uploads/2019/02/2-30.jpg>

- (a) Tautohua te tikanga o ia reta i te ture tātai e whai mai nei, me ngā waeine hoki.

$$P = \frac{F}{A}$$

Te reta	E tohu ana tēnei reta i te kupu:	Te waeine
$P$		
$F$		
$A$		

**QUESTION THREE: STEEP HILLS**

Source: <https://carfromjapan.com/wp-content/uploads/2019/02/2-30.jpg>

- (a) Identify what each of the letters represents in the following formula, including units used.

$$P = \frac{F}{A}$$

Letter	This letter represents the term:	Unit
<i>P</i>		
<i>F</i>		
<i>A</i>		

Me whai pereki kouna te waka ka taraiwa whakararo ana i te puke. Kei te pūnaha pereki o te waka ngā kōkeke e rua: he kōkeke iti mē tōna wāhi iti, ā, he kōkeke nui me tōna wāhi nui.



Te mātāpuna: [https://res.cloudinary.com/yourmechanic/image/upload/dpr\\_auto,f\\_auto,q\\_auto/v1/article\\_images/2\\_How\\_to\\_Open\\_Your\\_Car\\_Hood\\_A\\_diagram\\_of\\_the\\_how\\_brakes\\_fluid\\_is\\_applied\\_when\\_the\\_pedal\\_is\\_pushed\\_down](https://res.cloudinary.com/yourmechanic/image/upload/dpr_auto,f_auto,q_auto/v1/article_images/2_How_to_Open_Your_Car_Hood_A_diagram_of_the_how_brakes_fluid_is_applied_when_the_pedal_is_pushed_down)

(b) Mā te pereki e neke ai te kōkeke iti, ko te 20 N te tōpana. Ko te  $0.008 \text{ m}^2$  te wāhi o te kōkeke iti.

(i) Me whakaatu ko te 2500 Pa te pēhanga o tēnei kōkeke.

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(ii) He ōrite te pēhanga i ngā wāhanga katoa o te pūnaha pereki. Ko te  $0.04 \text{ m}^2$  te wāhi o te kōkeke nui.

Tātaihia te tōpana ka pā ki te kōkeke nui ka perekingia ana te waka.

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Cars need effective brakes when driving down a hill. A brake system in a car uses two pistons: a small piston with a small area and a large piston with a large area.



Source: [https://res.cloudinary.com/yourmechanic/image/upload/dpr\\_auto,f\\_auto,q\\_auto/v1/article\\_images/2\\_How\\_to\\_Open\\_Your\\_Car\\_Hood\\_A\\_diagram\\_of\\_the\\_how\\_brakes\\_fluid\\_is\\_applied\\_when\\_the\\_pedal\\_is\\_pushed\\_down](https://res.cloudinary.com/yourmechanic/image/upload/dpr_auto,f_auto,q_auto/v1/article_images/2_How_to_Open_Your_Car_Hood_A_diagram_of_the_how_brakes_fluid_is_applied_when_the_pedal_is_pushed_down)

(b) Braking causes the small piston to move with a force of 20 N. The small piston has an area of  $0.008 \text{ m}^2$ .

(i) Show that the pressure of this piston is 2500 Pa.

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(ii) The pressure is the same in all parts of the braking system. The large piston has an area of  $0.04 \text{ m}^2$ .

Calculate the force applied by the large piston when braking occurs.

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Te mātāpuna: <https://s3-eu-west-2.amazonaws.com/yps-assets/3006430ee743dd6ecb858327ca1cc38d.jpeg>

(c) Ko te  $20 \text{ m s}^{-1}$  te tere o te waka e neke ana i tētahi huarahi papatahi. E 4 hēkona i muri mai, ka tū.

(i) Tātaihia te whakaterenga o te waka i ēnei hēkona e 4.

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(ii) Ko te 1000kg te papatipu katoa o te waka me te taraiwa.

Tātaihia te tōpana me whai hei whakatū i te waka.

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(iii) Whakamāramahia te ahunga o tēnei tōpana.

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Source: <https://s3-eu-west-2.amazonaws.com/yps-assets/3006430ee743dd6ecb858327ca1cc38d.jpeg>

(c) A car is moving along a flat road at a speed of  $20 \text{ m s}^{-1}$ . It comes to a stop 4 seconds later.

