



YEAR 11 MATHEMATICS APPLICATIONS (AEMAA)
Test 4 2021: Univariate Data and Applications of Trigonometry

NAME: _____

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Calculator-Assumed: 1 A4 page notes allowed.

Formula sheet provided.

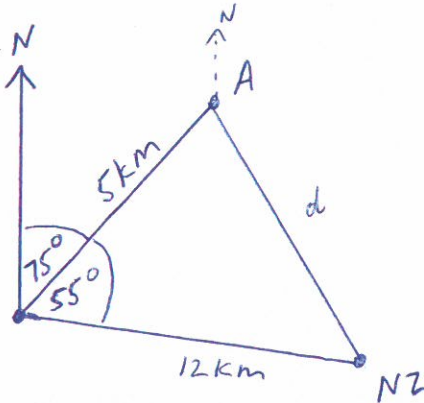
Total time: 50 minutes

Total Marks: 46

Question 1 [6 marks: 2,2,2]

At the Tokyo Olympics the Australian(A) sailing team sailed from the Jetty(J) on a bearing of 75° for 5 kilometres on a training run. At the same time the New Zealand(NZ) team sailed from the same Jetty(J) for 12 kilometres on a bearing of 130° .

(a) Draw a fully labelled diagram showing where each of the two teams ended up.



- ✓ Draws diagram showing A and NZ
- ✓ Fully labelled including angles and distances.

(b) Calculate how far apart the two sailing teams are.

$$d = \sqrt{5^2 + 12^2 - 2 \times 5 \times 12 \cos 55^\circ}$$

$$= 10.0085 \text{ km}$$

$$\sim 10 \text{ km}$$

- ✓ Substitutes correctly into Cosine Rule
- ✓ Calculates distance

(c) Find the bearing of the Jetty(J) from the Australian team(A).

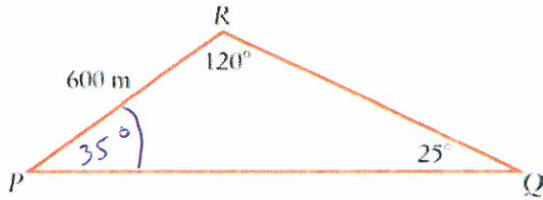
Co-interior angle
 $180 - 75 = 105^\circ$

Bearing $360 - 105$
 $= 255^\circ$

- ✓ Calculates Co-interior angle
- ✓ Calculates bearing.

Question 2 [4 marks: 3, 1]

The open water swimming course began at point P. The swimmers then swam up to and around a buoy at point R and then on to the finish at point Q.



(a) Calculate the distance from the buoy at R to the finish point at Q.

$$\frac{RQ}{\sin 35^\circ} = \frac{600}{\sin 25^\circ}$$

$$RQ = 814.32 \text{ m.}$$

✓ Calculates angle P (35°)
 ✓ Substitutes into Sine Rule
 ✓ Calculates RQ.

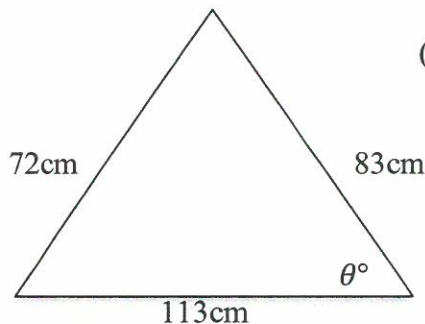
(b) Hence, calculate the total swimming course distance, to the nearest metre, from start to finish.

$$600 + 814.32 \approx 1414 \text{ metres.}$$

✓ Calculates total distance to nearest metre.

Question 3 [5 marks: 2, 3]

A koi fishpond was built in the athletes village. It is a triangular shape with side length dimensions of 72cm, 83cm and 113cm as shown in the diagram below.



(a) Determine the angle (θ°) of the fish pond as shown in the diagram.

$$\theta = \cos^{-1} \left(\frac{83^2 + 113^2 - 72^2}{2 \times 83 \times 113} \right)$$

$$= 39.5^\circ$$

✓ Substitutes into Cosine Rule.
 ✓ Calculates angle.

(b) Show the use of Heron's Rule to calculate the area of the koi fish pond to the nearest square centimetre.

$$s = \frac{72 + 83 + 113}{2} = 134.$$

$$A = \sqrt{134(134-72)(134-83)(134-113)}$$

$$= 2982.9294$$

$$\approx 2983 \text{ cm}^2$$

✓ Calculate semi-perimeter
 ✓ Substitutes into Heron's Formula
 ✓ Calculates Area to nearest cm^2

Question 4 [3 marks: 1,1,1]

The Australia Olympic Committee collected some data at the Olympics. Describe the type of data collected by circling the best description of it as either Nominal, Ordinal, Discrete or Continuous.

(a) The number of gold medals won by each country at the Tokyo Olympic Games.

Nominal Ordinal Discrete Continuous

✓ Identifies data types

(b) The type of medals won (Gold, Silver or Bronze) by Australia at the Olympic Games.

Nominal Ordinal Discrete Continuous

✓

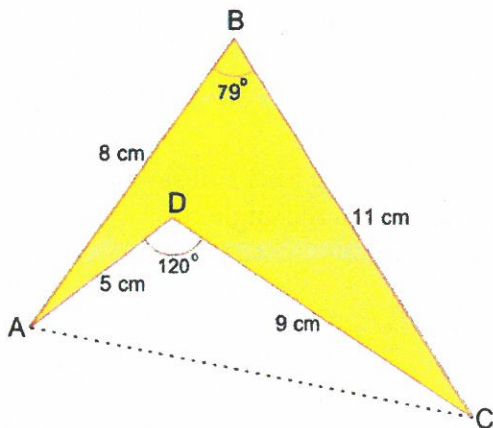
(c) The height of the players in the Australian beach volleyball team.

Nominal Ordinal Discrete Continuous

✓

Question 5 [3 marks]

Determine the area of the following logo that was considered for use on uniforms for an Olympic team in 2021, shown by the shaded area in the following diagram.



✓ Substitutes into area formula
- Finds ABC area.

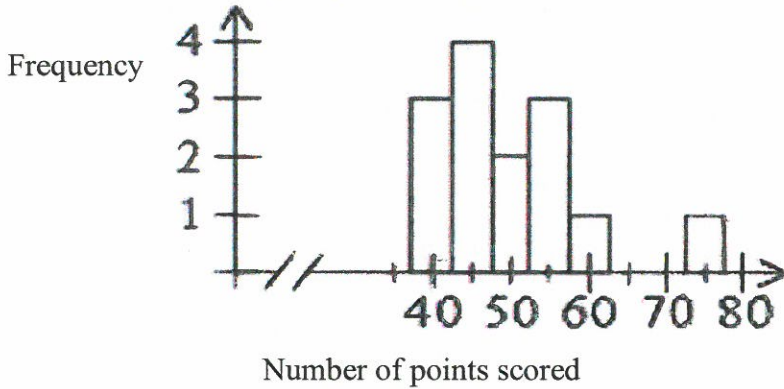
✓ Substitutes into area formula
- Finds A(ADC)

$$A = \left(\frac{1}{2} \times 8 \times 11 \times \sin 79^\circ\right) - \left(\frac{1}{2} \times 5 \times 9 \times \sin 120^\circ\right)$$
$$= 43.19 - 19.49$$
$$= 23.71 \text{ cm}^2$$

✓ Calculates shaded Area.

Question 6 [4 marks: 1,1,2]

Throughout the basketball competition in Tokyo the number of points scored per game by one of the teams was recorded and displayed as follows.



- (a) Calculate the estimated mean number of points scored per game.

$$\bar{x} = 50 \text{ points}$$

✓ Calculates mean.

- (b) Calculate the estimated standard deviation for the number of points scored.

$$\sigma_x = 9.26 \text{ points}$$

✓ Calculates st.dev.

- (c) State the modal class/es and describe the modality of points scored in the basketball competition.