(i) Calculate the acceleration of this car over these 4 seconds.

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(ii) The car and driver have a mass of 1000 kg together.

Calculate the force required to stop the car.

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(iii) Explain the direction of this force.

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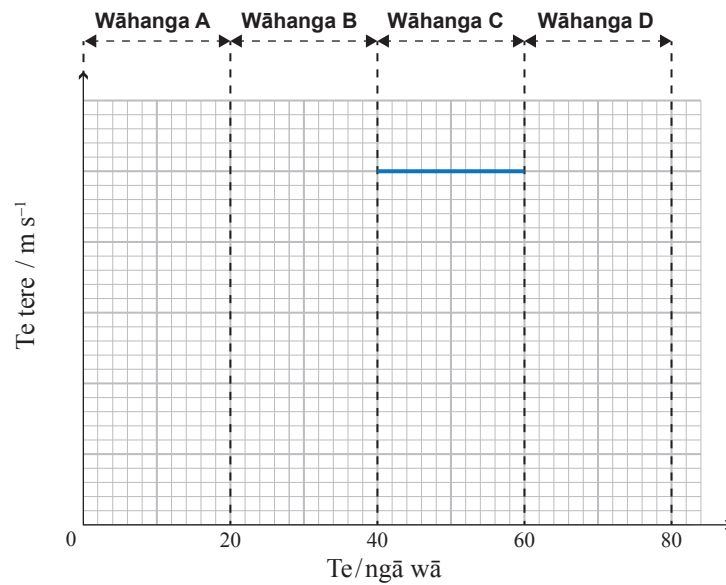
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## HE HOAHOA WĀTEA

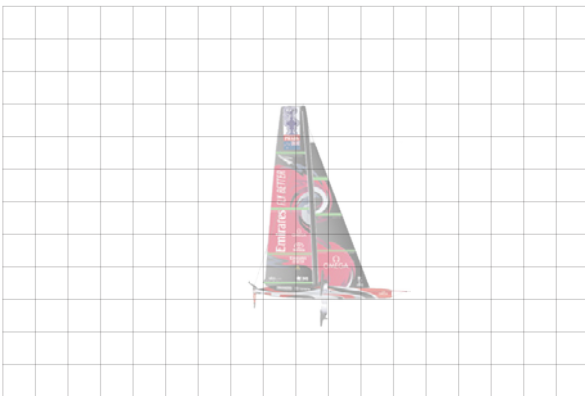
Ki te hiahia koe ki te tā anō i tō urupare ki te Tūmahi Tuatahi (b)(i), whakamahia te hoahoa i raro nei. Me āta tohu mai i te tuhinga e hiahia ana koe kia mākahia.



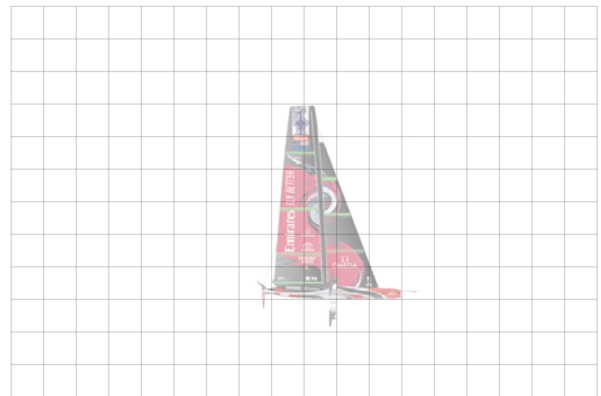
Te mātāpuna: <https://www.sailingscuttlebutt.com/2021/02/02/americas-cup-designing-the-best-ac75/>

Ki te hiahia koe ki te tā anō i tō urupare ki te Tūmahi Tuatahi (c), whakamahia ngā hoahoa i raro nei. Me āta tohu mai i te tuhinga e hiahia ana koe kia mākahia.