Modal class $42.5 \leq x < 47.5$

✓ Identifies modal class.

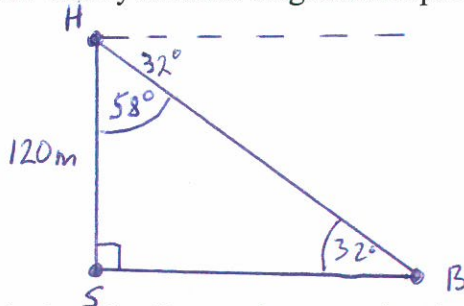
Unimodal, with a frequency of 4.

✓ Describes modality.

Question 7 [4 marks: 2,2]

At 9:30am a large metre shark was spotted off the Tokyo coast at Odaiba Beach by the Surf Lifesaving Helicopter. The helicopter hovered over the shark at an altitude of 120 metres. When the angle of depression from the helicopter to the beach is 32° , the co-pilot spots the shark directly beneath him.

- (a) Draw a fully labelled diagram to represent this situation.



✓ Draws right triangle with angle of depression 32° .

✓ Fully labels diagram

- (b) Calculate the distance between the shark and the beach.

$$\tan 32^\circ = \frac{120}{SB} \quad \text{OR} \quad \tan 58^\circ = \frac{SB}{120}$$

$$SB = \frac{120}{\tan 32} \\ = 192 \text{ metres.}$$

✓ Selects appropriate Trig Ratio substituting correctly.

✓ Calculates distance.

Question 8 [11 marks: 2,2,2,3,2]

The service times for taking food orders in the athlete village at two different restaurants were recorded. The Steakhouse results have been displayed below using a box plot.

The Burger Bar had the following service times, in minutes, for taking food orders:

0.5 9.6 2.1 5.7 1.1 1.2 1 1.1 1.8 1.9 2.4 6 8 9 0.8

(a) Calculate the five number summary for the Burger Bar service times.

Min = 0.5

$Q_1 = 1.1$

Median = 1.9

$Q_3 = 6$

Max = 9.6

✓ Calculates Median

✓ Calculates all 5 numbers.

(b) Show calculations to determine if the Burger Bar had any service times which were outliers.

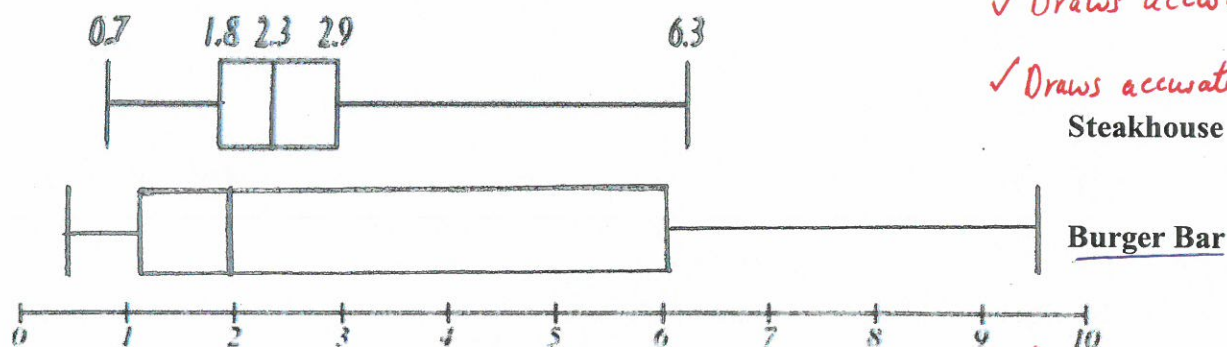
IQR: $6 - 1.1 = 4.9$

$1.1 - (1.5 \times 4.9) \leq x \leq 6 + (1.5 \times 4.9)$
 $-6.25 \leq x \leq 13.35$

✓ Calculates boundaries

∴ No outliers ✓ States no.

(c) Represent the Burger Bar service times as a parallel box plot in the position provided below.