**Wāhanga A**



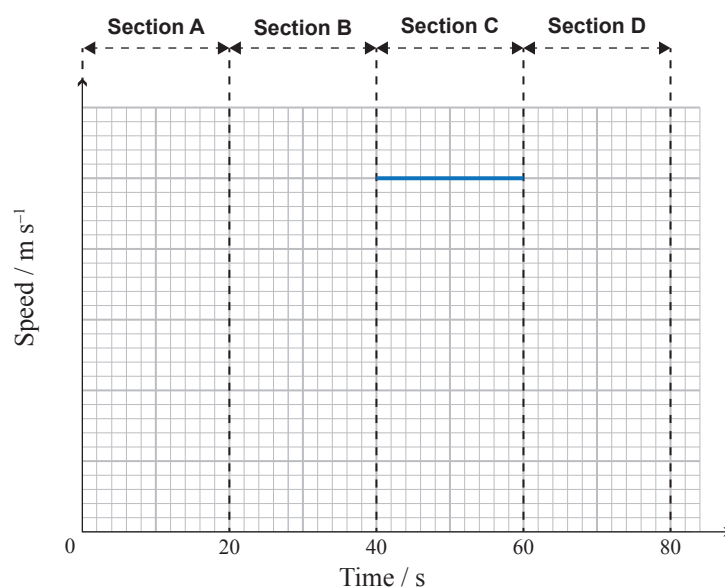
**Wāhanga B**



Te mātāpuna: <https://www.sailingscuttlebutt.com/2021/02/02/americas-cup-designing-the-best-ac75/>

## SPARE DIAGRAMS

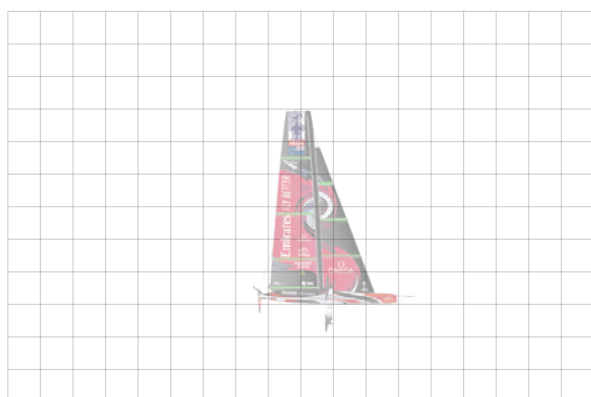
If you need to redraw your response to Question One (b)(i), use the diagram below. Make sure it is clear which answer you want marked.



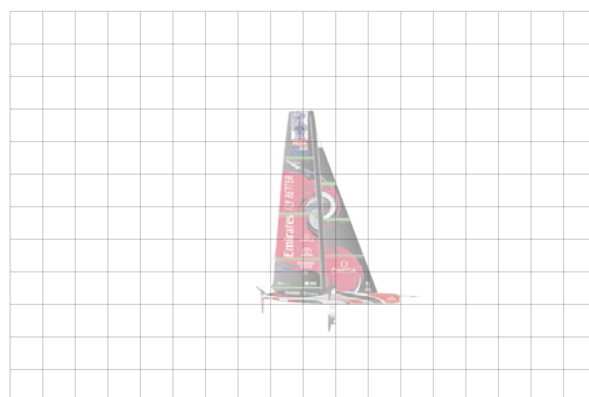
Source: <https://www.sailingscuttlebutt.com/2021/02/02/americas-cup-designing-the-best-ac75/>

If you need to redraw your response to Question One (c), use the diagrams below. Make sure it is clear which answer you want marked.

**Section A**



**Section B**



Source: <https://www.sailingscuttlebutt.com/2021/02/02/americas-cup-designing-the-best-ac75/>

**He whārangi anō ki te hiahiatia.  
Tuhia te tau tūmahi mēnā e hāngai ana.**

TE TAU  
TŪMAHI

**Extra space if required.**  
**Write the question number(s) if applicable.**

QUESTION  
NUMBER

*English translation of the wording on the front cover*

## Level 1 Science 2022

### 90940M Demonstrate understanding of aspects of mechanics

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of mechanics.	Demonstrate in-depth understanding of aspects of mechanics.	Demonstrate comprehensive understanding of aspects of mechanics.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

Make sure that you have Resource Booklet L1–MSCIE.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (XXXX). This area may be cut off when the booklet is marked.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

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