✓ Draws accurate Median Box

✓ Draws accurate whiskers

(d) Compare the location, shape and spread of the the steakhouse and burger bar with three clear statements including relevant calculations.

- Steakhouse has a higher Median service time of 2.3 minutes compared with BBar only 1.9 minutes.

✓ Compares location

- BBar is positively skewed whereas Steakhouse, more symmetrical but a slight positive skew.

✓ Compares shape

- BBar service times are not as consistent with an IQR of 4.9 mins compared to Steakhouse IQR 1.1 minutes.

✓ Compares spread.

(e) Which restaurant should an athlete choose to eat from if they were in a hurry to order food? Justify your choice.

Choose Steakhouse as more consistent service times. IQR 1.1 mins.

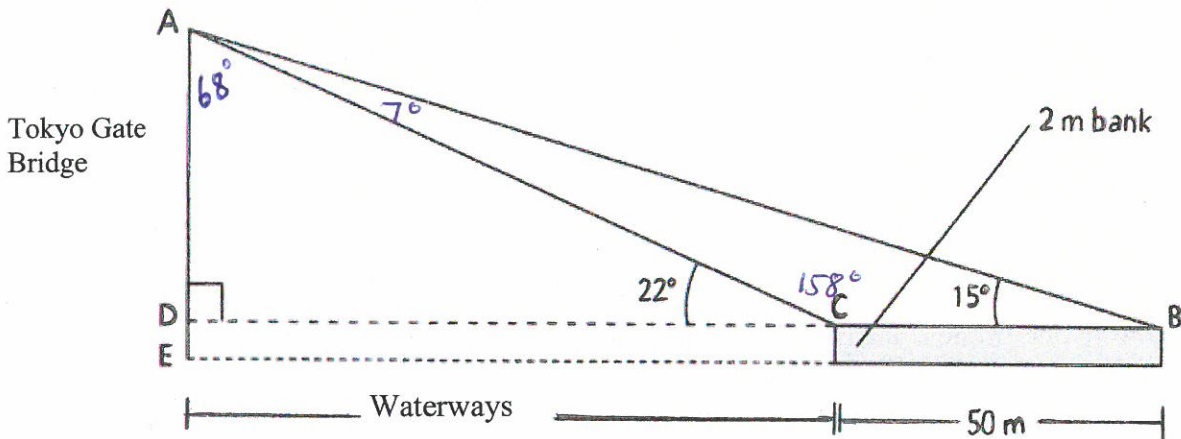
✓ States choice

OR Choose BBar as lower Median time of 1.9 minutes.

✓ Justifies referring to data

Question 9 [6 marks: 4,2]

Cynthia wanted to know the width of the Sea Forest Waterways where the Olympic Rowing competition was conducted. She measured the angle of elevation from the top of the 2 metre high bank where she is standing to be 22° to the top of the Tokyo Gate Bridge on the other side of the waterway. She then moved 50 metres back from the bank and measured the angle of elevation to be 15° .



(a) Calculate the height of the Tokyo Gate Bridge (AE).

$$\frac{50}{\sin 7^\circ} = \frac{AB}{\sin 158^\circ}$$

$$AB = 153.69 \text{ m}$$

$$\sin 15^\circ = \frac{AD}{153.69}$$

$$AD = 39.78 \text{ m}$$

$$\therefore \text{Height of Bridge (AE)}$$

$$39.778 + 2$$

$$= 41.78 \text{ metres.}$$

- ✓ Uses Sine Rule
- ✓ Calculates AB or AC (106.187 m)
- ✓ Calculates AD
- ✓ Calculates height of bridge

(b) Calculate the width of the Waterways (DC).

$$\tan 22^\circ = \frac{39.778}{DC}$$

$$DC = \frac{39.78}{\tan 22}$$

$$= 98.45 \text{ metres.}$$

$$\text{OR } \cos 22 = \frac{DC}{106.19}$$

$$DC = 98.45 \text{ m}$$

- ✓ Substitutes into Tan or Cos Ratio
- ✓ Calculates width.